ANNUAL REPORT

OF THE

Newark Aqueduct Board

FOR THE

YEAR ENDING NOV. 30TH, 1881.

INGALLS & CO., PRINTERS AND STATIONERS, 761 BROAD ST., NEWARK, N. J.

ANNUAL REPORT

—OF THE—

Newark Aqueduct Board,

NEWARK, NEW JERSEY,

FOR THE YEAR ENDING, NOVEMBER 30TH, 1881.

Officers and Members.

HENRY LANG, Mayor,
President.

FRANK W. MEEKER, *Secretary.*

GEORGE R. GRAY, *Superintendent.*

COMMISSIONERS.

ELECTED BY THE PEOPLE.

GEORGE D. RANDELL, JAMES L. GURNEY,	Terms expire with 1882.
THOMAS HARLAN, FREDERICK HELLER,	Terms expire with 1883.
*LOTT SOUTHARD, M. D., *JAMES R. SMITH,	Terms expire with 1884.

*Re-elected.

NEWARK, N. J.:
INGALLS & CO., STATIONERS AND PRINTERS, 761 BROAD STREET, NEWARK, N. J.
1882.

OFFICE OF THE NEWARK AQUEDUCT BOARD,
JANUARY 4th, 1881.

The accompanying report was this day submitted, accepted, ordered printed, and sent to the Common Council as the Report of the Board for the year ending November 30, 1881.

F. W. MEEKER,

Secretary.

SUPERINTENDENT'S REPORT.

To the Newark Aqueduct Board:

GENTLEMEN—As required by the By-Laws, I hereby submit report of the condition and operation of the Works for the year ending November 30th, 1881:

The whole quantity of water pumped at Belleville for the past year is 3,609,332,980 gallons. The highest daily average was 11,154,368 gallons in August; the lowest, 9,120,728 gallons in March. The daily average for the year was 9,888,583 gallons, an increase of 693,257 gallons over last year. Amount of coal consumed, 4,522 tons. The total amount of water pumped at the High Service Station is 879,420,572 gallons; greatest daily average, in August, 2,919,625 gallons; lowest, in April, 2,011,033 gallons; daily average for the year, 2,409,371 gallons, an increase over last year of 204,362 gallons. Coal consumed, 2,218,104 pounds. The cost for delivering water into the Receiving Reservoir at Belleville was \$9.04¾ per million gallons, and of delivery on the upper level by the High Service engine \$11.16$\frac{31}{100}$ per million gallons.

BELLEVILLE PUMPING STATION.

The engines and boilers at Belleville are in good order, with the exception of the pistons in Nos. 1 and 2—they need to be refitted; the boilers are all in good order; the feed pumps have had new plungers put in the last year and are in good order. The Newark Filtering Company have put up in the boiler room at Belleville one of their Filters, for the purpose of filtering the water used in the boilers; but it has not been in operation long enough for me to

give an opinion as to what it will accomplish in preventing the formation of scale. (The Filtering Company have placed this filter up at their own expense for a six months' trial.)

The repairs have been made by the regular employes, with two exceptions—one a piston for No. 3 pump, and the other a stuffing box-head for No. 1 pump.

HIGH SERVICE PUMPING STATION.

The new pump for this Station, built by Mr. H. R. Worthington, of five million gallon capacity, was completed and passed over to the Board Nov. 11th. Mr. D. H. Chase, the Chief Engineer, reports it as running very satisfactorily, and will perform the work the contract calls for, viz: "To deliver five million gallons in twenty-four hours into the High Service Reservoir, when running at a piston speed not exceeding one hundred and ten feet per minute."

That this pump was not procured any too soon is shown by the number of complaints made during the Summer months from water takers on the High Service Level of their not being able to get water on the second and third floors. The pressure on this level is maintained by pumping against a weighted valve, which correspondingly increases the pressure in the distributing mains. This causes a great strain upon the system, and subjects the mains to a duty for which they were not originally intended. It is, however, the only way the highest parts of this level can be supplied until a stand pipe is erected.

The great increase in the use of water reduced this pressure to such an extent as to cause great annoyance. I am happy to state that since we have started the new five million pump we have no further complaints—on the contrary, those who were most affected say they now get all the water they need.

The High Service Pump, No. 1, at Chatham street, has been in constant use since April, 1876, and needs a thorough overhauling. It was run at times beyond its nominal capacity, and during the Summer and Fall it was necessary to run it such a number of hours each day as to interfere with the repairs necessary to preserve it in proper condition.

PUMP MAIN, No. 2.

A recommendation was made in the last Annual Report that a new pump main be laid from the Engine House at Belleville to the Receiving Reservoir. The Board acted upon the recommendation early in the year, and the contract was awarded to Messrs. Shanley & Smith. It was not completed until November 19th, owing to the inability of the Warren Foundry, of Phillipsburgh, to furnish the pipes fast as needed.

I have thought it best to make the location of the various castings a matter of convenient record by including it in the report. The following is a detailed description of the work:

At the pump house the old connection of pump No. 3, with pump main No. 1, was taken out, and the connecting Y branch was plugged. Pump No. 3 was connected with the pump main, provision being made for connecting pump No. 4, whenever erected, by means of a Y branch, one side of which is plugged. This Y branch lies in the centre line between pumps Nos. 3 and 4, and $25\frac{5}{10}$ feet from the west wall of the engine house. This arrangement will facilitate the future connecting of pump No. 4, as only about 240 feet of the new pump main (No. 2) will have to be shut off, leaving pump main No. 1 intact, so as to be used while the connection is made, with only one plug to burn out.

About 240 feet from the engine house in the lot on the west side of the road, belonging to the Aqueduct Board, the two pump mains are connected. This connection is formed by six Y branches, three on each side, with a stop gate in the centre. Another gate has been located on the new main just above the connections, and one is situated on the old main (No. 1). Thus both pump mains may be used, either connected or separately, and the pumps 3 and 1 and 2 shut off without interfering with one another. The new gates or stops were furnished by Julius Jonson of New York, and require 252 turns to be either shut or opened.

A ten inch blow-off leading into the south basin has been provided for in the yard of the engine house. The ten inch branch on the main is laid downward at an angle of 45°, and has a $\frac{1}{8}$ bend attached by which the pump main can be entirely emptied.

The total length of the pump main from the Y branch connection

to the pipe that had previously been laid through the Reservoir bank, at the time of its erection, as a provision for a second pump main, is 5,168,45 feet. It is laid alongside of the old main, with a space of five feet six inches between them. No right of way had to be purchased, the width of thirty feet of the right of way for the old main being sufficient. Considerable difficulty was experienced in determining the right of way according to the old deeds, and monument stones are now being placed at suitable points by direction of the Executive Committee.

About 100 feet from the Reservoir a thirty inch connecting pipe branches off, leading along the east side of the Reservoir and connecting with the twenty-four inch supply main No. 1 near the gate house. The right of way for this connection, thirty feet wide, was purchased of Mrs. Jackson. Two thirty inch and one twenty-four inch gates are so placed as to bring this connecting pipe in use whenever the Reservoir should be temporarily shut off. This connecting pipe is also provided with a blow-off six inches in diameter and laid in the same manner as the blow-off at the engine house. It is attached to the twelve inch drain pipe from the Reservoir and is intended to empty the connecting pipe when not in use, to prevent the stagnation of the water. This blow-off was used as an air-cock when the new main was first filled. At present all the pumping through the new pump main is through this connecting pipe into supply main No. 1.

The erection of the new stand pipe and screen tower, as well as the new connections in the Reservoir, are not yet completed. The work of laying the main and making the connections was done under the supervision of Mr. Chas. E. A. Jacobson, C. E.

LOW SERVICE RESERVOIR.

Upon taking charge April 1st, I found that by order of the Board the Reservoir was being filled at the rate of six inches per day, this was continued until the 4th of April, on which day it contained twenty feet of water, which is the heighth at which the Board have agreed to consider the Reservoir filled. On Sunday, April 17th, the water being at this level, the gates were closed from 6 A. M. to 5 P. M., and no waste or leak was apparent; this test has been made several times since with the same result. On the 22d day of April

it was discovered that the earth had caved in near the fence nearly in a line with the spring in the brook; this was examined from day to day, but as no further result were noted it was thought to be occasioned by the action of the frost. On the 24th of May, however, the water being then at 20 feet, a break was discovered. The following report made to the Board at the time gives the particulars:

"The watchman employed at the Reservoir, at about quarter" "past six on the morning of the 24th of May, discovered that" "the springs along the brook adjoining were running much" "stronger than usual, and that the flow of water through the" "brook was very muddy; also, that it was increasing in volume" "indicating an escape of water from the Reservoir. The inlet" "pipes were immediately closed, and the connecting inlet to the" "Branch Brook Reservoir opened, which lowered the water some" "fifteen inches; but as the brook flow still increased the waste" "gates of the Low Service and Branch Brook Reservoirs were" "opened and the water has since been gradually drawn off, the" "last being run off this morning, June 1st. Examination shows" "one large hole in the bottom of the Reservoir on the south" "side, fifty feet west of the waste gate, together with several" "small ones of about a foot diameter in different locations near" "by.

"The last time the Reservoir was repaired, sticks were driven" "to mark the different spots, so that it might be seen if the same" "places were affected in case it became necessary to draw off" "the water again—all these places were found intact and the" "bottom in good repair."

Messrs. Crane & Co., the contractors, commenced to repair the break June 3d, filling the holes with a mixture of sand, clay and coarse dry saw-dust. On June 7th, the refilling was begun; June 10th, the level was 7 feet 2 inches, and the outlet pipe was opened to supply the city. The level was slowly raised from day to day, until at the present time there is 17 feet of water in.

CONSUMPTION OF WATER.

I am now approaching a subject which must engage the serious attention of the Board in the near future. The report of Messrs.

Howell & Croes giving probable consumption, was, as they considered, a liberal estimate, as it was made at a comparatively recent date and might have been expected to cover the probable use. The comparison given in the table below shows how it has been exceeded.

AVERAGE DAILY CONSUMPTION.

	Engineers' Estimate.	Amt. Furnished.	Highest Daily Average.
1878	7,280,624	7,280,550	8,444,792
1879	7,969,500	8,375,244	9,640,645
1880	8,700,000	9,386,064	10,475,667
1881	9,690,000	9,888,583	11,154,368
1882	10,800,000		
1883	12,112,500		
1884	13,350,000		
1885	14,550,200		

The provisions required for supply should largely exceed and must be equal to the highest daily average required, and if the same increase is made in the consumption of 82 as occured in 81, the limit of the carrying capacity of our supply mains will be nearly reached, their nominal capacity having been over taxed in the present year. A brief description of the supply mains is given:

The supply main No. 2 was laid in 1879, and extends from the Reservoir in Belleville to the corner of Summer and Arlington avenues in Newark. Through the latter avenue a pipe has been laid connecting with the twenty-four inch main No. 1, in Belleville avenue, at the cemetery. The total length, including connections, is 12,126 feet. If the pipe is extended through Summer avenue, Fifth avenue and Mt. Prospect avenue to the Low Service Reservoir, Chatham street, the amount required to be laid will be about 7,200 feet; when this is laid both mains will be independent.

The present capacity of the connected supply mains is about 10,500 gallons in twenty-four hours. This amount is somewhat increased, probably, by 1,000,000—1,500,000 gallons, by partly opening the gate at Eighth avenue and Broad street, by which a part of the consumption of the Low Service enters the system of distributing pipes directly, without having to pass through the Reservoir. The Belleville level is supplied independently of this. the connections feeding the same being located on the twenty-four inch main, above the connections of the same, with the thirty inch main.

The consumption of this level does not exceed 1,500,000 gallons in twenty-four hours. If the Belleville level was extended, additional supply could be obtained for the same, but this would necessitate several new connections to be made, and a great many dead ends in the street mains. The present capacity of supply can be placed at 13,000,000 gallons in twenty-four hours.

The extension of supply main, No. 2, would give to the works two independent supply mains, and place the same in the position of supplying, as follows:

Supply Main, No. 1	6,500,000
" " " 2	13,000,000
Total	19,500,000

or 1,500,000 gallons more than the full capacity of the pumps at Belleville.

I would therefore recommend that this main be extended in the coming year. An additional pumping engine should, for consideration of safety in case of accident, be placed in the Belleville Pump House, although it may not be needed in the coming year for supply.

Table giving consumption of water in detail will be found appended.

STORAGE RESERVOIR.

While I have at present no recommendation to make respecting the matter, I desire to call the attention of the Board to the lack of resources in the shape of reserve supply in case an accident should occur to shut off the supply from Belleville. When filled to their highest level your reserve, with the present Reservoirs, only amounts to 32,000,000 gallons, or 3 days' supply. The property owned by the Board, which contains the pond known as Branch Brook, is admirably adapted for a Storage Reservoir, and could be made available for the purpose at a much less expense than would be the case if any location was selected which is not so naturally adapted to the purpose. I append a description of the property, showing how the banks could be raised so as to adapt it for use as a Storage Reservoir.

The highest water level that can practically be obtained is the level of the Morris Canal, which is 106 feet above tide level, eight feet lower than the highest level of the Low Service Reservoir.

The reservoir would be bounded :

On the West by the banks of the canal, from Orange street to Second street; thence curving around a knoll of ground belonging to the Aqueduct Board to Fifth avenue, at the intersection of the same with Second street.

On the North by Fifth avenue, from Second street to Lake street.

On the East by Lake street, Aqueduct street, and a bank to be built across Branch Brook, near the Washoe Tool Manufactory, to Orange street.

At this bank the necessary outlet pipes and gates would have to be provided for to supply the city.

The area of the Reservoir would be about 27½ acres, with greatest depth of water of 30 feet and an available capacity of about 155,000,000 gallons, at a pressure not below the pressure of the old Branch Brook Reservoir. On the North and East sides, along Fifth avenue, Lake and Aqueduct streets, banks would be required of from four to twelve feet above the grade of the respective streets. At Lake street, Fifth, Sixth and Seventh avenues, about 97,000 cubic yards were filled in from the so-called Cathedral Lot, and the construction and repairing of the Low Service Reservoir. This would require to be removed, but a large portion of the material is of such good quality as to make it available for embankment.

DRIVEN WELLS.

Each well has been boxed with wooden boxes around the connections with the suction pipe, so that when in use they could be examined to ascertain if they were giving water or any leak appeared. The use of the Driven Wells was discontinued July 1st, as the time extended for the experiment by the owners of the Driven Well patent expired on that day, and the Board failing to make any satisfactory arrangements with them to continue the use of the same.

CLEANING FILTER BASINS.

The filter and settling basins, which are located north and south of the Belleville pump house, were originally intended to filter all the water that was used. For a long time they have been considered a failure in this direction, but recent developments show that a large

quantity of water can and does come into the basins, whether as filtered river water, or as spring water, is not determined.

Commissioner Smith, Chairman of the Executive Committee, desired early in the year to clean these basins, which had not been done since they were built. The Commissioner gave his personal attention to the matter and tried several plans without success, owing to the increased flow into them; as soon as the water was lowered.

At his suggestion, it was finally decided to sink a caisson well five feet in diameter in the south basin, to which the eight million pump could be attached, both for the purpose of drawing off the water and increasing the flow of pure water. In both particulars the experiment was successful; by its means the water can now be entirely pumped from the basin, while there is evidence of a large quantity coming from the well, the upward pressure causing it to flow over the top of the well. The work of cleaning the basins and testing their capacity is not yet completed, but a large supply from this source is looked for.

THE POLLUTION OF THE RIVER WATER.

The subject of river pollution, which was previously in charge of the Executive Committee, is now in the hands of a Joint Board, composed of three members of the Newark Aqueduct Board, two from the Board of Public Works, and one member of the Board of Finance of Jersey City.

The work which they have done is detailed in the report of the special committee who represent the Newark Board, and which is presented herewith. Prior to the organization of the Joint Board, the Messrs. Kingsland's were indicted for putting refuse containing carbolic acid into the water. A rather unexpected line was taken by the defense, who endeavored to prove that the water was so bad that the infusion of carbolic acid was a benefit instead of a damage. The result of the trial was a verdict which sustained the right of the city to receive the water unpolluted. It may be said that neither the Board nor the Committee desire anything unreasonable, nor do they wish to entail a ruinous expense upon the manufacturers on the stream. They have invited discussion of the matter, and will meet any plans or propositions which may be offered fairly, and endeavor to act in the interest of all.

PIPE.

The total amount of pipe laid during the year was 4,499 feet, of which 1815 feet was six inch, and 2,345 feet four inch, and 339 feet of three inch; stop gates, 7—one 10-in., four 6-in., and two 4-in.

The amount of pipe relaid to replace old, in consequence of the action of the frost last winter, was 890 feet in Orange, William and Bridge streets, of which 740 feet was 4 inch, and 150 feet of 3 inch.

The Secretary's report annexed contains the usual statements. The increase in the income from water rents for the year amounts to $20,010.25. Full details of the collections and general finances are also given.

In conclusion permit me to bear witness to the cheerful faithfulness with which the officers and employes of the several branches of the department have each performed their respective duties, and aided me in the discharge of the duties of my office.

GEORGE R. GRAY,

Superintendent.

SECRETARY'S REPORT.

DEPARTMENT OF ACCOUNTS,
November 30, 1881.

To the Newark Aqueduct Board:

GENTLEMEN—In compliance with Art. 4, Sec. 3, of the By-Laws, I herewith submit my annual report of the operations of this department for the fiscal year ending Nov. 30, 1881:

The balance of Cash on hand Nov. 30th, 1880, was..	$ 43,200.94
The gross receipts of 1881.....	429,137.35
	$572,338.29
The total expenditures.....	564,593.01
Balance Nov. 30th, 1881.....	$7,745.28

The above given expenditures include the amount on deposit in the Mechanics' National Bank at the time of its failure, viz: $65,878.67, which is charged up in full to the Receiver.

The following is a comparison of the running expenses for 1880 and '81:

	1880.	1881.
Belleville Pumping.....	$28,502.00	$32,654.61
High Service Pumping.....	8,344.06	9,817.11
Driven Well Pumping.....	392.97	
Expense Account.....	8,848.17	9,151.82
Salaries.....	10,351.57	10,274.75
Maintenance & Repairs of Works,	12,034.73	13,365.63
Insurance.....	209.42	209.42
Interest on Funded Debt.....	223,800.00	223,800.00
	$292,482.92	$299,273.34

WATER RENTS.

The water rents income, compared with 1880, shows an apparent decrease of $62,000. This is due, as explained in the report of 1880, to the change in the time of collections, by which three collections of assessed rates appear in the accounts of that year.

For comparison I have used the two collections which formed the basis of my comparison for that year :

The net income of 1881	$204,756.41
" " 1880	184,746.16
Increase income	$20,010.25

PROOF.

Gross charges, 1881		$229,813.54
" " 1880		211,243.69
Increase charges		$18,569.85
Deductions, 1880	$22,651.43	
" 1881	20,553.12	
Decrease,	$2,098.31	
Discounts, 1881,	$4,504.01	
" 1880,	3,846.10	
Increase,	$657.91	
Net gain drawbacks		$1,440.40
Increase income		$20,010.25

The details of the Collection accounts will be found among the financial tables.

The increased charges include 46 taps brought from 1880, unassessed, of which 41 added to the assessments of 1881	$890.00
Two were for meter account.	
Three remain unassessed, not having been put in use.	
Six hundred and seventy assessed taps of 1881	$8,985.86
One hundred and twenty-five carried into 1882, unassessed.	
Three are for meter account.	
Twenty-five are extra and unassessable.	
Increase net charges, measured water	$4,133.38

Total number of consumers, 11,676.

Total number of assessable taps and connections,	1881	809
" " " " "	1880	523
Increase		286

A classified table of the assessments is given with the statistics of consumption.

MEASURED WATER.

The number of new consumers at meter rates, 3.

There were six accounts aggregating as assessed, $1,767.75, transferred to meter account during the year.

The gross charges for measured water, representing a consumption of 43,492,827 cubic feet, or 325,761,274 gallons, an increase in consumption over 1880 of 5,544,327 feet, or 41,796,629 gallons		$48.929.43
	Discounts made	12,268.05
	Net charges, 1881	$36,661.38
	" " 1880	32,528.00
	Increase in income	$4,133.38

Discounts, 1881, $12,568.05.
" 1880, $10,164.07.

Increase discounts,	$2,103.98
Increased charges,	$6,237.36
Proof, 5,544,327 cubic feet @ $1.12½	6,237.36

Average discounts $25\frac{7}{100}$ per cent.

Making average charge for consumption of 1881, $84\frac{3}{10}$¢ per thousand cubic feet, or 11¼¢ per thousand gallons.

CART SPRINKLERS.

With a view of checking waste, a new system was inaugurated with the street waterer's in the past year. Heretofore they have paid $6 weekly for each cart, using as much water as they considered necessary. Under the new plan each sprinkler returned to this office the certified weight of his wagon filled and empty, from which the capacity was ascertained. He was then required to make a weekly return of the number of loads carried by each wagon, and

make an affidavit to its correctness. The charge was then made, for the amount of water used, at 12 cents per thousand gallons.

It is hardly necessary to say, that during the season there was no more water put on the streets than was necessary to do the work, and the mud holes, which a too lavish use of water had caused in former years, were not complained of.

The following table shows the entire amount used for this purpose:

NAME.	WAGONS.	GALLONS.
F. Zusi	3	2,602,732
J. Baer	4	3,299,494
J. Peter	1	1,597,900
S. H. Voorhees	2	4,069,040
D. Young	1	2,146,950
John Van Duyne	1	1,359,400
Andrew J. Gulick	1	2,511,500
Newark Street Sprinkling Co	2	2,738,560
L. Spahn	1	99,000
J. Miller	1	1,996,125
E. T. Wack	2	2,015,550
J. L. Foster	2	1,186,270
E. C. Smith	1	728,390
R. Coyne	2	531,640
B. K. Vreeland	1	959,660
Aug. Broemel	2	943,800
	27	28,786,011

The rate has been complained of, but in five cases the aggregate payments were less. The increase over all being but $630.42, with two new consumers and an unusually dry season.

SERVICES.

The balances of Service charges due and uncollected November 30th, 1880		$1,062.35
Charged for Services laid in 1881		10,958,44
		$12,020.79
Cash collections	$9,902.67	
Discounts	187.84	
Deductions and other credits	54.82	$10,145.33
Balance due November 30th, 1881		$1,875.46

A detailed statement of the services laid will be found among the tables. The system of laying services to the curb at a uniform charge has worked smoothly, and as the Board reserves the right to lay its mains on either side of the street most convenient for its purposes, it would seem to be the most equitable arrangement for consumers.

CONSTRUCTION.

The balances of construction accounts for 1881, per statement A		$2,736,614.79
Balances, per last report		2,671,580.40
Net increase of balances, 1881		$65,034.39

The expenditures are given in the general table of receipts and expenditures, the excess being supplies and materials on hand.

There is now available for expenditure on capital accounts.

The amount due the Board, per statement D		$187,721.75
Cash		7,745.28
		$195,467.03
Less current liabilities	$103,735.10	
Less surplus, to be credited on special tax arrears (see statement D)	8,266.11	112,001.21
		$83,465.82

In order to make this amount available the floating debt cannot be reduced below $100,000, as the outstanding monies due the Board will average that amount. This is not advisable while the Board has other resources, as the interest charges are a loss. In this connection I would suggest that some penalty should be fixed or interest charged on past due water rents, to cover the interest account when the Board is compelled to anticipate them, and the cost of collection which is also a loss.

The resources referred to, which might be applied for construction purposes, consist of the real estate not needed for the extension of the works, of which the Board is carrying a considerable amount.

