

FORTY-FIRST  
ANNUAL REPORT  
OF THE  
WATER DEPARTMENT  
OF  
CITY OF CINCINNATI,  
FOR THE  
YEAR ENDING DECEMBER 31, 1880.

*A report*  
A. G. MOORE,  
Superintendent and Engineer.

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CINCINNATI:  
PRESS OF ROBERT CLARKE & CO.

# APPENDIX.

CONTAINING THE

## History of the Cincinnati Water Works.

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*A. G. Moore, Superintendent and Engineer of the Cincinnati Water Works:*

DEAR SIR—In obedience to your request, I respectfully submit the following historical account of the Cincinnati Water Works, and in doing so I desire to express my thanks to yourself, for the interest manifested in its compilation and the suggestions offered; to Mr. B. F. Gossin, for his assistance; to Mr. George Shield, for his valuable information, and for his kindness in offering the article, on the Early History of the Water System, from the pen of his late respected father, E. M. Shield; to Messrs. C. T. Dumont, John Whetstone, Joseph Bell, H. Kiersted, Thomas McLean, Joseph H. Strehle, Charles H. Christopher, and Dennis Murphy, for the information given and to the Public and Mercantile Libraries and Ed. Henderson, Esq., City Clerk, for the use of books and papers.

THOMAS J. BELL,

*Assistant Superintendent.*

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### HISTORY OF THE CINCINNATI WATER WORKS.

Possibly no other department of the city possesses a more interesting history than the Water Works; not only for its special record, but because it is more closely connected with the development of the city, and illustrates its progress to a better advantage.

A water supply is a primary consideration in the establishment

of a settlement, and this want our settlers found in the natural sources of springs. As the town enlarged, other means were resorted to in the sinking of wells, the construction of cisterns, and providing mechanical devices to supply the deficiency from the river, during the season of drought. When it became a city of some importance, its demands required the application of a water supply, conveying the water under pressure through wooden pipes; the utilization of ox and horse power for raising the water from the Ohio river; the early adoption of steam as a motive power; the recognition of all improvements in engineering science, in its new extensions, and always keeping pace with the advancement of the age—the recording of these events therefore makes the history useful, as well as interesting, to all.

It is presumed our forefathers contended with the difficulties of the present day, in providing a water supply commensurate with the growing town; for the first fountain of supply in springs having become insufficient, they forced nature to deliver up its hidden treasures by sinking wells. But this resource necessarily entailed an expense, for construction and maintenance, which few, in those days, were able to bear. From this came the origin of our water tax, for those enjoying the pleasures of a well, from pecuniary motives, obliged others to pay for the privilege of the new system.

One of the early examples of this kind of water supply may be found in the *Spy* of May 17, 1799, in the following card inserted by Griffin Yeatman:

*“Observe this notice.—I have experienced the many expenses attending my pump, and any family wishing to secure the benefits thereof for the future, may get the same by sending me twenty-five cents each Monday morning.”*

Jealousy in trade excites competition, and even the water traffic of this period was not an exception to the rule; for as early as 1802, Jas. McMahon, an inventive Celt, constructed a drag for the transmission of water from the river, to supply the people, in opposition to the exorbitant demands of well owners. In 1805 Mr. Gibson enjoyed almost the exclusive monopoly of supplying about seventeen hundred inhabitants with river water transported by his portable water works—a cask on wheels.

## Document No. 1.

EARLY SPRINGS AND WELLS—REMINISCENCE OF EVENTS FROM 1800 TO 1819—PORTABLE WATER WORKS—SAM. ARTHUR—DESCRIPTION OF REEDER'S PUMPING WORKS AND HIS "DEAD WATER" TANK.

[Written by E. M. SHIELD.]

Nature, having an ancient contract with the elements, supplied the first water to the people of the town from springs. These springs were on the river front, under the bluff bank from Deer creek to Mill creek. Between Main street and Broadway, there were numbers of them that bubbled up through the gravel and sand on the beach underlining the bank, and in the summer were inviting drinking-places. The valleys were full of them, especially the base of the hills bounding on Deer creek. Where the freight depot of the Little Miami Railroad stands, was originally a tan-yard. In that yard was a large and copious spring, sufficient to supply all the water required for the tannery, and all that the people of the neighborhood wanted for drinking, and in the damp weather a large surplus of overflow. This spring contained salts, magnesia, and other medicinal correctives, and was resorted to by the citizens, numbers of them taking their families there of a morning to drink from Kilgour's spring. There was another large spring at Deacon Wade's tan-yard, on Congress street, between Pike and Butler streets. A Catholic church now occupies the ground. There was another in Deer creek valley, at the foot of Harrison street, which had a very large flow of water. There was also, further up the creek, at Hunt's tan-yard, northeast of Court street, a spring which furnished the water for that establishment. There is also a spring at Hutchison Tavern stand, now the home of Jacob Hoffner, in Mill creek bottom, which was famous in its day; it is yet running, but much decreased in its flow. All of the springs named were in use up to and in the thirties—the one of Congress street within the last ten years, but in largely diminished quantity. There is a cut-stone basin, built by the church, to hold the water, that yet stands on the west side of the church. Population increasing faster than the springs could or would supply, wells were resorted to, not only to furnish water for the use of the proprietors, but to sell to their neighbors. Messrs. Avery and Fithian, by advertisement in the "*Western Spy*," in the early part

of the century, under the heading "Living Water," "beg leave to inform the public that they have completed their well of excellent water, at a heavy expense, and that four dollars per year will be expected from every person or family using the water. Subscription paper now ready at the house of Mr. Avery."

There is an apologetic addendum to their advertisement, for the seeming high charge of the water. The well will have to be kept in order, and kept supplied with buckets, rope, and windlass, and cleaned out at least once a year. There were other pay and use wells in town, and these were increased by the people meeting and assessing on the realty, at various times, means to construct public wells. Of the latter, there was one on the north side of Lower Market street, midway between Main and Sycamore streets; one on the east side of Main street, a few feet from Myers' candy store; there was one on Front street, in front of the Miami Exporting Bank, a few feet west of Sycamore street, and they increased in number as the demand of the people called for them.

The population increasing by immigration more rapidly than the spring and wells could supply, mechanical engineering was brought into requisition to cover the deficit, and the result was the mounting of a cask on two parallel pieces of timber which, forward of the cask, formed a pair of shafts for a horse or ox to be harnessed, the whole establishment elevated on a pair of wheels; the cask at its rear end had a leather leader or hose fastened to the head at the lowest point. The hose was made of sufficient length to reach the top of the cask, and lap over, where it was looped on a hook. In the bilge, on top of the cask, a hole some ten inches square was cut; this was for running the water.

The engineer of this portable water works drove to the Ohio river, wheeled and backed in up to the shafts; then he clutched the handle of his pump—a vessel holding some three or four gallons of water, in which a wooden handle some six feet in length was fastened at an angle; poising the handle on the left knee, he lowered his pump into the river, and by a dextrous use of his hands and arms scooped the water into the cask. When full, he placed a cloth over the opening, and fastened it to the cask, to prevent the water from splashing out by jostling against the rough roads and crossing gutters. The customers whom he served had their barrels set close to the fence, in which a hole was cut to receive the leader. The water works backed up, the leader unlooped, and its mouth placed in the barrel; the flow from the reservoir followed, and

when the barrel was full the engineer seized the leader, closing the aperture by his grip, and, looping it on top of the cask, was ready for the next customer. Each one of them had their districts and regular customers, and the price for a barrel of water fixed; hence, no trouble from competition.

One of the numerous proprietors of these locomotive water works was Samuel Arthur. By common consent, mixed with a kindly feeling, he was called Uncle Sammy. He was a tall, lithe fellow, all bone and muscle, and active as a cat. He had a fine, expressive countenance, which he could change at will into all sorts of mirthful grimaces. In politics Sam was a Jeffersonian Democrat; in religion, a Methodist, and at revivals, in church, or camp-meeting, a powerful exhorter. Notwithstanding his alliance with the church, Sam. was fond of a dog fight, a chicken dispute, and occasionally took a lone hand with some festive cuss that was spoiling for a fight. On such occasion, he was somewhat Cromwellian in his delivery of speech. Before going in, he would deliver himself, "Good Lord, forgive me, but that fellow does want a licking," and in he sailed. Whether he whipped or got whipped, his remorse for the transgression was terrible. The suspension from the church affected him to a point bordering on delirium. His water customers always came to his relief, and he was taken back on probation, and eventually restored to full communion. Sam. held to the latest day of his activity, that he *did n't* want to fight; but when he *see'd* a fellow *spiling* for a row, something told him "Go in, Sam.," and that was all he knowed about it until the fellow *hollered*.

N. B.—Sam., with his water works was one of the mourners at the burial of the old cow.

On June 13, 1809, Ethan Stone, in consideration of five hundred dollars and the erection of a water works on the ground, conveyed to Jesse Reeder the following-described property: Beginning at a stake on the south side of Front street, the southwest corner of William Ruffin's house, bearing north  $31\frac{1}{2}^{\circ}$  east 9 rods and 13 links, thence south  $47\frac{1}{2}^{\circ}$  east to the river, thence up the river to the west side of the street leading northwardly and southwardly on the west side of Ruffin's house, northerly and parallel to the west side of said street to the south side of Front street to the beginning. This unintelligible description to the general reader, of the ground conveyed by Stone to Reeder was deciphered in a suit brought by parties in 1836, in the Common Pleas Court, before Judges Henderson and Cilley, to have Reeder's west line defined. It was found that

the boundaries of his lot were : Beginning at the southwest corner of Front and Lawrence streets, thence running west 102 feet on Front street, thence south to the Ohio river, being same width in rear as in front. Reeder was then living, and testified to his west line. Reeder was no ordinary man. He was a universal mechanic, and had inventive qualities of a high order. He first settled on Duck creek, and, as he said in his advertisement, carried on wagon making at his house, seven and one-half miles from Cincinnati, and three and one-half miles from Columbia, with a lot of well-seasoned lumber, which he would make up in work. Wheat and cattle will be taken for work, and money will not be refused. He moved down to Cincinnati in 1809, built a house on the corner of Front and Lawrence streets, the lower portion of which he occupied as a store, and the upper as his dwelling. He also built a warehouse on the bank of the river, in rear of his store, and solicited storage and sales on commission. The foot of Lawrence street was known as Reeder's Landing. He built his so-called water-works in 1819 and 1820, and offered the water for sale in the latter year.

The reservoir was an oblong wooden tank, some forty feet in length by thirty feet in width, and four or five feet in depth. It was elevated some six feet from the ground, to permit water carts to back under it to receive water into the top of the casks. At the south end of the reservoir was a well, excavated down below low water mark in the river. From this well was an open ditch, running to the river, dug down to low water mark, and through this ditch the water ran from the river by its own gravitation, and supplied the well. There was a wooden curb lining the well. On the bottom of the curbing, a wooded roller carrying a series of cogs at regular spaces, at the top of the curbing, which ran some three feet above the reservoir, was another roller similar to the one at the bottom of the well, and cogged the same.

Two tubes ran down, one on each side of the rollers. Through these tubes passed an endless chain, carrying leather buckets at intervals of space on the chain of some twenty inches. These buckets were inverted cones, the apex of the cone entering the water, to prevent the sudden shock that would arise from presenting the entire diameter of the bucket to the face of the water. The endless chain being put in motion through the tubes, by the application of power to the upper roller, brought the water up from the well, and as the buckets turned the upper roller discharged the water into the reservoir. In more simple words, the machine was

nothing more or less than a chain pump, driven by a sweep wheel, pulled by a blind horse, walking in a circle. The works were erected close to the west line of Reeder's lot, on the bank of the river. The small body of water contained in the reservoir, and it open and exposed to the sun, excited the suspicions of the people as to its purity, and it got the name of "dead water." Reeder failed to get the patronage of the water haulers, they preferring to drive to the river and scoop up "live water" in their casks, and that finished the water works of Jesse Reeder. The reservoir and appliances stood there, running to decay, until the fire on May 7, 1829, that destroyed from Congress street to the river, between Lawrence and Ludlow streets.

This finished the job.

#### THE FIRST WATER WORKS.

On the 24th of March, 1817, the following resolution was offered :

"Resolved, That a committee be appointed to confer with Messrs. Davis and Findley on the subject of watering the town, and that they report at the next meeting."

Messrs. Barr, James, and Perry were appointed that Committee.

At the following meeting, March 31, 1817, the committee reported that they had a conference with Messrs. Davis and Findley, agents for the Cincinnati Manufacturing Company, on the subject of watering the town, and submitted an ordinance granting certain privileges therein specified. The report and ordinance were adopted at this meeting.

#### CHARTER.

The ordinance or charter read as follows :

Sec. 1. *Be it ordained by the Town Council of the Town of Cincinnati, That the Cincinnati Manufacturing Company, their heirs, successors, and assigns, shall be, and they are, hereby vested with the exclusive privilege of conveying water, by tubes or otherwise, from the Ohio river, through the streets, lanes, and alleys, and commons of the town of Cincinnati, for the purpose of supplying the inhabitants of said town therewith; which privilege may and shall be enjoyed by the said company, their heirs, successors, and assigns, exclusively as aforesaid, for the term of ninety-nine years from and after the passing of this ordinance, on the following terms :*

1st. The said company shall complete the work so far as to convey the water into that part of the town lying south of Third street, commonly called the bottoms, within two years from and after the first day of July next; and they shall convey the water into that part of the town lying



north of Third street, commonly called the hill, so that the same may be delivered three feet above the first floor of James Ferguson's kitchen in the second ward of said town, within the term of three years from and after the said first day of July.

2d. After the said period of three years, the company, their heirs, successors, and assigns, shall continue to supply the citizens of the town (or such of them as may desire to receive and pay for the same) with a sufficient quantity of water, making proper allowances for unavoidable accidents, and for the necessary repairing and renewing of their works.

3d. They shall permit water to be taken freely and without expense from their reservoirs and conductors, wherever the same shall be necessary to extinguish fires in the town, and for this purpose they shall provide for each square or block to which they conduct the water, a fire plug or pen stock; and, if the town council shall at any time see proper to make reservoirs to be used in cases of fire, they shall be permitted to fill such reservoirs, free of expense, from the conductors of the company: *Provided*, the said reservoir be kept tight and in repair, and the water therein be used exclusively for the purpose of extinguishing fires.

4th. The company, their heirs, successors, and assigns, shall pay to the town council, yearly, and every year during the continuance of the privileges herein granted, the sum of one hundred dollars, which payment shall commence one year after the works are completed. The money so to be paid shall constitute a free fund, and shall be appropriated under the directions of the town council, in such manner as they shall see proper, in providing and preserving such articles as may be useful in extinguishing fires.

5th. The said company, their heirs, successors, and assigns, shall be permitted to dig in the streets, lanes, alleys, and commons of the town, for the purpose of sinking their conductors and repairing them as often as may be necessary, leaving the surface of the streets as before, causing as little inconvenience to the citizens as the nature of the case will admit; and they shall be permitted to demand and receive yearly, from the persons who shall use the water from their conductors such sum as they may voluntarily agree to pay for the same.

6th. The privileges granted by this ordinance shall not be forfeited by a temporary interruption in the supply of water occasioned by accident, or the want of repairs in the machinery, reservoirs, conductors, or other parts of the works: *Provided*, such accidents be remedied, and such repairs be made, within a reasonable time.

7th. During the term of ninety-nine years, hereinbefore specified, no other person or company shall be permitted to convey water through the streets, lanes, alleys, or commons of the town by tubes or other conductors for the purpose of supplying the citizens of the town with water.

Sec. 2. *Be it further ordained*, That if the charter of the said Cincinnati Manufacturing Company shall expire, or the said company be dissolved before the expiration of the aforesaid term of ninety-nine years, this or-

dinance and the privileges herein granted shall not hereby cease, but shall continue in full force and effect, and at the dissolution of the said company, all the privileges herein granted shall vest in the persons composing the said company, at the time of such dissolution, their heirs and assigns, in the proportion of their several interests in the stock of said company: *Provided*, the persons claiming the privilege aforesaid comply with the terms hereinbefore mentioned."

[Passed 31st of March, 1817.]

### CINCINNATI MANUFACTURING COMPANY.

This corporation was organized for the manufacture and encouragement of home industry. It advertised largely, and in the daily paper of those days may be found the following :

#### CINCINNATI MANUFACTURING COMPANY

have now for sale, at the store of

STEPHEN WHEELER & Co.,

*Broadway,*

WHITE LEAD

ground in oil and dry, of an excellent quality, which will be sold at a reasonable price. The lead works are now in complete operation under the care of Mr. Moses Meeker, whose experience and ability in the manufacture of white and red lead authorize the trustees to state that the public may be constantly supplied with those articles of the best quality, and at as low a rate as they can be sold in the western country.

Also a *variety of wooden goods* worthy of the attention of persons disposed to encourage the manufacture of their own country.

A quantity of *common and half blood wool* will be purchased.

A few barrels of good *vinegar* is wanted.

SAM'L W. DAVIES,  
JACOB WHEELER,  
JAMES FINDLEY,

*Trustees.*

The advertisement bears date of May 20, 1818, and appears in the papers for more than two years.

Our city officials, and even the citizens of the time, were not alarmed in granting powers to corporations, or manifested any fear of monopolies, when they gave to this company the exclusive privilege of supplying the city of Cincinnati with water for a period of 99 years, for an annual consideration of only \$100. They required, however, the company to furnish water into the "bot-

toms" south of Third street within two years, and north of Third within three years; the water to have sufficient force to flow three feet above the first floor of James Ferguson's kitchen. This historical structure was situated in the locality of the present *Enquirer* office.

The company did not consider that they had procured a "bonanza," nor did they possess either ability or finances to carry out such a large undertaking as the construction of a Water Works. By their request, the time specified in charter for supplying water to the district south of Third street was extended, on November 27, 1818, to July 1, 1820; and as late as the 22d of December, 1819, appears their first advertisement, as follows:

CINCINNATI MANUFACTURING COMPANY,  
December 22, 1819. }

The subscribers will contract for the delivery at their Water Works, by the 1st of April ensuing, of

1,000 logs of sound timber,

either white pine or white oak, 12 feet long, and from 10 to 18 inches in diameter.

SAM'L W. DAVIES,  
JACOB WHEELER,  
*Trustees.*

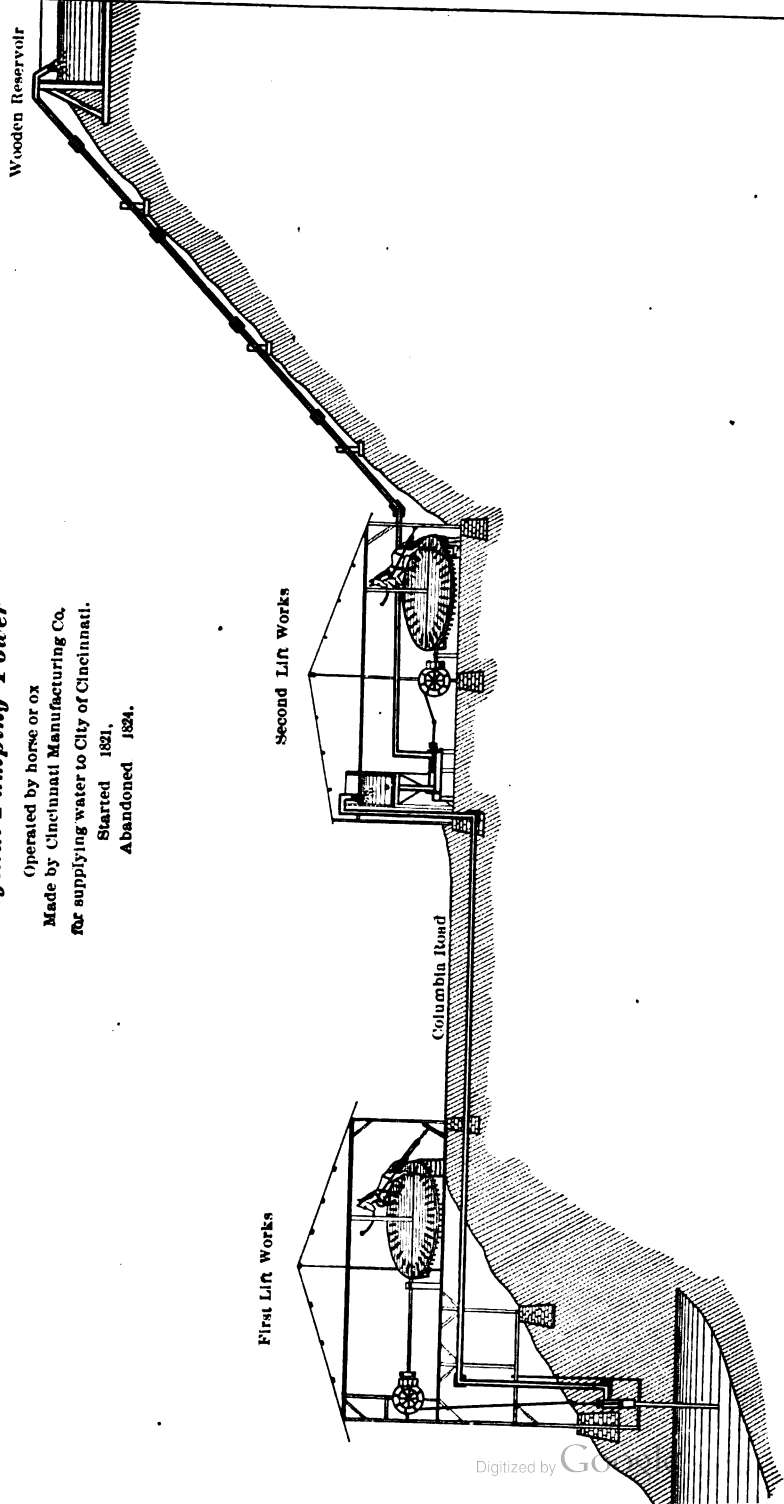
As the company was unable to carry out the provisions of the charter, they transferred all their interest and rights to Samuel W. Davies, on the 17th of March, 1820, who completed the first Water Works, from which water was delivered by pumping machinery into wooden reservoir, from whence it flowed through wooden pipes to Lower Market and Pearl street, where water was drawn from a wooden pen stock, for the first time, on the 3d of July, 1821.

#### DESCRIPTION OF THE FIRST WATER WORKS.

The Pumping Works consisted of two divisions, one located on the south side of Columbia road, now Front street, on the present site of the Pumping Houses; the other on the opposite side of the road. The south works contained the lifting pumps, which raised the water from the river and forced it through wooden pipes into a tank, in the north side works. From this tank the second pumps took their supply and delivered the water, also through wooden pipes, into a reservoir erected on the hill side. The buildings and machinery were constructed of wood.

**Original Pumping Power**

Operated by horse or ox  
Made by Cincinnati Manufacturing Co.  
for supplying water to City of Cincinnati.  
Started 1821,  
Abandoned 1824.





The pumps were operated by the generating force of oxen or horses, as the engineer desired, applied to their customary tread-mill. This tread was circular in form, about 20 feet in diameter, and set at an angle of 30 degrees; wooden pegs were driven into the periphery of the wheel, which mashed into a pinion fastened on the line of shaft. The crank for operating the pump was connected to the other end of this shaft.

A hoop-pole was utilized for throttle and governor combined, and the sonorous voice of the engineer assisted the power over its centers. To prevent the horse or ox traveling too slow, a halter was applied, and traces were used to control its fast speed.

The reservoir was made by excavating in the ground, a little south of the present Third street Reservoir, a space 6 feet deep, 40 feet long, and 30 feet wide; the bottom and sides were lined with heavy rough oak timber, securely braced by cross pieces bolted together.

In 1820 there were no improvements between Broadway and the Reservoir; the distributing pipe was therefore laid through Martin Baum's orchard to Broadway, thence along Fifth street to Sycamore, and down Sycamore to Lower Market, where the first fire-plug or wooden pen stock was placed.

Wooden logs were used exclusively for pipes. They were 10 inches external diameter, with  $2\frac{1}{2}$  hole bored by a pod auger, and banded together by an iron run.

#### PERIOD FROM 1821 TO 1825.

Mr. Davies experienced many difficulties in managing the Water Works during this time. His investment proved to be unprofitable, and being financially embarrassed, he was unable to extend the water pipes as the people desired, or keep the machinery in proper repair. He failed to fulfill the obligations imposed under his charter, which required him to pay annually into the city treasury \$100, or to apply the requisite number of pen stocks to each square for fire protection, and to provide freely the city with water. Consequently, the citizens became dissatisfied, and finally considered the Water Works of little benefit. This feeling is expressed in the *Gazette* of May 29, 1822. In an editorial of this date the editor refers, with pride, to the efficiency of the Fire Department, and the grand display, on the day previous, when new "leaders" were used in filling the engine, 300 feet from the plug, in three minutes; an achievement that eclipsed the bucket and hand to

hand system. He then refers to Colonel Davies Water Works as an auxiliary to this department, and says: "In this view alone they are of more consequence to the citizens than most people imagine."

They even questioned the purity of the water, and had Council appoint a committee to investigate the subject. The report was evidently satisfactory; at least the committee were convinced that no contamination existed, but pronounced the water to be PURE, CLEAR, and WHOLESOME.

Another subject, that caused considerable agitation, was the profligate use of water, and to partially correct the evil the owner of the Water Works was obliged to stop off the water during the night. This act aroused the indignation of the public, and Council was obliged to inquire into the violation of the charter. The committee appointed consisted of Thomas Henderson and Samuel Borden, who reported to Council October 15, 1823, the results of their observation. In their report they avoided passing any judgment on the validity of the grant, or of its proper assignment; but were of the opinion that the terms of the contract had not been complied with, in that—

1st. The payment of money was in arrearage.

2d. The proper number of pen stocks had not been erected.

3d. The water was kept off during night.

This last violation they refer to as one of special importance, for they say, "it has a tendency to seduce the citizens into a fatal security, while the devouring element spreads its devastating hand."

They acknowledged the fact of the wanton waste of water, which the person in possession of the works pleaded as a cause of his inability to keep the water on during night. In conclusion they recommended that the occupant of the Water Works be informed of the failures in the performance of the contract, and that he be requested to comply with the terms, and should he fail so to do, the Council would feel themselves imperiously called upon to declare the charter forfeited and the persons employed in digging up the streets trespassers.

In order to prevent the wastage of water, Council passed the following ordinance:

WHEREAS, The permitting of water to run to waste from the hydrants within the city is calculated to produce very great nuisances in many parts of the same, and greatly to incommode the citizens and endanger

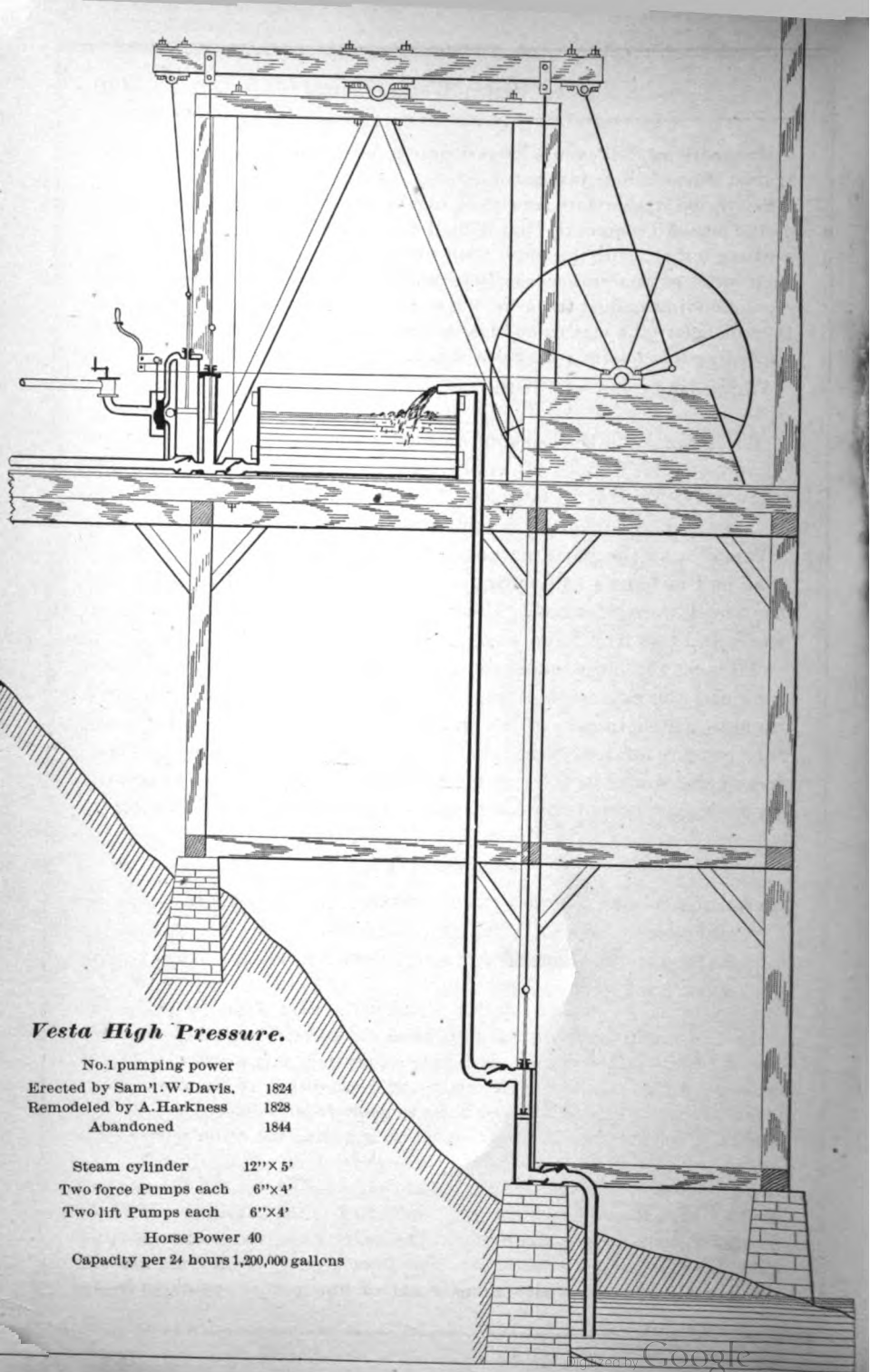
The Committee appointed to examine the  
Reservoir of the ~~water~~ water works from  
which this City is supplied with water, by  
Col G W Shreve, have performed their duty.  
And after a strict examination, Report,  
the Reservoir, to be, in excellent order, the  
water clear and pure, and in a healthy state.

Samuel Bodden  
Alex<sup>r</sup> Gibson  
Josiah Martin  
Committee









***Vesta High Pressure.***

No. 1 pumping power  
 Erected by Sam'l. W. Davis. 1824  
 Remodeled by A. Harkness 1828  
 Abandoned 1844

Steam cylinder 12" x 5'  
 Two force Pumps each 6" x 4'  
 Two lift Pumps each 6" x 4'  
 Horse Power 40  
 Capacity per 24 hours 1,200,000 gallons

their health, as well as in a great degree to lessen the security of the city against the merciless ravages of fire:

SEC. 1. Be it, therefore, and it is hereby ordained by the City Council of the city of Cincinnati, That it shall not be lawful for any persons subscribing for, or using the water from any hydrant within the city, to suffer such water to run unnecessarily to waste; and any such person or persons offending against the provision of this ordinance, shall, on conviction thereof before the mayor, be fined for every such offense in any sum not exceeding ten dollars, with costs of suit.

Passed 7th of January, 1824.

The increase in the consumption of water and the large wastage compelled Mr. Davies to apply new pumping power during the early part of 1824. Plate No. 2 represents a section of the machinery. The steam cylinder was taken from the steamboat "Vesta," and the parts arranged for a pumping engine. The engine had but one steam cylinder, with slide valve. The beam and fly-wheel were of wood. There were two lifting pumps made of wood and two iron force pumps.

To meet the large expenditures for the construction of this engine and the extension of pipe, Mr. Davies was obliged to borrow money, which increased his financial embarrassment. He therefore became anxious to relieve himself of this burden, and offered to sell the works to the city for \$30,000. The committee appointed by Council to report on his proposition submitted the following:

### Document No. 2.

DESCRIPTION OF LARGE STEAM ENGINE AND RESERVOIR—COST OF OPERATING WORKS PER DAY—NUMBER OF WATER TAKERS IN 1824 AND AMOUNT OF REVENUE—ENTIRE WORKS OFFERED FOR SALE AT \$30,000.

COUNCIL CHAMBER, *February* 18, 1824.

Your committee report that they have completely examined the condition of the establishment and have consulted experienced workmen in wood and iron as to the efficiency and permanency of the work.

The steam engine is believed to be as good as new, except the boilers, which will be sufficient for three or four years; the other parts of the engine will be good for fifteen or twenty years.

The power is sufficient for raising the supply of water for the city and drive all the machinery which can be erected in the building. It is now used but three days in the week. The cylinder of the engine is larger than that lately in the *steam mill*. The force pumps are of iron, and perform well. There is also a spare set of iron pumps which, in case of

accident, can be used. The lifting pumps are of wood connected with iron pipes, and the working chamber is of iron.

The machinery for working the pumps is constructed in the most durable manner. The pipes ascending from the engine up the hill about 400 feet are of iron.

The reservoir is permanent and will contain upwards of 200,000 gallons of water, and may be enlarged at an expense of about \$250 00 so as to contain 50,000 gallons more. Allowing 100 gallons per day for each family, it will then contain a supply for 500 families.

The pipes conducting the water to the city are of wood connected with iron, and are put down in a substantial manner, and from the information of Robert Riley and William Cones are of the opinion that they may be relied upon for 15 or 20 years, and, after consulting the persons above named, and engineers of experience, we hesitate not to say, that the whole work is executed in a manner creditable to the persons employed in it, and that it is an establishment of great value to the city. The expense of raising the water at present is as follows, supposing the engine to run every day excepting Sunday:

30 Bushels of coal, at 8 cents.....	\$2 40	} \$5 40 per day.
2 Hands, at \$1 50 .....	3 00	

Making an aggregate of \$1,690 20 per annum.

The present subscription from 254 subscribers is \$2,832 00. There are on the line of the pipe about 651 houses. Part of the power of the engine is now rented for a nail machine at \$1 00 per day. The property has cost, by a statement exhibited to us, upwards of \$40,000, and we do not think that the price now set upon it is unreasonable. The price asked for the whole property is \$30,000, including every thing belonging thereunto and necessary for completing the works, to-wit: All the tools and implements in the blacksmith shop and elsewhere, whatever belongs to the machinery worked by horses and building above the road are excepted.

The same consists of that purchase by Samuel W. Davies of Samuel Newill, and two pieces held by mortgage from Jacob Wheeler, supposed to be two or three acres. Samuel W. Davies agrees to pay \$4,000 of the debt due the State Treasurer, Jacob Wheeler. Ten thousand dollars of the price is due and can be paid to N. Longworth and Wm. Green & Co., and N. Longworth for himself, and Judge Burnett and General Harrison for Wm. Green & Co. have agreed that the Council may make the time of payment to suit themselves. Three thousand five hundred dollars is due the United States Bank and to G. W. Jones, which sum can, it is believed, be arranged so as to obtain time for the payment. These sums make together \$17,500. To relieve the proprietor from present and pressing difficulty, the sum of \$2,000 is required; the remainder, say \$10,000, can be paid in annual installments for ten years. The present owner has involved himself in debt to complete this work. We are per-

sued that he is not able to continue it, and that the city can not suffer such an establishment to decay. We believe, too, that the city ought to own it, and that it is a work of so public a character that its management should be directed more to the public interest than to individual emolument. We, therefore, recommend that the following resolution be adopted:

SAMUEL BORDEN,  
JOHN COOMBS,  
JAMES KEMPER,

*Committee.*

### FIRST VOTE ON THE PURCHASE OF WATER WORKS.

The Council immediately accepted this report, and passed a resolution to submit the question of purchase to the people. In accordance with instruction, the committee caused the following publication to be made:

*To the Freeholders of the City of Cincinnati :*

Sam'l W. Davies, having proposed a sale of his Water Works to the City Council, the subscribers have been appointed by the Board a Committee to lay before the citizens the terms of his proposal, and to recommend to the freeholders of the city, that at a suitable time and place, to be named by the Committee, they should vote by ballot, either for or against the purchase of said establishment, upon the terms proposed.

The Council have adopted this course from a conviction, that in a matter involving so much importance to the city as the purchase of that establishment, they would exercise an undue use of their power in making a purchase of it, without first obtaining the voice of the freeholders upon the subject. But, if after a full investigation of the proposal, which is set forth below, as well as all other matters in relation to the usefulness, permanency, expenses, and income of the Works, the said freeholders, or a majority of them, shall vote in favor of the purchase, the Council can close the contract accordingly, without meriting the imputation of an improper and unjust exercise of their power.

It may not be improper to remark that the subjoined proposal is founded upon the supposition that a good and sufficient title to the said Works shall be given to the city. And, suffice it to say, that this is a particular which can be satisfactorily determined before closing the contract for this purchase.

The Committee would therefore recommend that on Wednesday the 3d day of March next ensuing, between the hours of 10 A. M. and 5 P. M. of that day, the freeholders of the city should meet at the office of Thomas Tucker, near the corner of Upper Market and Main street, and then and there, after two judges and two clerks, being all freeholders, shall have been chosen, "viva-voce," by a majority of the freeholders present; provided, that John Mahard and John Rece will not serve as judges, and

Thomas Tucker and Samuel R. Miller as clerks, to vote by ballot, either for or against the purchase of said Water Works on the terms proposed by Samuel W. Davies, as below exhibited.

THOMAS HENDERSON,  
CALVIN FLETCHER,  
JOHN COOMBS,

*Committee.*

February 20, 1824.

N. B.—It is proper to state that interest will be charged on the several sums upon which a credit is proposed to be extended to the city.

PROPOSAL.

The Water Works, with all their appurtenances, including every thing necessary for conducting them, real and personal, excepting only the machinery formerly worked by horses, and the frame building above the road.

The rents are incumbered with a lien of \$750. The whole establishment is offered for \$30,000, which may be paid as follows:

This sum may be paid at any time convenient to the city.....	\$10,000 00
This sum to the city account of Jacob Wheeler's debt.....	4,000 00
This sum may be paid in 2, 3, and 4 years.....	3,500 00
This sum may be paid annually in 10 years.....	10,500 00
Cash .....	2,000 00
Total.....	\$30,000 00

SAMUEL W. DAVIES.

The question of purchase caused considerable excitement, and called forth a number of communications on the subject, principally against the purchase.

The objections were—

1st. The time was too limited for proper investigation and reflection on such an important question.

2d. The inability of the city to incur so heavy an expenditure.

3d. The liability of electioneering tricks and corruption growing out of public appointments for the Water Works.

4th. As it was unprofitable under an individual ownership, it would be a "sink-hole" to the city treasury, under a public management.

Some of the arguments advanced were very amusing. One correspondent wanted to know how long, before the benefits of the works would be extended commensurate with taxation, and whether there was more justice in taxing the community for water

they do not drink, than for wine and brandy. Another was afraid it would not pay a fair interest on the investment, and contrasts the earnings of a steam flour mill to the Water Works' returns. In answer to this, it was suggested, that if it was a question of profit, the city should build a flour mill.

One correspondent, of inquiring mind, called the public attention to the results of his investigation, on the grant to the Cincinnati Manufacturing Company, for the exclusive right of supplying the town with water for ninety-nine years, on their own terms, and in their own way; and, "being assured of the validity of the lease, says, the following very worthy men mean to apply for similar ones, viz., Phil. Flour, the miller; Ben. Barn, the baker; Harry Hide, the butcher; Lawrence Last, the shoemaker; and Gabriel Goose, the tailor."

The editor of the *Gazette* cautioned discretion in the matter involving so heavy an expenditure, "and if the city desired to purchase the works, to prevent them falling into disuse, the annual expense of keeping them in repair and operation should be ascertained, in order to know of the ability of the city to support them without inconvenience."