The extension of the works is not a matter of choice, but necessity, and I believe the application of any fund arising from the sale of your real estate to this use would be preferable to any other disposition which could be made of it; indeed, if it is not

reserved for this purpose, the only way the extensions can be made is by raising the amount in the tax levy, or increasing the debt, both of which measures I believe you are desirous of avoiding as long as the necessity for their use is not imperative.

CONSUMPTION OF WATER.

This subject which is called to your attention in the Superintendent's report, showing the increased facilities needed to meet the demand, has also an important bearing on your finances.

If the consumption can be reduced to the amount of supply really needed, it follows that the extension of works can be postponed, in proportion to the control of the waste.

Reference to table (consumption statistics) shows the proportionate increase in consumption, income, and expenses, for all the years for which the necessary data could be obtained.

The very marked increase in the consumption per tap indicates the waste, subject to a proper allowance for the increase in manufactures, and the more luxurious methods of plumbing in the later years. The increase of about 17½ per cent. in the past five years would be almost entirely due to waste, as the conditions of the manufacturing and plumbing would not differ to any great extent.

The extension of the supply main, and the setting of an additional eight million gallon pump at Belleville, are roughly estimated to cost $90,000, and the limit of the capacity so secured, will be nineteen and one-half million delivery, and twenty-six million pumping. The excess of pumping capacity being no more than it should be, to admit of one engine being laid off for repairs.

The following estimate of the time this capacity will serve, is based upon an increase of three and one-half per centum per annum in the consumption per tap, and an increase of twenty-five taps annually:

1882.....	12,727	taps,	@	859	gallons	per	tap.....	10,932,000
1883.....	13,552	"	"	889	"	"	"	12,047,000
1884.....	14,377	"	"	920	"	"	"	13,227,000
1885.....	15,202	"	"	952	"	"	"	14,472,000
1886.....	16,027	"	"	985	"	"	"	15,786,000
1887.....	16,852	"	"	1019	"	"	"	17,172,000
1888.....	17,577	"	"	1055	"	"	"	18,543,000

1889 in the same ratio exceeds the capacity, as would also
1888 if the period of highest consumption were calculated instead of the average, so that if the Board decided to use repressive measures to reduce the consumption per tap to a reasonable figure, they have about six years in which to accomplish it. I do not think I have fallen into the usual error of underestimating the increase in the above table.

A further extension of the capacity, after this limit is reached, must be made at a much increased expense, as it involves a new supply main, new pump house at Belleville, with boilers, engines, etc., all of which must be projected on a scale large enough to keep up with the same increasing demand for another period of years.

The remedy is either a thorough and extensive system of inspection with penalties for waste, or the adoption of the meter system.

I cannot find, in the experience of other water companies, anything in favor of the inspection system. It is expensive ; it involves dispute as to the responsibility for waste. The enforcing of penalties is odious to the consumer, and constantly places the action of the Board in an unfavorable light, inasmuch as the necessity for the restriction is not appreciated, while under the most favorable conditions, the waste continues, though perhaps not to such a great extent.

In favor of the meter system, I could quote the favorable opinions of the officials of Fall River, Worcester, Boston, Providence, Pawtucket and Milwaukee, who have published very full statements of the working of the meter system in their respective cities.

For lack of space to give all, I have selected the views of Mr. Edmund B. Weston, Engineer of the Providence (R. I.) Water Works, both on account of his exhaustive treatment of the subject, and also, because the conditions of supply so nearly approximate our own.

Mr. Weston says :—"My opinion of the meter system is, that it" "is an admirable one, and the best way of measuring and supplying" "water. During last year the cost of maintenance was about" "$805.00, as the consumers pay for the meters and maintaining" "the same. This amount is expense incurred by the departments" "over the receipts, for salaries of the men employed in setting and" "repairing meters, and for tools, etc. As to the number of inspec-"

"tors required, we have sometimes more, sometimes less. There"
"are two men employed regularly to read meters, and during the"
"busy season we have two more on the same work. Then, there is"
"a meter repair department, in charge of a regular mechanic. The"
"percentage of meters injured by frost is very small and only"
"occurs when proper precautions are not taken in setting. I"
"would recommend the introduction of the meter system in all"
"cities, because the water supply is more or less limited every-"
"where, and the use of meters, in my opinion, is the only way to"
"check waste and keep the supply within proper bounds. I think"
"the use of meters makes the water cheaper to consumers. It"
"lessens extravagance while not affecting the quantity needed for"
"necessary purposes. It affects the revenue favorably, and we"
"find, by statistics, that the use of meters in the city tends to make"
"the consumption much less in proportion to population, than"
"where none are used; proving that it compels consumers who"
"are obliged to pay for all they use to be more careful. The"
"consumer pays for the meter. I consider the meter system as"
"tending to make a great saving of fuel, wear and tear, etc. of"
"pumping machinery. When I state that the meter makes the"
"water cheaper to the consumer, I mean that it generally does to"
"consumers whose fixture rate would exceed $14 or $15, and"
"then the tendency of the consumers is to be more particular as"
"to the manner in which their fixtures are set. Undoubtedly the"
"revenue, if collected at present fixture rates, would be greater"
"than that derived from the sale of water by measurement. The"
"increased expense, if the consumption of the city was twice as"
"great as it is at present, as far as fuel is concerned, would be"
"small in proportion to the increase of revenue; for in building"
"the works an increase of consumption was considered for the"
"future. This would not be the case, however, if much additional"
"outlay had to be incurred for building Reservoirs, furnishing new"
"Engines, etc., as the interest on this outlay would be probably"
"more than enough to offset the increase of revenue. The Water"
"Board employs permanently one collector and examiner of"
"fixtures, with an assistant; they, with the aid of a clerk from the"
"office, read all the meters quarterly, which takes from three to"
"four weeks. These employes would be required if there were"

"not any meters in use. As to the difference in cost of water as"
"supplied by fixture rates and by meter, the following table will"
"show:

COMPARISON OF AMOUNTS PAID BY METER AND FIXTURE RATES, PROVIDENCE, R. I.

No. of service stops.	For what purpose used.	Amt. paid before meter was set at fixture rates.	Amount paid per year after meter was set.			
		Yr.	Amt.	Yr.	Amt.	Year, etc.	Amt.
1395	Dwellings	1874	$17.	1878	$13.26	1879	$13.28
986	Dwellings	1875	13.			Annually since	10.00
1150	Dwellings	1874	30.	1876	26.50	1879	10.68
891	Dwellings	1873	27.	1876	14.91	All other years	10.00
1243	Dwellings	1875	19.			Annually since	10.00
1220	Dwellings	1873	50.	1876	40.03	1879	27.95
205	Dwellings	1874	11.	1874	24.81	1879	10.00
221	Dwellings	1875	21.	1878	11.10	All other years	10.00
227	Dwellings	1873	14.	1876	12.30	All other years	10.00
243	Dwellings	1872	39.	1874	18.69	1879	11.92
1009	Dwellings	1874	12.			Annually since	10.00
1358	Dwellings	1873	36.	1877	17.65	1879	12.24
763	Dwellings	1875	17.	1878	18.49	All other years	10.00
1514	Dwellings	1873	29.	1874	10.00	1879	11.53
2824	Dwellings	1874	16.	1875	10.00	1879	14.64
47	Store	1875	28.	1877	16.94	1879	11.31
125	Stable	1877	20.	1878	30.04	1879	32.05
14	Provision Corners	1875	35.	1877	34.45	1879	25.64
4194	Stable	1876	43.	1877	29.06	1879	26.83
2097	Market and Dwelling	1875	22.	1878	18.29	1879	10.00

Columns one and two show the greatest and least amounts that have been paid since meters were set.

"The above dwellings are located in various portions of the city."

"The department sets all meters. I have never heard that"
"the meter system was, in any way, injurious to health, and this"
"idea, which I know has been advanced by some, can be dis-"
"proved by facts. The class of diseases which have taken prom-"
"inence since the introduction of water in cities, were almost"
"unknown before that, showing that the excessive use of water"
"has largely increased them. Under the old plan, where closets"
"and cesspools were located out of doors, and where the use of"
"water was greatly contracted, owing to the trouble of obtaining"

"it, the mortality in cities from diphtheria and kindred diseases"
"was very light. Now, it is a well-known fact among chemists"
"that the excessive use of water produces fermentation among"
"those substances which are deposited in drains and sewers,"
"and that if there is any direct relation between the diseases"
"alluded to, and the gases evolved from this fermentation, they"
"are responsible for the increased sickness and mortality; so"
"that a limited use of water could not materially alter the con-"
"dition of things, seeing that the liberal supply used in cities"
"when the diseases are prevalent, has no effect in checking them."
"Besides, I think that as physicians are divided as to the cause of"
"these diseases, the sewer gas theory is not deserving of any"
"great attention. As to supplying a number of families from one"
"meter, we charge for the quantity used, irrespective of the"
"number of consumers, and the landlord is responsible for the"
"bill. If the tenant makes an arrangement to have a meter put"
"in, of course we hold him. If bills of any estate are not paid,"
"we shut off water without regard to owner. We charge thirty"
"cents per thousand gallons where the consumption through a"
"single tap amounts annually to $300 or less. Where the con-"
"sumption exceeds in amount the sum of $300 annually, through"
"a single tap, a discount of twenty per cent. on the excess over"
"$300 is allowed, and deducted from the amount due for the"
"fourth quarter. But in no case where a meter is used is the"
"annual charge less than $10, which minimum charge is payable"
"in advance. As to the cost of measured and unmeasured water,"
"the following figures will show:

"Total receipts last year from water..... $229,551.78"
"Water at three cents per hundred gallons, by meter 114,079.28"

"$115,472.50"

"About forty-five per cent. of services are metered. We have"
"about 4,375 meters in use. As to the number of those who"
"change from fixture to meter rates, I may say, that the minimum"
"annual charge when meters are set is $10. Consumers, there-"
"fore, do not generally apply meters unless the fixture rates"
"exceed $14 or $15, as the interest on the outlay and the wear"

"and tear of the meters are considered. But the greater portion" "of the large domestic consumers have meters set when the water" "is first turned on. When meters are set on old services, it is" "owing to the addition of fixtures, which would increase the" "amount of the annual bill, if paid at fixture rates. I do not" "think the meter system causes any more conflict between the" "department and consumers than the regular rate system. It is," "on the whole, much more satisfactory to the consumers, as they" "know they are paying only for what water they use; and to the" "department, as it knows it is being paid for all leaks and waste" "on the premises. It is optional with the consumer whether to" "use a meter or not; but it is in the power of the Board to set a" "meter whenever they desire. Of course they do this only where" "the consumption of water is in excess of what it should be, if" "paid for at tariff rates. Consumers are well pleased with the" "meter system. Sometimes parties find fault when they think" "they are paying more than they should. It is difficult to con-" "convince some people that water can be precisely measured; but" "as we are satisfied by the most accurate tests that the meters" "adopted by this department register with perfect correctness," "there is only one conclusion: When a consumer thinks his" "meter is registering too much, on account of some defect, we" "remove and examine it at his expense."

I am also indebted to Clinton D. Sellew, Esq., Secretary of the Providence Board, for the following statistics, from which it will be seen how nearly parallel are the conditions of supply in both cities, and how widely dissimilar the results under the meter and assessment system:

	Providence.—1880.—Newark.	
Total pumping gallons	1,297,931,369	3,365,489,444
Daily average "	3,546,260	9,220,519
Miles of Pipe	$155\frac{3}{10}$	$136\frac{173}{528}\frac{9}{0}$
Inhabitants per mile	675	1,015
Taps per mile	$61\frac{6}{10}$	$81\frac{4}{10}$
Daily average gallons per tap	$370\frac{2}{10}$	831
Water rents income	$247,705.06*	$184,746.16

*City pays $50,000 per year for water.

Mr. Sellew further says: "We attribute the comparatively" "small consumption largely to the fact that nearly one-half of our" "supplies are through meters."

Comparison of the above daily average, and the consumption per tap, makes any further comment unnecessary.

How can this Department be Made Self-Sustaining?

The first step toward this desirable result is indicated in the statistics given in regard to Providence.

If the consumption per tap can be cut down to 370 gallons, or allowing for the excess of manufacturing use to 500 gallons per tap, it would cut down the pumping at the present number of taps to about six millions per day, and the outlay of about ninety-thousand dollars, as before mentioned, would make the capacity good for 25 or 30 years. For this time the running expenses ought not to increase more than one per cent. per annum on the present outlay, and the difference in the pumping expense would more than pay the maintenance and repairs of meters,* or the other expenses attending the meter system.

The carrying into effect of the meter system, if adopted, could be done gradually, beginning with the factories and continuing until all places except dwellings were metered,† by which time the effect upon the income and consumption would determine the advisability of extending the system to dwellings. It is possible that it may decrease the income to some extent, but the present rate of consumption will increase the expense and maintenance at the end of six years (when the next extension becomes necessary), at least $30,000 per annum, and the bonded debt at least $200,000. Whereas, by the adoption of the meter system, if a like result with Providence could be obtained, I believe it would be possible to avoid increasing the debt and the corresponding expense of maintenance. The risk of increasing the deficiency by decreasing the income, is one that can be controlled by suspending the setting of meters at any time the loss is found to be too great; but I do not

*The expense of maintenance, repairs, and setting meters, is given in the Providence report of 1880, as $12,692.13, which is paid by the consumer.

†Now being done in New York city at the expense of the consumer.

think such a result is to be apprehended. Some decrease of income would be warranted, if by its means the increase in expense of $30,000 annually is avoided.

Assuming the present rate of increase in income to be $15,000 annually, and that the meter system depreciated the income ten per cent., and the time occupied five years, the increase in income annually, by new taps, would then be $9,500 for five years, and $13,500 thereafter, making the Board self-sustaining in about eight years.

But this would throw the entire expense of water supply on the consumer, a portion of which should be borne by the city at large.

Providence Water Works (owned by the city) has 1,137 fire hydrants, for which the city pays $30 each, annually, for fire purposes.

For other public uses the amounts charged bring the cities' payment up to about $50,000 per annum. The city of Newark has the benefit of 1,140 fire hydrants, for which it pays the expense of repairs, amounting to about $500 per year.

I would recommend that the city of Newark be charged such sum as you may deem proper for the use of each hydrant, and that they be kept in order at the expense of the Board.

If it were fixed at $30 per hydrant it would increase the water rents by $34,200—it would not increase the amount to be raised by the city, but would put it on a proper footing, and reduce the deficiency to $60,000, to be met by increased income in about six years.

This could be met at once if the Board possessed the right to levy a small benefit tax on improved property which does not take the water along the line of the mains. Such property is enhanced in value, and it would seem fair that it should bear its proportion of the expense; it would give the Board a permanent and increasing income, and relieve the tax levy of that amount.

A more liberal policy in laying street mains would also increase the income. There are many thickly settled portions of the city which are not piped, and all that is needed to make it a paying investment to pipe them, is more stringent regulations in regard to petitions, so that each signer may be required to file his application for a service pipe to the curb with the petition, and agree to pay a

fixed sum from the time the water is turned on in the main until he commences to use it. This would not be arbitrary, as it is entirely optional with him whether he signs the petition or not, while it would put a stop to the signing of petitions to oblige others, or to improve the property of those who do not take the water.

It is true that extension of the mains would increase the consumption, but it would not proportionately increase the expenses.

If the income under these conditions of extension is required to equal such a per centage on the cost of the work as will pay the interest, and leave a per cent. of profit on the cost of supply, then, up to a certain limit, there is no better investment of such capital as can be spared for the purpose than extension of the street mains; and it will further aid in making the works self-sustaining.

The income of the Board, exclusive of the special tax, and less expenses, pays $.03\frac{76}{100}$ per cent. on the debt, funded at an average of $6\frac{88}{100}$ per cent.

I have refrained from any comment upon the losses on account of the Mechanics' Bank failure, as they could not be adjusted in the accounts of this year.

The report of the members of the Inspection Board, auxilliary to the Boards of Jersey City and Newark, is annexed.

Rather more than the usual number of statements accompany this report. I am desirous at all times to make them as full and detailed as possible, for your information.

Very respectfully submitted,

F. W. MEEKER,

Secretary.

FINANCIAL STATEMENTS.

OFFICE OF THE NEWARK AQUEDUCT BOARD,
November 30th, 1881.

To certify that at the close of business this day, the undersigned made a personal examination of the cash, cash vouchers and securities of the Newark Aqueduct Board, and reconciled the balances as shown by the books of the Board.

FINANCE COMMITTEE: GEORGE D. RANDELL,
JAMES L. GURNEY.

TRIAL BALANCE.

YEAR ENDING NOVEMBER 30, 1881.

The Receiver of the Mechanics' Bank	$65,878,67
Cash	7,745.28
Real Estate, No. 1	26,964.15
" " " 2	8,346.00
" " " 3	6,875.00
" " " 4	4,170.50
" " " 5	750.00
" " " 6	13,327.00
" " " 7	500.00
" " " 8	300.00
" " " 9	2,250.00
" " " 10	3,760.00
" " " 11	10,456.36
" " " 12	15,000.00
" " " 13	21,291.00
" " " 14	1.00
" " " 15	2,000.00
" " " 16	6,000.00
" " " 17	12,500.00
" " " 18	1.00
" " " 19	500.00
" " " 20	100.00
" " " 21	500.00
" " " 22	4,790.04
" " " 23	500.00
" " " 24	4,880.00
" " " 25	4,300.00
" " " 26	2,660.00
" " " 27	625.00
" " " 28	3,550.00
	$230,521.00

Amount brought forward,	$230,521.00
Real Estate, No. 29	4,200.00
" " " 30	9,196.00
" " " 31	3,780.00
" " " 32	9,380.00
" " " 33	6,738.00
" " " 34	9,000.00
" " " 35	15,816.00
" " " 36	1,201.00
" " " 37	1.00
" " " 38	1,400.00
" " " 39	4,250.00
" " " 40	5,125.00
" " " 41	8,680.00
" " " 42	1,200.00
" " " 43	2,300.00
" " " 44	15,375.00
" " " 45	1,500.00
" " " 46	11,814.00
" " " 47	4,247.88
" " " 48	100.00
" " " 49	250.00
" " " 50	600.00
" " " 51	1,200.00
" " " 52	1,800.00
" " " 53	21,136.27
" " " 54	9,393.89
" " " 55	4,696.95
" " " 56	11,883.64
" " " 57	1,693.92
" " " 58	5,101.69
" " " 59	532.50
" " " 60	11,113.86
" " " 61	450.00
" " " 62	339.00
" " " 63	389.55
" " " 64	8.075.00
	$424,481.15

Amount brought forward,	$424,481.15	
Pump main, No. 2	41,968.65	
Street mains, stock and material	5,061.43	
Bond and mortgage	9,800.00	
Street mains	1,150,592.29	
High service engine house	27,847.44	
" " " No. 1	21,407.40	
" " " " 2	19,494.46	
" " reserve pumps	13,619.26	
" " reservoir	94,415.45	
Low service reservoirs	297,082.30	
Branch brook reservoirs	54,294 15	
Receiving reservoir, Belleville	133,645.05	
Keeper's house, receiving reservoir, Belleville	3,192.60	
Pump main	92,888.57	
Supply main, No. 1	153,182.42	
" " " 2	80,714.68	
New supply survey	8,549.03	
River wall, dock and basins	266,112.99	
Belleville pump house	56,309.39	
Pumping engine, No. 1, Belleville	55,909.73	
" " " 2, "	55,591.95	
" " " 3, "	78,918.29	
Engineers' and firemens' dwellings	22,696.52	
Inventory—Belleville	3,063.78	
" —Stable	2,494.00	
" —Office	1,847.33	
Telegraph apparatus and line	1,240.00	
Insurance	209.42	
Water meters	16,300.48	
Bills payable		$100,000.00
General interest acct	215.89	
Loss and gain		1,798.96
Belleville fuel account	36,806.14	
Coupon interest	193,060.00	
Registered bond interest	30,740.00	
	$3,453,752.24	$101,798.96

Amount brought forward,	$3,453,752.24	$101,798.96
Expense	8,786.48	
Salaries	10,274.75	
Maintenance and repairs, telegraph	338.46	
Belleville engine stores	1,444.85	
" Engineers' and firemens' wages	10,764.69	
High service fuel account	5,305.47	
" " Engine stores	604.91	
" " Engineers' & firemens'. wages	4,282.79	
Maintenance	6,841.66	
Repairs street mains	1,259.85	
" real estate	220.59	
" water meters	1,066.11	
" High Service Reservoir	18.15	
" " " reserve pumps.	129.41	
" " " engine house..	237.24	
" Belleville pumping engines.	1,652.54	
" " pump house	145.92	
" engin's and firem's dwellings	449.96	
" Receiving Reservoir	25.35	
" Low Service Reservoir	79.25	
" Branch Brook "	160.60	
" tools and miscellaneous	219.65	
" hydrants		
" supply main, No. 2	16.88	
" pump main, No. 1	12.38	
" river wall, dock and basins.	70.47	
" keeper's house	171.37	
" driven wells	588.25	
Collection account, miscellaneous water rents	17,095.93	
Hydrant account	140	
Rents, real estate	70	
Coupon bonds		$2,758,000.00
Registered bonds		482,000.00
	$3,526,226.20	$3,341,798.96

Amount brought forward,	$3,526,226.20	$3,341,798.96
Coupons payable		3,640.00
Water rents		204,713.30
Penalties, fines, etc		238.00
Service account		789.19
Collection account, water rent, Oct. adv	27,321.21	
Collection account services	1,875.46	
Mains of 1881	3,922.14	
Tax Receiver	26,848.39	
Special tax		100 000 00
" " arrears	42,940.13	
Plumbers' drafts		95.10
Driven Wells	10,568.76	
Caisson Well	2,240.30	
Sundry personal account	5,691.96	
National State Bank	3,640.00	
	$3,651,274.55	$3,651,274.55

STATEMENT A.

CONSTRUCTION ACCOUNTS.

BELLEVILLE—	
Pump House	$56,309.39
Engineers' and Firemens' dwellings	22,696.52
River Wall, Dock and Basins	266,112.99
Receiving Reservoir	133,645.05
Keeper's House, receiving reservoir	3,192.60
Driven Wells	10,568.76
Caisson Well	2,240.30
Pumping Engine No. 1	55,909.73
" " " 2	55,591.95
" " " 3	78,918.29
Pump main No. 1	92,888.57
" " " 2	41,968.65
NEWARK—	
High Service Engine House	27,847.44
" " " No. 1	21,407.40
" " " " 2	19,494.46
" " Reserve Pumps	13,619.26
" " Reservoir	94,415.45
Low Service Reservoir	297,082.30
Branch Brook "	54,294.15
MAINS—	
Supply main No. 1	153,182.42
" " " 2	80,714.68
Street mains	1,150,592.29
" " of 1881	3,922.14
Total	$2,736,614.79

STATEMENT B.

REAL ESTATE.

Real Estate, No.	1	$26,964.15
" " "	2	8,346.00
" " "	3	6,875.00
" " "	4	4,170.50
" " "	5	750.00
" " "	6	13,327.00
" " "	7	500.00
" " "	8	300.00
" " "	9	2,250.00
" " "	10	3,760.00
" " "	11	10,456.36
" " "	12	15,000.00
" " "	13	21,291.00
" " "	14	1.00
" " "	15	2,000.00
" " "	16	6,000.00
" " "	17	12,500.00
" " "	18	1.00
" " "	19	500.00
" " "	20	100.00
" " "	21	500.00
" " "	22	4,790.04
" " "	23	500.00
" " "	24	4,880.00
" " "	25	4,300.00
" " "	26	2,660.00
" " "	27	625.00
" " "	28	3,550.00
" " "	29	4,200.00
" " "	30	9,196.00
" " "	31	3,780.00
		$174,073.05

STATEMENT B.—REAL ESTATE.—CONTINUED.

			Amount brought forward.....	$174,073.05
Real	Estate	No.	32.....	9,380.00
"	"	"	33.....	6,738.00
"	"	"	34.....	9,000.00
"	"	"	35.....	15,816.00
"	"	"	36.....	1,201.00
"	"	"	37.....	1.00
"	"	"	38.....	1,400.00
"	"	"	39.....	4,250.00
"	"	"	40.....	5,125.00
"	"	"	41.....	8,680.00
"	"	"	42.....	1,200.00
"	"	"	43.....	2,300.00
"	"	"	44.....	15,375.00
"	"	"	45.....	1,500.00
"	"	"	46.....	11,814.00
"	"	"	47.....	4,247.88
"	"	"	48.....	100.00
"	"	"	49.....	250.00
"	"	"	50.....	600.00
"	"	"	51.....	1,200.00
"	"	"	52.....	1,800.00
"	"	"	53.....	21,136.27
"	"	"	54.....	9,393.89
"	"	"	55.....	4,696.95
"	"	"	56.....	11,883.64
"	"	"	57.....	1,693.92
"	"	"	58.....	5,101.69
"	"	"	59.....	532.50
"	"	"	60.....	11,113.86
"	"	"	61.....	450,00
"	"	"	62.....	339.00
"	"	"	63.....	389.55
"	"	"	64.....	8,075.00
				$350,857.20

STATEMENT C.

STOCK, MATERIALS, AND OTHER PROPERTY OF THE BOARD.

Inventory No.	1—Street mains, stock and material....	$5,061.43
" "	2—Stock, furniture, &c., at Belleville and High Service Pumping Stat'n	3,063.78
" "	3—Stock and stable property.	2,494.00
" "	4—Office furniture and fittings.....	1,847.33
" "	5—Telephone lines and properties....	1,240.00
" "	6—Belleville fuel and stores on hand, Nov. 30th	16,361.07
" "	7—H. S. fuel and stores on hand Nov. 30th.....	116.63
" "	8—Service stock and material on hand Nov. 30th.....	189.01
" "	—Water meters set and on hand.....	16,300.48
	—Hydrants on hand Nov. 30th.....	140.00
	—New supply survey.....	8,549.03
	—Mortgages	9,800.00
	—Advances on High Service fuel of 1882.....	259.43
		$65,422.19

STATEMENT D.

ANTICIPATED ASSETS.

DEBTS DUE TO THE BOARD :—

Balance due Nov. 30th, miscellaneous water rents	$17,095.93
" " " " Oct. advance " "	27,321.21
" " " " account tax levy, 1881	26,848.39
" " special tax arrears	42,940.13
" " uncollected service charges	1,875.46
" " rents of real estate	70.00
" " from sundry personal accounts	5,691.96
The receiver of the Mechanics' National Bank, Dr	65,878.67
	$187,721.75

STATEMENT E.

MAINTENANCE AND REPAIRS OF WORK.

Maintenace, care of reservoirs, purity of water, &c....	$6,841.66
Repairs, street mains, stop cocks, &c.....	1,259.85
" real estate.....	220.59
" water meters, including setting.....	1,066.11
" high service reservoir.....	18.15
" high service reserve pumps.....	129.41
" high service pump house.....	237.24
" Belleville pumping engines.....	1,652.54
" " pump house.....	145.92
" engineers' and firemens' dwellings.....	449.96
" receiving reservoir.....	25.35
" low service reservoir.....	79.25
" branch brook reservoir.....	160.60
" tools and miscellaneous.....	219.65
" supply main, No. 2.....	16.88
" pump main, No. 1.....	12.38
" river wall, dock and basins.....	70.47
" keeper's house, receiving reservoir.....	171.37
" driven wells.....	588.25
	$13,365.63

$\frac{49}{100}$ of 1 % on costs of works.

STATEMENT F.

HIGH SERVICE PUMPING.

FUEL—

990 5/20 tons, average $5.04 1/4	$4,991.57
Engine stores	542.75
Engineers' and Firemens' wages	4,282.79
	$9,817.11

STATEMENT G.

BELLEVILLE PUMPING.

FUEL—

Coal—4,522 4/20 tons @ $4.58 3/4	$20,488.75
Wood—Eight cords	47.22
Engine stores	1,353.95
Engineers' and Firemens' wages	10,764.69
	$32,654.61

STATEMENT H.

GENERAL ACCOUNT OF THE NEWARK AQUEDUCT BOARD, YEAR ENDING NOV. 30, 1881.

Details see Statement.		INCOME.	RUNNING EXPENSES.	ASSETS.	LIABILITIES.
	Cash			$7,745.28	
	Coupon trust fund, National State Bank			3,640.00	
A	Construction accounts			2,736,614.79	
B	Real estate			350,857.20	
C	Stock, materials and other property			65,422.19	
D	Anticipated assets, (debts due the Board			187,721.75	
	Coupon bonds				$2,758,000.00
	Registered bonds				482,000.00
	Bills payable				100,000.00
	Coupons payable				3,640.00
	Plumbers' drafts, (outstanding)				95.10
E	Maintenance and repairs works		$13,365.63		
F	High service pumping		9,817.11		
G	Belleville pumping		32.654.61		
	Expense account		$8,597.47		
	Salaries		10,274.75		
	Maintenance & repairs telephone line, etc.		338,46		
	Insurance		209.42		
	General interest		215,89		
	Coupon " bonds		193,060.00		
	Registered interest bonds		30,740.00		
	Water rents	$204,713.30			
	Penalties, fines, etc	238.00			
	House rents and miscellaneous gains, (balance loss and gain)	1,798.96			
	Service account, gains	789,19			
	Special tax account	100,000.00			
			$299,273.34		$3,343,735.10
	Gain		8,266.11	Surplus	8,266.11
		$307,539.45	$307,539.45	$3,352,001.21	$3,352,001.21

SINKING FUND STATEMENT.

CASH.

	DR.	CR.
Balance November 30th, 1880.....	$54,714.43	
Annual payment city for 1880.....	3,500.00	
From interest on investments.....	9,239.73	
" temporary loans paid in	60,000.00	
Disbursed on temporary loans.....		$60,000.00
On deposit in Mechanics' Bank....		65,494.16
Balance November 30th, 1881.....		1,960.00
	$127,454.16	$127,454.16

LEDGER.

Sinking fund account.....		$176,954.16
City of Newark.....	$3,500.00	
Bond account.....	106,000.00	
Receiver of the Mechanics' Bank*..	65,494.16	
Cash.....	1,960.00	
	$176,954.16	$176,954.16

* Amount on deposit in the Mechanics' National Bank at time of failure.

STATEMENT J.

SINKING FUND STATEMENT FROM 1860 TO 1880.

YEAR.	Appropriation from Mayor and Common Council.	Receipts from Interest from Investments.	Surplus Water Rents Paid in.	Loans Paid in.	Total Receipts of the Year.	Disbursed Accrued Interest.	INVESTMENTS DURING THE YEAR.	Total Amt of Fund Invested.	Cash Balance Nov. 30th of each year.	Total Amt. of Fund.
1861	$3,500		.....	.....	3,500.00	....	Volunteer Aid Bond, city $3,500	$ 3,500	.....	$ 3,500.00
1862	3,500	$ 265.41	.....	.....	3,765.41	....	.....	3,500	$3,765.41	7,265.41
1863	3,500	560.00	$9,000	.....	13,060.00	....	Volunteer Aid Bond. ... 4,000 N. C. Water Board..... 12,500	20,000	325.41	20,325.41
1864	3,500	1,360.00	.....	.....	4,860.00	$40	Newark City Water Bd's, 1,500	21,500	3,645.41	25,145.41
1865	3,500	1,572.50	6,000	.....	11,072.50	....	N. C. Water B..... 6,000 Temporary, City..... 3,500 Temporary N. A. B ... 1,700	32,700	3,517.91	36,217.91
1866	3,500	1,538.29	.....	$7,000	12,038.29	....	Temporary, City..... 3,500 N. A. B..... 8,200	37,400	3,856.20	41,256.20
1867	3,500	2,562.50	.....	.....	6,062.50	....	Temporary, N. A. B.... 6,415	43,815	3,503.70	47,318.70
1868	3,500	1,870.00	.....	.....	5,370.00	....	.....	43,815	8,873.70	52,688.70
1869	3,500	1,870.00	.....	.....	5,370.00	....	.....	43,815	14,243.70	58,058.70

SINKING FUND STATEMENT FROM 1860 TO 1880.—CONTINUED.

1870	$3,500	$ 122.50	.....	$ 3,622.50	....	.....	$43,815	17,866.20	$61,681.20
1871	3,500	3,962.50	.....	20,000	27,462.50	....	Newark City Water Bd's 40,000	63,815	$ 5,328.70	69,143.70
1872	3,500	3,285.00	.....	3,500	10,285.00	....	.....	60,315	15,613,70	75,928.70
1873	3,500	3,162.50	.....	.....	6,662.50	....	.....	60,315	22,276.20	82,591.20
1874	3,500	3,040.00	.....	.....	6,540.00	....	.....	60,315	28,816.20	89,131.20
1875	3,500	3,040.00	.....	.....	6,540.00	....	.....	60,315	35,356.20	95,671.20
1876	3,500	15,232.44	.....	56,315	75,047.44	....	Newark City Water Bd's 56,000	60,000	54,403.64	114,403.64
1877	3,500	9,530.00	.....	.....	13,030.00	....	Newark C. W. Reg. Bd's 50,000	110,000	17,433.64	127,433.64
1878	3,500	8,231.89	.....	27,000	38,731.89	....	Temp. Loan, City. 23,000	106,000	33,165.53	139,165.53
1879	3,500	8,287.81	.....	35,000	46,787.81	....	Temp. Loan, City. 70,000	141,000	9,953.34	150,953.34
1880	3,500	9,761.99	.....	87,500	100,761.09	....	Temp., City..... 50,000 " N. A. B..... 2,500	106,000	58,214.43	164,214.43

WATER RENTS.

STATEMENTS OF ACCOUNT.

Miscellaneous Water Rents.—Collection Account.

	DR.	CR.
Balance arrears of previous collections	$14,004.43	
Balance arrears of April, 1880, coll'n	1,926.33	
Balance arrears of Oct., 1880, coll'n	1,721.55	
Balance arrears of April, 1881, coll'n	1,820.38	
Measured water, net charges, 1881..	36,661.38	
Sprinkling carts	3,434.50	
Building purpose	1,855.02	
Special contracts	575.65	
Special charges, filling cisterns, &c..	570.62	
Fractional charges	552.31	
Public schools (back water rents)	471.75	
Refunded duplicate payments	8.00	
Transferred credits	5.21	
Ice cutting	300.00	
Cash		$42,299.17
Deductions		4,470.98
Transferred credits		28.67
Overcharges		12.38
Balance		17,095.93
	$63,907.13	$63,907.13

April, 1881. Advance Water Rents.—Collection Account.

	DR.	CR.
Assessed charges	$92,351.45	
Refunded duplicate payments	28.11	
Transferred credits	16.67	
Cash		$79,735.42
Deductions		8,574.82
Discounts		2,260.61
Transferred charges		5.00
Balance		1,820.38
	$92,396.23	$92,396.23

Oct., 1881. ADVANCE WATER RENTS.—COLLECTION ACCOUNT.

	DR.	CR.
Assessed charges	$91,693.61	
Cash		$58,144.35
Discounts		2,243.40
Deductions		3,984.65
Balance due		27,321.21
	$91,693.61	$91,693.61

ADVANCE WATER RENTS, OCTOBER, 1880.

BROUGHT FROM 1880.

	DR.	CR.
Balance due November 30th, 1880.	$29,447.02	
Added assessed charges	1,347.25	
Refunded duplicate & overpayments	52,02	
Transferred credits	12.50	
Cash		$25,583.84
Deductions		3,522.67
Overcharges		30.73
Balance		1,721.55
	$30,858.79	$30,858.79

RECAPITULATION.

	DR.	CR.
Balance Nov. 30, of Oct. 1880, acct.	$29,447.02	
Balance Nov. 30, 1880, of miscellaneous water rents	15,930.76	
Assessed charges of 1881	185,392.31	
Miscellaneous charges of 1881	44,421.23	
Balance of cross entries, Dr.	45,73	
Cash		$205,762.78
Deductions		20,553.12
Discounts		4,504.01
Balance due November 30th, 1881		44,417.14
	$275,237.05	$275,237.05

DETAILS OF FUEL ACCOUNTS.

BELLEVILLE.

DR.

Balance coal on hand December 1, 1880, cost of handling included..	2,815 tons 6 cwt., @ 4.43 7/10 c.	$12,492.54
Purchased in 1881 :		
Trial coal.....	965 tons.....	
Contract delivery to Nov. 30, 1881	4,273 tons 16 cwt.....	
Total coal of 1881.....	5,238 tons 16 cwt., @ $4.41 4/5 c.	23,145.52
Cost of handling 5,238.16 tons, including new hoisting engine, and demurrage on account of breaking down of engine, &c..	.....26 3/10 c.	1,374.76
Wood on hand Dec. 1, 1880.....	1½ cords.....	8.62
Wood purchased.....	7 "	41.60
		$37,063.04

CR.

Total coal for pumping, 1881 :		
2,815.06 tons, @ $4.43 7/10 c.....		
1,706.18 " " 4.68 1/10 c.....	4,522 4/20 t's. Av'g cost, $4.58¾	$20,488.75
Reservoirs.....	56 " " " 4.58¾	256.90
Wood used.....	8 cords.....	47.22
Balance on hand Nov. 30, 1881....		16,267.17
" " " " 30, 1881....	½ cord.....	3.00
		$37,063.04

HIGH SERVICE.

DR.

Balance coal on hand Nov. 30, 1880	73 tons, @ $4.30.....	$ 313.95
Purchased, including trimming and handling.....	935 " " 5.10 1/10	4,769.65
Paid advance cartage on coal delivered on ac. 1882 supply.....		259.43
		$5,343.03

CR.

Coal for pumping, 1881 :		
73 tons, @ $4.30... $ 313.95		
917 5/20 " " 5.10 1/10 4,677.62	990 5/20 t's. Av'g cost, $5.04¼	$4,991.57
Charged reservoir maintenance....	7 7/20	37.56
Balance.....	10 8/20	54.47
Balance advance charges on coal supply for 1882.....		259.43
		$5,343.03

DETAILED RECEIPTS AND EXPENDITURES

FOR YEAR ENDING NOV. 30th, 1881.

RECEIPTS.

Balance on hand Nov. 30th, 1881		$43,200.94	
Water rent collections	205,762.79		
Tax Receiver account of tax levy, 1880	23,631.26		
" " " " " 1881	73,151.61		
Temporary loans	210,000.00		
Belleville Township account of contract	1,500.00		
F. Young, on account of mortgage	50.00		
City of Newark, for hydrants	550.00		
" " " repairing hydrants	269.00		
Service collection	9,902.67		
Sales on service account	125.52		
Rent of real estate	988.00		
Interest on bond and mortgage	727.68		
Sale of oil barrels and old pipe, &c	18.30		
Penalties and fines	238.00		
Sundry personal accounts	2,222.52		
		529,137.35	572,338.29

EXPENDITURES.

Real estate, No. 1, general improvements	14.16		
Laying sewer pipe from office to Cedar-st.	212.86		
Grading and improvement Plot 4 $10.50			
" " " " 13 6.00			
" " " " 14 683.88			
Taxes paid on real estate " 64 1,136.36	1,836.74		$2,063.76

CONSTRUCTION.

STREET MAINS.			
Cash expenditures laying street mains, 1881		1,742.69	
CAISSON WELL.			
Caisson well	$2,000.00		
Extra rock work—contract providing extra allowance in case rock was encountered	240.30	2,240.30	
HIGH SERVICE PUMP, NO. 2.			
Payments on account of contract for H. S. pump, No. 2	15.000.00		
	$15,000.00	$3,982.99	$2,063.76

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,	$15,000.00	$3,982.90	$2,063.76
REPAIRING FOUNDATION.			
Castings	301.44		
Mason material	184.88		
" work	12.00		
Iron	3.81		
Lumber	47.52		
Other supplies	.56		
Setting	30.00		
Labor	505.62	16,085.83	
PUMP MAIN, NO. 2.			
Payments on contract, @ $6.15 per foot		34,805.73	
Making connections at Gate House with 24-inch main connecting with influent pipe, at reservoir, connecting waste pipe, disconnecting No. 3 from old, and connecting with new main, Y branches, setting gates, etc. All done by the Board, in addition to the work of the contractors			
Castings for stand pipe	30.35		
Cartage on castings	12.00		
Cement	3.75		
Lumber	5.64		
Block and wedges	23.91		
Other supplies	37.06		
Machine work	32.51		
Expense, handling	166.52		
Screen tower	557.09		
Gates	1,608.00		
Engineering and survey	782.48		
Right of way	825.75		
Recording deed	2.30		
Material furnished	171.32		
Labor	2,892.00	7,150.68	
STREET MAIN STOCK AND MATERIAL.			
Iron pipe, 3 inch	279.19		
" " 4 "	946.33		
" " 6 "	1,172.25		
" " 8 "	45.64		
" " 10 "	52.63	2,496.04	
		$64,521.27	2,063.76

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,		$64,521.27	$2,063.76
Stops, 4 inch	154.56		
" 6 "	66.24		
" 10 "	41.80	262.60	
6-inch valves		33.12	
Pig lead		711.74	
Sleeves		34.06	
Special castings		254.18	
DRIVEN WELL ACCOUNT.			
Balance of expenditures in putting down 40 wells. Expended in 1880, $4,371.01			
Driven Wells	557.90		
Points	598.82		
Derrick, labor and handling	273.95		
Carting stops	15.00		
Drawing	20.00		
Steel	14.16		
Tubing and fitting	12.48		
Special castings	113.93		
Wire cloth	6.32		
Blocking for wells	2.50		
Lumber	103.28		
General supplies	28.00		
Tools	11.99		
Mason work	22.40		
Expense	58.19	1,838.92	67,655.89
MAINTENANCE OF WORKS.			
GENERAL MAINTENANCE.			
Care of property, etc		2,074.32	
MAINTENANCE OF RESERVOIRS.			
Pay of watchmen, gardeners, keepers, etc.	2,717.62		
General improvements	77.65		
Gardeners' expenses	6.89		
Selling flowers	22.00		
Fuel	28.50		
Lamps for water gauges	28.75		
Tools	13.40		
REGULATION OF SUPPLY.		2,894.81	
One 10-in valve to regulate pressure	35.50		
Cost of setting same	30.87	66.37	
		$5,035.50	$69,719.65

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,		$5,035.50	$69,719.65
PURITY OF WATER.			
Inspection—Patrol expenses	$137.45		
" —Board "	28.54		
General expense	10.61		
Analysis of water	69.44		
Jars for analyzing	5.70		
Machine work	3.14		
Supplies	56.15		
Pumping out Basins	20.66		
Hose used	212.50		
Gate between river and basin	173.92		
Wire cloth screen	12.92		
Boat	10.00		
Raft	1.83		
Superintendence of pumping	25.00		
Labor, drawing hydrants and purifying water	735.41	1,503.27	
REPAIRS OF STREET MAINS.			
Labor	779.80		
Plumbing	5.75		
Paint	8.25		
Coke	6.40		
Clay	.50		
Supplies	67.25		
Labor charged to Sundry Personal Accounts for services rendered	795.14		
Re-connecting frozen mains	63.69		
Repairing stop cocks	66.41		
Repairing valves	.70		
" leaks	3.25		
Material for repairs	21.91		
Lumber for stop boxes	48.11		
Wood	30.75		
General repairs	20.88	1,918.79	
REPAIRS OF REAL ESTATE.			
General repairs	2.52		
Plumbing	53.22		
Glass for tenements	11.35		
	$67.09	$8,457.56	$69,719.65

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,	$67.09	$8,457.56	$69,719.65
Lumber	10.05		
Supplies	4.30		
Repairs at office	53.11		
Carpenter and mason work	92.75	227.30	
REPAIRS ENGINEERS' AND FIREMENS' DWELLINGS.			
Plumber work	58.57		
Paint	13.36		
Glass	9.50		
Material for repairs	47.51		
Paper hanging	12.84		
Repairs	8.53		
Carpenter and mason work	318.45		
REPAIRS OF KEEPER'S HOUSE.			
New pump	27.25		
Material for repairs	2.61		
Painting	64.97		
Lumber	13.28		
Hardware	4.66		
Carpenter work on house and barn	58.60	640.13	
REPAIRS OF WATER METERS.			
General repairs	200.30		
New dial	5.00		
Machine work	116.04		
Freight	9.98		
SETTING METERS.			
Supplies	6.21		
Tools for meters	9.58		
Special castings	137.10		
Lumber for boxes	54.36		
Connecting and plumbing	291.31		
Labor	227.59	1,057.47	
REPAIRS OF HIGH SERVICE PUMP.			
Machine work	13.17		
General repairs	28.10		
Valves	37.80		
Oil cups	2.24		
	$81.31	$10,382.46	$69,719.65

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,	$81.31	$10,382.46	$69,719.65
Supplies	3.61		
Repair of donkey pump	30.99		
Carpenter work	6.00	121.91	
REPAIRS OF BELLEVILLE PUMP.*			
Repairing boilers	25.70		
New piston body	126.85		
Tubing No. 3 boiler	291.29		
" " 1 "	354.55		
Valves	262.16		
New air chamber	45.06		
" grate bars	23.80		
New steam trap	27.50		
Gauge cock	8.25		
Pipe for pump	12.22		
Hardware	14.15		
Lumber	35.29		
Supplies and general repairs	42.71		
Lumber and Iron for well hole	28.39		
Lagging	62.96		
Mason work	66.12		
Machine work	149.42		
Carpenter work	83.62	1,660.04	
REPAIRS OF HIGH SERVICE ENGINE HOUSE.			
Exchange of gas fixtures	15.22		
Paint	6.50		
Lumber	4.00		
Supplies	2.52		
Carpenter work, changing stairs to accommodate new pump	209.00	237.24	
REPAIRS OF BELLEVILLE PUMP HOUSE.			
Repairs fountain	11.85		
Carpenter work	118.17	130.02	
REPAIRS OF RIVER WALL, DOCK AND BASIN.			
Mason material	32.45		
" work	38.02	70.47	
		$12,602.14	$69,719.65

*This amount increased by work and material for adapting Pump, No. 3, to draw from the caisson.

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,		$12,602.14	$69,719.65
REPAIRS OF LOW SERVICE RESERVOIR, SEVENTH AVENUE.			
Repairing valves	22.50		
Hardware	1.00		
Painting	55.75	79.25	
REPAIRS OF HIGH SERVICE RESERVOIR, SOUTH ORANGE AVENUE.			
Paint	7.15		
Labor at Gate House	11.00	18.15	
REPAIRS OF BRANCH BROOK RESERVOIR.			
Repairing banks		160.60	
REPAIRS OF RECEIVING RESERVOIR, BELLEVILLE.			
Paint	1.20		
Lumber	6.55		
Labor	17.60	25.35	
REPAIRS PUMP MAIN, NO. 1.			
Repairs at break		12.38	
REPAIRS OF SUPPLY MAIN, NO. 2.			
Repairing gate chamber		14.50	
REPAIRS TOOLS.			
General repairs	106.52		
Replacing	55.68		
Blacksmith work	43.60	205.80	
REPAIRS AND MAINTENANCE OF DRIVEN WELLS.			
Repairs	10.11		
Expense	1.20		
Lumber	6.24		
Paint	6.90		
Other supplies	7.12		
63 casings over driven well connections, 4 feet deep	556.68	588.25	13,706.42
			$83,426.07

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

EXPENSE.