The result of the vote was announced by the judges and clerks, as follows:

Number for purchase.....	25
Number against purchase.....	294
Number on subject of loan.....	2
<hr/>	
Total votes cast.....	321

**CINCINNATI WATER COMPANY.**

As the city refused to accept Mr. Davies' proposition, he turned his attention to the formation of a corporation, and having interested a number of influential citizens in the project, they appointed a committee from among themselves, to investigate the subject and report the results. They submitted the following:

"The subscribers, having been appointed a committee to investigate the present state of the Cincinnati water works for the purpose of fixing a value on the property, which is to be transferred to the joint stock company incorporated by the legislature of Ohio, under the name and style of the Cincinnati Water Company, report that they have examined the documents submitted to their inspection, from which it appears,

*First.* That the property proposed to be transferred by Samuel W. Davies, to the above named company, consists of—



1. The building on the Ohio river, containing the machinery for raising water to the reservoir.
2. The steam engine and machinery attached to it.
3. A quantity of tools for boring pipes, repairing engines and pumps.
4. Land on which the building and reservoir, etc., are situated containing about 362 ft. front on the north side of the Columbia road, running back to High street, and on the south side of said road about 200 feet front, running down to low water mark in the Ohio river.
5. 670 feet iron pipe.
6. 26,349 feet wooden pipes laid in the principal streets, and 26 iron cross pipes, and 50 large brass cocks.
7. A reservoir on the hill.
8. Two lifting and one forcing pump.
9. The charter, granting the exclusive privilege of supplying the city with water for ninety-nine years, the whole of which property the committee estimate at the sum of thirty-five thousand dollars, Mr. Davies agreeing to give his services to the company for one year without charge.

*Second.* That the income, arising from water rents for the last year, was about \$4,400, and the expenses of supplying same about \$1,500.

*Third.* That the income is rapidly increasing with the growth of the city, and that, with suitable regulations, which it would be in the power of a chartered company to enforce, to prevent abuses, etc., and an expenditure of about \$2,000 in laying additional pipes, the revenue might be greatly increased.

*Fourth.* That the liens upon the property above mentioned amount to about \$18,000, including arrears of interest, of which it will be necessary to pay off \$4,500 immediately; the remainder may probably remain unpaid for some time.

*Fifth.* That it probably will not be necessary to call in more than one-third of the amount of the capital stock during the first year.

*Sixth.* And that a dividend of six per cent. on the whole amount of the stock might be expected the first year, and an annually increasing rate of dividend for some years thereafter.

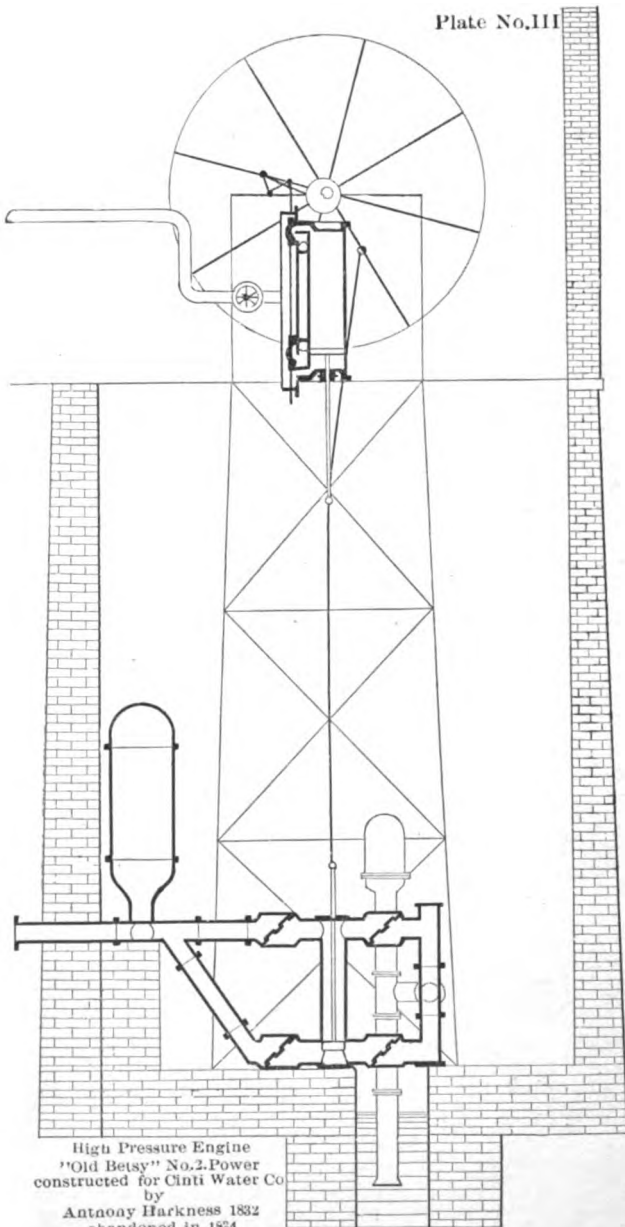
M. P. CASSELLY,  
WM. GREENE,  
DAVIES B. LAWLER,  
JNO. P. FOOTE.

The capital stock in the above company is divided into 350 shares of \$100 each, 200 shares are offered to subscribers, about one-half are taken, one-sixth to be retained by former proprietor, and the residue to be held by the company or disposed of, as they may direct hereafter.

A subscription book is deposited with Mr. Thos. Bell, who will receive the subscriptions and make known the terms more particularly at his exchange office in the old Miami Banking House, on Front street.

April 11, 1826."





High Pressure Engine  
 "Old Betsy" No. 2. Power  
 constructed for Cinti Water Co  
 by  
 Antoaoy Harkness 1832  
 abandoned in 1834  
 Steam cylinder 25" 8'  
 Pump cylinder 17" 8'  
 Pump Main 20" 750 feet  
 Capacity 3,000,000 gal.

The Cincinnati Water Company was incorporated under a special act of the legislature, passed January 7, 1826, which gave to Sam'l W. Davies and associates the power to organize this company, with a capital stock not exceeding \$75,000. The officers were—Jno. P. Foote, President; Wm. Greene, Secretary; and Sam'l W. Davies, Superintendent.

#### **PERIOD 1825 TO 1832.**

The management of the Water Department by the Cincinnati Water Company, during this interim, was no better for the general welfare of the public than it was under Mr. Davies' ownership; for the same rule existed of shutting off the water during the night, to prevent wastage of water, and at times of stopping it for days to make repairs. But it may be said to their credit, that they placed the Works in more permanent condition, by the construction of three new Reservoirs, of stone and earth embankments, on the site of the present Third Street Reservoir; by the laying of an 8-inch iron pipe in High street during the year 1828 (which formed the only supply main for the city until 1845); and in 1832 by the erection of an additional pumping engine, called "Old Betsy," operated by a slide valve. (See Plate No. III.)

In December, 1831, the city was out of water over three weeks, in consequence of the destruction, by fire, of the pumps and part of the building.

#### **SECOND ATTEMPT TO PURCHASE THE WATER WORKS.**

Desiring to submit again this subject to the people, Mr. Griffin offered, for the consideration of Council, the following resolution, on the 2d of February, 1832:

"That a Committee be authorized, if they deem it expedient, to offer to the Cincinnati Water Company \$125,000 for their Water Works, exclusive of the reservation in their proposition, or \$150,000 for said Works, inclusive of said reservation, on condition that the measure be sanctioned by the citizens,"

which was adopted, and on the 24th of the same month the Committee submitted the following elaborate report:

## Document No. 3.

TERMS OF PURCHASE—CONDITION OF WORKS—EXPENSES AND RECEIPTS  
FOR 1832, WITH ESTIMATE TO 1841—ESTIMATED NUMBER OF  
HYDRANTS FOR 1870—QUESTION OF PURCHASE TO BE SUBMITTED  
TO THE PEOPLE.

COUNCIL CHAMBERS, *February 24th, 1832.*

The committee, appointed by Council on water works, report that the amendments suggested to the bill received by the Council, from Mr. Miller, on the subject of supplying the city with water, were forwarded to our Representatives agreeably to the instructions of the Board, but were not received by them in time to be inserted. The bill was, however, amended and passed. A certified copy of the act has been received. Mr. Wright was employed to investigate the nature and extent of the rights and privileges of the water company, whose opinion is herewith submitted.

At a conference with the members of the water company, the committee were distinctly informed that no alteration would be made to the terms of the proposition submitted by that company to the citizens. For the information of the citizens, the committee have endeavored to collect all the facts necessary to enable them to estimate the expense of conducting the works; the income and the improvements that will be necessary to be made immediately in order to supply the increased demand for water. The result of their investigation is, that if by act of the Legislature, the principal superintendent of the water works could be appointed for a term of years, and the management of them be committed to a competent and responsible individual, that the revenue of the works would not only defray the yearly expenses and make the necessary repairs, but would leave a surplus fund in the year 1870 more than sufficient to pay off the loan, after which period a further reduction might be deemed proper and be made in the charges of water and still leave a permanent and probably increasing surplus revenue adequate to the creation of a sinking fund for the gradual and certain discharge of all the remaining debts of the city. Before an additional supply of water can be furnished, the sum of \$22,500 will have to be expended in improving the works, and \$40,000, at the rate of \$9,000 a year, in iron pipe and logs, viz: for a new engine, \$14,000; engine house, \$2,000; 700 feet of 20-inch pipe, from engine to reservoir, \$4,500; finishing reservoir, \$2,000; equaling \$22,500.

For 8-inch iron pipe, at \$3 50 per foot .....	}	\$40,000
For 4-inch iron pipe, at \$2 50 per foot .....		
For logs, at 50 cents per foot .. .....		
Amount to be paid water company.....		150,000
Making the sum. ....		<u>\$212,500</u>

Although the purchase and contemplated improvements will amount to above \$212,500, it will not be necessary to borrow more than \$200,000, as \$40,000 of the proposed loan will be expended at the rate of \$9,000 a year, the unappropriated part of that sum will meet the deficiency in the income of the water works the first year, and the surplus revenue of the works in the third and fourth years will be sufficient to meet the estimated deficiency of \$12,500.

The increase of the hydrants for the last three years have averaged 350 a year; but in the following estimate of the expense and income of the water works, the increase of new hydrants is estimated at only 300 a year for the first three years, at 200 a year for the next succeeding five years, and only at 100 a year after 1840.

The price of water to be reduced twenty per cent. in 1838, and twenty per cent. in 1840, and a further reduction of ten per cent. after 1850, being fifty per cent. less than the average price in 1832. When the above named improvements are completed, the power of the engines are estimated to be sufficient to supply 8,000 hydrants. An additional reservoir may have to be made, and the iron pipes extended after the year 1840. If these improvements should become necessary, the contingent fund will be found adequate to meet the following statement of estimated expense and income of the works for each year from 1832 to 1840 inclusive, viz:

EXPENSE IN 1832.		INCOME IN 1832.	
Interest on loan at 5 per cent.....	\$10,000	1,420 hydrants, at \$10.....	\$14,200
Repairs generally .....	600	300 new hydrants during the year, estimated to be equal to 150, at \$10.....	1,500
25,000 bushels coal, at 10 cents .....	2,500	Rents from tenements now on premises.....	150
Insurance and stationery..	300	Deficiency .....	2,050
Salary of Superintendent..	1,500		
Engineer and Assistant....	1,200		
Collector .....	600		
Clerk .....	400		
		Total.....	\$17,900

Total..... \$17,100

YEAR.	EXPENSE.	INCOME.	NET REVENUE.
1833 .....	\$17,900.....	\$18,850.....	950
1834 .....	17,900.....	21,650.....	3,750
1835 .....	17,900.....	24,150.....	6,250
1836 .....	17,900.....	26,150.....	8,250
1837 .....	18,900.....	28,150.....	9,250
1838 .....	18,900.....	24,900.....	5,250
1839 .....	18,900.....	25,750.....	6,850
1840 .....	18,900.....	27,350.....	8,450

\$.....

\$.....

Deduct the amount of deficiency in the first year..... \$2,050  
 And the amount to be applied to extending pipes..... 12,500

Total..... \$14,550  
 Leaving a surplus or contingent fund of \$34,450.

Estimating the increase of new hydrants after the year 1840 at 100 a year, the whole number in 1870 will be 6,500. If, after the year 1840, the surplus revenue of the water works should be applied to a sinking fund it will, in 1870, amount to \$220,000, or \$20,000 more than enough to pay off the loan, as will appear by the following estimate:

EXPENSE OF YEAR 1841.		INCOME OF YEAR 1841.	
Estimated at .....	\$19,000	3,500 hydrants, at an average of \$6 each.....	\$21,000
Surplus .....	2,000		
Total.....		\$21,000	
Surplus revenue of 1841 being \$2,000, will, in 1850, amount to.....	\$20,000		
Annual increase 100 of hydrants, at an average of \$6 each, will be .....			30,000
4,500 hydrants being the number in 1850, at \$5, will leave a surplus revenue for the year 1851 of \$3,500, which, in 1870, will equal .....			70,000
100, the increase of hydrants each year for 20 years, at \$5 each, amounts, in 1870, to.....			\$100,000
Total.....		\$220,000	

Making the total amount of the surplus or sinking fund in 1870 \$220,000, without reckoning the interest arising from its investments or the \$34,450 provided for contingencies.

It will be perceived that the odd twenty hydrants were dropped. If the growth of the city should be such as to call for a greater number of hydrants than has been estimated, the additional receipts arising from such increase would be amply sufficient gradually to refund the expense of the necessary improvements, and it would eventually add to the amount of the surplus revenue or sinking fund. In coming to a conclusion, favorable to the purchase of the water works, the committee wish to be distinctly understood as being of the opinion, that the establishment, if purchased, should be placed under the management and control of some competent and responsible individual, without which they believe that such purchase would be likely to prove a public burden, rather than a public benefit, and be productive of no essential improvement, either in the actual supply of water, or in the price at which it can safely be afforded to the citizens.

The committee conclude by recommending for adoption the following:

*Resolved*, That the report of the committee on the water works be accepted, and that so much of said report as relates to the estimated expense and income of the establishment, with the communication received from the water works company, together with the act of the Legislature, to provide for an adequate supply of water, and passed February 11, 1832, be published in hand-bills for the information of the citizens, all of which is respectfully submitted.

E. HINMAN,  
PEYTON S. SYMMES,  
D. GRIFFIN,  
E. S. HAINES,

*Committee.*

One of the interesting features of this Report was the probable estimate made by the Committee, of the growth of the Water Department. They calculated that in 1870 there would be 6,500 hydrants in use—while the actual number was 18,629.

The election was held on the 10th of March, 1832, and resulted as follows :

	For Purchase.	Against Purchase.
1st Ward.....	56	84
2d Ward.....	86	113
3d Ward.....	44	226
4th Ward.....	55	90
5th Ward.....	62	104
<b>Total.....</b>	<b>303</b>	<b>717*</b>

\*An error occurs in the footing of "Against Purchase" of 100 votes.

As the city declined to accept the offer of the Water Company, they concluded to enlarge the Works, commensurate with the growing demand of the city, and to do this, they were obliged to apply to the Legislature of 1831-'32 for the right to increase their capital stock.

The City Council interposing, the Legislature refused to act. The Council, however, withdrew its objection in 1835, and the Legislature granted the permissions.

### THIRD ATTEMPT TO PURCHASE.

The advocates of the purchase of the Works still persisted in agitating the question with such vigor, that Council was finally prevailed upon to consider the subject again. A Committee was accordingly appointed, on the 2d day of December, 1835, to solicit a proposal from the Water Company. This Committee reported on the 9th of the same month that the company were willing to sell on the same basis offered in 1832, being 6 per cent. on the next revenue.

On the 30th of December, the Council resolved, upon the suggestion of Mr. Woodruff, to request the Legislature to pass a law giving the city the right to purchase.

March 11, 1836, the Legislature passed the act empowering the city, after submitting the question to the citizens, to borrow money at the rate not exceeding 5 per cent. and not exceeding fifty years—the Water Works to be controlled by four judicious and competent freeholders, having other qualifications of members of Council and President of Council.

On the 21st of March, the Committee on Water Works submitted the following report, known as the "Flood, Veto, Cholera, and Panic Document."



## Document No. 4.

TERMS OF PURCHASE; ESTIMATES OF RECEIPTS AND EXPENSES TO 1845, AS COMPARED WITH PREVIOUS YEARS OF VETO, FLOOD, CHOLERA, AND PANIC.

CINCINNATI, *March 21, 1836.*

Your Committee appointed to negotiate with the Water Company, in relation to the purchase of their works, have had the subject under consideration, and will now proceed to lay before Council the result of their investigation.

The real estate proposed to be sold is described in a letter of the Secretary of the Company, and is hereunto annexed. There are now laid down 22 miles of wooden and 2 miles of iron pipe, and in use 2,368 hydrants producing a net revenue of \$16,418.22 for the year ending December, 1835. The company propose to sell the works for a sum sufficient to produce the same income at 6 per cent., and should the city make the purchase, the Committee think it will be necessary, immediately, to make the following additions to the present works, in order that they may be extensively useful and profitable, to wit:

To lay down 2,000 feet of 10-inch, 3,000 feet of 8-inch, 6,500 feet of 5-inch, and 4,500 feet of 4-inch pipe, all of iron. The laying down of those pipes will afford an ample supply of water over the entire city, and produce a corresponding increase of revenue.

The purchase of the present Works will require 273,637 dollars, and from the best calculation that the Committee are enabled to make, it will require a loan of 320,000 dollars to make the purchase and complete the improvement and extensions of the works to meet the wants of the public.

Now, whether the city should or should not make the purchase, has been the principal inquiry with the Committee, and for the ascertainment of which fact they have had recourse to the inspection of the books and history of the company for the last four years, thereby expecting to find the probable results of the future. They have taken the years '32, '33, '34, and '35, the years of *veto, flood, cholera, and panic*, which they think will not lead to an over-estimate of increase of revenue in the future, and they find that during those years, the revenue of the company increased from \$9,000 to \$16,418, or 20 per cent. per annum; they have seen the rent assessment for the first quarter of the year 1836, and find an increase indicated of 25 per cent. Your Committee therefore run little risk of disappointment in estimating the gross revenue of '36 at 27,000 dollars, or the net revenue to the company of \$19,000.

The expenses of the company for running the works during the year '35 were \$6,900. The Committee are of the opinion, that the expense of

the city, in case they owned the works, would be, say, 9,000 dollars; the interest on a loan of \$320,000, at 5 per cent., would be 1,600 dollars; in all, interest of capital and expenses, say \$25,000. These expenses would not increase for 10 years, after the improvements contemplated should be completed.

The Committee, feeling the great responsibility of this measure, and being anxious to avoid any thing in this report that might deceive themselves or mislead the Council, had fixed on 2,500 dollars progressive increase of revenue as a data whereon to predicate their calculation, as will appear from the following table. They have contemplated also a deduction of water rents of 10 per cent. after the third year, and a further deduction of 10 per cent. after the sixth year, extending these calculations through the next ten years:

1836,	permanent expenses	\$25,000,	probable revenue	\$27,000
1837	"	"	25,000	"
1838	"	"	25,000	"
1839*	"	"	25,000	"
1840	"	"	25,000	"
1841	"	"	25,000	"
1842*	"	"	25,000	"
1843	"	"	25,000	"
1844	"	"	25,000	"
1845	"	"	25,000	"
			\$250,000	\$342,930

\*10 per cent. off.

If the committee are not much mistaken, there would be an excess of revenue at the end of 10 years, of \$92,930 dollars over the expenses, which put to interest about thirty years, would pay off the principal of the loan, and the work extended and left unincumbered, with any charge except the permanent expenses of \$25,000 per annum, and the price of water reduced twenty per cent. to the citizens. From these calculations, the council will perceive the process by which the committee have arrived at the conclusion, that it would be to the interest of the city to make the purchase, in a pecuniary point of view. There are also other reasons which have had some influence with your committee in making up their opinion. The water company claim the exclusive privilege of furnishing the citizens with water at their own price, which, if true, would make it a monopoly of the most odious character.