Amount brought forward,			$83,426.07
EXPENSE ACCOUNT.			
Inspection, clerk hire and wages	5,742.44		
General office expense	576.79		
Coal for office building	117.25		
Light for office building	150.88		
Stationery and books	320.74		
Advertising and printing	668.00		
Inspection of works	88.70		
Stable supplies and expense	1,084.68		
Repairs of Vehicles and Harness	381.88		
Exchange of horses	125.00		
Legal expense	477.01		
Translation and drawings of foreign reports	57.50		
Appraisement of real estate	200.00		
Damage	64.00		
Repairing transit	70.00	10,124.87	
SALARIES		10,274.75	
TELEPHONE LINE.			
Contract for repairs, expiring March 1st	75.00		
Contract for rent, expiring March 1st	70.84		
New contract, repairs and rent to Nov. 15th	129.37		
New boxes and bells	25.00		
Zincs	4.50		
Storm service	11.25		
Messenger service	22.50	338.46	20,738.08

PUMPING.

BELLEVILLE PUMPING.			
Coal, (average cost per ton) $4.58¾	23,133.52		
Wood	48.00		
New hoisting engine	375.00		
General supplies	5.60		
Cost of handling fuel	999.76		
Belleville engineers' and firemans' wages	10,481.15		
Taxes and expense	63.34	35,106.37	
		$35,106.37	104,164.15

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,		$35,106.37	104,164.15
BELLEVILLE STORES.			
General supplies	234.39		
Machine "	86.66		
Packing	18.90		
Waste	36.18		
Expense	6.95		
Kerosene	40.89		
Oil	789.95		
Repairs of tools	38.15		
Repairing scales	24.00		
" wheelbarrows	46.39		
White lead	3.95		
Pokers	5.00		
Hardware	1.80		
Tools	11.26	1,344.47	36,450.84
HIGH SERVICE PUMPING.			
Coal, (average cost per ton) $5.04¼	4,693.21		
Wood	9.50		
Lumber for coal run	13.44		
Cost of handling fuel	312.93		
Engineers' and Firemens' pay roll	4,282.79	9,311.87	
HIGH SERVICE ENGINE STORES.			
General supplies	88.58		
Machine "	23.74		
Tools	1.23		
Repairing tools	14.72		
Fittings	2.60		
Waste	12.00		
Oil	157.41		
Gas at pump house	265.76	566.04	9,877.91
SERVICE ACCOUNT.			
⅝ inch lead pipe	2,344.23		
1 " " "	42.20		
2 " " "	90		
Freight on lead pipe	13.63		
605 curb stop cocks	525.75		
782 corporation stop cocks	650.87		
	$3,577.58		150,492.90

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,	$3,577.58		150,492.90
Stop boxes	160.74		
35 patent boxes	90.00		
703 stop box covers	253.08		
Lumber for boxes	3.24		
Supplies	31.34		
Labor	3,494.60		
Plumbing	4.47		
Repairing taps	45		
Refunded discount	35		
Repairing tapping machines	70.72		
Plumbers' credits for joints	893.95		
			8,580.52

COUPON INTEREST.

Amount coupons outstanding Dec. 1, 1880, $1,855, paid	1,820.00		
Coupon interest due 1881, $193,060, paid	189,455.00		
Deposited in Nat. State Bank in trust to pay coupons outstanding	3,640.00		194,915.00
Registered bond interest due 1881, paid			30,740.00

MISCELLANEOUS EXPENDITURES.

New meters, 1-4 in. gem 6-1 " rotary 1-4 " " 5-½ " crown 7-¾ " " 10-1 " " 4-2 " "	1,583.63		
Connections	8.00		
Freight	4.77		
Time loans paid	110,000.00		
Interest on same	1,225.53		112,821.93
Drawbacks on contract, H. S. Pump No. 2			66.23
Labor charged to contractor for H. S. Pump, No. 2			67.88
Labor charged to contractor for Caisson			299.59
			497,984.05

DETAILED RECEIPTS AND EXPENDITURES.—CONTINUED.

Amount brought forward,			497,984.05
HYDRANTS.			
Six new hydrants	120.00		
Casings	18.12	138.12	
REPAIRS OF HYDRANTS.			
Labor	123.36		
Machine work	2.70		
Lumber	36.54		
Paint	4.50		
Other material	2.48		
Repairs	3.88	173.46	311.58
OFFICE INVENTORY.			
Map Cabinet	16.23		
Chairs for Superintendent's room	27.00		43.23
BELLEVILLE INVENTORY.			
Oil tank	12.00		
Pump	100.00		
Pulley	35.00		147.00
HIGH SERVICE INVENTORY.			
Stove at gate house			18.00
REFUNDED WATER RENTS OF 1881	85.63		
BACK WATER RENTS	124.85		210.48
RECEIVER MECHANICS' NATIONAL BANK.			
Amount on deposit at failure			65,878.67
BALANCE NOV. 30			7,745.28
			572,338.29

WATER RENTS—TABLE OF MONTHLY RECEIPTS.

	Assessed.	Measured.	Building.	Cart Sprinkling.	Interest on Pipe and Meters.	Special.	Arrears.	Total Monthly Collections.
December, 1880	$ 6,497.92	$3,532.72	$138.12	$110.00	$109.10	$97.70	$219.66	$10,705.22
January, 1881	10,496.86	1,194.75	35.03			18.52	205.25	11,950.41
February "	5,685.54	181.07	22.95			12.33	22.77	5,924.66
March, "	5,273.22	7,453.34	68.23			61.87	328.65	13,185.31
April, "	48,914.85	2,043.75	215.91	169.75		76.48	750.38	52,171.12
May, "	5,734.22	3,643.54	188.82	416.79		67.73	274.08	10,325.18
June, "	5,005.77	5,052.85	166.50	404.10	231.92	90.10	156.88	11,108.12
July, "	6,851.51	695.19	245.68	506.53	10.00	36.00	124.31	8,469.22
August, "	7,908.19	1,156.30	307.96	661.25		164.75	246.84	10,445.29
September, "	3,719.57	5,014.98	202.84	762.76		194.87	177.40	10,072.42
October, "	49,504.73	1,550.86	128.13	315.12		145.34	480.05	52,124.23
November, "	7,872.23	796.38	153.84	128.16		55.00	275.80	9,281.41
	$163,464.61	$32,315.73	$1,874.01	$3,474.46	$341.02	$1,020.69	$3,262.07	$205,762.59

STATEMENT OF PIPES LAID

DURING THE YEAR ENDING NOVEMBER 30TH, 1881.

DATE 1881.	LOCATION.	SIZE.	NO. OF FEET.	COST.	TOTAL.
Jan'y 6	River street, from Oxford to Mott street.....	6 in.	494		
	492 feet 6 inch pipe.....			$241 08	
	560 lbs. lead.....			30 80	
	1 single branch.....			7 00	
	1 plug.....			1 19	
	sundry materials.....			10 72	
	labor.....			256 33	
					$547 12
Mar. 7	William street, from Plane street, east,.....	4 "	145		
	144 feet 4 inch pipe.....			37 44	
	140 lbs. lead.....			7 70	
	1 4 inch stop cock.....			12 88	
	1 4 inch stop cock, box, cover and frame			2 50	
	sundry materials.....			3 52	
	labor.....			69 99	
					134 03
Mar. 24	Orange street, from Broad to Spring street...	4 "	595		
	588 feet 4 inch pipe			158 76	
	560 lbs. lead.....			30 80	
	2 4 inch single branches.....			6 80	
	2 4 inch plugs.....			84	
	1 4 inch sleeve.....			1 91	
	1 8 x 6 single branch.....			8 00	
	1 6 x 4 reducer.....			2 24	
	1 8 inch sleeve.....			3 22	
	1 4 inch stop cock.....			12 88	
	1 4 inch stop cock, box, frame and cover,			2 50	
	sundry materials.....			10 33	
	labor.....			174 69	
					412 97
Apr. 16	Bridge street, from Ogden street, west.....	3 "	150		
	150 feet 3 inch pipe.....			31 09	
	sundry material.....			2 47	
	labor.....			54 63	
					88 19
May 17	Polk street, between Clover and Market sts..	6 "	381		
	378 feet 6 inch pipe.....			180 48	
	395 lbs. lead.....			19 75	
	1 6 inch double branch.....			8 20	
	1 6 inch plug.....			2 38	
	1 6 inch stop cock.....			16 56	
	1 6 inch stop cock, box frame and cover..			2 50	
	sundry materials.....			6 24	
	labor.....			82 34	
					318 45
June 30	Prospect Place from Hayes street, east	3 "	168		
	168 feet 3 inch pipe.....			35 28	
	6 feet 4 inch pipe.....			2 00	
			1933	$37 28	$1,500 76

STATEMENT OF PIPES LAID—CONTINUED.

DATE 1881.	LOCATION. SIZE.	NO. OF FEET.	COST.	TOTAL.
June 30.	Amount brought forward	1933	$37 28	$1,500 70
	190 lbs. lead		9 50	
	1 3 inch double branch		3 15	
	1 4 x 3 reducer		1 85	
	1 4 inch single branch		3 40	
	1 4 inch sleeve		1 01	
	1 4 inch angle		2 45	
	sundry materials		2 30	
	labor		55 50	
				117 34
June 30.	Colden street, from dead end south of Warren street, to Canal.....3 in.	171		
	168 feet 3 inch pipe		35 28	
	5 feet 4 inch pipe		90	
	130 lbs. lead		6 50	
	1 3 inch sleeve		1 49	
	2 4 x 3 reducers		3 70	
	sundry materials		1 99	
	labor		51 75	
				101 61
June 30.	Market street, from Bowery to Mott street... 6 "	578		
	576 feet 6 inch		270 72	
	542 lbs. lead		27 10	
	1 6 inch ¾ bend		3 90	
	1 6 inch sleeve		2 80	
	sundry materials		8 60	
	labor		125 38	
				438 50
June 30.	Mott street, from Market to Bowery street... 6 "	362		
	342 feet 6 inch pipe		171 92	
	481 lbs. lead		24 05	
	1 6 x 4 single branch		6 47	
	3 6 inch sleeves		8 40	
	12 feet 4 inch pipe		3 24	
	1 6 x 6 double branch		8 20	
	1 6 inch plug		1 19	
	3 6 inch stop cocks		49 68	
	3 6 inch box frames and covers		7 50	
	sundry materials		6 96	
	labor		67 87	
				355 48
Sep. 15.	South Seventh street, from Eleventh ave. north 4 "	451		
	444 feet 4 inch pipe		133 20	
	220 lbs. lead		13 20	
	1 6 x 4 reducer		2 24	
	1 4 inch single branch		3 40	
	2 4 inch plugs		84	
	1 4 inch sleeve		1 91	
	1 4 inch stop cock		12 88	
	sundry materials		5 44	
	labor		109 50	282 61
		3495		$2,796 30

STATEMENT OF PIPES LAID—CONTINUED.

DATE 1881.	LOCATION.	SIZE.	NO. OF FEET.	COST.	TOTAL.
	Amount brought forward		3,495		$2,796 30
Oct. 17.	Emmett street from Broad to Penn. R. R. Av.	4 in.	465		
	450 feet 4 inch pipe			136 14	
	12 feet 3 inch pipe			5 88	
	320 lbs. lead			19 20	
	1 6 x 4 reducer			2 24	
	2 4 inch single branch			6 80	
	2 4 inch plugs			84	
	sundry materials			5 64	
	labor			111 50	
					288 24
Oct. 25	Hawkins street from dead end to Central R.R.		525		
	312 feet 4 inch pipe			94 20	
	204 feet 3 inch pipe			46 92	
	350 lbs. lead			21 00	
	1 6 x 4 reducer			2 24	
	2 4 x 3 reducers			3 70	
	1 3 inch sleeve			1 49	
	1 4 x 4 single branch			3 40	
	1 3 x 2 single branch			1 75	
	sundry materials			5 28	
	labor			89 75	
					269 73
Nov. 26	Elliott street from Washington ave. to within 100 feet of Summer ave.	4 "	904		
	900 feet 4 inch pipe			270 00	
	840 lbs. lead			50 40	
	1 4 inch double branch			3 92	
	1 4 inch plug			42	
	1 4 inch stop cock			12 88	
	sundry materials			11 12	
	labor			219 13	567 87
	Street mains, new and relaid, total		5,389		$3,922 14
	Pump main, No. 2	30 in.	6,024		
	Total pipe		11,413		
	Deduct relaid		890		
	Total new pipe		10,523		

New street mains laid $\frac{4400}{5280}$ of a mile.

Mains relaid as above, 890 feet.

Mains relaid in repairing not included above, 84 feet.

Total miles pipe connected with works, $138\frac{1702}{5280}$.

SERVICES FROM NOVEMBER 30, 1880, TO NOVEMBER 30, 1881.

MONTH.	SIZE.	No. SERVICES.	No. TAPS ONLY.	NEW TAPS TO REPLACE OLD ONES.	No. FEET OF PIPE.	COST.	CHARGE.
December, 1880	⅝ in.	27	4	1	514½	$343.17	$378.00
January, 1881	⅝ "	17	....	....	398½	268.28	238.00
February, "	⅝ "	16	8	2	312½	265.71	224.00
March, "	⅝ "	42	....	5	816½	525.71	591.68
April, "	⅝ "	102	5	14	1,912½	1,251.17	1,435.35
May, "	⅝ "	92	1	1	1,767½	1,130.61	1,296.56
June, "	⅝ "	71	3	2	1,449½	929.75	1,000.00
July, "	⅝ "	53	1	....	1,160½	703.99	737.29
August, "	⅝ "	73	....	....	1,511¼	965.38	1,021.89
September, "	⅝ "	104	....	....	2,111	1,318.98	1,446.69
October, "	⅝ "	82	5	....	1,426½	1,083.61	1,183.05
November, "	⅝ "	70	....	....	1,549	1,003.12	1,005.43
		749	27	25	14,929¾	$9,789.48	$10,557.94
March, 1881	¾ in.	1			26½	$16.80	$15.50
April, "	¾ "	1			12	10.85	14.00
June, "	¾ "	4			89½	67.47	66.00
October, "	¾ "	2			47½	35.20	31.00
November, "	¾ "	1			23	17.38	15.50
		9			198½	$147.70	$142.00
March, 1881	1 in.	1			26½	$30.01	$23.00
April, "	1 "	2			28	35.37	46.00
May, "	1 "	1	3		14½	42.13	49.50
June, "	1 "	2			61	46.53	46.00
September, "	1 "	2			21½	30.88	46.00
November, "	1 "	1			27	23.01	23.00
		9	3		178½	$207.93	$233.50
May, 1881	1¼ in.	1			25	$24.14	$25.00

RECAPITULATION.

Total No. Services	Size.	No. Services.	No. Taps only.	New Taps to replace old ones.	No. Feet of Pipe.	Cost.	Charge.
	5/8 in.	749	27	25	14,929¾	$9,789.48	$10,557.94
	¾ "	9			198½	147.70	142.00
	1 "	9	3		178½	207.93	233.50
	1¼ "	1			25	24.14	25.00
		768	30	25	15,331¾	$10,169.25	$10,958.44

PER FOOT.

	Cost Per Foot.	Charge Per Foot.
5/8 inch.	$ .65 6/10	$ .70 7/10
¾ "	.74 6/10	.71 7/10
1 "	1.16 8/10	1.31 2/10

Total number taps and connections	834
To replace old ones	25
Total affecting consumption	809

CONNECTIONS.

	1 in.	2 in.	4 in.	6 in.	
December			1	1	
January		1	1		
February			1		
May			1		
June		1			
July	1				
September			2		
November				1	
	1	2	6	2	Total, 11.

INVENTORY No. 1.

INVENTORY OF STREET MAINS, STOCK AND MATERIALS.

IRON PIPE.				
Three inch	240 feet,	@ $ .22	$ 52.80	
Four "	84 "	" .30	25.20	
Six "	204 "	" .50	102.00	
Eight "	60 "	" .77	46.20	
Ten "	72 "	" 1.40	100.80	
Twelve inch, 12 ft., lengths.	108 "	" 1.33	144.18	
" " 9 ft., "	702 "	" 1.00	702.00	
Fourteen "	12 "	" 1.32	15.88	
Sixteen "	156 "	" 1.87½	292.50	
Twenty-four inch, 12 ft., lengths	24 "	" 3.17	76.08	
" " pieces	20¼ "	" 2.50	50.63	
Thirty " 12 ft., lengths.	156 "	" 4.80	748.80	
" " pieces	50 "	" 4.00	200.00	$2,557.07
SLEEVES.				
Two inch	No. 2,	@ $ .80	$ 1.60	
Three "	" 6,	" 1.49	8.94	
Four "	" 2,	" 1.93	3.86	
Six "	" 9,	" 2.92	26.28	
Eight "	" 7,	" 3.66	25.62	
Ten "	" 7,	" 4.50	31.50	
Twelve "	" 2,	" 5.60	11.20	
Sixteen "	" 2,	" 9.45	18.90	
Twenty "	" 8,	" 9.70	77.60	
Twenty-four inch	" 4,	" 13.60	54.40	
Thirty "	" 9,	" 22.05	198.45	458.35
ONE-QUARTER BENDS.				
Three inch	No. 4,	@ $1.05	$ 4.20	
Four "	" 2,	" 1.80	3.60	
Six "	" 4,	" 4.00	16.00	
ONE-EIGHTH BENDS, OR ANGLES.				
Three inch	No. 4,	@ $1.85	$7.40	
Four "	" 2,	" 2.52	5.04	36.24
				$3,051.66

INVENTORY No. 1.—Continued.

Amount brought forward.....				$3,051.66
BEVELLED HUBS.				
Three inch .....No.	4, @	$1.61	$6.44	
Four " ..... "	2, "	2.03	4.06	
Six " ..... "	4, "	3.01	12.04	22.54
CAPS.				
Four inch .....No.	22, @	$ .60	13.20	
Six " ..... "	6, "	.91	5.46	
Ten " ..... "	2, "	3.50	7.00	
Twelve " ..... "	7, "	4.20	29.40	
Sixteen " ..... "	2, "	4.00	8.00	
Twenty " ..... "	1,		4.90	
Twenty-four inch..... "	1,		14.35	82.31
PLUGS.				
Four inch .....No.	57, @	$ .42	23.94	
Six " ..... "	23, "	1.19	27.37	
Ten " ..... "	2, "	1.43	2.86	
Twenty " ..... "	2, "	5.00	10.00	64.17
REDUCERS.				
Four to three.....No.	2, @	$3.04	6.08	
Three to two..... "	6, "	1.08	6.48	
Ten to six..... "	1, "		9.45	
Twenty to sixteen..... "	1, "		14.40	
Six to four... ..... "	2, "	2.24	4.48	40.89
SINGLE BRANCHES.				
Ten by six.....No.	2, @	$8.40	16.80	
Six by four..... "	10, "	6.47	64.70	
Six by six..... "	7, "	6.75	47.25	
Ten by ten..... "	1, "		8.90	
Four by twelve..... "	1, "		15.00	
Ten by two..... "	1, "		8.50	
Six by twelve..... "	1, "		20.00	
Twenty by four ..... "	1, "		24.25	
Sixteen by six..... "	4, "	23.35	93.40	
Ten by four..... "	2, "	9.75	19.50	
Two by two ..... "	2, "	1.50	3.00	
Three by three..... "	4, "	2.40	9.60	
Eight by six..... "	3, "	7.25	21.75	
Twenty by twelve..... "	1, "		26.63	379.28
				$3,640.85

INVENTORY No. 1.—Continued.

Amount brought forward.....			$3,640.85
DOUBLE BRANCHES.			
Ten by six.....No. 3, @ $11.30		$33.90	
Six by four..... " 11, " 7.00		77.00	
Six by six..... " 7, " 8.20		57.40	
Ten by ten..... " 1, "		11.50	
Six by twelve..... " 1, "		14.70	
Sixteen by six..... " 3, " 23.20		69.60	
Three by three..... " 4, " 3.15		12.60	
Eight by six..... " 1, "		10.00	
Twenty by six..... " 3, " 26.20		78.60	
Four by four..... " 6, " 3.92		23.52	388.82
MISCELLANEOUS.			
Y Branch, 16 x 10.....No. 1, @		35.00	
Bends, 24-inch..... " 2, " $36.08		72.16	
Plugs, 30-inch..... " 2, " 10.80		21.60	
Stop-cock, 12-inch..... " 1, "		48.00	
Check valve, 30-inch..... " 1, "		855.00	1,031.76
			$5,061.43

INVENTORY No. 2.

BELLEVILLE AND HIGH SERVICE PUMPING STATIONS.

Amount brought from 1880 report.....	$2,898.78
Additional charges, 1881.	
Stove and fixtures at gate house.....	18.00
Oil can, Belleville.....	12.00
Pump, "	100.00
Pulley, "	35.00
	$3,063.78

INVENTORY No. 3.

STABLE STOCK, &c.

Amount of Stock from 1880 report.....	$2,494.00

INVENTORY No. 4.

OFFICE FURNITURE AND FITTINGS.

Amount brought from 1880 Report	$1,804.10
Map cabinet	16.23
Chairs	27.00
	$1,847.33

INVENTORY No. 5.

TELEPHONE LINES AND CALLS.

Amount brought from 1880 Report	$1,240.00

INVENTORY No. 6.

BELLEVILLE FUEL AND STORES.

3,475 $\frac{18}{20}$ tons of coal,		@	$4.68 $\frac{1}{10}$	$16,267.17
½ cord of wood,		"	6.00	3.00
⅝ in. rubber packing,	3 lbs.	"	.50	1.50
1⅛ " "	16 "	"	1.00	16.00
Hemp	40 "	"	.25	10.00
Rotten stone,	10 "	"	.15	1.50
Plumbago,	5 "	"		
Emory cloth,	54 sheets,	"	.05	2.70
Potash,	42 boxes,	"		4.00
Waste,	30 lbs.	"	.15	4.50
Soap,	20 bars,	"	.10	2.00
Scrubbers,	2			.50
Brooms,	2			.60
Lard oil,	30 gals.	"	1.00	30.00
Cylinder oil,	9 "	"	.75	6.75
Kerosene,	6 "	"	.20	1.20
Babbitt's metal,	20 lbs.	"	.15	3.00
Manhole gaskets,	6 "	"	.60	3.60
Handhole "				
Gauge glasses,	7	"	.30	2.10
Lamp chimneys,	7	"	.10	.70
" wicks,	44	"		.75
				$16,361.07

INVENTORY No. 7.

HIGH SERVICE FUEL AND STORES.

Coal on hand Nov. 30, 1881,	$10\frac{8}{20}$	tons		$54.47
$\frac{1}{16}$-inch rubber packing,	3	lbs., @ $	.35	1.05
Combination "	15	" "	1.00	15.00
Italian hemp "	50	" "	.15	7.50
Bath brick,	2	"	.08	.16
Rotten stone,	2	" "	.15	.30
Emery cloth,	12	sheets "	.05	.60
Potash,	12	boxes "	.10	1.20
Waste,	40	lbs., "	.15	6.00
Scrubbers,	2	"	.25	.50
Brooms,	7	"	.30	2.10
Lard oil,	12	gals. "	1.00	12.00
Cylinder oil,	10	" "	.75	7.50
Handhole gaskets,	3	"	.15	.45
Gauge glasses,	26	"	.30	7.80
				$116.63

INVENTORY No. 8.

SERVICE STOCK.

On hand Nov. 30, 1881.

$\frac{5}{8}$-inch corporation stops	No.	31, @ $	.87½	$27.12
$\frac{5}{8}$ " curb "	"	23, "	.80	18.40
1 " corporation "	"	12, "	1.75	21.00
1 " curb "	"	8, "	1.50	12.00
¾ " " "	"	5, "	1.25	6.25
Wooden curb boxes,	"	56, "	.50	28.00
Patent " " covers	"	30, "	.40	12.00
$\frac{5}{8}$-inch lead pipe,	$10\frac{0}{0}$,	733½ lbs., "	.07½	49.50
¾ " " " "		74 " "	.07½	5.03
1 " " "		75½ " "	.07½	5.12
2 " " "		53 " "	.07½	3.59
$\frac{5}{8}$ couplings,	5,	"	.20	1.00
				$189.01

INVENTORY No. 9.

GENERAL INVENTORY OF SUPPLIES AND MATERIALS ON HAND NOT INCLUDED IN FOREGOING INVENTORIES.

STREET MAINS AND REPAIRS.

Picks	18
Crow-bars	6
Shovels	35
Setts	16
Yarning irons	7
Chisels (hand)	16
" (hatchet)	10
Hammers	13
Sledges	5
Wrenches	14
Ladles	6
Stop keys	12
Hydrant keys	7
Sets blocks	5
" ropes	5
Pumps	8
Derricks	3
Lead pots	2
Wheelbarrows	2
Pipe tongs	3
Lanterns	2
Scrapers	6
Hose butts	7
Axes	3
Hand saws	1
Grindstones	2
Tool boxes	2
Jack screws	4
Oil cans	7
Vise	3
Screwdrivers	3
Rammers	3
Wedges	2
Pails	2
Scales	2
Cross-cut saw	1
Hoes	2
Dirt buckets	2
Iron chain	61 feet
Curb stop keys	5
⅝ tap machine	2
1 " "	1

MISCELLANEOUS.

Stop cocks, 8-inch	3
" " screw	18
" box frames	34
" boxes	16
" " plugs	33
Hydrants in good order	7
" out of order	21
" soles	19
" cases (octagon)	2
" " (square)	13
" rods	17
" screws and taps	12
Corner irons	63
Yarn	547 lbs.
Hydrant heads	23

WATER METERS.

½-inch	Gem		3
½	"	Worthington	1
½	"	Ball & Fitts	1
¾	"	Spooner	1
¾	"	Gem	1
1	"	Gem	3
1	"	Rotary	3
1	"	Desper	1
1	"	Crown	7
2	"	Gem	3
2	"	Worthington	1
3	"	Worthington	2

Glasses	3
Meter box frames	15
" " covers	13
" boxes	3

INVENTORY No. 9.—Continued.

TELEGRAPH.

Insulators—Iron 26
" Glass 46
Jars 6
Zincs 9
Brackets 17

CARPENTER'S REPORT.

LUMBER.

1¼-inch ..... 130 feet.
Pine plank, 2-inch ..... 2 "
Pine boards 6
2-inch 103
3-inch 90
Stop boxes 20

PAINT.

White lead 80
Ven. red 30

HARDWARE.

10p. nails ..... 95 lbs.
8p. " ..... 8 "
20p. " ..... 80 "
40p. " ..... 45 "
60p. " ..... 8 "
6p. " ..... 20 "

BELLEVILLE PUMPING STATION

Engine lathe 1
Shaper 1
Drill press 1
Machine vise 1
Pipe vise 1
Hammers 2
1 ton differential block 1
½ " " " 1
Ratchets 1
Screw wrenches 2
Pipe stocks 2
Pipe cutters 2
2½-inch hose 164
¾ " " 50
1 " " 24
Shovels, No. 3 3
" " 4 3
Tube scrapers 2
Dies 15
Machine taps 26
Screw plates 4
Twist drills 15
Breast " 1
Sets cans and trays 2
Oil pot 1
Shears 1
Surface plate 1
Augurs 2
Hack saw frame 1
Calipers 2
Plyers 1
Sets block and fall ropes 1
Grindstone 1
Hand lamps 4
Kerosene lamps 8
Wheelbarrows 5
Coal buckets, 4 cwt 4
Wheelbarrow scales 2
Clamps 4
Pipe tongs 18
Fire Hooks 4
Slice bars 1
Fire hoes 1
Suction hose, 2-inch 150
Screw driver 1
Pipe taps 8
" dies 8
Lanterns 3
Hand saw 1

BLACKSMITH'S TOOLS.

Hammer 1
No. 2 forge 1
Anvil 1
Sledges 1
Tongs 5
Hardy 1
Suages 2
Flatter 1

INVENTORY No. 9.—Continued.

Belleville Pumping Station.—Cont'd.

ELLS.

¼-inch..... 3
⅜ " 11
½ " 15
¾ " 11
1 " 2
1¼ " 3
2 " 4
3 " 2

TEES.

¾-inch..... 1
1 " 1
1¼ " 1
2½ " 1
4 " 1

UNIONS.

¼-inch..... 2
½ " 2
¾ " 2
2 " 1

PIPE.

¾-inch..... 13 feet.
1 " ..... 300 "
1¼ " ..... 21 "
1½ " ..... 25 "
2 " ..... 20 "
2½ " ..... 17 "

PLUGS.

½-inch..... 2
2 " 1

NIPPLES.

2½-inch..... 3

GLOBE VALVES.

1-inch..... 1

BAR IRON.

¾-inch..... 24 lbs.
⅞ " ..... 30 "
1 " ..... 82 "

BOLTS.

1-inch..... 35

Reducers..... 11
Z springs..... 44
Valves..... 2
Air pump valves..... 14
Extra piston rods..... 3
Valve seats..... 2
Flange unions..... 4
Nails..... 5 lbs.
Barrow bearings..... 34
Steam dampers..... 2
Springs..... 200
Pinch bars..... 2
Nuts..... 29 lbs.
Files..... 14
Ball marline..... 4 lbs.

H. S. PUMPING STATION.

Monkey wrench, 12-inch..... 4
2 sets wrenches..... 2
Hoes..... 1
Pokers..... 3
Rakes..... 1
Slice bars..... 1
Chisels..... 3
Plyers..... 1
Hammers..... 2
Machine and pipe vise..... 2
Sledges..... 1
Files..... 4
1¼-inch hose..... 25 feet.
Wheelbarrows..... 2
Scoop shovels..... 2
Hand lamps..... 4
Spittoons..... 6

ELLS.

¼-inch..... 12
⅜ " 3
¾ " 3
1 " 2
1¼ " 2
1½ " 3
2 " 2

INVENTORY No. 9.—Continued.

H. S. Pumping Station.—Cont'd.

TEES.

⅜-inch	1
½ "	1
1¼ "	13
1½ "	2
2½ "	5

UNIONS.

¼-inch	2
¾ "	2

COUPLINGS.

¼-inch	2
⅜ "	4
¾ "	2
1½ "	2
2 "	2

PIPE.

¼-inch	16 feet.
⅜ "	14 "
½ "	12 "
¾ "	18 "
1 "	9 "
2 "	12 "

PLUGS.

½-inch	1
1 "	2

NIPPLES.

¼-inch	15
⅜ "	16
½ "	4
¾ "	14
1 "	12
1¼ "	6
2 "	2
3 "	4

GLOBE VALVES.

⅜-inch	3
½ "	4
¾ "	4
1¼ "	2
1½ "	1

CHECK VALVES.

½-inch	1
1¼ "	1
2 "	1
Reducers	14
Springs	64
Lead	8 lbs.
Pinch bars	2
Cocks	4
Files	4
Watering pots	2
Enterprise packing	48 lbs.
Wood	6 cords.

STATISTICS OF CONSUMPTION.

COMPARISON OF CONSUMPTION, EXPENSES AND INCOME.

	Whole Quantity of Water Pumped.	Average daily consumption.	Miles of Pipe.	Inhabitants per mile.	No. of taps per mile.	Whole number of taps.	Average daily consumption per tap, gallons.	Average daily consumption per head of population.	Estimated Net quantity furnished consumers, deducting 20 per cent. for leakage, drawing hydrants, &c.	Water Rents Income.	Receipts per m gallons on estimate amount furnished consumers	Receipts per m gallons on gross amount pumped.	Gross Amount Pumped. Cost of pumping p m galls.	Gross Amount Pumped. Cost of supply per m galls.	Cost of supply includes all operating expenses and interest on debt.
											Cents.	Cents.	Cents.	Cents.	
1870	472,020,164	2,109,567	51 32/52 80	2045	65.5	3,383	623	20	377,616,132	$55,079.45	14 6/10	.11 7/10			
1871	904,038,857	2,754,900	70 52/52 80		63.1	4,480	615		723,231,087	72,952.23	10 8/10	.08 5/10			
1872	1,307,145,301	3,571,435	88 30/52 80		63.4	5,616	636		1,045,716,241	91,880.78	08 7/10	.07 3/10	01.427		
1873	1,632,865,234	4,473,604	106 21/52 80		62.	6,598	680		1,306,292,187	107,160.27	08 2/10	.06 5/10	01.425		
1874	1,727,295,969	4,732,718	114 52/52 80		65.	7,389	640		1,381,835,776	125,417.19	09 8/10	.07 25/100	01.319		
1875	1,947,776,390	5,471,283	122 38/52 80		66.7	8,196	667		1,558,221,112	133,874.41	08 6/10	.06 9/10	01.289	.14 3/10	$279,633.76
1876	2,271,741,536	6,206,944	126 52/52 80		70.4	8,885	700		1,817,393,230	137,945.14	07 5/10	.06 7/100	01.183	.12 5/10	284,083.52
1877	2,450,744,400	6,714,369	128 44/52 80		73.6	9,485	708		1,960,595,520	157,012.51	.08	.06 4/10	01.250	.11 2/10	274,555.11
1878	2,657,400,900	7,280,550	130 47/52 80		76.7	10,048	724.5		2,125,920,720	163,141.19	07 7/10	.06 15/100	01.143	.10 3/10	275,706.48
1879	3,056,964,006	8,375,244	135 74/52 80		78.1	10,557	793.5		2,445,571,206	172,084.86	07 3/10	.05 6/10	00.844*	.09 5/100	276,954.77
1880	3,365,489,444	9,195,326	136 17/52 80	1000	81.4	11,093	829	81 3/10	2,692,452,356	184,746.16	.07	.05 5/10	01.075*	.08 7/10	292,482.92
1881	3,609,332,980	9,888,583	138 17/52 80		86.	11,902	831		2,887,466,384	204,756.41	07 1/10	.05 7/10	01.176*	.08 3/10	299,273.34

Miles Pipe per 1000 Inhabitants.

1870..... 26/52 80

1880.....one 71/52 80

*Average cost of coal, 1879, per ton.....$2.29

" " " 1880, " 4.43 7/10

" " " 1881, " 4.58 3/4

Percentage of Increase in Five Years, from 1875 to 1880 inclusive.

Consumption.....70 per cent.

Cost of supply..... 4 6-10 per cent.

Income from water rents.....38 per cent.

COMPARISON OF THE RATES AND REGULATIONS OF DIFFERENT CITIES FOR MEASURED WATER.

The rates at which metered water is sold by different water companies varies largely. The following rates and regulations have been collated fiom various *Water Rates*, which have come to hand, to wit :*

	Cents per 1000 gal's
Newark, N. J.	12½
Discounting 2 per cent. for each $100 of metered water per annum. Example :—	
Consumption amounting to $100 per annum, 2 per cent.	
" " 200 " 4 "	
" " 300 " 6 "	
up to $2000, 40 per cent. being the maximum discount &c.	
Morris Aqueduct, Morristown, N. J.	40
"A minimum charge of $8.00 per year in each dwelling in which a meter is used will be made, whether water amounting to that sum is actually consumed or not."	
Lynn, Mass.	
Under 12,000 gallons daily	25
Over 12,000 daily, "the price of the excess to be fixed by the board."	
Schenectady, N. Y.	
Daily average 500 gallons or less	50
" 1,000 "	45
" 3,000 "	40
" 5,000 "	35
" 10,000 "	30
" 15,000 "	25
" 20,000 "	20

*Compiled from statistics of Union Water Meter Company.

	Cents per 1000 gal's.
Hartford, Conn.	
Daily average 500 gallons or less	30
" 500 to 1,000 gallons	25
" 1,000 to 2,000 "	20
" over 2,000 " rates to be fixed by the Commissioners, not less than	16
Lawrence, Mass.	
300 gallons or less per day	30
300 to 1,000 gallons per day	27.5
1,000 to 3,000 " "	25
3,000 to 6,000 " "	22.5
6,000 to 10,000 " "	20
Favorable rates will be made with manufacturers using water in large quantities.	
Chicago, Ill.	10
Meter rates must be paid monthly at the rate of 10 cents per 1000 gallons.	
Evansville, Ill.	
Bills for measured water to be paid monthly.	
Monthly average, 200,000 gallons or less	20
" " over 1,200,000 gallons	10
The price of any odd number of gallons, between 200,000 and 1,200,000, shall be arrived at by multiplying the excess of the number of thousands over 200 by 8 cents, and adding the product to $40.00.	
Cincinnati, O.	15
Dayton, O.	
Daily average, 200 gallons or less	50
" " 200 to 300 gallons	40
" " 300 to 500 "	30
" " 500 to 1,000 "	25
" " 1,000 to 5,000 "	20
" " over 5,000 "	15
The year to be estimated at three hundred (300) days. Special rates given to large consumers.	

	Mills per foot.
Cleveland, O.	
For the first 50,000 cubic feet or less	1 3-10
" any amount between 50,000 and 100,000 cubic feet.	1
" " " 100,000 " 200,000 "	9-10
" " " 200,000 " 300,000 "	8-10
" " exceeding 300,000 cubic feet	7-10
St. Paul's, Minn.	Cents per 1000 gal's.
Daily average, 1,000 gallons or less	50
" 1,000 to 3,000 gallons	40
" 3,000 to 5,000 "	35
" 5,000 to 10,000 "	30
" over 10,000 "	25
And in addition the rent of the meter.	
Newport, Ky.	
Daily average, 500 gallons or less	35
" 500 to 1,000 gallons	33
" 1,000 to 2,000 "	31
" 2,000 to 3,000 "	29
" 3,000 to 4,000 "	27
" 4,000 to 5,000 "	25
" 5,000 to 6,000 "	23
" 6,000 to 7,000 "	21
" 7,000 to 8,000 "	19
" 8,000 to 10,000 "	17
" 10,000 to 20,000 "	15
" 20,000 and over	10
New Albany, Ind.	15
If the quantity is *estimated*, the rates are the same as at Newport, Ky., up to 15,000 gallons daily, which is at 15 cts. per 1,000 gallons, and for a daily average over 15,000 gallons	15
Louisville, Ky., has also the same provision in their water rates for *estimated* water.	

	Cents per 1000 gal's.
Louisville, Ky.	
By meter measurement.	
Daily average, 1,200 or less per month, $5.40.	
" 1,200 up to and including 5,000 gallons	15
For the second 5,000 gallons daily	14
" third 5,000 "	14
" fourth 5,000 "	12
" fifth 5,000 "	11
" sixth 5,000 "	10
" seventh 5,000 "	9
" eighth 5,000 "	8
" ninth 5,000 "	7
" tenth 5,000 "	6
For all additional quantities	6
Milwaukee, Wis.	
For "the average quantity estimated during the year."	20
Manchester, N. H.	
For a continuous supply :	
	Per 100 cubic feet
Averaging less than 15 cubic feet per day, per 100 cubic feet	40
Daily average 15 to 25 cubic feet	30
" 25 to 50 "	20
" 50 to 100 "	15
" 100 cubic feet or more	10
"Provided no meter rate shall be less than $8.00 per annum."	
Holyoke, Mass.	Cents per 1000 gal's.
Not exceeding 50,000 gallons per month	15
From 50,000 to 200,000 " "	10
"Excess over 200,000 " " special rates."	
"The right is reserved to stop the use of water for manufacturing purposes, except for steam boilers, when the public interest may require. A reasonable interest on cost of meter and setting will be added to above rates."	

	Cents per 1000 gal's.
Worcester, Mass.	
"Where the quantity of water used is determined by meter, the assessment per 1,000 gallons shall be at the following rates :—	
"For 1,000 gallons per day, or less, the sum of twenty-five cents per 1,000 gallons.	25
"For from 1,000 to 5,000 gallons per day, the sum of twenty cents per 1,000 gallons.	20
"For from 5,000 to 15,000 gallons per day, the sum of fifteen cents per 1,000 gallons.	15
"All meters set on private estates shall be subject to the inspection and control of the water commissioner, or such agent or officer as the committee on water shall designate to have the care and supervision of meters.	
"The officer whose duty it is to care for the meters in the city, or his agent, shall have free access at all times upon the premises of the owner thereof for the purpose of reading the meter, or he may remove a meter at any time for the purpose of testing the accuracy of its measurement; and when any meter shall be found incorrect in measurement, and unworthy further use, such a meter so condemned will be replaced at once by one which is approved by the committee on water at the expense of the owner thereof."	
Danvers, Mass.	
Daily average, 5,000 gallons or less.....	20
Over " " " special rates.	
Springfield, Mass.	
"Measured water, when the daily consumption is 300 gallons or less, 30 cents per 1,000 gallons, but in no case will measured water be furnished at a less rate than $10 per annum, for each family so furnished. Parties using meters for any purpose or on any part of their premises, will be required to measure all the water supplied to such premises. Measured water other than those specified, special rates."	30

	Cents per 1000 gal's.
Fall River, Mass.	
Measured or estimated water	30
Provided no charge shall be less than ten (10) dollars per annum.	
Cambridge, Mass.	30
"When the quantity used averages not less than 500 gallons per day, a meter shall be applied, if the proprietor or occupant request it."	
Boston, Mass.	30
Ottumwa, Iowa.	
Not exceeding 50,000 gallons per month	30
The same reservation as to the use of water and charge for the use of meters is made as at Holyoke, Mass.	
Taunton, Mass.	
1,000 gallons per day or less	25
Special rates given for quantities exceeding a daily average of 1,000 gallons. Minimum charge for metered premises ten dollars ($10), the consumer to pay for the meter and putting in. No restriction as to the use of metered water.	
Johnstown, N. Y.	25
Albany, N. Y.	
Daily average, 200 gallons or less	40
" 200 to 300 gallons	30
" 300 to 1,000 "	25
" 1,000 to 2,000 "	20
" 2,000 to 10,000 "	10
Quantities in excess of 10,000 gallons daily, rates fixed by the commissioners.	
Syracuse, N. Y.	
Daily average, 2,500 gallons or less	40
" 2,500 to 5,000 gallons	35
" 5,000 to 7,500 "	30
" 7,500 to 10,000 "	25
" over 10,000 "	20

	Cents per 1000 gal's.
Utica, N. Y.	
Daily average, 200 to 300 gallons	50
" 300 to 1,000 "	40
" 1,000 to 5,000 "	30
" 5,000 to 10.000 "	25
" over 10,000 "	
Rate to be fixed by the board.	
No meter rates to be less than $10 per annum.	
Newton, Mass.	
"Meters will be furnished and maintained by the city at cost, to all takers who prefer to use them, and the city reserves the right to put in a meter in any case at its own cost, and charge for water by measure instead of schedule rates."	
Burlington, Iowa.	
Daily average, 1,000 gallons	40
" 1,000 to 5,000 gallons	30
" 5,000 gallons and upwards	20
The Burlington Water Company reserves the right to establish meters, or to change rates if these are found insufficient.	
Titusville.	
Daily average, 300 to 500 gallons or less	30
" 500 to 1,000 "	20
" 1,000 to 5,000 "	15
" over 5,000 "	12½
Kalamazoo, Mich.	
Daily average, 200 gallons or less	40
" 200 to 300 gallons	30
" 300 to 1,000 "	25
" 1,000 to 3,000 "	20
" 3,000 to 10,000 "	15
Over 10,000 gallons daily, special rates. Where water is estimated the year is taken at 310 days.	

	Cents per 1000 gal's
Waterbury, Conn.	
Daily average, 500 gallons or less	30
" 500 to 1,000 gallons	25
" 1,000 to 2,000 "	20
" over 2,000 gallons, the rates shall not be less than 10 cents, as shall be fixed by the commissioners.	
Grand Rapids, Mich.	
Daily average, 1,000 gallons or less	30
" 1,000 to 5,000 gallons	25
" 5,000 to 10,000 "	20
Portland, Me.	
Daily use first 1,000 gallons	50
" in excess of 1,000 to 10,000	40
" " 10,000	30
Pawtucket, R. I.	
For 1,000 gallons or less per day	30
" 1,000 to 3,000 gallons per day	25
" 3,000 to 5,000 " "	20
" 5,000 to 10,000 " "	15
In excess of 10,000 gallons, special rates, provided that in no case shall the charge be less than $10.00.	
No restrictions as to the use of water passing through a meter.	
Rochester, N. Y.	
200 gallons or less per day	30
200 to 1,000 gallons per day	25
1,000 to 2,000 " "	20
2,000 to 5,000 " "	15
5,000 and upwards	10
Burlington, Vt.	
Over 1,000 and under 4,000 gallons	50
" 4,000 " 7,000 "	40
" 7,000 " 25,000 "	30
" 25,000 gallons per month	20

Cents per 1000 gal's.

Binghampton, N. Y.

For measured or estimated water..... 25

Toronto, Ont.

"A general charge of 27 cents per thousand gallons will be made for all water supplied by meter, subject to a reduction of 33⅓ per cent. should the rates be paid within one month after they become due."

"The following charges will be made for the use of the meter, in addition to the above :"

½ or ⅝	inch,	per annum.....	$2.00
¾	"	"	4.00
1	"	"	8.00
2	"	"	14.00
3	"	"	25.00
4	"	"	45.00
6	"	"	100.00

Providence, R. I.

"When the consumption of water through a single tap amounts annually to $300 or less, per 1,000 gallons..... 30

"When the consumption exceeds in amount the sum of $300 annually through a single tap, a discount of 20 per cent. on the excess over said $300, will be allowed and deducted from the amount due for the fourth quarter.

"Provided however, that in no case where a meter is used, shall the annual charge be less than $10.00, which annual charge will be payable in advance.

"The use of meters in the city of Providence is governed by the following regulations, "subject to additions and amendments, to wit :

METERS.

"When a consumer shall prefer to pay the cost of such a meter as shall be approved by the commissioners, together with the cost of putting in and of maintenance, rather than to pay schedule rates, or for the quantity estimated, a meter will be put in.

"The commissioners reserve the right to put in a meter at the cost of the city, in any case, and charge for measured water, instead of being governed by the above schedule.

"If a meter gets out of order and fails to register, the consumer will be charged at the average daily consumption, as shown by the meter when in order. Repairs of meters will be made by the commissioners at the expense of the owners, whenever the commissioners deem repairs necessary.

"When water passes through a meter it may be used for any and all purposes. No service pipes, however, will be allowed to be laid across a street.

"All meters will be set by an employee of the commissioners and shall not be moved or disturbed without permission from the proper officer."

St. Louis, Mo.

This city has under consideration, "an ordinance to secure a more equal distribution and to lessen the waste of water."

The provisions relating to the rates are as follows:—

SEC. 1. "All licenses for the right to use water, other than licenses issued to manufacturers and other large consumers of water under meter rates, shall state:

1st. The premises on and purposes for which the water is to be used;

2d. The amount paid for the license;

3d. The total and average daily quantity of water the water-taker is entitled to use without additional payment;

4th. Such other information as may be deemed requisite by the assessor or collector of water rates."

SEC. 2. "Any party holding a water license may use a greater quantity than the total quantity stated in the license during the specified time, provided that at the expiration of the license said party shall pay to the assessor and collector of water rates, fifteen cents for each one-

hundred cubic feet of water used in excess of the total quantity stated in the license."