Your committee also look with dread to a transfer of these rights into the hands of foreign stock jobbers, against whose cupidity the citizens would have no protection; it would also be desirable to stop the continual conflict between the city authorities and the agents of the company in laying down their pipes and breaking up our streets, and the committee think that this great city should have the exclusive control of its water works, especially in cases of fire and in warm and sickly seasons, when it may be necessary to wash and flood our streets.

But notwithstanding the great advantage it would be to the city to own

those works, your committee would forego it sooner than thereby to fix on the real estate of the city any additional taxes. It is, therefore, with pleasure that they perceive complete protection against such an event in the provision of a law lately passed by our legislature at its last session, to which they would refer the citizens before they make the important decision. Under all the views that your committee have been enabled to take of this matter, they can not hesitate to recommend the purchase, and in doing so they think they discharge their duty to themselves, and to this great and growing city. All of which is respectfully submitted.

D. GRIFFIN,  
*Chairman.*

An abstract of this report, together with the act of the legislature, was ordered published in the daily papers, and 500 hand bills struck off for distribution.

The time of voting was set for the 1st of April, 1836, when the people rejected the proposition for the third time, by the following vote:

	For Purchase.	Against Purchase.
1st ward.....	94	227
2d ward.....	284	290
3d ward.....	67	272
4th ward.....	104	159
5th ward.....	407	326
Total.....	956	1,274

### **PURCHASE OF THE WATER WORKS.**

Hardly two years had elapsed before the question of the purchase of the works was introduced again in Council, whether by its advocates or through the instrumentality of the Water Company it is not known, but the inference is drawn, from the study of the records, that the company were very desirous of having the city take the works off their hands; especially so, at this time, for we find, from a report submitted to Council on August 28, 1838, that their expenses had increased, while the water rents had slightly diminished since 1836; and if the city had taken the works at the writing of this report, the sum would have been \$80,000 less than the offer of 1836.

The company, to compensate for this deficiency, and possibly to bring the question of purchase to an issue, advanced the water rents 20 per cent. This act aroused the popular feeling for an extermination of this monopoly, and to appease the excitement, Mr. Griffin introduced in the Council of 6th of June, 1838, a resolution

to confer with the company, in reference to the purchase and examination of the books.

This was adopted, and a committee appointed, who reported the results of their investigation on the 28th of August, as follows :

#### Document No. 5.

#### COMPARISON OF REVENUE OF 1835 AND 1838—INCREASE IN WATER RENTS OF 20 PER CENT. BY THE COMPANY—COMMITTEE'S REASONS FOR THE NECESSITY OF THE PURCHASE OF THE WORKS.

COUNCIL CHAMBER, *August 29, 1838.*

The committee appointed to negotiate with the Water Works Company in relation to the purchase of the water works, would present to the council a letter, from the president of the company, containing a detailed proposition to the city council, which is herewith presented :

The terms of the proposition appear to be about \$80,000 less in proportion to the revenue than the proposition of 1836; but your committee have discovered that the net revenue of the works does not appear so flattering as the committee of 1836 had reason to expect. This is no doubt from the increase of permanent expenses, which was in 1835 \$6,700, and in 1837 \$10,860. Perhaps this difference of expense may be placed to the immense power of the present engine used by the company. Whether this item could be materially reduced by the employment of water power, may be a subject for the consideration of the council hereafter.

It will be recollected that the water rents have been increased about twenty per cent. during the last year, to enable them to realize the present revenue which is now net \$20,162; in 1835 it was net \$16,418; thus it would seem to present the revenue of 1837 at the same as 1835, except the twenty per cent. advance in water rents. The hope, therefore, of creating a surplus revenue for the liquidation or extinguishment of the debt incurred in the purchase, can not be relied upon with any certainty; yet your committee are of the opinion, notwithstanding the unpromising appearance of the revenue of those works, that there are many reasons of the most weighty character, which should induce the city to purchase them. The committee think it entirely unnecessary here to enumerate them, they having been presented to the public several times during the discussion of this subject, and have never been successfully answered. There are one or two reasons of alarming weight, which, of themselves, should be sufficient to determine any free man on the subject.

The power that the company claims, and its duration, the late twenty per cent. advance in the price of water, proclaim to the citizens the dangerous tendency of such a power in the hands of any company. The committee would herewith recommend that the proposition be again sub-

mitted to the people, if practicable under the law of March 11, 1836, and if not, that an alteration of said law be proposed to the legislature during the next session, to enable the council to submit the proposition of purchase or no purchase to the voters of the city.

D. GRIFFIN,  
*Chairman.*

One of the amusing statements in this communication is the account of the heavy expense for operating the pumping works, which the committee traced to the "immense engine," and suggested, as a remedy, the utilization of the water power from Miami canal.

The report was accepted and the second Tuesday of October following fixed for taking the vote. This day was afterward changed to the fourth Tuesday of the same month. The result was :

	For the Purchase.	Against the Purchase.
1st ward.....	290	50
2d ward.....	403	75
3d ward.....	165	200
4th ward.....	193	65
5th ward.....	321	39
6th ward.....	96	56
7th ward.....	105	36
Total.....	1,573	*311

\* Error in footing of 210.

The vote was a very decided one and showed the determination of the people to control the water supply. But the opposition contended that the law of 1836 was not applicable at this time. The consummation of the sale was, therefore, postponed until the legislature could remedy the defect, by passing a new law, which they did on the 16th of March, 1839, giving the right to the city to borrow \$300,000, at a rate not exceeding 6 per cent., for the purchase of the Water Works.

The Council appointed the 3d day of May for submitting the question to a vote under the special law. The result this time was :

	For Purchase.	Against Purchase.
1st ward.....	165	69
2d ward.....	185	76
3d ward.....	66	133
4th ward.....	109	78
5th ward.....	114	80
6th ward.....	40	66
7th ward.....	49	51
Total ....	728	553

# Cincinnati Water Works

Original Plan of purchased property June 15, 1839.,

High

Street

About 193 ft.

About 180 ft.



Reservoirs

Line

Kilgour

3 pole St. laid out instead of one laid out by E. Stone

About 600 ft.

Lot No. 2

About 200 ft.

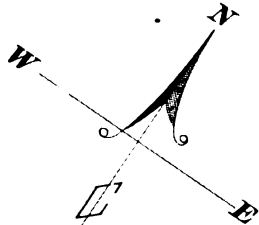
3 pole St. laid out by E. Stone to be vacated and laid out on Kilgour line

Lot No. 3

About 183 ft.

About 310 ft.

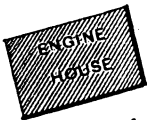
Laboratory



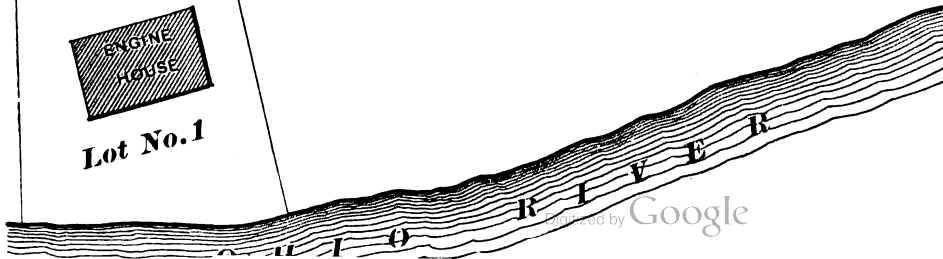
Street

Front

About 163 ft.



Lot No. 1





Upon announcement of the result, immediate steps were taken to consummate the sale, and all the articles of settlement were agreed upon, on the 15th of June, 1839, and ratified by the Council on the 17th. Mr. Hazen, of the Third Ward, on voting against the ratification of the sale, stated that he did so in compliance with the majority vote of his ward.

The articles of agreement provided :

1st. That for the sum of \$300,000 in city bonds, bearing 6 per cent., and redeemable in 1865, the Water Company transferred all its rights, title, and privileges in said Water Works, the property consisting of—

The tract of land shown in Plate No. 4.

The Reservoir on High street.

The Pumping House on Front street.

The two pumping engines " Vesta " and " Betsy " with all the appurtenances.

19 miles of wooden and  $3\frac{1}{2}$  miles of iron pipe.

2d. The city to take possession of works as soon as necessary papers were signed.

3d. The city to take the coal, pipe on hand, etc., at their cost.

4th. The purchase to take effect on the 15th of June, and bonds to date therefrom.

5th. The city to accept the grant to Col. Davies of free water for his own family, during his life and that of his wife, if she survives him.

6th. The company to collect all the outstanding debts, etc., on the date of transfer.

This agreement was signed by Edward Woodruff, on behalf of the city, and W. S. Johnson for the company.

On the 25th of June, the Committee on Claims took formal possession of the works. The officers of the company were kept until the 15th of September.

#### CINCINNATI WATER WORKS, 1839 TO 1847.

The first meeting of the standing committee of the City Council, constituting the special Board of Directors, was held in Council Chamber on Saturday evening of 7th of September, 1839. The first Board was composed of—

Edward Woodruff, President, member from Fifth Ward.

E. Hinman, member from Second Ward.



- Q. Lovel, member from Seventh Ward.
- A. H. Ewing, member from First Ward.
- W. S. Hubbell, member from Sixth Ward.
- Z. Martin, member from Third Ward.

At this meeting the following officers were elected :  
 Isaac Evelett, Secretary, at a salary of \$1,000.  
 Samuel W. Davies, Engineer, at a salary of \$1,000.

On the 12th they rented the office at northwest corner of Fourth and Walnut streets at \$7 per month.

The Directors immediately settled down to business, by ordering a quantity of *tins* for numbering hydrants. They also disposed of the request of the Hospital, to increase the supply branch from five-eighths to one inch, by allowing a five-eighths ferrule and one-inch pipe, that the supply in the neighborhood might not be affected too seriously.

On the 25th of October, 1839, they adopted the following water rates, payable yearly in advance :

1st or lowest grade for a family,	\$10.00	per annum.
2d	" " "	12.00 " "
3d	" " "	14.00 " "
4th	" " "	16.00 " "

Bath, \$3.00 ; each hose, \$1.00 ; gardens, \$1.00 to \$4.00.

Hose, including garden, \$10.00.

The large expenditure for fuel used for steaming purposes at the pumping works was a subject of inquiry, and how it could be economized. The matter was referred to an engineer, by name of N. Buford, for investigation, who submitted an elaborate report on the utilization of the water power from the Miami canal, as a substitute for the steam pumping system. He proposed to convey the water from the sixth or "Fagin Lock," through culvert, to the pump-house, where he designed to have an "eighteen-foot" over-shot wheel. He calculated that 900 cubic feet of water per minute could be drawn from the canal, and that this class of wheel would give an effective power, as three to two, and the result he found to be twenty-two horse power. But he was astonished to find it would require thirty-six and one-half horse power to raise the water into the Reservoir, required for daily consumption. Finding the deficiency too large, he changed his base, and adopted the fourth lock as the source of power and the application of two over-shot wheels. He contemplated using the first wheel for operating the

force pumps, and the second, which he located in the pump-house, and twenty-one feet below the first, for working the lifting pumps. By this division he expected to pump 1,400,000 gallons into the Reservoir for each day's run. He recommended this plan because the first wheel was above the high water mark, and the water supply could never be interrupted on this account. He submitted, with the report, two estimates for the conduits—one of brick structure, 2,200 feet in length and 3.19 feet in diameter, to cost \$6,880; the other of thirty-inch iron pipe to cost \$14,075.

The report appears to have been very satisfactory to the Board, for they acted promptly in the matter of securing a proposition from the lessee of the canal-power, Mr. Clark Williams, who offered the privilege for an annual consideration of \$6,000. The whole subject was referred, in August, 1840, to Council for its approval, but this body failed to recognize the merits of the new system.

The first annual report was submitted to Council, on the 15th of December, 1840, of which the following is a copy :

**First Annual Report of the Board of Water Works from June 15, 1839, to December 15, 1840—Eighteen Months.**

RECEIPTS.

Amount of water rent collected and deposited in the City Treasury from June 15, 1839, to December 15, 1840. ....	\$60,220 11
Amount received for 30 brass ferrules, at \$2 each .....	60 00
	\$60,280 11

EXPENDITURES.

EXTENSION AND IMPROVEMENT OF THE WORKS.

Amount paid for wood and iron pipes—Labor laying the same—Brass work—New set of boilers for engine—Fence around the reservoir—Lead—Paving and cartage.....	\$13,268 16
--	-------------

RETURNED WATER RENTS.

Amount paid returned rents to sundry persons from June 15, 1839, to December 15, 1840 .....	\$1,839 77
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CURRENT EXPENSES.

Amount paid for keeping the engine in good running order—Materials—Weekly wages of hands—Cartage—Stationery—Office rent, etc.....	\$4,285 71
Amount paid for 67,423 bushels of coal—Cartage and measuring fees—From June 15, 1839, to December 15, 1840.....	6,504 16

Amount paid Wm. S. Johnson, three months' services as secretary.....	300 00
Amount paid E. Hinman, three months' services as collector.....	375 00
Amount paid S. H. Davies, eighteen months' services as engineer.....	1,500 00
Amount paid J. Eveleth, nine months and seventeen days' services as secretary.....	796 57
Amount paid E. Carpenter, fifteen months' services as collector.....	1,250 00
Amount paid F. J. Irwin, on account of services as secretary.....	333 00
	<hr/> \$15,344 44

Amount paid six months' interest on \$300,000 City Bonds, due December 15, 1839.....	\$9,000 00
Paid exchange on currency and premium to pay same.....	994 80
Amount paid six months' interest on \$300,000 City Bonds, due June 15, 1840.....	9,000 00
Paid exchange on currency and premium to pay same.....	738 45
Amount paid three months' interest on \$1,075—City order given for materials purchased of water company.....	16 13
Amount paid six months' interest on \$1,075—City order given for materials purchased of water company.....	32 25
Amount paid nine months' interest on \$1,075; and two months' interest on \$575, balance of same—City order given for materials purchased of water company.....	61 65
Amount paid six months' interest on \$300,000 City Bonds, due December 15, 1840.....	9,000 00
Amount premium to pay the above in Philadelphia $4\frac{1}{2}$ per cent.....	427 50
	<hr/> \$60,280 11

Balance being amount of receipts over expenditures to the credit of water works in City Treasury, December 15, 1840..... \$556 96

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\$29,270 78

Respectfully submitted,

JAMES F. IRWIN,  
*Secretary.*

### Statement of the Condition of the Water Works on December 15, 1840.

There are now laid in the city—

Wooden pipes from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches diameter.....	19 $\frac{1}{2}$ miles
Iron pipes from 4 to 20 inches diameter.....	4 $\frac{1}{2}$ miles
<b>Making in all.....</b>	<hr/> 23 $\frac{1}{2}$ miles

There has been laid since the purchase of the works by the city—

Wooden pipes of 2½ inches diameter.....	3,337 feet
Iron pipes of 4 to 10 inches diameter .....	3,311 feet
<b>Making in all .....</b>	<b>6,648 feet</b>

Being all the pipes laid down in that period, except the ordinary *repairs of logs*, the expense of which *equals* the cost of 3-inch iron pipes, and, in view of this fact, I again respectfully suggest to the committee the importance of *abandoning the putting down logs entirely*, and laying nothing but *iron pipes*. It is at once seen that although the original cost of *logs* is much cheaper than iron, yet the *repairs* of such logs cost as much as the first cost of *iron pipes* of *double capacity*. As regards economy, therefore, there can be but one opinion, and that is in favor of good *iron pipes*. Another disadvantage from the use of logs, which is severely felt in the upper part of the city, is the impossibility of supplying through them as much water as the wants of the citizens require. Being necessarily of small diameter, and the draught on them constant, the water will not rise in the upper part of the city to within twenty feet of the height of the reservoir. In cities such as Philadelphia, where the average height of their reservoir is less than in our own city, they have an abundant supply of water not only for domestic purposes, but in *cases of fire also*, which I deem one of the first objects of a well regulated water works. The reason of this abundant supply is obvious, as in Philadelphia they have iron pipes of capacity sufficient for all their wants. They suffered formerly in Philadelphia in the same manner as ourselves when, at one time, they had six lines of *wooden pipes* leading their water to the city, which they finally abandoned and substituted *iron pipes* of large diameter.

There has been discontinued since the city came into possession of the water works—

Of wooden pipes.....7,871 feet

Of this amount 3,311 feet have been replaced with *iron pipes*, and 4,560 feet have been discontinued on streets where the former company had laid down iron pipes and still continued the use of the logs. The attachments were therefore changed to the *iron pipes* and the logs abandoned, by which considerable leakage and many repairs have been avoided.

The consumption of water in the city has averaged for the last year 1,080,000 gallons daily, which has been distributed to 3,000 tenants, being an average daily supply to each tenant of 360 gallons. This large average supply is attributable partially to the constant practice throughout the city of families and other establishments supplying themselves with water from the hydrants and pipes without authority, which has become a very serious drawback upon the resources of the works. But this large average supply (so greatly beyond the wants of the citizens) is principally owing to the innumerable leaks from the *wooden pipes*, which

it is impossible to discover, as the water descends into the gravel and into the numerous *sink holes* so common on the upper plain of the city.

As the iron pipes are substituted this supply will diminish, and I have no doubt when the wooden pipes are all abandoned, iron substituted, and some prompt measures enforced against such as take water without authority, that the present amount of fuel consumed by the engines will supply double the number of tenants.

The average supply of water to each tenant in the city of Philadelphia is 177 gallons daily, being less than half the quantity supplied from the works in this city.

The present engines and pumps can supply, by working twelve hours each day, 2,100,000 gallons of water by running both engines at the same time.

Respectfully submitted,

(Signed)

S. H. DAVIS,  
*Superintendent.*

All of which is respectfully submitted to the City Council by

EDWARD WOODRUFF, *President*,  
OLIVER LOVELL,  
D. CARROLL,  
M. BROOKS,  
D. GRIFFEN,  
A. H. EWING,

*Board of Water Works.*

In March, 1842, the Board found it necessary to increase the distributing main, but the size bothered them, and caused considerable discussion. After changing the kind of pipe several times they finally ordered a twenty-inch main, on the 20th of June, 1845.

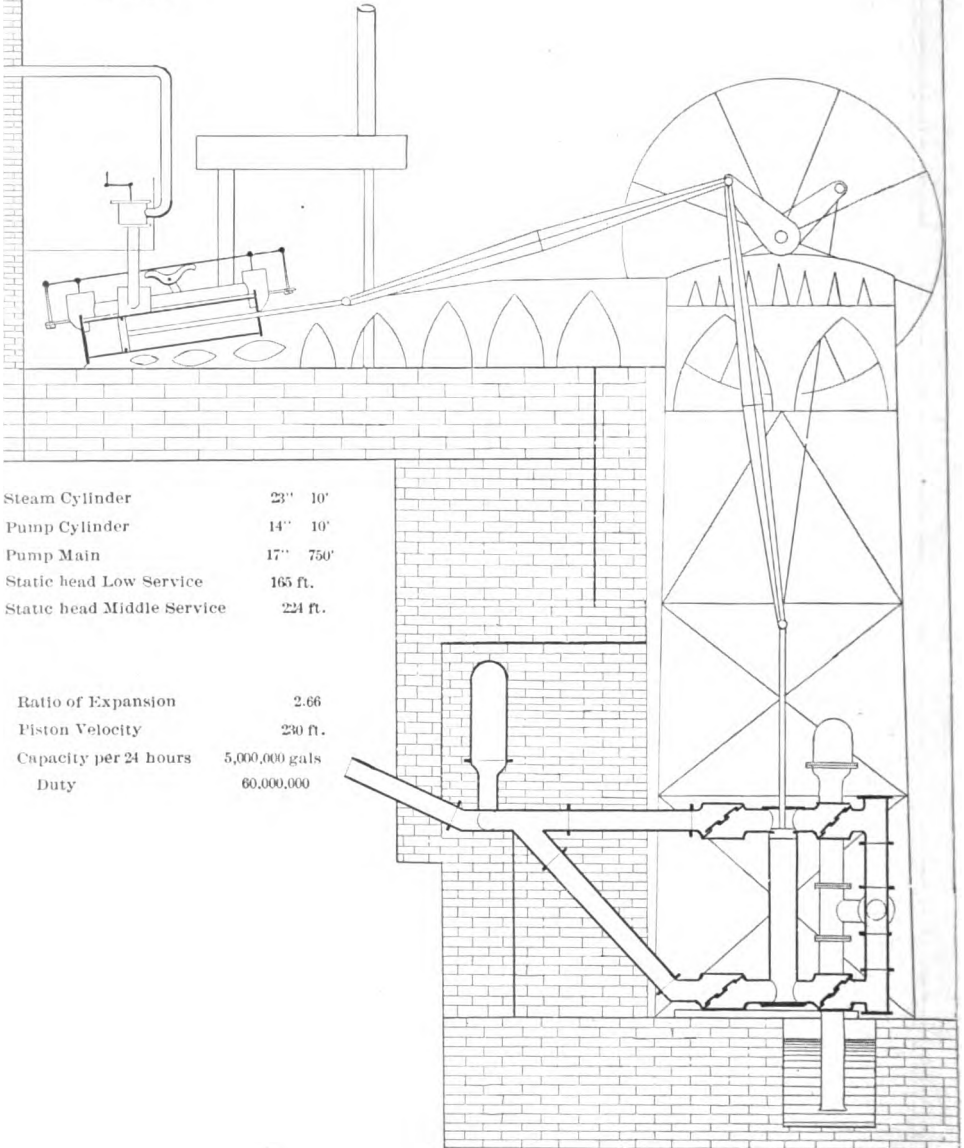
Numerous complaints were made during the years 1843 and 1844, of damages to property by leakages from log pipes, and to correct the evil and prevent the waste of water, iron pipes were substituted.