* * * * * *

SEC. 4. "The total quantity of water stated in the license, and which the holder thereof is entitled to use without extra payment within the time specified, shall be determined by allowing one hundred cubic feet of water for each fifteen cents of the amount paid for said license, and an additional thirty cubic feet of water for each and every day during the time for which the license has been issued."

* * * * * *

SEC. 6. "All meters placed under the provisions of this ordinance, shall be paid for by the city out of the water-works revenue, and all work of placing, repairing and keeping said meters in order shall be done under the control of the water commissioner."

The several other provisions of the ordinance relate to the conditions of setting the meters, their management and the penalties for non-payment of rates under it, and for credits, etc., in case of a removal of water-taker before his license has expired.

The ordinance looks to the general introduction of meters in the city.

TABLE OF METERS IN USE IN THE CITY OF NEWARK.

Number of Meters used	177
" " turned off	9
Total number of meters set	186

Business Purpose.	No. of Meters in use.	Business Purpose.	No. of Meters in use.
Tannery	33	Saw factory	1
Public Schools	25	Forming hats	1
Hat factory	16	Shipping	1
Brewery	15	Woolen fibre	1
Malt house	6	Steel works	1
Stables	5	Fertilizing	1
Leather finishing	5	Glue manufacturing	1
Cotton thread mill	3	Hosiery	1
Saw mill	3	Hardware	1
Refining and smelting	3	Stone cutting	1
Celluloid manufacturing	3	Locks	1
Jewelry "	3	Trunks and bags	1
Miscellaneous (to let power)	3	R. R. depot	1
Theatre	3	Oleomargarine	1
Patent leather cloth	3	Tinware	1
Cutlery and hardware	3	Wood turning	1
Chemical works	2	Lead pipe	1
Machine shops	2	Iron foundry	1
Saddlery hardware	2	Smoothing Iron	1
Boots and shoes	2	Varnish	1
Silk mill	2	Elevator	1
Bakery	2	Hotel	1
Motors	2	Vinegar	1
Sewing machines	2	Wire cloth	1
Wagon Material	2	Oil cloth	1
Paint works	1	County jail	1

KIND OF METERS.

	½	¾	1	1½	2	3	4	Total
Crown	4	5	11		3			23
Worthington		1	5		12	11	3	32
Rotary			27			1	3	31
Gem	6	15	48	1	18	1	3	92
Desper	2		3					5
Hartford		1						1
Boston			1					1
Stoddard			1					1
	12	22	96	1	33	13	9	186

CLASSIFICATION OF ASSESSED WATER RENTS.

DWELLINGS.			
5,299 one family, @ $6.25	$33,118.75		
2,532 two families, @ $10.00	25,320.00		
		58,438.75	
TENEMENTS.			
1,039 three families, @ $14.00	14,546.00		
4,623 families in tenements, at commuted rates	18,642.00		
1,373 boarders	687.00		
		33,695.00	
FIXTURES.			
2,715 hot and cold baths	13,266.00		
288 cold baths	707.75		
2,669 kitchen boilers	3,546.75		
4,399 water closets	12,031.75		
346 urinals	1,555.50		
11 aquariums	69.50		
2 turkish baths	40.00		
1 shower "	10.00		
Public water closets and urinals	175.00		
45 public baths	450.00		
59 fountains	710.00		
16 public fountains	1,600.00		
9 sewing machine motors	34.50		
		34,196.75	126,330.50
BUSINESS PLACES.			
400 miscellaneous charges for shop use	1,920.25		
340 offices	807.00		
1,744 stores	4,681.75		
296 extra clerks charged	97.50		
786 saloons	4,135.50		
118 bakeries	616.25		
118 barber shops	638.00		
33 butchers	101.00		
7 private markets	247.00		
80 tailors	244.75		
23 blacksmiths	114.00		
Curriers—Morrocco and leather dressing	150.00		
15 tanneries	670.00		
22 laundries	396.50		
11 foundries	66.00		
Jeweler's use	413.00		
		126,330.50	126,330.50

CLASSIFICATION OF ASSESSED WATER RENTS.—Continued.

Amount forward,	$15,298.50	126,330.50
BUSINESS PLACES—Continued.		
14 dentists	73.00	
Restaurants and ice cream saloons	492.75	
15 Banks	120.00	
14 Photographers	137.50	
3 Lapidaries	41.00	
Slaughter Houses	60.00	
Bottling and Bottle Washing	150.00	
Plating	126.50	
Small Breweries	325.00	
Cows and Stock	95.00	16,919.25
FACTORY USE.		
3,358¼ horse power charged	16,791.75	
9,041 Hands	2,371.75	
103 Hatters' Kettles	1,010.00	
23 Hatters' Coloring Kettles	115.00	
Hatters' other use	139.50	
Miscellaneous Factory uses	1,872.50	
Water Motors	1,738.00	24,038.50
MISCELLANEOUS.		
Public Buildings and uses, City and County	1,960.00	
Private and Parochial School, 1,618 scholars	198.00	
Other use	104.50	
19 Club Rooms	117.00	
25 Lodge Rooms	115.00	
20 Halls, Meeting Rooms, &c	153.00	
Engine Supply, railroads	2,300.00	
Depot use, railroads	831.00	
Private Fire purposes	250.00	
Lodgings	39.50	
Special Hose uses	107.50	
Miscellaneous uses	17.50	
22 Tanks for miscellaneous use	334.00	
Per cent. increase charged Belleville	180.90	
Washing Vegetables	52.50	
Washing Barrels	25.00	
4,410 Stalls, Stables	9,568.50	
30 Green Houses	156.25	
Church use	346.00	16,856.15
		184,144.40

1873.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap, previous years.	Average monthly temperature.	Rainfall. Inches.	Average rainfall, previous years. Inches.	Remarks.
Dec. '72	4,240,829	5,616	755		24.581	3.785	3.941	Snow on 10 days. Rain on 7 days.
Jan. '73	4,617,650	5,664	815		24.774	5.820	3.726	Snow on 7 days. Rain on 7 days.
Feb. '73	5,234,530	5,671	923		27.407	3.885	3.340	Snow on 6 days. Rain on 5 days.
Mar. '73	4,446,402	5,678	783		34.472	2.760	3.549	Snow and rain on 16 days.
Apr. '73	4,099,449	5,753	713		46.475	5.835	3.735	Snow and rain on 14 days.
May '73	3,850,765	5,895	654		57.971	3.755	4.368	Rain 11 days.
June '73	4.501,461	6,008	749		68.592	1.715	3.734	Rain on 5 days.
July '73	4,738,803	6,175	767		74.129	6.615	3.739	Rain on 13 days.
Aug. '73	4,255,600	6,310	674		70.403	7.765	5.168	Rain on 15 days.
Sept. '73	4,677,013	6,397	731		63.887	3.550	3.340	Rain on 10 days.
Oct. '73	4,912,615	6,470	759		53.371	3.740	3.649	Rain on 6 days.
Nov. '73	4,167,861	6,533	638		36.117	4.679	3.732	Snow and rain on 17 days.

Total rainfall for the year, 53.895 inches. Average daily consumption for the year, 4,473,603 gallons.

Total of averages, previous years, 46.021 inches. Average consumption per tap for the year, 680 gallons.

Total number of taps at the end of the year, 6,598.

Notes from Mr. W. A. Whitehead's meteorological records:

The mean temperature of the Winter months was the lowest of any Winter except one since 1843–44, being 25.590, while the mean of the Winter months 1867–68 was 24.980.

Snow fell to a depth of 62½ inches.

On August 14th, 1.820 inches of rain were deposited, and on the 31st of the same month 2.630 inches.

1874.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap, in previous years. Galls.	Average monthly temperature.	Rainfall. Inches.	Average rainfall, previous years. Inches.	Remarks.
Dec. '73	4,401,066	6,598	664	755	35.384	2.470	3.919	Snow on 5 days. Rain on 8 days.
Jan. '74	4,354,382	6,630	656	815	32.613	5.670	3.776	Snow on 5 days. Rain on 11 days.
Feb. '74	4,584,618	6,653	689	923	29.656	3.168	3.380	Snow on 11 days. Rain on 3 days.
Mar. '74	4,519,909	6,673	677	783	37.827	2.135	3.561	Snow and rain on 15 days.
April '74	4,364,632	6,745	647	713	41.475	8.715	3.737	Snow and rain on 19 days.
May '74	4,218,705	6,822	617	654	58.617	2.755	4.473	Rain on 9 days,
June '74	5,347,227	6,918	773	749	69.408	3.580	3.669	Rain on 7 days.
July '74	5,188,228	6,998	741	767	73.484	4.230	4.202	Rain on 8 days.
Aug. '74	5,226,300	7,082	738	674	69.213	2.785	5.252	Rain on 6 days.
Sept. '74	5,346,833	7,139	749	731	66.792	9.050	3.450	Rain on 6 days.
Oct. '74	4,790,899	7,251	661	759	53.689	2.435	3.652	Rain on 4 days.
Nov. '74	4,449,391	7,312	609	638	40.979	2.860	3.904	Snow and rain on 7 days.

Total rainfall for the year, 49.853 inches. Average daily consumption for the year, 4,732,718 gallons.

Total of averages of previous years, 46.975 inches. Average consumption per tap for the year, 640 gallons.

Total number of taps at the end of the year, 7,389.

Notes from Mr. W. A. Whitehead's meteorological records:

The mean temperature of the Winter months was 32.220, and snow fell during the same to a depth of 36 inches. From the 10th to the 19th of September 7.830 inches of rain were deposited, and the remainder of the total for the month fell on the 29th.

1875.

Month.	Average daily consumption. Gallon.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap in previous years. Galls.	Average monthly temperature.	Rainfall Inches.	Average rainfall, previous years. Inches.	Remarks.
Dec. '74	4,379,388	7,389	593	709	31.185	2.810	3.890	Snow on 3 days. Rain on 7 days.
Jan. '75	4,876,147	7,447	655	734	22.915	3.310	3.837	Snow on 10 days. Rain on 4 days.
Feb. '75	5,657,629	7,454	759	806	22.915	2.400	3.320	Snow on 5 days. Rain on 5 days.
Mar. '75	5,328,434	7,463	714	730	31.839	3.820	3.192	Snow on 10 days. Rain on 3 days.
April '75	5,076,825	7,491	678	680	43.417	3.135	3.965	Snow and rain on 11 days.
May '75	4,821,154	7,620	633	636	60.125	1.590	4.418	Rain on 8 days.
June '75	5,658,474	7,735	731	761	68.754	2.335	3.558	Rain on 9 days.
July '75	5,773,377	7,874	733	754	72.880	5.985	3.875	Rain on 11 days.
Aug. '75	5,748,743	7,951	723	706	70.940	10.215	5.519	Rain on 15 days.
Sept. '75	6,200,798	8,013	774	740	62.504	1.930	3.656	Rain on 5 days.
Oct. '75	5,356,043	8,074	663	710	51.831	2.890	3.771	Rain on 8 days.
Nov. '75	5,216,594	8,137	641	624	37.983	4.360	3.734	Rain on 10 days.

Total rainfall for the year, 44.980 inches. Average daily consumption for the year, 5,471,283 gallons.

Total of average of previous years, 46.760 inches. Average consumption per tap for the year, 667 gallons.

Total number of taps at the end of the year, 8,196.

Notes from Mr. W. A. Whitehead's meteorological records:

The mean temperature of the Winter months was nearly as low as during the Winter 1872-73, being 25.672, while snow fell to a depth of 43 inches. In March, 17½ inches of snow fell, and its mean temperature was below all but one of the 31 preceding, this being the March of 1872, with 30.230.

1876.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap, previous years. Gallons.	Average monthly temperature.	Rainfall. Inches.	Average rainfall, previous years. Inches.	Remarks.
Dec. '75	5,972,783	8,196	729	671	32.302	2.614	3.849	Snow on 3 days. Rain on 13 days.
Jan. '76	5,701,723	8,248	691	709	34.899	1.200	3.820	Snow on 2 days. Rain on 11 days.
Feb. '76	5,807,660	8,293	700	790	32.130	5.355	3.294	Snow on 7 days. Rain on 7 days.
Mar. '76	5,633,430	8,314	678	725	36.129	10.000	3.212	Snow and rain on 13 days.
April '76	5,403,581	8,382	645	679	48.462	3.305	3.939	Rain on 11 days.
May '76	5,973,287	8,473	704	635	59.456	3.045	4.322	Rain on 10 days.
June '76	6,908,943	8,531	810	751	72.176	1.585	3.517	Rain on 7 days.
July '76	7,610,468	8,535	864	747	78.310	3.060	3.939	Rain on 7 days.
Aug. '76	6,771,343	8,686	780	712	74.150	2.450	5.328	Rain on 2 days.
Sept. '76	6,471,460	8,742	728	751	62.810	7.505	3.604	Rain on 12 days.
Oct. '76	6,305,703	8,774	718	694	46.673	1.260	3.775	Rain on 8 days.
Nov. '76	5,989,768	8,828	678	629	43.717	4.040	3.693	Rain on 11 days.

Total rainfall for the year, 45.419 inches. Average daily consumption for the year, 6,206,944 gallons.

Total of averages of previous years, 46.746 inches. Average consumption per tap for the year, 700 gallons.

Total number of taps at the end of the year, 8,885.

Notes from Mr. W. A. Whitehead's meteorological records :

The mean temperature of the Winter months was 33.110, only five of the series (since 1843–44) having a higher mean. While snow fell to a depth of 11¾ inches, 2.265 inches of rain fell from the 13th to the 15th of February. On the 20th and 21st of March, 2.000 inches of rain were deposited, and on the 25th, 3.920 inches. The mean temperature of June exceeded all but one of the series. Of the 3.060 inches of rain in July, 1.980 inches fell on the 30th and 31st, while the mean temperature of that month exceeded that of all previous Julys covered by the records. In August, 2.400 inches of rain fell on the 17th, and on the 17th of September, 3.560 inches.

1877.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap, previous years. Gallons.	Average monthly temperature.	Rainfall. Inches.	Average rainfall previous years. Inches.	Remarks.
Dec. '76	6,891,150	8,885	776	685	23.814	2.515	3.799	Snow on 10 days. Rain on 2 days.
Jan. '77	7,108,088	8,928	796	706	25.802	3.060	3.456	Snow on 6 days. Rain on 3 days.
Feb. '77	6,628,269	8,943	741	768	34.464	1.650	3.403	Snow and rain on 4 days.
Mar. '77	6,309,363	8,980	703	713	37.564	6.075	3.721	Snow and rain on 13 days.
April '77	6,023,390	9,021	667	671	49.404	3.125	3.903	Snow and rain on 9 days.
May '77	6,838,415	9,105	751	652	60.560	1.010	4.182	Rain on 10 days.
June '77	7,219,058	9,185	786	766	71.583	4.170	3.585	Rain on 11 days.
July '77	7,346,672	9,250	796	776	77.883	5.980	4.233	Rain on 12 days.
Aug. '77	6,681,101	9,289	719	729	75.570	7.730	5.243	Rain on 10 days.
Sept. '77	7,850,527	9.339	841	746	66.74	1.470	3.703	Rain on 4 days.
Oct. '77	6,988,231	9,381	745	700	55.569	7.735	3.668	Rain on 11 days.
Nov. '77	6,376,997	9,434	676	641	44.817	6.915	3.793	Rain on 12 days.

Total rainfall for the year, 51.435 inches. Average daily consumption for the year 6,714,369 gallons.

Total of averages of previous years, 46.089 inches. Average consumption per tap for the year, 708 gallons.

Total number of taps at the end of the year, 9,485.

Notes from Mr. W. A. Whitehead's meteorological records:

The mean temperature of the Winter months, 28.030, was the lowest with exception of three of the series. Snow fell to a depth of 35¼ inches. On August 13th and 14th, 3.340 inches of rain fell, and on the 25th, 1.120 inches, The rainfall in October was larger than any preceding October, and on November 8th and 9th, 2.1250 inches of rain were deposited.

1878.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallon.	Average cons. per tap, previous year. Gallons.	Average monthly temperature.	Rainfall Inches.	Average rainfall previous years. Inches.	Remarks.
Dec. '77	6,391,896	9,485	674	703	37.645	0.920	3.763	Rain on 2 days.
Jan. '78	6,876,350	9,529	722	723	30.996	6.445	3.444	Snow on 5 days. Rain on 3 days.
Feb. '78	6,798,782	9,563	711	762	32.241	4.960	3.352	Snow and rain on 6 days.
Mar. '78	6,477,404	9,584	676	711	45.155	3.635	3.791	Rain on 12 days.
April '78	6,529,745	9,648	677	670	55.554	1.730	3.880	Rain on 8 days.
May '78	6,911,013	9,728	710	672	60.734	4.205	4.092	Rain on 9 days.
June '78	7,131,869	9,799	728	769	68.200	2.446	3.601	Rain on 8 days.
July '78	8,444,792	9,839	858	780	73.250	4.330	4.283	Rain on 11 days.
Aug. '78	8,123,151	9,889	823	727	73.093	8.060	5.317	Rain on 10 days.
Sept. '78	8,390,619	9,920	846	765	67.467	2.535	3.743	Rain on 10 days.
Oct. '78	8,082,230	9,952	812	709	50.407	2.823	3.784	Rain on 8 days.
Nov. '78	7,165,201	10,003	716	648	42.654	4.570	3.795	Rain on 9 days.

Total rainfall for the year, 46.659 inches. Average daily consumption for the year, 7,280,550 gallons.

Total of averages of previous years, 46.845 inches. Average consumption per tap for the year, 725 gallons.

Total number of taps at the end of the year, 10,048.

Notes from Mr. W. A. Whitehead's meteorological records:

The mean Winter temperature, 33.294, exceeded 31 of the 34 Winters of the series, and snow fell to a depth of only 11¼ inches. On the 5th and 6th of May, 1.234 inches of rain were deposited, and on the 31st, 1.610 inches. The mean temperature of July exceeded all but one of the series.

1879.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap.	Average cons. per tap, previous years. Gallons.	Average monthly temperature.	Rainfall. Inches.	Average rainfall previous years. Inches.	Remarks.
Dec. '78	7,895,358	10,048	786	699	31.827	7.469	3.681	Snow and rain 11 days.
Jan. '79	8,112,018	10,088	804	722	25.686	2.890	3.527	Snow on 8 days. Rain on 3 days.
Feb. '79	7,927,369	10,092	786	754	27.683	2.530	3.398	Snow on 13 days. Rain on 3 days.
Mar. '79	7,361,900	10,102	729	705	38.424	3.745	3.786	Snow and rain on 12 days.
April '79	7,184,631	10,185	705	671	47.962	4.760	3.819	Rain on 13 days.
May '79	7,743,614	10,236	757	678	63.831	2.175	4.095	Rain on 8 days.
June '79	8,775,643	10,301	852	763	71.550	3.038	3.596	Rain on 12 days.
July '79	9,041,490	10,337	875	793	75.359	5.050	4.284	Rain on 9 days.
Aug. '79	8,479,374	10,383	817	743	71.750	9.120	5.324	Rain on 8 days.
Sept. '79	8,901,479	10,412	855	778	62.450	3.750	3 670	Rain on 6 days.
Oct. '79	9,640,645	10,436	924	726	59.360	0.320	3.643	Rain on 3 days.
Nov. '79	9,421,292	10,496	898	660	41.760	1.940	3.685	Rain on 8 days.

Total rainfall for the year, 46.787 inches. Average daily consumption for the year 8,375,244 gallons.

Total of averages of previous years, 46.508 inches. Average consumption per tap for the year, 793 gallons.

Total number of taps at the end of the year, 10,557.

Notes from Mr. W. A. Whitehead's meteorological records:

On December 10th, 3.995 inches of rain fell. The mean temperature of the Winter months, 28.400, was below all but eight covered by these records, the mean of the 35 preceding Winters being 30.210. Snow fell to a depth of 35 inches. The mean temperature of June was only exceeded by five of the series, and that of July by ten. On August 17th and 18th, 4.680 inches of rain were deposited, and on the 25th, 1.150 inches. On September 4th and 5th, 1.500 inches, and on the 14th, 1.000 of rain fell. The rainfall of October was below that of any previous October.

1880.

Month.	Average daily consumption. Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap previous years. Gallons.	Average monthly temperature.	Rainfall. Inches.	Average rainfall previous years.	Remarks.
Dec. '79	8,407,997	10,557	796	711	35.000	5.330	3.786	Snow on 7 days. Rain on 5 days.
Jan. '80	8,277,956	10,595	781	734	37.640	2.590	3.515	Snow and rain on 8 days.
Feb. '80	8,605,304	10,618	810	758	35.099	2.830	3.374	Snow and rain on 8 days.
Mar. '80	8,788,399	10,646	825	709	37.451	4.900	3.755	Snow and rain on 12 days.
April '80	8,852,949	10,688	828	676	51.175	3.305	3.845	Snow and rain on 12 days.
May '80	10,325,482	10,739	962	689	68.383	0.760	4.064	Rain on 5 days.
June '80	10,479,638	10,798	971	776	73.696	1.185	3.555	Rain on 6 days.
July '80	10,247,904	10,859	940	805	75.310	7.460	4.305	Rain on 14 days.
Aug. '80	9,395,355	10,904	861	753	72.258	4.680	5.494	Rain on 11 days.
Sept. '80	9,446,091	10,946	863	789	65.954	2.480	3.616	Rain on 6 days.
Oct. '80	9,150,602	11,004	832	755	52.705	2.100	3.665	Rain on 8 days.
Nov. '80	8,339,072	11,052	755	694	38.437	2.365	3.765	Rain on 6 days.

Total rainfall for the year, 39.985 inches. Average daily consumption for tne year, 9,195,326 gallons.

Total of averages of previous years, 46.739 inches. Average consumption per tap for the year, 829 gallons.

Total number of taps at the end of the year, 11,093.

Notes from Mr. W. A. Whitehead's meteorological records :

On December 24th to 26th, 2.480 inches of rain were deposited. The mean temperature of the Winter months, 35.710 was unprecedented, the mean of the previous Winters covered by the records being 30.440. On March 16th, rain fell to a depth of 1.040 inches, and on the 19th, 1.170 inches, and on the 20th, 1.260 inches. The mean temperature of May and June exceeded any of the respective months of the series.

1881.

Month.	Average daily Consumption Gallons.	Number of taps at beginning of each month.	Consumption per tap. Gallons.	Average cons. per tap, previous years. Gallons.	Average monthly tempertaire.	Rainfall. Inches.	Average rainfall previous years. Inches.	Remarks.
Dec. '80	9,458,882	11,093	853	722	26.687	2.685	3.828	Snow on 9 days. Rain on 2 days.
Jan. '81	9,836,873	11,126	884	740	24.447	5.050	3.489	Snow on 9 days. Rain on 2 days.
Feb. '81	10,557,124	11,145	947	764	27.946	4.645	3.359	Snow on 5 days. Rain on 7 days.
Mar. '81	9,120,728	11,170	817	724	37.274	6.835	3.815	Snow and rain 11 days.
April '81	9,174,879	11,214	818	695	48.529	1.715	3.830	Rain on 6 days.
May '81	9,219,686	11,324	814	723	64.117	2.917	3.979	Rain on 12 days.
June '81	9,654,384	11,423	845	800	66.746	5.040	3.493	Rain on 13 days.
July '81	10,520,432	11,504	915	822	75.072	1.340	4.388	Rain on 7 days.
Aug. '81	11,154,368	11,559	965	767	75.935	0.230	5.472	Rain on 5 days.
Sept. '81	10,834,112	11,632	931	798	73.721	0.870	3.586	Rain on 7 days.
Oct. '81	9,768,623	11,740	832	764	57.939	2.730	3.624	Rain on 10 days.
Nov. '81	9,412,621	11,829	796	701	44.108	3.075	3.729	Rain on 12 days.

Total rainfall for the year, 37.182 inches. Average daily consumption for the year, 9,888,583 gallons.

Total of averages of previous years, 46.592 inches. Average consumption per tap for the year, 831 gallons.

Total number of taps at the end of the year, 11,902.

Notes from Mr. W. A. Whitehead's meteorological records:

On December 5th, 1.140 inches of rain were deposited. The mean temperature of the Winter months was 26.430, and the average of the 38 preceding Winters, 30.690. Snow fell to a depth of 49 inches. In March, rain fell on the 5th, 1.120 inches, on the 9th and 10th, 1.565 inchet, and on the 19th, 2.580 inches. The temperature of May was only exceeded by that of last year. The mean temperature of 38 previous Julys was 73.310, that of Augusts, 71.55, and that of Septembers, 64.110. The temperature on the 7th of September, 100.50, was the highest recorded of any day of any of the years covered by the records, and the mean of the month more than five degreet over any September of the period. The mean temperature of October was above all except one of the 38 preceding. The drought of the three consecutive months of July, August and September, was unprecedented, the total rainfall being only 2.490 inches, while the total of the averages amounted to 13.436 inches.

Comparative Statement of the Consumption on the High and Low Service Level.

	Average for the year.			Highest monthly.			Lowest monthly.		
	Daily Consumption. Gallons.	Number of taps.	Consumption per tap.	Daily Consumption. Gallons.	Numbes of taps.	Consumption per tap.	Daily Consumption. Gallons.	Number of taps.	Consumption per tap.
1878.				In July			In April		677
Both Levels....	7,280,550	10,048	725	8,444,792	9,839	858	6,529,745	9,648	
Low Level.....	5,323,465	7,538	706	6,209,713	7,411	839	4,758,649	7,310	651
High Level.....	1,957,085	2,510	780	2,235,075	2,428	920	1,771,096	2,338	757
1880.				In June			In Janu'y		781
Both Levels....	9,195,326	11,093	829	10,479,638	10,798	971	8,277,956	10.595	
Low Level.....	6,937,232	8,119	855	7,950,861	7,942	1,001	6,245,142	7,836	797
High Level.....	2,258,094	2,974	759	2,528,777	2,856	885	2,032,814	2,759	737
1881.				In August			In March		
Both Levels....	9,888,583	11,902	831	11,154,368	11,559	965	9,120,728	11,170	817
Low Level.....	7,479,212	8,536	876	8,234,743	8,373	984	7,019,103	8,151	841
High Level.....	2,409,371	3,366	716	2,919,625	3,186	917	2,101,625	3,019	696

Note.—In 1878, being still in the time of the depression of business, the consumption per tap on the High Level exceeded the consumption on the Low Level, while in 1880 and 1881, after the revival of business, this was reversed.

	DUTY.	Gallons deliver'd in reservoir per pound of coal.	Pounds of coal to one of ashes.	Cost per million gallons delivered in reservoir.
Packer Coal, @ $4.45	53,490,340	356.5	5.7	$5.57
Schuylkill " " 4.40	54,416,783	363.2	6.3	5.40
Plymouth " " 4.35	56,171,253	374.	8.5	5.19
Logan " " 4.23	55,157,217	367.5	5.8	5.13
Baltimore " " 4.25	54,550,132	364.	6.8	5.21

Statement of Work of Pumping Engines at Belleville, for the Year Ending Nov. 30, 1881.

Month.	No 1.	No. 2.	No. 3.	STROKES.		GALLONS.		Total gall's.	No. 1 and 2.		No. 3.		Total coal	Ashes.
				No. 1 & 2.	No. 3.	No. 1 and 2.	No. 3.		Firing.	Bnk'g	Firing.	Bnk'g		
December...	360.25	396.15	340.20	2,074,085	1,059,335	157,630,460	135,594.880	293,225,340	420,477	5,154	358,711	3,724	788,066	120,494
January.....	594.30	573.25	168.05	3,193,416	486,277	242,699,616	62,243,456	304,943,072	648,051	6,650	165,849	3,724	824,274	133,812
February....	400.55	513.35	290.55	2,544,382	798,644	193,373,032	102,226,432	295,599,464	521,564	3,990	332,022	9,846	867,422	136,895
March.....	228.25	540.15	328.35	2,097,540	963,512	159,413,040	123,329,536	282,742,576	411,780	6,792	297,546	13,032	729,150	127,239
April.....	511.55	577.15	132.10	2,968,580	387,768	225,612,080	49,634,304	275,246,384	617,091	10,374	127,684	1,995	757,144	123,686
May.....	555.50	646.35	126.45	3,183,954	342,420	241,980,504	43,829,760	285,810,264	674,801	8,442	118,066	1,962	803,171	129,135
June.....	472.00	680.00	175.10	3,058,510	446,756	232,446,760	57,184,768	289,631,528	662,161	5,586	153,637	13,799	835.183	140,623
July.....	562.35	688.10	171.10	3,501,900	468,664	266,144,400	59,988,992	326,133,392	731,677	4,256	205,458	3,192	944,583	138,052
August.....	578.25	486.20	356.35	2,949,424	950,228	224,156,224	121,629,184	345,785,408	629,199	4,627	338,540	5,586	977,995	146,856
September..	353.20	304.10	560.35	1,714,400	1,521.320	130,294,400	194,728,960	325,023,360	358,835	4,256	568,130	5,852	937,073	113,160
October.....	547.45	439.20	305.15	2,554,224	849,268	194,121,024	108,706,304	302,827,328	580,844	8,778	299,051	3,458	892,131	130,864
November..	275.35	218.40	514.35	1,303,920	1,431,773	99,097,920	183,266,944	282,364,864	274,577	7,581	476,970	14,364	773,492	116,188
	5 441.40	6,064.00	3,470.10	31,144,335	9,705,965	2,366,969,460	1,242,363,520	3,609,332,980	6,531,057	76,529	3,441,664	80,434	10,129,684	1,557,004

Highest daily average, in August..... 11,154,368 gallons.
Lowest daily average, in March..... 9,120,728 "
Daily average for the year..... 9,888,583 "
Increase over last year..... 693,257 "

STATEMENT OF WORK OF HIGH SERVICE PUMPING ENGINE, FOR YEAR ENDING NOV. 30, 1881.

	H. M.	Strokes.	Gallons.	Firing.	Banking.	Total coal.	Ashes.
December	558 00	1,789,610	67,289,336	164,100	17,400	181,500	27,485
January	626 45	2,011,603	75,636,172	177,800	11,100	188,900	23,326
February	577 00	1,855,838	69,779,508	167,800	10,200	178,000	22,449
March	562 30	1,132,723	65,150,385	156,515	17,200	174,715	19,976
April	506 00	1,604,548	60,331,005	135,700	18,000	153,700	17,963
May	540 00	1,776,115	66,781,924	154,200	17,400	171,600	25,284
June	556 30	1,843,668	69,321,919	159,489	15,000	174,489	25,047
July	679 00	2,230,200	83,855,520	195,000	5,400	200,400	34,557
August	702 00	2,407,138	90,508,389	196,000	5,100	201,100	29,473
September	612 05	2,221,012	83,510,051	192,300	6,400	198,700	31,486
October	583 45	2,021,106	75,993,585	194,700	7,200	201,900	29,139
November	607 15	1,895,285	71,262,678	186,300	7,800	194,100	32,626
	7110 50	23,388,845	879,420,572	2,079,904	138,700	2,218,604	318,811

Highest daily average, in August.....2,919,625 gallons.
Lowest daily average, in April.....2,011,033 "

Daily average for the year.....2,409,371
Increase over last year.....204,362

Corrected Statement of Work of Pumping Engines at Belleville for Year ending November 30th, 1881.

Month	No. of hours in operation.			Strokes. Nos. 1 & 2	Strokes. No. 3.	Gallons. Nos. 1 and 2.	Gallons. No. 3.	Total Galls.	Coal Nos. 1 and 2.		Coal No, 3.		Total Coal	Ashes.
	No. 1.	No. 2.	No. 3.						Firing.	Bank'g.	Firing.	Bank'g.		
Dec...	.....	164.10	578.05	522,280	1,726,208	39,693,280	220,954,624	260,647,904	129,548	.....	749,764	20,075	899,387	114,204
Jan....	45.40	136.05	525.40	575,423	1,663,160	43,732,148	212,884,480	256,616,628	142,019	2,475	682,313	25,666	852,473	105,579
Feb...	33.20	7.40	640.50	117,378	1,879,946	8,920,728	240,633,088	249,553,816	22,825	.....	737,541	19,226	779,592	112,930
Mar...	224.55	192.00	499.45	1,111,822	1,468,296	84,498,472	187,941,888	272,440,360	242,851	3,881	552,938	10,482	810,152	119,789
April.	281.35	208.00	418.10	1,354,560	1,270,640	102,946,560	162,641,920	265,588,480	288,384	4,522	470,090	7,714	770,710	116,288
May .	561.25	698.45	187.50	3,395,124	484,848	258,029,424	62,060,544	320,089,968	720,190	8,177	172,210	1,596	902,173	132,220
June..	325.50	460.05	392.45	2,149,592	1,179,845	163,368,992	151,020,160	314,389,152	435,793	5,586	401,386	5,975	848,740	120,156
July..	292.40	403.15	452.40	1,936,408	1,332,172	147,167,008	170,518,016	317,685,024	447,948	10,640	488,189	8,977	955,754	138,505
Aug..	332.15	225.40	501.25	1,334,096	1,483,318	101,391,296	189,864,704	291,256,000	346,494	8,987	578,802	6,251	940,534	147,422
Sept..	108.40	31.00	652.15	389,488	1,982,669	29,601,088	253,781,632	283,382,720	90,440	1,728	749,040	6,517	856,725	128,980
Oct...	207.05	61.00	581.30	790,288	1,746,928	60,061,888	223,606,784	283,668,672	159,670	5,187	606,132	13,300	784,289	118,872
Nov..	204.45	120.25	467.15	921,416	1,407,368	70,027,616	180,143,104	250,170,720	192,846	6,384	477,644	6,920	683,794	105,548
Total.	261.810	270.805	5,898.10	14,597,875	17,625,398	1,109,438,500	2,256,050,944	3,365,489,444	3,228,008	57,567	6,666,049	132,699	10,084,323	1,460,493

Highest daily average in June.....10,479,638 gallons.
Lowest daily average in January..... 8,277,956 "
Daily average for the year..... 9,195,326 "
Increase over last year..... 820,082 "

Corrected Statement of Work of High Service Pumping Engine for the Year ending Nov, 30, 1880

MONTH.	Hours in operation.	STROKES.	GALLONS.	Firing.	Banking.	Total coal.	Ashes.
	H. M.						
December	546	1,729,108	65,014,461	163,443	19,900	183,343	30,105
January	544	1,675,990	63,017,224	159,472	18,600	178,072	29,913
February	511	1,616,523	60,781,265	174,221	17,400	164,621	32,162
March	531	1,617,330	60,811,608	143,887	17,100	160,987	29,336
April	543 30	1,614,784	60,715,878	147,050	12,724	159,774	21,978
May	600	1,977,252	74,344,675	170,550	12,600	183,150	19,653
June	614 15	2,017,641	75,863,302	171,200	9,300	180,500	19,878
July	582 15	1,908,164	71,746,966	168,600	15,900	184,500	21,848
August	593 30	1,960,236	73,704,874	160,881	16,200	177,081	20,059
September	574 30	1,865,656	70,148,666	155,600	15,000	170,600	18,939
October	556 30	1,814,772	68,235,427	154,400	18,000	172,400	20,788
November	527 30	1,666,194	62,648,894	149,000	18,900	167,900	23,636
	6,724 00	23,388,845	879,420,572	1,891,304	191,624	2,082,928	288,295

Highest daily average in June.....2,528,777 gallons.
Lowest daily average in March.....2,003,402 "
Average for the year.....2,258,094 "
Increase over last year..... 10,150 "

POLLUTION OF THE PASSAIC RIVER

EMBRACING THE

REPORT OF THE SPECIAL COMMITTEE

APPOINTED TO REPRESENT THE

NEWARK ✵ AQUEDUCT ✵ BOARD

IN THE BOARD OF INSPECTION OF

THE PASSAIC RIVER AND ITS TRIBUTARIES.

REPORT OF

SPECIAL COMMITTEE ON POLLUTION.

Among the first steps taken by the Newark Aqueduct Board for the purification of the supply was the sending of circulars, requesting information as to the character and amount of refuse discharged into the stream, to all the manufacturers and others along the river and its tributaries who were suspected of polluting the water. The circulars were signed by and sent with the concurrence of the Jersey City Board, and were distributed under the direction of the Executive Committee, to whom the subject had been referred. About ten per cent. of the number issued were returned to the office.

The extent of the pollution discovered, and the magnitude of the task assigned to the committee, led to a more comprehensive system of inspection.

The Jersey City Board at this time became interested, and a Conference Committee from each Board was appointed.

The annexed report of the Joint Committee was endorsed by their respective Boards, and led to the formation of the present Board of Inspection:

"Your Committee report, that at the request of the Board of"
"Public Works of Jersey City a meeting was held at their rooms"
"on September 20th, and they were then informed of the action"
"taken by the Newark Board, and gave it their hearty indorse-"
"ment, and expressed a desire to co-operate with the Newark"
"Board in further continuing the work, bearing their pro rata of"
"the attending expenses."

"A second meeting, called at the request of the Jersey City"
"Board, was held at the office of the Newark Aqueduct Board,"
"September 29th. Present, F. P. Budden, President; Commis-"
"sioners Van Kueren and Williams, of the Board of Public"

" Works, accompanied by Commissioners Smith and Drohan, of "
" the Board of Finance; Engineer Sites and Clerk Mallory. Your "
" Committee, Commissioners Gurney and Harlan, and the officers "
" of the Board were in attendance."

" James Courter, Inspector for the Newark Aqueduct Board, "
" was present and addressed the meeting, giving an account of "
" his services as Inspector. Mr. Courter stated that the indiffer- "
" ence and inattention with which his first efforts were met in "
" attempting to get a compliance with the law had been exchanged "
" for an expressed desire on the part of the majority to do any- "
" thing reasonable to check the pollution; that this change was "
" the result of the determined action of the Board, supported by "
" the courts. Mr. Courter then described the condition of the "
" various inlets and points of pollution at the time of his first "
" visiting them, and stated the different improvements since made, "
" from which it appears that there are but few instances of neglect "
" to remove privy vaults and water-closet waste from the stream, "
" the most of them having been done and the balance now pre- "
" paring to make such removals. At the conclusion of the report, "
" President Budden, of Jersey City, expressed his entire satisfac- "
" tion with the course taken by the Newark Board, and stated that "
" the two Boards should join forces and make the inspection more "
" extended and thorough, the expense to be equally borne by the "
" two cities."

" Commissioners Smith and Drohan, of the Board of Finance, "
" spoke to the same effect, and, after further discussion of the best "
" plan to pursue, it was unanimously agreed to present the follow- "
" ing resolutions to their respective Boards, with recommendation "
" for their adoption."

" Offered by F. P. Budden, of Jersey City: "

" *Resolved*, That James Courter be and he is hereby appointed "
" Sanitary Inspector and Detective Patrol, to report as required, "
" and to act under authority and on the part of the Newark "
" Aqueduct Board and the Board of Public Works of Jersey "
" City, conjointly, at a salary of $1,200 per annum, the propor- "
" tion of said salary to be paid by this Board to be $600 per "
" annum."

"*Resolved*, That a committee of three be appointed by this"
"Board, whose duty it shall be to organize, with a like committee"
"of the Jersey City Board, as an Inspection Board, for the further"
"inspection of the sources of pollution; that this Inspection Board"
"shall direct the action of the Patrol and receive the reports of"
"the same; they shall jointly determine what action is advisable,"
"and, upon agreement of a majority, may submit a joint resolu-"
"tion to the Boards of the two cities for action; they will also"
"report their proceedings to the said Boards."

"*Resolved*, That while the Newark Aqueduct Board disclaim"
"any desire to act in a manner inimical to the interests of any"
"individual, corporation or municipality, they consider the pollu-"
"tion of the Passaic and its tributaries, by which the lives and"
"health of a quarter of a million of people are endangered, to be"
"so flagrant a violation of sanitary law and common sense, and"
"so clearly illegal in all its aspects, and the responsibility attach-"
"ing to this Board, who, for the present at least, must continue to"
"supply this Passaic water, to be of such weight as to call for"
"determined action on the part of this Board to as far as possible"
"suppress pollution."

"*Resolved*, That we cordially invite any and all who may be"
"embarrassed by, or are in doubt as to what this Board requires,"
"to lay before us or the Board of Inspection a fair and impartial"
"statement of the facts and figures relating to their cases, in order"
"that we may assist them, if possible, in devising means to correct"
"or dispose of their deleterious matter; and"

"*Resolved*, That to such parties as show a disposition to abate"
"their nuisances or correct their pollution of the water we will"
"show all the leniency consistent with safety; and"

"*Resolved*, That where there is displayed a total disregard of"
"or utter indifference to the cautions of this Board to polluters"
"of the water, it is clearly the duty of this Board to waste no time,"
"but to enforce the law."

"LOTT SOUTHARD,"
"JAMES R. SMITH,"
"GEO. D. RANDELL,"
"*Committee.*"

At a meeting of the Newark Aqueduct Board held October 5th, 1881, the foregoing report was read, accepted, and the resolutions unanimously adopted, as was also the following, offered by Commissioner Gurney:

"*Resolved*, That the present Committee on Pollution be" "continued as the committee to organize with the Jersey City" "committee, under the authority and for the purposes stated in" "the resolution adopted in the report of the committee."

On the 27th of October the representatives of the Jersey City and Newark Boards perfected an organization, under the title of "The Board of Inspection of the Pollution of the Passaic River and its Tributaries," with the following members: F. P. Budden, Benjamin Van Kueren, Simeon H. Smith, Jersey City; Lott Southard, James R. Smith, George D. Randell, Newark, and elected the following officers: President, Lott Southard, Newark; Vice President, F. P. Budden, Jersey City; Secretary, F. W. Meeker; Inspector, James Courter; Chemist, Prof. A. R. Leeds.

The work done by this Board in the way of inspection and prevention of pollution during the short term of its organization is of the utmost importance. It is believed that the work of restoring the Passaic river water to its original state of purity and high rank among potable waters can be accomplished by distributing the work over a series of years, each step being taken as the necessity arises, and that it can be finally effected without hardship or damage to the manufacturing interests. If this is practicable, the question of a future abundant and wholesome supply for the cities of Newark and Jersey City is solved, at a light cost, compared with any other proposed plan. There is also no guarantee that any other supply proposed will not in time become liable to pollution in a greater or less degree.

The Board is now considering the erection of a dam across the Passaic river, at some point below the works, to keep back the salt water and sewage contamination which backs up from Newark with the tide. The necessity of some provision is shown in the

Chemist's report, annexed, which gives the points of greatest impurity and indicates the remedy.

I also append the charge of Judge Depue to the Grand Jury respecting the pollution of the Passaic.

Respectfully submitted,

F. W. MEEKER,

Secretary.

JUDGE DEPUE'S CHARGE.

Gentlemen of the Grand Jury:

The condition of the supply of water in this city has for some time past attracted considerable attention. It has elicited discussion in the newspapers and among the inhabitants of the city generally. An adequate supply of wholesome water, in a city whose population is approaching 140,000 inhabitants, from some source, or by some means, is a matter of public necessity. It has become a public duty of the gravest import. The method by which this duty shall be discharged has been the subject of careful consideration by all classes of citizens who are interested in the health, prosperity and financial condition of the city.

The expedient of the use of driven wells has not been permanently adopted by the Water Board, after experiments made in that direction, and it seems to have been the settled policy of the authorities that water shall be obtained for the present supply from the Passaic, or from some extraneous source. Before any project is adopted looking to the abandonment of the present works of Belleville, and the supply of water from other sources, it is wise to consider the financial problem involved. The works at Belleville were erected in 1869 and '70. Their cost was $3,500,000. In 1878 the annual interest on the debt thus contracted amounted to $220,000.

In a report made to the Aqueduct Board in 1879 estimates were presented of the cost of the works necessary to an adequate supply from other sources. The lowest estimate of the cost of the works necessary to obtain an adequate supply elsewhere was in the neighborhood of $2,000,000. The expense of obtaining such a supply from other localities was considerably greater than the figures mentioned. In none of the estimates presented in this report was anything included as compensation to individual owners

for their water rights, an item which may, and probably would, largely increase the expenses of obtaining water for the city from any other than the present source. I have given these figures to impress upon you the importance of one duty you will be called upon to perform during your present service—inquiry with respect to and prevention, as far as is practicable, of the pollution of the waters of the Passaic. The Passaic is a public river. Its waters flow for public benefit exclusively. Individuals can have no rights in the stream which justify them in polluting its waters and creating nuisances pernicious to health and comfort for personal convenience or private benefit. Indictments will be for a public wrong of this character.

At the last term of this Court the attention of the Grand Jury, then convened, was directed to this subject, and a number of indictments were found for polluting the waters of the Passaic and its tributaries, which resulted in convictions or pleas of guilty.

A report has been prepared by an employee of the Aqueduct Board, and laid before the Court, showing the extent to which the waters of the Passaic and its tributaries were polluted, before this action of the Grand Jury, exhibiting the success obtained by means of those prosecutions, and the efforts of the agents of the Board in abating nuisances. This report shows what has been accomplished by that means, and indicates what may be accomplished by a vigorous prosecution of the efforts to abate these nuisances; indeed, I may say that it is the opinion of those who have given much attention to this matter, and are capable of forming a correct judgment on the subject, that by suppressing nuisances created by private persons, and protecting at a moderate expenditure the reservoirs from the influx of sewerage from the cities, water may be procured from the Belleville works equal to that provided for other cities, and fit for domestic and other uses. At all events, it is the duty of the Court, and of those intrusted with the administration of justice, to use their powers in the endeavor to achieve this result. The remedy is with the Grand Jury.

This report states that in a number of instances commendable efforts are being made by the proprietors of manufactories to dispose of their waste and other deleterious substances, formerly

discharged into the river, in such a way as to prevent their reaching the stream. In other cases no efforts in that direction are being made, and pollution of the waters is being persevered in without regard to the health or comfort of the great number of citizens who are compelled to rely on the river for their supply of water. Complaints in such cases, I understand, will be laid before you. In your investigation on the subject you will be aided by the employees of the Water Board and assisted by the public Prosecutor.

ESSEX QUARTER SESSIONS.

STATE,

vs.

J. & R. KINGSLAND.

CHARGE HON. LUDLOW McCARTER, *Judge.*

At the conclusion of the Prosecutor's argument, Judge McCarter, addressing counsel, said: "There is a preliminary question to be disposed of by the Court before proceeding to instruct the jury on the law and facts in this case.

"Inasmuch as it is a vital question, and independent of the question of jurisdiction, hereafter to be passed upon, and if the point is well taken, no judgment could be pronounced on the verdict which would avail the State in case it should be against the defendants. I will state the reasons for the Court's decision, so that the defendants may have the benefit of an exception if they desire to take one. The point is this. The premises where the alleged nuisance originated are described as being located in Essex county, whereas the proof shows, that the defendants' mill, which is the *locus in quo* of this alleged nuisance is in the County of Passaic. This is claimed to be a fatal variance between the description of the premises as contained in the indictment and the proofs adduced on the trial. It is manifest from the reading of this indictment that the pleader supposed at the time he drew it that the defendants' mill was located in Essex county, because he uses the words "there situated" in referring to the defendants' premises. The venue of the indictment being laid in Essex county the words "there situated" must be held to refer to the County of Essex.