December 22, 1843, Colonel Samuel W. Davies, after many years of usefulness to his fellow-citizens, died. On the 10th of January, 1815, 'Squire Samuel W. Davies was, by an act of the Ohio Legislature, made Chief Executive of the embryo city, with the title of Mayor. Previously the President of the Town Council had acted as Chief Executive. From 1833 until 1843 he received the repeated honors of the Mayoralty; the builder of the first steam Water Works for the city; one of the incorporators of the first Water Company; and a partner in the first woolen mill.

He was of English birth, but devotedly attached to American in-



Duplex Non-Condensing  
 No.3.Power  
 Designed by Geo.Shield  
 Constructed by  
 Yeatman and Shield,Cintf O  
 1844 - 1847  
 Cost \$75,000



Steam Cylinder	23" 10'
Pump Cylinder	14" 10'
Pump Main	17" 750'
Static head Low Service	165 ft.
Static head Middle Service	224 ft.

Ratio of Expansion	2.66
Piston Velocity	290 ft.
Capacity per 24 hours	5,000,000 gals
Duty	60,000,000

stitutions. An upright, square-dealing, popular man, he was fearless in the discharge of his duty.

In April, 1842, S. L. Tatem was elected, by popular vote, as Engineer of the works. In October, 1844, the Directors accepted the proposition of Messrs. Yeatman and Shield, for the construction of a new pumping power, after the design of Mr. George Shield. The rates agreed upon were—

For iron castings fit up,	5½	cents	per	pound.
For wrought forgings,	14	"	"	"
For brass castings,	40	"	"	"
For copper work,	45	"	"	"
For boiler work,	9	"	"	"

The erection of the machinery proceeded very slowly, and caused considerable feeling between the parties. The excessive cost on the "pound" rate was also a subject of dispute, and when the contractors claimed the pump mains as part of the engine contract, the Directors refused, and ordered the work stopped. Messrs. Yeatman and Shield appealed to Council for recognition of their rights, and a resolution was accordingly introduced, ordering the Directors of the Water Works to construe words "metallic attachments in the contract, as meaning the iron pipes leading up the hill." A compromise was afterward effected by the contractors accepting a rate of four and three-fourths cents per pound for the pipe castings.

At the commencement of the construction of this power, the "Vesta" engine was abandoned, and the whole pumping duty placed on the "Betsy," which performed its work admirably until spring of 1846, when the pump became impaired during high water, and to effect an immediate correction, the river was dammed off. During the work, the city was without water.

The new engines were started in March, 1846, and worked under a cloud of dissatisfaction and unfavorable comment. At one time the Directors were about to condemn the engines, and proceedings were to be instituted against the contractors for damages, but the Solicitor held that Messrs. Yeatman and Shield were only employed to do the work, subject to the supervision, alteration, and direction of the Engineer of the Water Works, and as the design was a new and experimental one, they were not liable for defects in the construction.

During Mr. A. Warden's administration, several material changes were made, in the introduction of five-eighths cam, instead of full



stroke, and the application of new pumps and chambers, that increased their efficiency.

The joints of the old pumps were made of iron cement, and, to prevent air being taken in when a vacuum had to be maintained, water-tanks were constructed around them.

High water of 1847 prevented the operation for a short time.

In 1875 the engine parts were overhauled, and the mains connected with the Eden service pipes, since which date they have been used, almost exclusively, for the new service. They are to-day the most economical engines in service.

In 1842, Mr. N. Longworth urged on Council the great importance of a Reservoir on higher ground, and offered to sell a valuable site on Mt. Adams, for Reservoir and promenade purposes, at \$500 per acre, which, he stated, was not one-fourth of its value; but the proposition was rejected on the ground that the price charged was double its value. In 1846 the subject was introduced in Council, and a Committee appointed, of which Mr. Griffin Taylor was the head, to wait on Mr. Longworth. He offered to sell to them at one-third less than he would to an individual, but the Committee declared the price exorbitant, and would not trouble Council with a report. They deemed \$1,400 per acre for broken hill ground, "too poor to raise sour-kroust, most exorbitant," and could not realize what, they deemed a visionary idea, that it would ever sell for building lots. Mr. Longworth appears to have taken exceptions to the Committee's action, and, to place himself in a proper light, made a proposal, in writing, that the Council should take possession, without any fixed price, and pay no interest, but when he sold adjacent ground, to alhim within \$500 per acre of his private sales, after deducting taxes. In this communication, he stated that in five years it would be worth five times the sum asked; and, further, that at the expiration of this time he would report to Council its value. He did not literally comply with this obligation, for before three years had elapsed he was selling this property for from \$10,000 to \$14,000 per acre.

In the closing remarks of the communication, dated December 30, 1848, he desires to place himself on record in this matter, which the writer has now the pleasure of complying, using his phraseology :

"For the day is not distant when the inquiry will be made, why were not sites for these purposes obtained by Council when our hills were of little value, and why was it delayed till they were cut down and converted into building lots? Some old residents may say, 'We recollect that N.

Longworth, at an early day, urged on Council the urgent necessity of buying ground for these purposes, and offered to sell at far less than its value; but when called on by a Committee of Council, composed of the knowing ones of the city, demanded a most exorbitant price, and more than double its value. The Committee were disgusted at his pretended public spirit, and so reported to Council.'"

On the 19th of March, 1840, the Legislature passed a law, making certain offices elective ones. Among them was the officer of Engineer of Water Works.

The Council appears to have taken exception to this interference in the municipal affairs; and in framing the ordinance in conformity to the law, they expressed themselves in the most satirical language, and defined the duties of the officers in a very amusing manner. The section relating to the Engineer of Water Works provided:

"That the only duties required of any Engineer of Water Works, who may be hereafter elected, shall be to cause the engines of said works to be well greased or oiled, and to swob out the flues and head up the boilers thereof, until other duties are hereafter prescribed by ordinance, or directed by said Board of Directors, and shall receive such compensation, not exceeding fifty dollars per annum, as may be determined by resolution of the City Council."

The law also provided for the appointment, by Council, of a Superintendent of Water Works, but the Board of Directors never availed themselves of this office, until June 5, 1846, when Council passed the ordinance granting the privilege to make the appointment, and defining the duties of the office.

The people continued to elect annually the Engineer of Water Works, until 1845, when by ordinance of March 28th, of this year, the Council made the appointment.

The management of the Water Works was also changed by ordinance of April 11, 1846, to a trusteeship of three members, having other qualifications than members of Council, to be appointed, however, by Council. The members selected were Samuel Fosdick, D. F. Meader, and S. E. Foote. Mr. R. R. Springer was mentioned in connection with the office. Mr. Fosdick declined, and Mr. Griffin Taylor appointed instead, his opponent being the late George Graham.

Four members of Council protested against the ordinance, and the opposition succeeded in having it repealed, by ordinance passed May 6th, and the management placed in the control of a Board, consisting of the President, the Recorder, and three mem-

bers of Council. The first and only Board, organized under this ordinance, was composed of—

J. G. RUST, President of Council.

N. W. THOMAS, Recorder.

D. F. MEADER, Member of Council.

GRIFFIN TAYLOR, Member of Council.

A. SAWYER, Member of Council.

On the 3d of February, 1847, the Legislature passed the law, instituting the Board of Three Trustees, to be elected annually.

#### 1847 TO 1860.

The first meeting of the Board of Trustees was held on 22d April, 1847.

Their transactions for the first two years were those incident to the management of the work, and were of no special importance, unless we except the purchase of a smoke consumer for \$200. On the 5th of September, 1849, they accepted the plans of Mr. T. R. Scowden, for the construction of new reservoir, and ordered the work to be commenced at once, as the old reservoirs were unsafe. The contract was given to Messrs. Bailey and Smiley, who completed the eastern division in December, 1850, and the western division on 16th September, 1853.

The Reservoir is above the ground, and constructed entirely of selected and dressed limestone. Its extreme depth is 23 feet, and the flow line  $20\frac{1}{2}$  feet. It is made in two divisions, the western being 180 by 116 feet, and the eastern 163 by 116 feet.

The north and north half of east wall is 12 feet wide at base, and  $1\frac{1}{2}$  inch batter on inside, and plump on the outside; the south wall and half of east wall, 16 feet at base,  $1\frac{1}{2}$  inch batter on inside, and 3 inches on outside. Division wall is 12 feet at base, sloping on either side,  $1\frac{1}{2}$  inch to the foot. The footings of all the walls are not less than 8 feet below the bottom of Reservoir, and at the south-east corner it is 20 feet. It was thought, at one time, that this portion of the wall had settled. The total capacity is  $5\frac{1}{2}$  millions of gallons. The cost was about \$50,000.

This was the only Reservoir the city used until 1875. It is cleaned in the spring of every year, when 18 to 30 inches depth of deposit are removed. Last year the time was delayed, and the

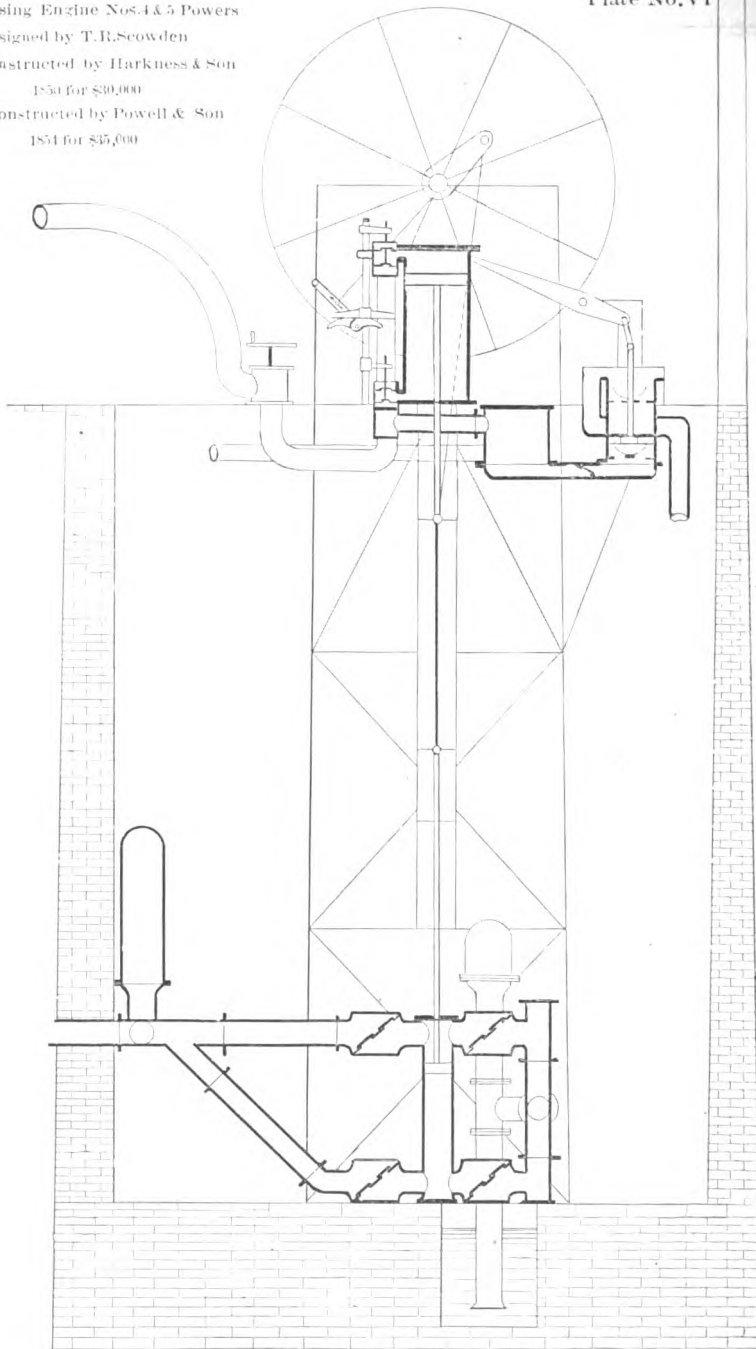


Condensing Engine Nos. 4 & 5 Powers

designed by T. R. Scowden

No. 4—constructed by Harkness & Son  
1854 for \$30,000

No. 5—constructed by Powell & Son  
1854 for \$35,000



Steam cylinder 45" 8'  
 Pump cylinder 18" 8'  
 Air Pump 36" 3"  
 Main 20" 750 ft  
 Static head 165 ft.

Ratio of Expansion 3  
 Piston Velocity 240 ft.  
 Capacity each power 4,500,000 gals.  
 Duty 50,000,000

river, being exceptionally high, there were 5 feet found in some parts of the western basin.

The plans for the condensing Engine No. 4, prepared Mr. by T. R. Scowden, were adopted, on 2d May, 1850, and on the 9th, the following bids for the construction of the machinery were received: From A. B. Latta, for \$45,500; George Shield, \$38,750; A. Harkness & Son, \$30,000; and Niles & Co., \$29,500. The contract was awarded to A. Harkness & Son, against the protest of one of the Trustees and Niles & Co. The only apparent reason for giving the work to Harkness & Son was the longer time given for the payments.

The trial of the engine occurred 17th of February, 1851, and the operation satisfactory. Since this date the power has been in constant service. The only important change made in the original construction was the compensation in the steam ports, for the weight of the parts on the downward stroke, instead of the counter-balance.

The foundations for the new engine and boiler house were commenced on the 11th May, 1850; also laying of four lines of 20-inch iron pipe, 230 feet in length, to channel of river, with strainer to be placed in cavity, made in an abrupt ledge of rock, which forms the bed of the river immediately at a point where the water is the deepest.

In 1853, the Board very wisely turned their attention to the examination of the water supply and its contamination; and by their order, Prof. Locke submitted one of the most comprehensive analytic reports, on water pollution, that had been made up to that time. The results were very gratifying, for he gave a favorable comparison with the celebrated Croton water, when he stated that the solid matter, in a gallon of Ohio water, exceeded the Croton water by only seventy-six thousandths of a grain.

SOLID MATTER IN U. S. STANDARD GALLONS.

	Carb. of Lime.	Total Solid Matter.
Schuylkill River.....	1.872	4.260
Croton River.....	2.131	6.66
Charles River.....	.161	1.668
Spot Pond.....	.3722	1.2468
Long Pond.....	.2380	1.222
Mystic Pond.....	.9894	34.7671
Ohio River, 12 miles below Big Sandy.....	.6260	4.0044
Ohio River at Cincinnati, Oct. 23, 1852.....	3.2615	6.7361
Little Miami River.....	5.0330	14.8265
Whitewater River.....	9.8769	15.2001
Big Miami, below junction of Mad River.....	8.3524	17.4064
Big Miami, above junction of Mad River.....	10.7907	18.1070
Mad River.....	12.3543	19.0644
Spring at the Brewery on Sycamore Hill.....	15.0007	35.0788

They also ordered him to make an examination of the effect the laboratory, adjoining the reservoir, had upon the water supply. He reported finding a number of pellets of soot that came from stack of this institution, which contained a large quantity of sulphuric acid, which was destructive to property and vegetation in the neighborhood ; but diluted with water, it had no effect on it.

In 1854, the Board awarded to D. Powell & Sons the contract for the construction of a duplicate of No. 4 power, for the sum of \$35,000. During the erection of the machinery, their foundry and the patterns of this engine were burned, which delayed the work, but Messrs. Harkness & Sons assisted the progress by loaning their patterns. The work was completed, and the engine started August 19, 1854.

The pump chambers and valves of Nos. 3, 4, and 5 powers are of similar plan, double acting in construction, with an upper and a lower chamber for each pump. The seat is a brass plate, with four square water ways, and set in the chamber, at an angle of 45 degrees. The valves are of brass and hinged to the seat by steel pins ; they have a free lift.

The Board succeeded in having an ordinance passed 16th February, 1860, assessing a tax of ten cents per front foot on all property abutting on streets in which mains were laid, for the more equitable adjustment of the water tax. The author of this ordinance was the then City Solicitor, now Ex-President R. B. Hayes.

In 1863 this ordinance was repealed, and in lieu of same, Council assumed the interest on the Water Works bonded indebtedness, which they continued to provide for (except on the issue of 1875) until December, 1878, when the obligation was transferred to the Water Works.

In May, 1860, the Board ordered the 20-inch line to be laid in Pearl street, which was the first pipe coated with coal tar by Dr. Smith's process.

#### SHIELD ENGINE NO. 6.

The plans for a 24-million pumping engine were submitted by George Shield to the Board, November 15th, and an estimate of cost, amounting to \$81,779.55, which were adopted, and patterns ordered to be made. On the 14th of February, the following bids for iron castings were opened :

Niles Works,	3 $\frac{3}{4}$ cents per pound.
Moore & Richardson,	4 $\frac{1}{4}$ " " "
David Griffey,	3 $\frac{3}{8}$ " " "

Condensing Engine

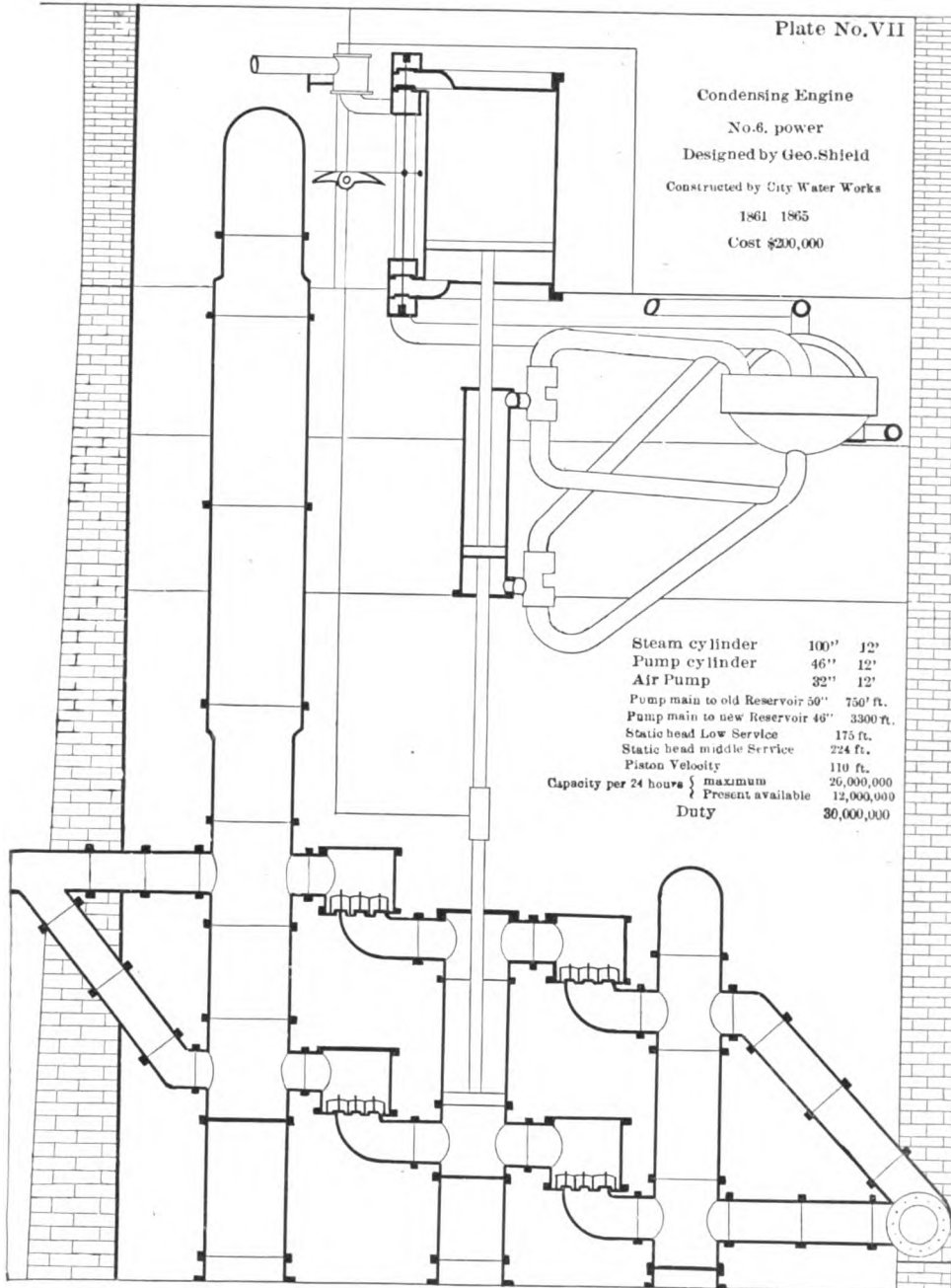
No. 6. power

Designed by Geo. Shield

Constructed by City Water Works

1861 1865

Cost \$200,000



Steam cylinder	100"	12'
Pump cylinder	46"	12'
Air Pump	32"	12'

Pump main to old Reservoir 50" 750' ft.

Pump main to new Reservoir 46" 3300 ft.

Static head Low Service 175 ft.

Static head middle Service 224 ft.

Piston Velocity 110 ft.

Capacity per 24 hours	}	maximum	26,000,000
		Present available	12,000,000
		Duty	30,000,000





And the contract awarded to Niles Works, with 5 per cent. off for cash.

The *improvements* consequent upon the construction of this pumping engine, and the cost of same to January 1, 1867, were :

For aqueduct and 60 wrought iron inlet pipe....	.....	\$28,743 58
“ new building.....	.....	106,351 37
“ new engine and pump.....	.....	110,230 39
“ ascending force main and viaduct.....	.....	66,492 67
“ stand pipe, tower and pipe.....	.....	46,002 56
“ auxiliary pumping engine.....	.....	2,605 60
“ street service and supply—8” Line.....	.....	408 80
Total.....	.....	<u>\$360,834 97</u>

In addition to the amount, the sum of \$50,117.96 was expended for the “ Wilson ” valves, boilers, and alterations.

The force main is made of  $\frac{3}{8}$ -inch boiler iron, 50 inches in diameter, and 632 feet in length ; 172 feet being laid in a tunnel or viaduct. The rivet holes are all counter-sunk, for the purpose having a smooth internal surface. The pipe is well coated with a metallic paint. The expansion and contraction was provided by three V-shaped flanged joints, riveted on the pipe and at the apex. The strain, was too severe, and they were taken out and cast-iron slip joint substituted. This pipe has burst no less than three times by the heavy impact of water, caused by improper filling of pump, and for the purpose of strengthening that part in the viaduct, 127 wrought-iron bands were applied, at a distance of 16 inches. The general plan of the engine and pump is shown in Plate No. VIII, but, as the castings are of an unusual size, the dimensions and weights of the principal parts may be interesting.

The steam cylinder is 100 inches in diameter, and 12 feet stroke, with 2-inch metal, and weighs 37,926 pounds. It was bored in the pit, in which it was cast.

The piston head weighs 12,366 pounds ; the first one was found fractured after a short period of service—probably due to the shrinkage of metal in casting.

The cylinder head weighs.....	.....	16,000 pounds.
Main pump, with $3\frac{1}{2}$ inch metal, weighs.....	.....	25,719 pounds.
Each chamber is $6\frac{1}{2}$ feet high, $6\frac{1}{2}$ feet in diameter, with $3\frac{1}{2}$ inch metal, and weighs.....	.....	25,654 pounds.
Two Y pipes, one weighing 30,000 and the other 35,448 pounds.....	.....	<u>65,448</u>
Four valve chamber caps.....	.....	38,640 pounds.
One cross pipe.....	.....	25,423 pounds.
Four pieces of air chambers, aggregating in weight.....	.....	<u>88,327 pounds.</u>

Total weight of castings, for engine and pump, was about 900 tons. The cross head is a solid wrought-iron forging, weighing 12,237 pounds. The total weight of moving parts of the engine and pump is 27 tons.

The Hosking treble beat Cornish valve, with maple-wood seats, was at first used, and to its action was attributed the failure of the pump, although the plan was a copy of the original valve. The beats were respectively 60, 50, and 32 inches in diameter, the height of valve 3 feet 10 inches, and lift  $4\frac{1}{2}$  inches. The weight of each valve was 2 tons.

In 1867, a new valve was substituted, consisting of a pyramid of four gum valves and cast-iron frame and seats. The seats contained an innumerable number of small water-ways, which prevented the proper filling of pump at moderate speeds. This valve was taken out in summer of 1874, and 7-16 inch puppet valves,  $2\frac{3}{4}$  lift, of iron disc, with gum plates, and a cast-iron seat, were applied to each chamber; since which date the pump has been operated, often, to its full capacity.

During last spring, under your orders, the pump forced the water over the top of the stand pipe for the first time, and during last July it delivered water into Eden Reservoir, under an additional head of 65 feet, through the new 46-inch pump main.

In 1865, Mr. J. P. Kirkwood made a thorough survey and investigation of the various sources for a new water supply, and adopted a pumping system, using the Ohio river as a source. The site selected was about two miles above the present pumping works, and the plan embraced two lifts, with subsiding and filtering reservoirs. The cost was placed at. \$3,038,214.07.

The plan was highly recommended by a majority of the Water Commissioners, but the minority report advocated retaining the pumping works, and the construction of additional reservoirs. The latter plan was adopted, and the Garden of Eden purchased for Reservoir and Park purposes on 6th January, 1866.

In 1867, a circumstance occurred, which demonstrated the effect of Miami canal eddy upon our water supply. On 11th of April, of this year, the "Henry Clay" Distillery, located at the corner of Kilgour and Pearl streets, was burned, and the wasted whisky found its way to the canal; thence into the river, and by the eddy was carried into the pump wells, and in consequence the people enjoyed an adulterated drink for a day or so. The evil was immediately remedied by the sinking of barges. And the stone aqueduct



Duplex Non Condensing Engines

No. 1 Power  
(Hunt Street Auxiliary Works)

Designed by A. G. Moore, Constructed by Niles Works 1869.

Cost. \$15,000.00

Steam Cylinder 18" x 5,

Pump Cylinder 13 1/2" x 5,

Piston Velocity 200 ft.

Capacity 4,000,000, gallons

Duty 60,000,000,

Pump main 2705 ft of 20 inch

Pump main 450 ft of 16 inch

Friction head 290 ft

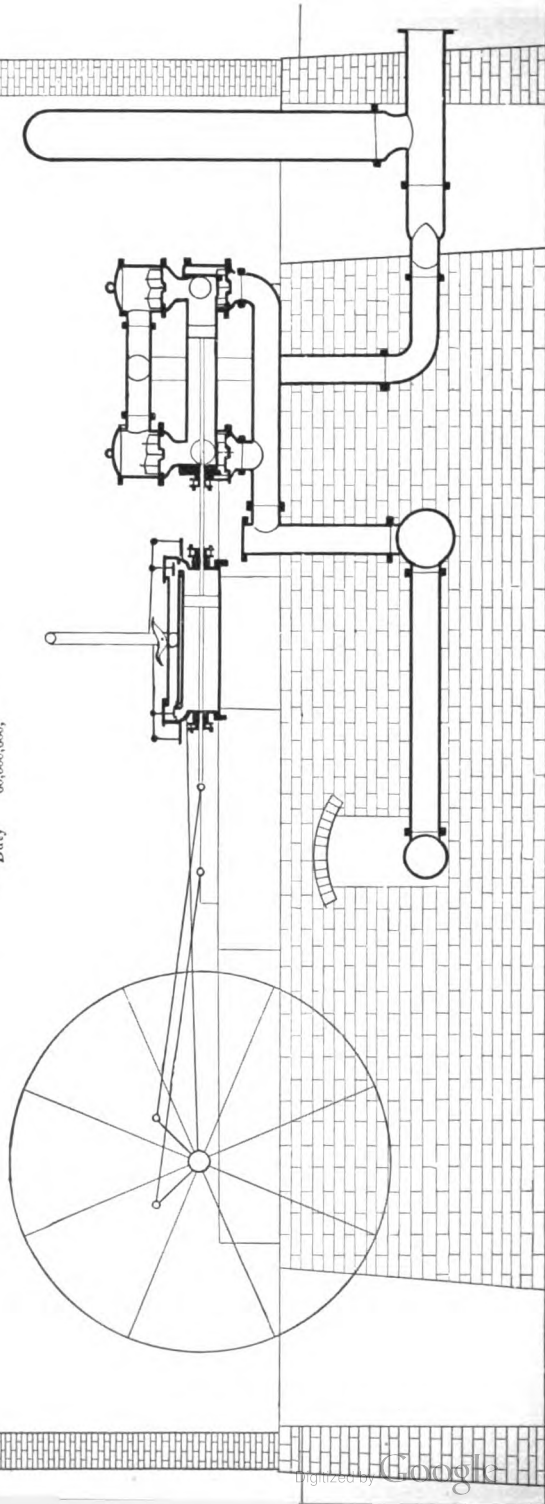
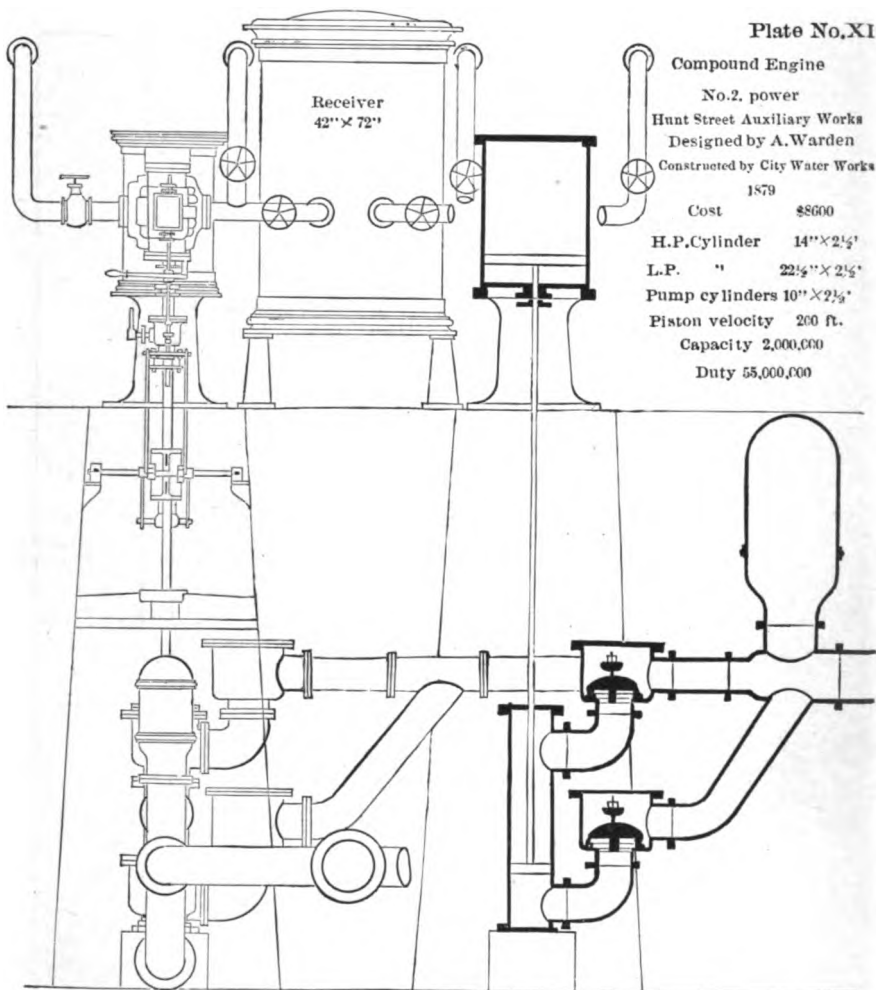


Plate No. XI



Compound Engine

No. 2. power  
 Hunt Street Auxiliary Works  
 Designed by A. Warden  
 Constructed by City Water Works

1879  
 Cost \$8600

H.P. Cylinder 14" x 2½'

L.P. " 22½" x 2½'

Pump cylinders 10" x 2½'

Piston velocity 200 ft.

Capacity 2,000,000

Duty 55,000,000



and 40-inch iron pipes were extended in 1872 into the channel of the river, and a new shore line established. During the progress of the latter work, Mr. Mallott was killed by the explosion of a portable boiler.

**HIGH SERVICE SUPPLY.**

In 1869, the auxiliary works were established for the supply of the hill-tops, having one pumping engine, 1½ millions of gallons capacity, and one iron tank. The consumption of water increased so rapidly that an additional tank was erected in 1871, and in 1874 the 9-inch pumps were replaced by 11-inch pumps, and the latter were taken out in 1879 and replaced by a set 13½ inches in diameter, with four 6-inch brass puppet valves, 2-inch lift, to each chamber, instead of single valve. An additional pumping engine was also constructed during this year. Each tank is 60 feet in diameter, and 38 feet high, and its bottom plates rest on a bed of sand. The weight and thickness of the plates are—

1st Ring.....	7 1/2"	thickness, weighing	17 1/2 lbs. per sq. ft.
2d Ring.....	7 1/2"	"	15 "
3d Ring.....	7 1/2"	"	12.5 "
4th Ring.....	7 1/2"	"	12 "
5th Ring.....	7 1/2"	"	11 "
6th Ring.....	7 1/2"	"	10 "
7th Ring.....	7 1/2"	"	9 "
8th Ring.....	7 1/2"	"	8 "
Bottom plate.....	7 1/2"	"	12 "

All plates are 50" by 140"; the joints are all lap-welded, the vertical one being double-riveted. Each ring has an angle-iron, stiffening ring. The cost of each tank was \$15,000.

**TEST OF ENGINES AND BOILERS.**

In August, 1872, Mr. Chas. Hermany, of Louisville, made a scientific test of all the pumping engines at the main works.

The results, when contrasted with the performance of other works, were not very flattering, but two facts should be considered, that materially affect the conclusions drawn. One is, that most of the engines had been in operation for a number of years; and the other, that at the time the engines were designed high duty was not considered so essential an object as at the present day.

The duties developed by the actual delivery of water were—

No. 3 Power.....	43,566,178 foot pounds.
No. 4 Power.....	37,789,990 foot pounds.
No. 5 Power.....	34,064,970 foot pounds.
No. 6 Power.....	23,580,687 foot pounds.



The capacities per 24 hours were found to be—

	Calculated Gallons.	Actual Gallons.	Percentage of Loss.
No. 3 .....	5,152,630	4,702,805	8.73
No. 4 .....	4,932,084	4,651,967	6.06
No. 5 .....	4,661,634	4,263,297	8.54
No. 6 .....	12,846,976		

The Engineer of the Water Works objected to imposing the additional lift of about 10 feet on the No. 6 Power, lest its main might burst, and thus endanger the water supply. The actual capacity of the No. 6 Power could not, therefore, be ascertained, as the delivery of water was directly into the distributing mains.

The power developed and the relative consumption of fuel were—

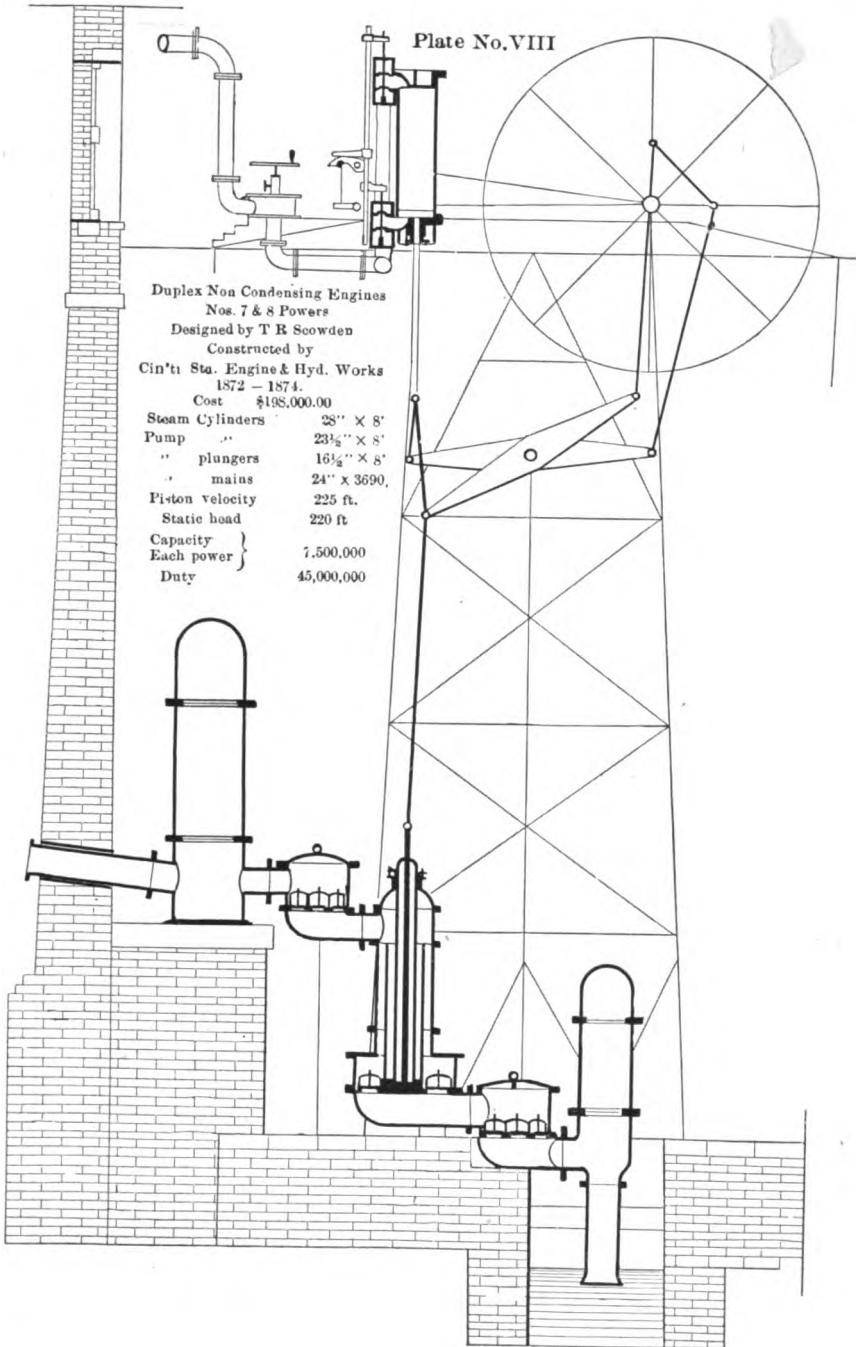
	Gross Indicated H. P.	Pounds of Coal per Hour.	
		Per Indicated H. P.	Per Actual H. P.
No. 3 .....	169.43	4.243	5.565
No. 4 .....	160.16	4.932	6.177
No. 5 .....	162.76	4.878	6.553
No. 6 .....	402.31	7.738	9.246

The cards taken by indicator showed—

	Boiler Pressure ..	Initial Pressure ..	Terminal Pressure ..	Back Press- ure at Mid- dle Stroke.	Vacuum ..	Average Pressure ..
No. 3, east cylinder, upper end .....	80	66.9	8.6	1.3	.....	33.79
No. 3, east cylinder, lower end .....	80	67	11.8	1	.....	36.715
No. 3, west cylinder, upper end .....	80	70.5	7	0.7	.....	29.945
No. 3, west cylinder, lower end .....	80	64.8	10	1	.....	31.65
No. 4, upper end .....	40	2	-8.2	.....	11.4	7.235
No. 4, lower end .....	40	24.5	-4	.....	11.25	18.895
No. 5, upper end .....	40	1.2	-7.5	.....	10.62	7.515
No. 5, lower end .....	40	23.2	-0.6	.....	11.5	22.565
No. 6, upper end .....	40	5.5	-0.2	.....	8.92	12.075
No. 6, lower end .....	40	18.3	10	.....	7.89	20.475

Duplex Non Condensing Engines  
 Nos. 7 & 8 Powers  
 Designed by T R Scoowden  
 Constructed by  
 Cin'tn Sta. Engine & Hyd. Works  
 1872 - 1874.  
 Cost \$198,000.00

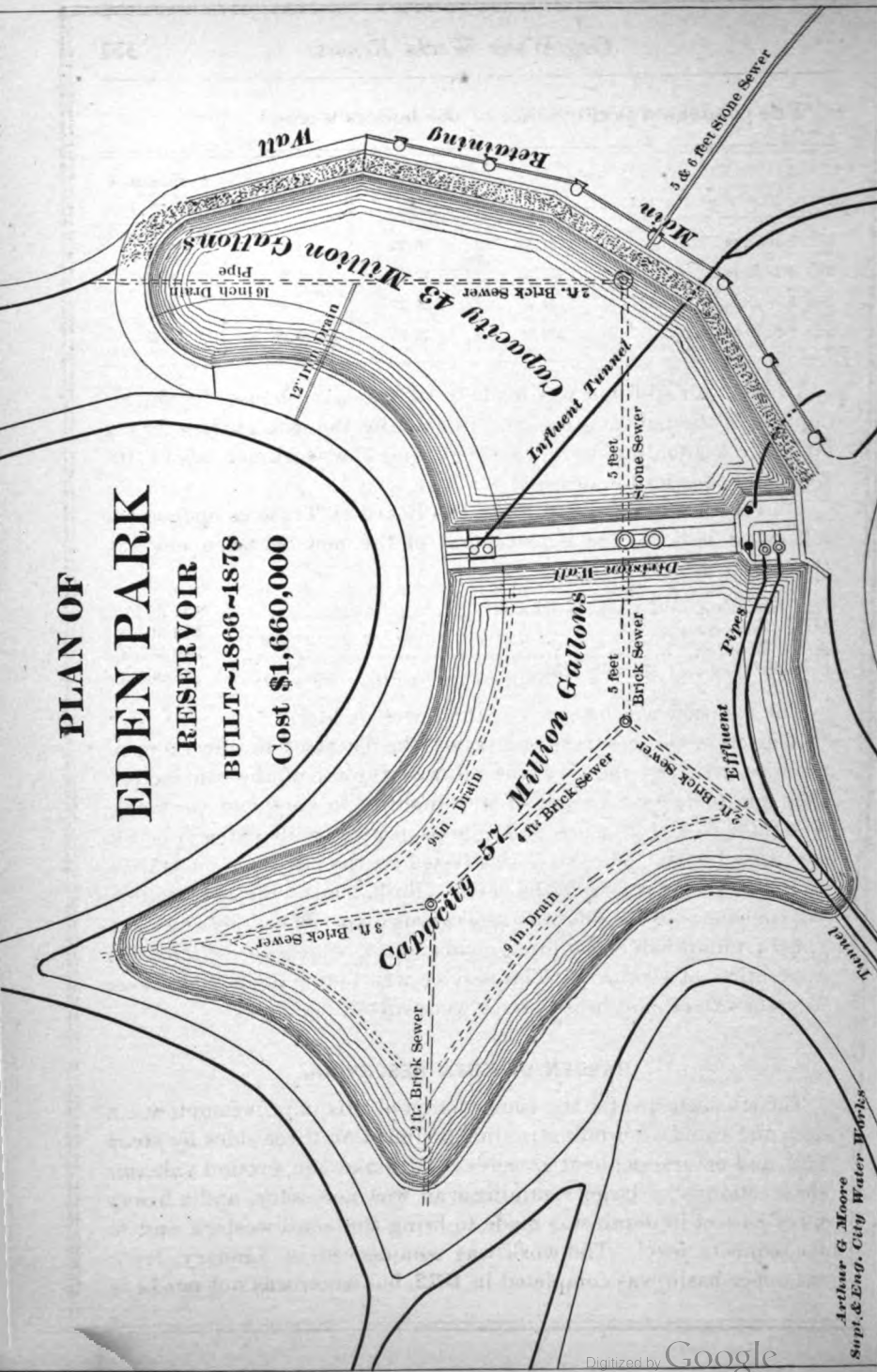
Steam Cylinders	28" x 8'
Pump	23½" x 8'
plungers	16½" x 8'
mains	24" x 3690,
Piston velocity	225 ft.
Static head	220 ft.
Capacity	} 7,500,000
Each power	
Duty	45,000,000







**PLAN OF  
EDEN PARK  
RESERVOIR  
BUILT ~1866-1878  
Cost \$1,660,000**



Arthur G. Moore  
Supt. & Eng. City Water Works

## The condensed performance of the boilers were—

	Grate Surface, Sq. Ft.	Pounds of Coal per Sq. Ft. of Grate, per Hour.	Percentage of Ashes.	Evaporation at 212°.
No. 3 boilers.....	44.05	16.23	4.78	8.51
No. 4 boilers.....	133.20	12.64	5.5	8.03
No. 5 boilers.....	64.43	20.37	4.43	8.58
No. 6 boilers.....	133.76	13.75	5.26	10.12

In 1872, an addition was made to the pumping-house, for the reception of the new engines, and in erecting the iron girders for the roof, the scaffolding broke, precipitating the workmen about 100 feet, and causing the death of six men.

On the 13th of January, 1872, the Board of Trustees opened the following bids for the construction of the new Scowden engines. (See Plate No. VIII.)

Cin. Sta. Eng. and Hyd. Works.....	\$97,575 50
Miles Greenwood.....	114,300 00
A. G. Moore.....	132,000 00
Cope & Maxwell Man'g Co.....	148,960 00

The contract was awarded to the lowest bidder.

A hitch in the contract compelled the Trustees to effect a compromise, whereby the city was allowed the use of the contractors' shop and tools for a period of five months, to complete the work. The total cost of engines and pumps proper, with extra bracing, was \$204,150.48. The No. 7 was tested on the 9th of October, 1874, and the No. 8 three months later. Both trials were satisfactory, but considerable trouble was afterwards experienced, by the clogging of pump valves by foreign substances, which necessitated the application of strainers. The service was found to be too severe for gum valves, and brass valves were substituted.

## GARDEN OF EDEN RESERVOIR.

The site, selected for the construction of this improvement, was a deep and rapid descending ravine, bounded on three sides by steep hills, and embraces about 13 acres. To make the ground valuable the erection of a large retaining wall was necessary, and a heavy fill of 84 feet in depth was made to bring the southwestern end to the requisite level. The work was commenced in January, 1866; the upper basin was completed in 1872, but water was not put in it,

owing to the non-completion of the pumping engines, until October, 1874; the lower basin was ready for service in the fall of 1878. The main retaining wall is a magnificent structure, and with its eight elliptical arches and Dayton stone trimmings, presents a bold and imposing appearance.

The wall is  $48\frac{1}{2}$  feet at the base and 120 feet in height. Its least width is  $18\frac{1}{2}$  feet, although on the top it is  $25\frac{1}{8}$  feet wide, which is designed for foot and wagon way. This increased breadth is made by the eight arches, each having a span of 55 feet and a rise of 18 feet. The extreme length of the wall is 1,251 feet, and contains about 76,000 perches of stone.

The Trustees undertook to do the masonry, but finding it too expensive, they concluded to have it done under contract, and in response to their proposal, received the following bids, September 26, 1873:

	Excavation, Per Cub. Yd.	Masonry, Per Perch.
Robert Davidson.....	35 cts.	\$10 80
Gilbert, Buente & Hutbrink.....	85 "	13 50
George N. Barger.....	50 "	7 90
J. B. H. Nolte.....	65 "	10 45
W. L. Kay.....	50 "	15 50
T. J. Peter.....	44 "	8 24

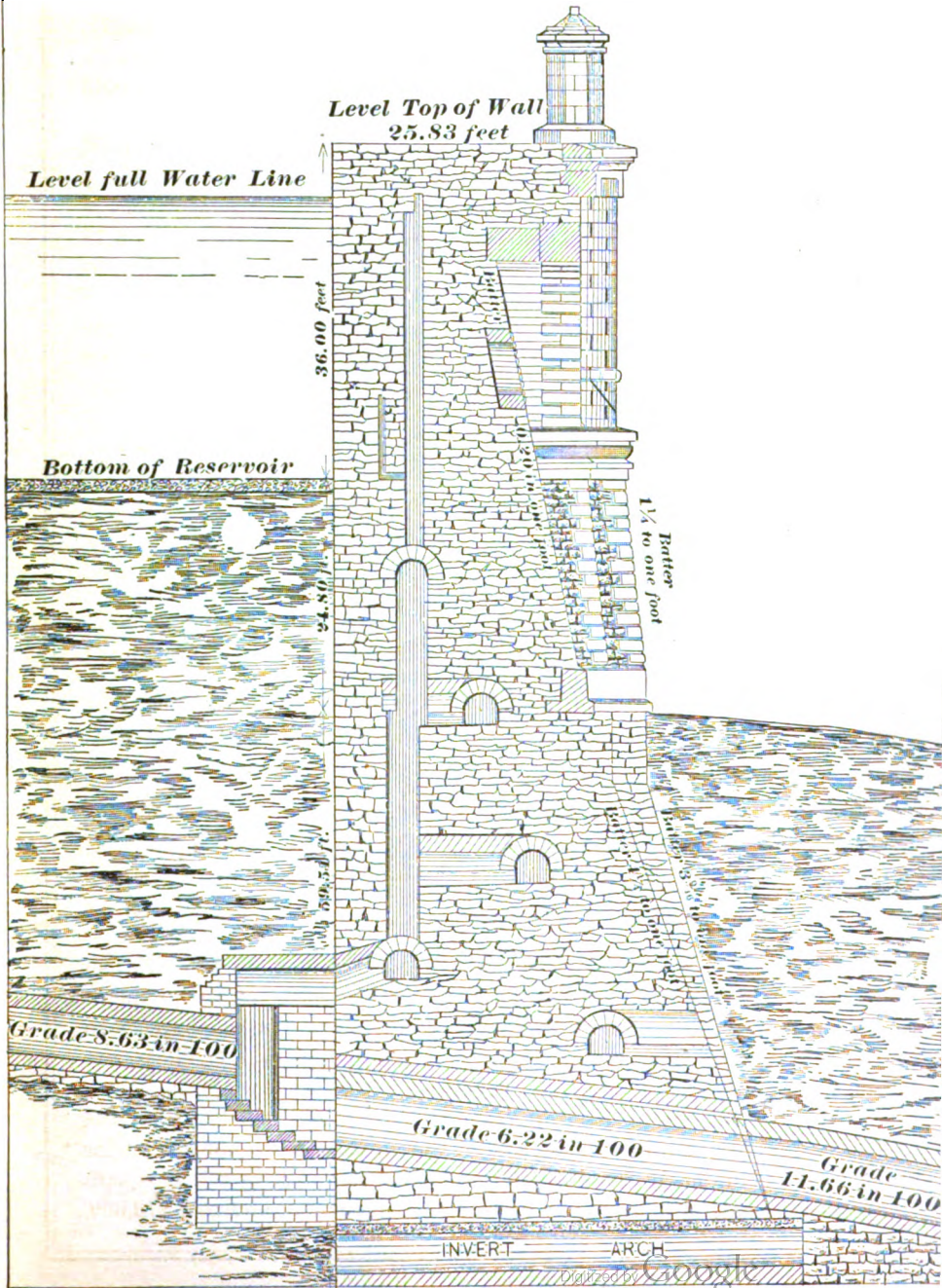
The cement was not included in the bids for masonry, as the Water Works agreed to furnish that material.

The contract was awarded to George Barger. His final estimate was accepted in September, 1876, and was as follows:

46431.68 perches of stone, at \$7.90 per perch.....	\$366,810 28	
29539.99 cubic yards of excavation, at 50 cents..	14,769 54	
Special work for Dayton stone, coping, gutters, etc.	35,059 89	
		\$414,639 71
Amount refunded, less for stone used and tools bought.....		1,932 89
Total cost of "Barger" contract.....		\$412,706 82

The division wall is 30 feet at the base, 10 feet on top,  $67\frac{1}{2}$  feet high, and 307 feet in length, between the influent and effluent chambers. The effluent chamber is made in a pentagon shape, with two apartments, one of them being a "dry well." There are oval water ways controlled by valves. There are two 35-inch iron distributing mains leading from this chamber, which lay on the bottom of the upper basin, and at the northwestern end they enter a brick tunnel 12 feet diameter and 1,100 feet in length. This tunnel is made of four courses of brick set in cement, and cost \$73,000.

# SECTION OF MAIN RETAINING WALL Garden of Eden Reservoir.



Arthur G Moore.

Scale 20 feet per inch





The slopes of the upper basin are two to one, puddled with blue clay and embedded with concrete. The bottom is also concreted. As stated in another part of this article, the upper basin was finished nearly two years before being put in active service; during this interim the concrete was subjected to the effects of the changing weather, and when water was introduced, to the height of 15 feet, a large leak was discovered, due to the damaged concrete and broken drains. To effect a remedy, the two-foot brick sewers were plugged up, and the water finding no outlet, the deposit soon made an impervious bottom. Profiting by the experience, the concreting for the lower basin was done in the most substantial manner. The slope of this basin is two to one, and is paved with dressed stone set on ends, and the interstices afterwards grouted with cement.

The concrete consists of one part of the best brand of Louisville cement, to one part of clean sharp river sand, one and one-half parts of clean river gravel, and two and one-half parts of screened and broken limestone. These parts were mixed in wagons, prepared especially for this work, which conveyed, by rail, the concrete to the proper place. The concrete was laid in layers of 6 inches where the thickness exceeded this figure. On the filled portion of this basin the depth of concrete is 18 inches. The cost per cubic yard, including the preparation of tools, was \$4.39, and for the paving of slope \$6.10 per perch.

Last fall the water was drawn from the upper basin for the purpose of removing the deposit that had accumulated during six years of its use, but the depth was found to average not over 15 inches.

#### **MARKLEY FARM.**

In 1872 the city purchased a site from John Markley, ten miles above the city, for a new Water Works. The property embraces 146 acres, for which the sum of \$22,321.50 was paid.

Mr. T. R. Scowden submitted plans and estimates for the new works to be located on these grounds, which embraced a pumping system with two lifts, subsiding and distributing reservoirs, and two 42-inch delivery mains, the whole to cost four and one-half millions of dollars.

#### **WESTERN HILL SUPPLY.**

On February 25, 1879, the Board of Public Works awarded to Stacey & Co., of this city, the contract for the erection of a steel

tank, (designed by J. E. Bell,) 48 feet in height and 100 feet in diameter, for the sum of \$25,275. The size and weights of the sheets are:

	Thickness.	Length.	Width.	Weight pr. sq. ft.
1st ring.....	$\frac{5}{16}$ inches.	12.395 feet.	4.197 feet.	25.17 lbs.
2d ring.....	$\frac{1}{8}$ "	12.384 "	4.197 "	22.50 "
3d ring.....	$\frac{1}{8}$ "	12.345 "	4.187 "	20.14 "
4th ring.....	$\frac{1}{8}$ "	12.337 "	4.156 "	17.62 "
5th ring.....	$\frac{1}{8}$ "	12.309 "	4.156 "	15.10 "
6th ring.....	$\frac{1}{8}$ "	12.303 "	4.125 "	15.10 "
7th ring.....	$\frac{1}{8}$ "	12.168 "	4.125 "	12.58 "
8th ring.....	$\frac{1}{8}$ "	12.158 "	4.104 "	10.07 "
9th ring.....	$\frac{1}{8}$ "	12.158 "	4.104 "	10.07 "
10th ring.....	$\frac{1}{8}$ "	12.158 "	4.104 "	10.07 "
11th ring.....	$\frac{1}{8}$ "	12.158 "	4.104 "	10.07 "
12th ring.....	$\frac{1}{8}$ "	12.158 "	4.104 "	10.07 "
Bottom plates...	$\frac{1}{8}$ "	.....	.....	15.10 "

The specifications required the tensile strength to be 65,000 pounds per square inch, but the test of the plates gave an average strength of 75,000 pounds; its elastic limit averaged 45,000 pounds, and the reduction in area of 32 to 47 per cent. The vertical joints are butt ends and double riveted on each side of seam.

The works are still in course of construction. The pumps will have a head of 440 feet (less 104 feet on the receiving side, due to the Eden Reservoir head) to overcome in the delivery of water.

#### DISTRIBUTION OF WATER.

Owing to the irregular topography of Cincinnati, the water supply is a difficult and troublesome subject, but this is partially compensated by the division of supply in relation to the elevation. In November, 1877, the middle or Eden service was permanently established, and the subdivisions now are—

*Low service.*—Supplied by Third street Reservoir, 172 feet above low water mark, with two 20-inch mains.

*Middle Service.*—Supplied by Eden Park Reservoir, 233 feet above low water mark, with two 36-inch mains.

*High service.*—Supplied by Mt. Auburn Tanks, 492 feet above low water mark, with two 16-inch mains.

The pressures from fire plugs in the various parts of the city, and the relative heights and distances, are as follows:

Table of Pressures.

LOCATION.	Size of main in inches.	Service.	Elevation in feet at low water.	Distance in miles from reservoir.	Pressure.
Fourth and Elm.....	20	Middle.	120	1.4	40 to 44
Bank alley and Third st.....	3	"	146	1.01	60
Pearl and Walnut.....	20	Low.	103	.71	33 to 35
Public Landing and Sycamore st.....	10	"	112	.72	35 to 40
Front between Mill and Ramsey.....	20	"	.....	1.74	37
Eighth and Main.....	20	Middle.	112	.96	45
City Buildings.....	35	"	113	1.04	47
Sixth and Mound.....	8	"	.....	1.7	41
Fourth st. between Smith and Park.....	4	"	132	2.5	45
Wood st. between Fourth and Fifth.....	4	"	174	1.05	50 to 55
Freeman and George.....	20	Low.	.....	1.9	33
Elm and Water.....	10	"	115	1.16	35 to 43
Lower River Road—Boal face creek.....	6	Middle.	150	4.23	61
Lower River Road—Boal face creek.....	6	Low.	87	.....	28
Lower River Road—Gaff's Distillery.....	8	"	.....	2.5	31
Lick-run and Harrison avenue.....	6	Middle.	167	3.4	62
Lick-run, at last fire plug.....	6	"	.....	.....	52
Spring Grove ave., bet. Straight and Addison.....	6	"	159	2.5	65
Old Brighton House.....	10	"	158	2.07	48
Front and Washington.....	10	Low.	97	.5	37
Eastern avenue and Kemper lane.....	10	"	92	.85	37
Eastern avenue, at No. 11 Engine House.....	10	"	96	1.6	35
Eastern avenue, at No. 18 Engine House.....	10	"	101	3.5	34
Eastern avenue and Willow st.....	10	"	.....	3.9	30
End 6-inch line Forrest avenue.....	6	High.	.....	2.66	115
Woodburn and Madison pike.....	6	"	.....	1.66	48
Gilbert avenue, north of Chapel.....	10	"	99	1.13	40
Garden of Eden, below "Shelter House".....	10	"	.....	1.08	60
Mt. Adams, at Engine House.....	8	"	.....	1.5	48
Mt. Adams, at highest point.....	4	"	.....	1.5	41
Fifth and Eggleston avenue.....	6	Middle.	.....	.7	59
Main and Mulberry.....	6	High.	304	.85	110 to 115
Sycamore and Boal.....	6	"	.....	1.9	118
Sycamore and Liberty.....	6	Middle.	94	.8	38

Table of Pressures—Continued.

LOCATION.	Size of main in inches.	Service.	Elevation be- low Reser- voir . . . . .	Distance in miles from Reservoir.	Pressure.
Vine st., north of McMicken ave. . . . .	4	"	86	1.4	40
Clifton avenue and Vine st. . . . .	6	High.	347	.8	139
Northwest corner Clifton ave. and Vine st. . . . .	4	Middle.	.....	1.25	30 to 35
Mulberry and Rice. . . . .	6	High.	267	.72	95
Ohio avenue and Parker st. . . . .	4	"	.....	.5	26
Clifton avenue—highest point. . . . .	6	"	59	.....	15
Calhoun and Clifton avenue. . . . .	10	"	.....	.57	17
Ludlow avenue—end of pipe. . . . .	10	"	.....	1.0	78
Carthage pike and Ludlow avenue. . . . .	10	"	.....	.76	65
Washington avenue and Hammond st. . . . .	10	"	93	.32	35
Mt. Auburn Tanks. . . . .	6	"	79	.....	18
Auburn st. and Evans—highest point. . . . .	6	"	28	.12	10
Highland avenue—near Widows' Home. . . . .	4	"	99	.47	45
Reading road and Oak st. . . . .	4	"	.....	.6	35
Gest and Evans. . . . .	10	Low.	110	2.72	35
Eighth st. and State ave. . . . .	10	Middle.	129	3.0	46
Eighth st. and State ave. . . . .	20	Low.	68	3.65	20

### WATER PIPES.

The first iron pipe was laid in 1824, from engine house to Reservoir. In 1839, there were  $4\frac{1}{4}$  miles of iron pipe in use, and in 1847 the wooden pipes were entirely abandoned. The first pipe coated with coal-tar, for protection of iron, was the 20-inch main, laid in Pearl street, in 1860. Previous to this time the exterior only was whitewashed.

In 1862, the smaller pipes were first cast on ends, which gave a more uniform thickness of metal than the old way of making them in horizontal molds. The testing of pipe, under hydrostatic head, was introduced in 1863, on the 20-inch main for Hamilton Road.

Under the present management, the pipes are not only tested, under a pressure of 300 pounds, but a sample of the iron, used in each order for pipe, is subjected to a tensile test, as well as the noting of the mixture of metals. The pipes are also weighed by the Inspector, and only one per cent. allowed over the specified weights.

In crossing Mill creek with the Eighth street 20-inch line, a new ball and socket and expansion joint, with leather cup packing, was used from a plan of late Superintendent, Jas. E. Bell.

Total weight of the 188 miles of pipe in use is over 30,000 tons.

In order to ascertain the effect the water has upon the old uncoated pipes, the accretions of matter, taken from one of the pipes, was given to Prof. Warder, for analysis, with the following results:

CINCINNATI, O., April 16, 1881.

Mr. A. G. Moore, Superintendent Cincinnati Water Works:

DEAR SIR—The deposit from water mains submitted to me for examination has been carefully analyzed, with the following results:

The substance has an earthy appearance, deeply colored with iron rust, and it contains scaly masses, which evidently became detached from the surface of the water pipes.

The analysis indicated the following composition:

	Percentage of Original Substance.	Percentage of Substance Dried at 100° C.
Moisture expelled at 100° centigrade.....	12.6	.....
Loss by ignition, including combined water and organic matter.....	9.3	10.7
Sesquioxide of iron.....	50.2	57.4
Alumina (soluble in hydrochloric acid)...	1.4	1.6
Sand and clay (insoluble in hydrochloric acid).....	27.0	30.8
Sulphate of lime.....	trace.	trace.
Carbonate of lime.....	trace.	trace.
Chloride of sodium.....	slight trace.	slight trace.
Ammonia.....	slight trace.	slight trace.
Total.....	100.5	100.5

The deposit is thus seen to consist essentially of hydrated sesquioxide of iron, mixed with considerable river mud. The former substance, as well known, is only partially dehydrated at 100° C., and the greater part of the loss on heating, both above and below this temperature, must be regarded as water of hydration.

The oxide of iron found corresponds to 35.1 per cent. of metallic iron in the original substance, thus indicating an active corrosion of the pipes, by which they are gradually weakened until they are liable to burst by the pressure of the water. This action proceeds, as I am told, in spite of the coating of coal tar with which all new mains are now protected. The practical questions relating to the cause of this corrosion, and the most

economical method of preventing it, would require a much fuller investigation for their solution than it was possible to make in the time placed at my disposal. The salts—usually found dissolved in normal drinking water occur in this deposit also, but only in very small amounts. The river mud and the iron rust appear to act, in part, as a filter, in retaining a small amount of organic matter—probably not more than one per cent. of the whole deposit. This carbonaceous matter is slightly soluble in warm water; it resembles decaying vegetation, in yielding a dark colored solution with caustic soda; but it may have been derived, at least in part, from the coating on the pipes. I have also begun the study of its deportment with oxide of iron.

The oxygen and carbonic acid dissolved in the water are far more likely to be the cause of the injury than any of the substances found in the deposit; and though each barrel of water would contain but a small amount of these gases, yet the aggregate quantity flowing through each year is sufficient to produce much rust in iron pipes.

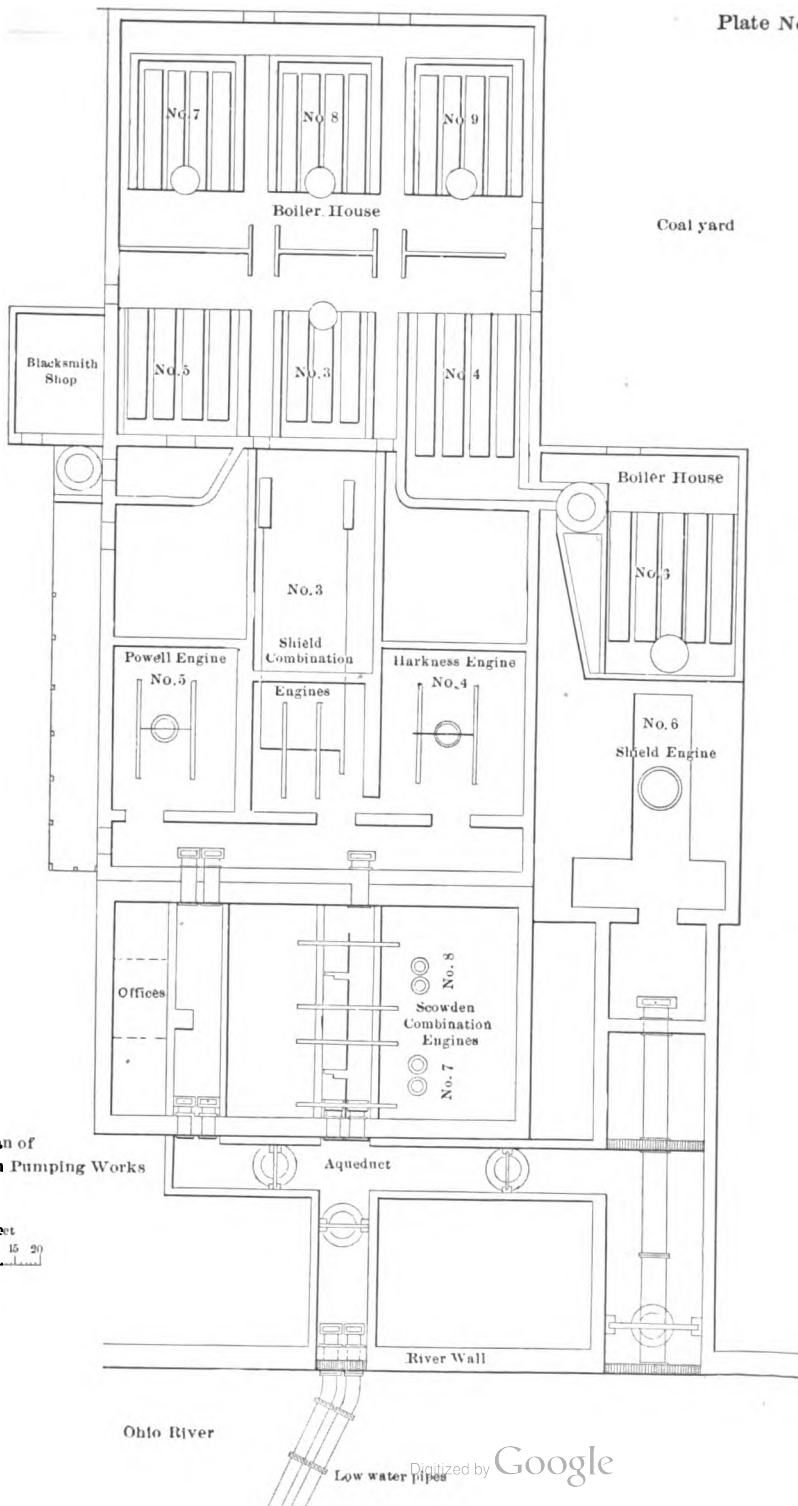
To remove the dissolved gases or salts from our water supply is out of the question. I would therefore recommend that special inquiry be directed to the means of protection, including the materials used for coating the pipes and the mode of application. Information may also be gained from other cities where similar water is used; and, finally, it may be necessary to institute a special series of laboratory experiments to ascertain the materials and processes best adapted to afford the protection desired.

It may also be stated that the material examined resembles limonite, which is a valuable iron ore, where found in sufficient quantity. When ground and roasted, this material would make a useful red paint.

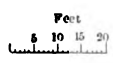
Respectfully submitted by

R. B. WARDER.

Our experience has demonstrated the fact that the greatest deterioration in the uncoated pipes is on its upper internal side, because the bottom is protected by the deposit from the water; but what that loss is would be difficult to say, owing to the irregular thickness of pipes, due to the method of casting them in those days. The pipe, from which this mud and oxide were taken, had been in use about 35 years, and its least thickness was  $\frac{3}{8}$  of an inch. Presuming it was half an inch originally, the loss, in 35 years, would be  $\frac{1}{4}$  of an inch.



Plan of Present Main Pumping Works









## Ordinances Relating to the Cincinnati Water Works—Continued.

FOR WHAT PURPOSE.	Date of Passage.
Making Engineer of Water Works an appointment of Council .....	March 28, 1845.
To provide for a Board of Three Trustees, appointed by Council .....	April 11, 1846.
Repealing above, and making a Board of Directors from Council as managers.....	May 6, 1846.
Making the office of Superintendent, with same salary as Engineer.....	June 5, 1845.
Act of Legislature to provide for a Board of Trustees, to be elected by the people.....	Feb. 3, 1847.
Authorizing loan of \$200,000 for Water Works purposes...	Feb. 11, 1847.
Approving the By-laws of the Board of Trustees.....	June 16, 1847.
Authorizing loan of \$100,000 for Water Works purposes...	April 6, 1849.
Authorizing loan of \$100,000 for Water Works purposes...	April 24, 1850.
Authorizing loan of \$100,000 for Water Works purposes...	May 9, 1851.
Authorizing loan of \$75,000 for Water Works purposes...	March 30, 1853.
Establishing new rules for Water Department.....	Dec. 13, 1854.
Making the Water Works provide for interest on its bonds.....	Feb. 21, 1855.
To transfer \$20,000 from General Fund to Water Works account, to be returned in six months.....	May 28, 1856.
Protection of river front within 1,000 feet of pump-house against deposit of filth, etc.....	Jan. 12, 1859.
To assess special tax of ten cents per front foot on property abutting on streets having water mains.....	Feb. 15, 1860.
To repeal above Ordinance of assessment.....	May 16, 1862.
Regulating the placing of watering-troughs.....	July 20, 1866.
Making it lawful to kill birds that injure the trees and shrubbery of the Water Works grounds.....	March 27, 1868.
Authorizing the loan of \$150,000.....	Aug. 7, 1868.
Authorizing the loan of \$150,000.....	June 11, 1869.
Authorizing the loan of \$150,000.....	July 14, 1871.
Authorizing the loan of \$300,000.....	Sept. 6, 1872.
Authorizing the loan of \$300,000.....	Oct. 29, 1875.
Act creating the Board of Public Works.....	March 17, 1876.
Act giving Board of Public Works control of Water Works Fund, and to provide therefrom the interest on their bonds.....	May 2, 1877.
Ordinance to lease "Consedine Place," Western Hill, for Reservoir purposes.....	Nov. 9, 1877.
Act establishing Board of City Commissioners, and abolishing Board of Public Works.....	May 14, 1879.
Act replacing the Board of Public Works in power.....	March 3, 1880.

**BOARD OF DIRECTORS**

*Appointed by Council for the management of Water Works from 1839 to 1847.*

**1839.**

Edward Woodruff, Pres...5th Ward.  
 A. H. Ewing.....1st Ward.  
 E. Herman.....2d Ward.  
 Jonah Martin .....3d Ward.  
 D. Griffin .....4th Ward.  
 N. S. Hubbell .....6th Ward.  
 O. Lovel.....7th Ward.  
 S. W. Davies .....Engineer.  
 J. Evelett .....Secretary.

**1840.**

Edward Woodruff, Pres...5th Ward.  
 A. H. Ewing.....1st Ward.  
 M. Brooks .....2d Ward.  
 S. Hazen .....3d Ward.  
 D. Griffin .....4th Ward.  
 D. Carroll .....6th Ward.  
 O. Lovel.....7th Ward.  
 S. W. Davies.....Engineer.  
 J. F. Irwin.....Secretary.

**1841.**

Edward Woodruff, Pres...5th Ward.  
 A. Cullam .....1st Ward.  
 Samuel Trevor .....2d Ward.  
 J. Martin .....3d Ward.  
 D. Griffin .....4th Ward.  
 D. E. Strong.....6th Ward.  
 W. Vanhorne .....7th Ward.  
 S. W. Davies .....Engineer.  
 John F. Keys .....Secretary.

**1842.**

Edward Inskip.....1st Ward.  
 Samuel Trevor .....2d Ward.  
 H. Brackman.....3d Ward.  
 William Bromwell.....4th Ward.  
 M. R. Taylor .....5th Ward.  
 D. E. Strong.....6th Ward.  
 R. M. Hawkins .....7th Ward.  
 H. L. Tatem .....Engineer.  
 John F. Keys.....Secretary.

**1843.**

Tim Walker .....1st Ward.  
 T. T. Smith.....2d Ward.  
 J. A. Butterfield.....3d Ward.  
 A. Higbee .....4th Ward.  
 M. A. Taylor.....5th Ward.  
 D. E. Strong.....6th Ward.  
 R. C. Phillips .....7th Ward.  
 E. E. Roll .....8th Ward.  
 H. L. Tatem .....Engineer.  
 J. F. Keys.....Secretary.

**1844.**

Joseph Smith.....1st Ward.  
 J. G. Rust .....2d Ward.  
 S. Hazen .....3d Ward.  
 A. Higbee .....4th Ward.  
 D. T. Snelbaker .....5th Ward.  
 A. Webb .....6th Ward.  
 L. E. Brewster.....7th Ward.  
 A. Sawyer.....8th Ward.  
 A. Moore .....9th Ward.  
 H. L. Tatem .....Engineer.  
 J. F. Keys.....Secretary.

## 1845.

C. S. Burdsal.....1st Ward.  
 — Stephenson.....2d Ward.  
 D. H. Morton .. .....3d Ward.  
 D. F. Meader .....4th Ward.  
 J. B. Clark .....5th Ward.  
 D. E. Strong.....6th Ward.  
 L. E. Brewster.....7th Ward.  
 Jacob Rockenfield .....8th Ward.  
 M. H. Cook .....9th Ward.  
 H. L. Tatem..... Engineer.  
 J. F. Keys.....Secretary.

## 1846.

(Appointed under ordinance May 6)  
 J. G. Rust.....President of Council.  
 N. W. Thomas .....Recorder.  
 Griffin Taylor...Member of Council.  
 A. Sawyer .....Member of Council.  
 D. F. Meader...Member of Council.  
 T. R. Scowden .....Engineer.  
 J. F. Keys.....Secretary.

## TRUSTEES AND OFFICERS OF CITY WATER WORKS, 1847 TO 1880.

## TRUSTEES.

1847. Griffin Taylor.....1850.	1860. Charles Rule .....1863.
1847. James C. Hall .....1852.	1861. M. Eckert.....1864.
1847. N. W. Thomas .....1852.	1862. Joseph Torrence .....1865.
1850. William McCammon .....1853.	1863. David T. Woodrow .....1866.
1852. S. B. McLean .....1855.	1864. Henry Kessler.....1870.
1852. S. J. Kellogg .....1853.	1865. Henry Pearce.....1874.
1853. H. Clearwater.....1856.	1866. Isaac Greenwald .....1869.
1853. George Crawford .....1854.	1869. John Simpkinson .....1872.
1854. J. H. Gerard .....1857.	1870. Chris. Moerlein .....1873.
1855. C. W. West .....1858.	1872. G. W. C. Johnston.....1875.
1856. A. Buchanan .....1859.	1873. Paul Reinlein.....1874.
1857. John Schiff.....1860.	1874. Henry P. Bowman .....1876.
1858. George Keck.....1861.	1874. B. Dannenhold .....1876.
1859. B. T. Stone .....1862.	1875. Charles Hilb.....1876.

## SUPERINTENDENTS.

1847. E. Hinman .....1852.	1865. J. P. Mayer * .....1870.
1852. Lewis Warden.....1854.	1870. Henry Earnshaw .....1874.
1854. James Cooper.....1857.	1874. G. Brashears .....1875.
1857. Lewis Warden.....1857.	1875. William Kirton .....1878.
1857. S. W. Irwin .....1859.	1878. James E. Bell * .....1879.
1859. R. C. Phillips .....1861.	1879. Americus Warden †.....1880.
1861. John Earnshaw.....1863.	1880. A. G. Moore †.....
1863. Thomas J. Weaver .....1865.	

\* Died while in office.

† Superintendent and Engineer.

SECRETARIES.

1847. John F. Keys.....	1850.	1870. A. Torrence.....	1873.
1850. J. R. Baldrige .....	1853.	1873. Thomas E. Snelbaker.....	1875.
1853. John P. Slough .....	1856.	1875. J. H. Grueter.....	1880.
1856. J. M. Hanson .....	1865.	1880. R. E. Zeidler.....	
1865. E. B. Townsend.....	1870.		

ENGINEERS.

1847. R. T. Scowden.....	1853.	1867. John Richardson .....	1873.
1853. Lewis Warden.....	1857.	1873. R. T. Scowden.....	1874.
1857. Americus Warden.....	1859.	1874. Americus Warden.....	1879.
1859. George Shield .....	1867.		

BOARD OF PUBLIC WORKS.

[Elected by people April, 1876. Abolished by Legislature May 14, 1879.]

John E. Bell, President .....	Term expired 1881.
Jacob Gessert .....	Term expired 1880.
C. B. Foote .....	Term expired 1879.
Ed. C. Boyce.....	Elected 1879.
David Baker.....	Term expired 1878. Re-elected for five years.
John D. Caldwell.....	Term expired 1877. Re-elected for five years.

BOARD OF CITY COMMISSIONERS.

[Appointed by Judge of Police Court, by Act of May 14, 1879. Abolished by Legislature March 3, 1880.]

Nat. Caldwell, President,	G. K. Duckworth,
C. W. Rowland,	Lewis Weitzel.
S. Wolfstein,	