"Without expressing any opinion as to what would have been the disposition of this motion if it had been made when the State

rested, I think the motion now comes too late; for the reason that all the facts in this case necessary to raise this question, were before the Court before the defendants opened their defense or introduced any testimony. If the motion had been made, then the Court could have amended the indictment if it saw fit so to do, as provided for in the 43d section of the criminal proceedure act, but the defendants having introduced their defense and the case having been closed and every question, both of law and fact having been raised by the defendants, which would in any way avail them, I do not think that this variance is material to the merits of the case, nor has it in any way prejudiced the defendants in introducing their defense.

"The motion to direct an acquittal on the ground of variance is therefore denied."

Addressing the jury, Judge McCarter then said:

"Gentlemen of the Jury:—The defendants Joseph and Richard Kingsland are indicted for creating a public nuisance, within the County of Essex. The specific charge against these parties is that they caused and permitted to be conveyed into a certain ancient stream of pure water known as the Passaic River, a quantity of carbolic acid, which was produced from the manufacture of paper on their premises. In plain English, gentlemen, this is the charge. The defendants deny that this Court has jurisdiction to try them for this offense, if any offense has been committed, for the reason that the offense, if any, was committed in Passaic county. I am not aware that the precise point presented here has been passed upon in this State; but Chief Justice Beasley has stated the principle of law (which I think applies to this case) as follows:—

"'*The rule therefore appears to be firmly established and upon very satisfactory grounds, that when the crime is committed, by a person absent from the country in which the act is done, through means of a merely material agency or by a sentient agent, who was innocent, in such cases the offender is punishable where the act is done.*

"'*The law implies a constructive presence from the necessity of the case; otherwise the anomaly would exist of a crime, but no responsible criminal.*'

"For the purposes of this case, as a matter of law, my instructions to you are, that the originator of a nuisance to a stream in

one county which affects such stream in another county is liable to prosecution in the latter county, precisely as the author of a libel uttered by a person in one county and published by others in another county from which the utteree is absent at the time, is triable in the latter county. I shall therefore assume that this Court has jurisdiction to try this alleged offense, and proceed to consider the case on its merits. And let me here add a word by way of caution to you, so that you will consider the real issue which you are to try under this indictment. First, as to the parties: The parties to this indictment are the State of New Jersey on the one side and the defendants on the other. Neither the City of Newark nor the Newark Aqueduct Board, nor any private individual are parties to this case.

"And gentlemen, you must determine this case solely on the evidence; you ought not to be and you must not be biassed or influenced by anything said or published outside of the Court room. The question for you to answer is whether these defendants are guilty of the offense charged in this indictment; not whether a number of other persons residing in the same vicinity, at Paterson, Passaic, Newark or elsewhere, are equally guilty with them. With these preliminary remarks I pass to the consideration of the case.

"It appears from the evidence in the cause that nearly all the water which supplies the City of Newark containing a population of about one hundred and twenty-five thousand inhabitants is taken from the Passaic River above Belleville and supplied through the Newark Aqueduct Board; and Newark has always been supplied with water for domestic and other purposes from this source; and that the defendants are manufacturers of paper; and that their mill is located on what is known as "Third River," which empties directly into the Passaic River some distance above the point from which the Newark Aqueduct Board obtains its supply of water for the use of the City of Newark.

"That the Passaic is a public navigable river, affected to some extent by the tide, and that the defendants have been engaged in their business of manufacturing paper for upwards of thirty years; that there was discovered in the water taken from the Passaic, some time in the Spring of 1880, a disagreeable and an offensive taste (which continued for a period of about ten days, rendering the

water unfit for drinking purposes) which was caused by putting into the water carbolic acid. It further appears by the evidence of Mr. Ward and Mr. Smith, who you remember went to trace the origin or source of this alleged pollution, that they visited the pond into which the refuse of the defendants' mill emptied, and found by tasting the water there that it tasted very strongly of carbolic acid ; and that they went up the Passaic as far as the Dundee Dam, but found no trace of it there ; and that they next visited the defendants' mill and had an interview with the defendants' about the matter, and called their attention to it ; and that in the course of that conversation the defendants' stated to them that they had been grinding over some paper commonly called "moth paper," used to put under carpets, that is, a paper made and saturated with carbolic acid ; and that the defendants' stated that they had some of this paper that had been broken or damaged in some way, and they had ground it over ; and that in working it the water had been allowed to escape into the stream, and they were surprised that so small a quantity should produce so great a result ; and they further stated that they would not manufacture any more paper like that, and that they promised that it should not occur again, and expressed regret that it had occurrred.

"It further appears from Mr. Ward's testimony that he discovered the same taste in the water again in the month of December, 1880, and that he and Mr. Chase visited the Kingsland Pond and there found the same taste as before. That thereupon they visited the defendants' at their mill, and the defendants' informed them that the trouble did not arise from them this time. They claimed that they had not wasted the paper, although they had ground some over.

"It further appears as a matter of fact, and is not disputed, that these were the only occasions when the taste of carbolic acid was discovered in the Newark Aqueduct water ; and that the pollution of the water by this means ceased when the attention of these defendants' was called to it, and has not occurred since. I will remark here that Mr. Chase substantially corroborated the testimony of Mr. Ward as to the last visit to defendants' premises.

"One of the defendants, Mr. Richard Kingsland, testifies that in December, 1880, they used three hundred and eighty pounds

of paper which contained about five per cent. of carbolic acid, which would make about nineteen or twenty pounds of carbolic acid, and this was mixed in with the other paper; and he then describes the manner in which the carbolic acid got into the stream, which I will not mention here in detail. He further testifies that he commenced making carbolic acid paper in the Spring of 1880, and that just before Mr. Ward's first visit they had worked over thirteen hundred pounds of broken paper and the washings from it had run into the stream. Mr. Joseph Kingsland, the other defendant, substantially corroborated the testimony of Richard Kingsland.

"This, gentlemen, is a brief history of that portion of the case, which I deem material to call your attention to in detail from the time of the discovery of the pollution of the water, until the discovery of the alleged source from whence it came.

"From this statement of facts, gentlemen, one thing is clear, that some one in the Spring of 1880, and in the following December, put into the Passaic River or into some stream or pond which emptied into it, carbolic acid, which rendered the water, which came therefrom to the City of Newark, peculiarly disagreeable and offensive for domestic purposes; and one of the questions of fact for you to determine is, whether these defendants did it or procured it to be done. But before proceeding further in the discussion of this case let me define to you what in law a public nuisance is, because these defendants are indicted for creating a public nuisance. I am aware that it is very difficult to define it; indeed it has been said by high authority that no precise definition of a public nuisance can be given, and that each case has to be judged of by itself. But for the purposes of this case I will adopt the following:

"'A public nuisance is a violation of a public right, either by a direct encroachment upon pnblic rights or property, or by doing some act which tends to a common injury, or by omitting to do some act which the common good requires, and which it is the duty of every person to do, and the omission to do results injuriously to the public.'

"To give an illustration under the rule thus defined:—The thing complained of must be such as in its nature or its consequences is a nuisance, an injury, or a damage to all persons who

come within the sphere of its operations, though it may be so in a greater degree to some than to others. You perceive that the question of intention or care are not elements in this offense. It is a question rather of results of some act done, legal or otherwise. Therefore a business which is lawful to carry on may be conducted in such a way as to constitute a public nuisance. These defendants had a lawful right to carry on their business of manufacturing paper. They are not indicted for carrying on their business. The State does not seek to interfere with their business. They are indicted for polluting the water of the Passaic River, putting carbolic acid into it, and thereby constituting a public nuisance.

"The indictment avers that the Passaic River is an ancient stream of pure water. And it appears from the evidence in the cause that as a matter of fact that the waters of the Passaic were within the last twenty years free from all pollution save that which comes from nature, and it was used for all kinds of domestic purposes;

"The question will arise here, What is meant by the expression used in this indictment? "an ancient stream of pure water";

"It means a stream which has a right to be reasonably pure as a matter of law, and not to be polluted by artificial means. And it is the legal right of the public generally, including the people of the City of Newark to have the water of the Passaic River come to them in its natural state free from pollution. And if these defendants put or caused to be put into the Passaic River or into Third River—which empties into it—carbolic acid which rendered the waters used by the people of Newark, and the public generally, offensive and disagreeable to the taste or smell, and impaired its value for domestic uses, then they are guilty of creating a public nuisance and ought to be convicted under this indictment.

"But if on the other hand the putting of this carbolic acid did not appreciably affect the water, that is to say did not render it offensive to the taste or smell, or impair its use for domestic purposes, then they are not guilty and ought not to be convicted.

"It follows from this that two questions of fact will arise which you will be called upon to answer from the evidence in this cause.

First: Did the defendants or their agents cause this carbolic acid to be put into the Passaic river?

Second: "And if so, did it appreciably effect the water used by the people of Newark and the public so as to constitute a public nuisance?

"And I will here observe that it is not necessary, in order to convict these defendants, that this carbolic acid should be injurious to health. It is sufficient if it render the water offensive or disagreable to the taste or smell.

"Now, on the question of fact as to whether this carbolic acid came from the defendants' mill, I direct your attention to the testimony on that point to that of Messrs. Ward and Smith, and to the investigation which they made in tracing the origin of the pollution; and to the testimony of the Messrs. Kingsland themselves, as to the times and amount of carbolic acid used by them in the manufacture of a particular kind of paper; and as to when the alleged pollution ceased.

"And I also direct your attention to the fact, that from the evidence in this cause it does not appear that the waters of the Passaic were polluted by carbolic acid prior to the Spring of 1880, nor since December last. As bearing directly on the question of fact as to the source from whence this pollution came, this is a significant fact. Does or does it not point directly to the defendants' mill as the origin of this peculiar pollution? You ought to have no difficulty on this branch of the case.

"I also call your attention, as bearing on this point, to the testimony of Prof. Chandler (who I may remark is one of the most eminent men in his profession in this country), who says that a most minute quantity of carbolic acid will give taste and odor for a long time to a stream.

"On the question of fact as to whether the carbolic acid appreciable effected the water of the Passaic used by the public, I direct your attention to the testimony of Mr. Ward, James Smith, Dr. Smith, Dr. Southard and Prof. Chandler.

"Mr. Smith testifies that when the water was used in the tea it contained a disagreable taste and rendered it unfit for use.

"Dr. Smith says the water was disagreable to the taste.

"Dr. Southard also says it was disagreable and peculiarly offensive.

"This, gentlemen, is substantially the case as made by the State, and upon which it claims a conviction of these defendants.

"You will perceive that although it has taken some time to try this case and a vast mass of irrelivant testimony has been introduced into it, yet the case is really confined in a very narrow compass.

"The defense is a denial that the defendants' put or caused to be put the carbolic acid into the Passaic. But even if they had done so, the water of the Passaic was so foully polluted by other persons, that what they did made no appreciable addition to the pollution already there; and that the carbolic acid, if it came from their premises in point of fact, really purified the water and rendered it more fit for the use of the public.

"A great mass of testimony was admitted on this branch of the case for the purpose of showing the condition of the water, and not for the purpose of excusing these defendants' for any offense which they may have committed. And this testimony is only important in this connection, and ought to be considered by you only in this aspect of the case. Because, gentlemen, as a matter of law, it is my duty to say to you, that it is no defense to this indictment that other persons have also contributed to the pollution of the water by the same means as the defendants, or otherwise. The fact that others are committing a wrongful act is no excuse for another's wrong.

"It may, in a proper case be shown, in mitigation of sentence, and in that way might be addressed to the Court, but cannot be urged to acquit the defendants. Neither does it make any difference, or in any measure operate as an excuse that the nuisance cannot be obviated without great expense; or that the public could obviate the injury at a triffling expense. It is the duty of every person to prevent a nuisance. The public is not bound to expend a dollar or to do any act to secure for itself the exercise or enjoyment of a legal right of which it is deprived by reason of the wrongful acts of another.

"And my instructions to you are, as a matter of law on this point, that although you may be satisfied from the evidence in the cause that the water which came from the Passaic was polluted by the refuse matter discharged from the factories of Paterson and Passaic, and elsewhere, yet, if the defendants, by putting carbolic acid into the river, appreciably effected the water used by the public, so as to render it offensive and disagreable to the taste or

smell, and impaired its use for domestic purposes, then they are guilty of creating a public nuisance and ought to be convicted.

"The state has a right to put on trial such parties as are indicted, and the mere fact that other persons who may or may not be guilty of a similar offense as the one charged here, and their absence, and the relative degree of their guilt ought to have no influence on your verdict in this case.

"It is also my duty to say to you that, as a matter of law, that it is no defense to this indictment to prove that carbolic acid improves the water, because it is the right of every person to have the water come to them in its natural state, and they are to exercise their own taste and judgement, and are not obliged to have their property improved against their will.

"Nor is it any defense to this indictment to show that the acts of the defendants were not intentional, or that it was caused by an accident or carelessness. If the acts of the defendants' amount to a nuisance to the community, the question of intent is immaterial. Nor will length of time legalize a public nuisance.

"And although these defendants' are what are known as riparian owners, this gives them no legal right to pollute the water so as to effect the public who have a right to use it.

"This case, gentlemen, is one of the most important ever tried in this country, and its result may involve serious consequences. But with these you have nothing to do.

"The State is bound to make out its case beyond a reasonable doubt, and if a reasonable doubt exists, arising from the evidence, the defendants' are entitled to the benefit of it by a verdict of acquittal. But, if you are satisfied from the evidence in the cause that they are guilty, let no consideration of sympathy, or the fact that the defendants' are eminently respectable, or the fact that others may be equally guilty with them, deter you one moment from so declaring by your verdict.

REPORT OF

Professor A. R. LEEDS, Ph. D.,

ON THE

CONTAMINATION OF THE PASSAIC RIVER.

STEVENS INSTITUTE OF TECHNOLOGY,
NOV. 21, 1881.

To the Board of Inspection of the Pollution of the Passaic River and its Tributaries:

In response to your resolution of Nov. 17th, transmitted to me through the letter of the Secretary, and which reads "That Pro-" "fessor Leeds be requested to prepare a report upon the pollution" "of the Passaic river for publication, and to express his opinion as" "to the best methods of effecting a remedy," I have the honor to transmit the following report, and to send therewith the accompanying charts of figures and results.

The Board has already received the results of analyses of samples of the drinking water of Newark and Jersey City, as collected at various times during the past Summer. In order, however, that what was done later may be better understood, it will be necessary to incorporate these earlier results in the following report:

The first analysis was that made upon a sample drawn from the faucet in the office of Dr. L. Southard, 121 Union street, upon the 7th of June. It contained in 100,000 parts:

Free Ammonia	0.0006
Albuminoid Ammonia	0.0046
Oxygen required to oxidize organic matters	0.273
Nitrates	0.192
Chlorine	0 43
Total Solids	8.12
Inorganic Matter	5.10
Organic and Volatile Matters	3.02

It will be seen that the water at that time was in good condition. It then began to deteriorate, and by the 20th of the same month was open to some complaints, the amount of albuminoid ammonia having risen to 0.03 parts in 100,000, which is twice the amount permissible in good drinking water. All the four following samples were collected on the same day, June 20th—the Newark sample being drawn from the faucet in the office of Dr. Southard, 10:30 A. M.; the Jersey City sample at the office of the Board of Public Works, 1 P. M.; the Hoboken sample from the faucet in the laboratory of the Stevens Institute of Technology, 12 M.; the Croton at the Barclay street ferry-house, 1 P. M.

	Newark.	Jersey City.	Hoboken.	New York.
Free Ammonia	0.003	0.003	0.003	0.004
Albuminoid Ammonia	0.03	0.031	.....	0.027
Oxygen required	0.70	1.08	0.874	0.73
Nitrites	None.	None.	None.	None.
Nitrates	0.444	.....	0.592	0.6105
Chlorine	0.39	0.31	0 27	0.26
Total Hardness	3.20	3.00	3.70	3.00
Permanent Hardness	3.00	2.40	3.45	2.60
Temporary Hardness	0.20	0.60	0.25	0.40
Total Solids	11 00	11.50	8.60	9 00
Mineral Matters	5.00	.....	4.10	2.50
Organic & Volatile Matters.	6.00	.....	4 50	6.50

The conclusion drawn from the analyses was, that while the Passaic water was below the standard of unexceptional drinking water, it was but little, if at all, inferior to the Croton. This conclusion was supported by certain competent New York chemists, but attacked in the columns of the *Sanitary Engineer.* This led me to make a comparison of the Passaic water, not only with the Croton, but also with the water supplies of the principal Eastern cities. If the Passaic water was worse than that generally used,

then I should have regarded it imperative to denounce its further consumption. If, on the contrary, it compared favorably with other water supplies, the stigma under which it labored from the revelations during the Kingsland trial would be in part removed, and instead of abandoning the Passaic as hopelessly polluted, the project of restoring it to its condition of original purity would be encouraged.

The design was to collect all the samples on the same day, June 23d, and telegraphic despatches were sent to the Health Officers and City Engineers of the various cities to that end. The samples were not all collected on the same day, however, for various reasons. At Washington the Health Officer, Dr. Townshend, at the time of receiving my telegram was summoned to attend the wounded President, and in the excitement of that event the sample was overlooked by him until several days later.

The specimen of Rochester water collected June 23d was execrable, and would have made the Rochester water the worst in the list. On representing this fact to the Chief Engineer of Rochester it turned out that the night preceding the collection of the sample a large fire had occurred, and to make good the deficiency in their water supply thus produced, the water from the Genesee river had been pumped into the pipes. The later sample was that derived from Hemlock lake, the ordinary source, and which is of great purity.

To determine whether any difference resulted from flowing through different lengths of pipe, and drawing from some points where there was little and from other points where there was a great flow, four samples were taken at various points in Hoboken and six in Jersey City. These points were carefully selected by Chief Engineer Sites, and the samples were drawn at nearly the same hour in the day. The results show remarkable differences, and that the average of the Hoboken water is of somewhat better quality than that of Jersey City.

COMPOSITION OF CITY WATERS IN THE UNITED STATES.

GRAINS PER GALLON.

	HOBOKEN.				JERSEY CITY.																
	1. Steven's Institute. June 23.	2. 4th and Adams. June 23.	3. 1st and Willow. June 23.	4. 14th and Willow. June 23.	5. Bergen Avenue crossing Newark and N. Y. R. R. June 23, 3.50 P. M.	6. Columbia Place and Old Bergen Road, Greenville. June 23, 4.10 P. M.	7. Whiton Street and Maple, La Fayette. June 23, 4.35 P. M.	8. South Street, 75 feet W. Pearce avenue. June 23, 3.05 P. M.	9. Henderson St., near Montgomery. June 23, 2.25 P. M.	10. Delivery Pumps at High Service. June 23. 2.50 P. M.	11. PATERSON. Above Great Falls. June 23.	12. CROTON. Christopher Street Ferry. June 23.	13. BROOKLYN. Ridgewood, from 321 Gates avenue. June 23, 7 P. M.	14. BOSTON. Cochituate, Jamaica Plains. June 23.	16. PHILADELPHIA. June 24.	17. WILMINGTON. Office Register W. D. June 24, 9:30 A. M.	18. BALTIMORE. June 25.	19. WASHINGTON. July 5.	20. Hydrant. OSWEGO. From Wm. Cartwright, Water Office. July 9th.	21. Well. OSWEGO. P. Cullinan, Well, W. 5th St. July 9.	38. CINCINNATI. From Hydrant. C. F. Klayer, July 15th.	39. ROCHESTER. J. Nelson Tubbs, Chief Engr Water Works. Received July 23d.
1 Free Ammonia	0.0012	0.0014	0.0013	0.0019	0.0028	0.0031	0.0029	0.0017	0.0026	0.0044	0.0015	0.0016	0.0005	0.0076	0.0006	0.0020	0.0029	0.0035	0.0020	0.049	0.0067	0.00087
2 Albuminoid Ammonia	0.0181	0.0169	0.0192	0.0169	0.0250	0.0233	0.0222	0.0169	0.0245	0.0245	0.0309	0.0157	0.0048	0.0356	0.0105	0.0175	0.0117	0.0157	0.0152	0.0123	0.014	0 013
3 Oxygen Required	0.50	0.50	0.57	0.48	0.55	0.50	0.43	0.49	0.52	0.50	0.56	0.47	0.24	1.05	0.27	0.33	0.33	0.350	0.370	0.34	0.50	0.46
4 Nitrites	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
5 Nitrates	0.3966	0.3907	0.4082	0.3956	0.5307	0.3674	0.3966	0.3907	0.4082	0.4432	0.2741	0.4840	0.6998	0.6998	0.3966	0.3033	0.3557	0.485	0.61	4.25	0.43	0.367
6 Chlorine	0.151	0.128	0.157	0.181	0.140	0.128	0.134	0.134	0.122	0.128	0.175	0.204	0.321	0.187	0.175	0.875	0.163	0.157	2.39	9.29	0.469	0.113
7 Total Hardness	1.87	1.92	1.75	1.81	1.87	1.75	1.81	1.87	1.75	1.87	1.75	1.92	1.34	1.22	0.82	0.58	5.48	2.799	5.83	3.62	3.73	3.20
8 Permanent Hardness	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 Temporary Hardness	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 Total Solids	7.12	9.00	4.96	4.32	5.42	6.30	5.66	5.87	6.30	6.12	6.82	6.87	3.50	4.96	8.34	5.83	5.48	6.70	10.54	71.38	9.45	5.83
11 Mineral Matter	3.26	1.86	2.33	1.75	1.98	3.03	3.03	3.50	3.56	3.44	2.04	2.92	2.92	1.17	3.50	1.75	4.20	3.21	6.63	47.53	5.25	2.33
12 Organic & Volatile Matter	3.86	7.24	2.63	2.57	3.44	3.27	2.63	2.33	2.74	2.68	4.78	3.95	.58	3.79	4.84	4.08	1.28	3.49	3.91	23.91	4.20	3.50

The water from the driven wells, as shown by an examination of the free and albuminoid ammonia, was the purest; that of Hoboken the next; then the water of the Newark Reservoir; then of Newark and the Jersey City Reservoir last.

At the time, this unfavorable result for the Jersey City water was attributed to the large amount of sediment in its reservoir, which has never been cleaned during the entire period of twenty-five years since it was built. To see what foundation there was for this opinion, Chief Engineer Sites obtained for me a sample of the Reservoir mud. An analysis showed that it contained a large amount of various kinds of organic matter, and that this matter was capable of yielding nitrogenous substances which would somewhat affect the purity of the water. But the principal cause of the inferior character of the Jersey City water was due to the actual difference between the composition of the Passaic water at the intake of the Jersey City Reservoir, as compared with that at the Newark intake. This difference was developed by subsequent researches, and will be fully explained further on.

All these examinations, however, could be of but little permanent value compared with the great questions at stake. These were two in number:

1st. To determine with precision the various sources of the impurities in the Passaic river, and the extent and character of the deterioration thereby produced.

2d. To discover whether any counteracting forces are at work, so that the water may be wholly or in part restored by natural agencies to the same condition as it was in before contamination. This second question is of the highest importance, in the light of statements put forward by eminent English authorities that running water purifies itself after flowing a very limited number of miles in contact with light, earth and air. A detailed exposition of these opinions will be found in the report of the Royal Commission on River Pollution. Other authorities have advocated precisely contrary views, and stated that water once polluted cannot be used with safety, however great the number of miles of flow. While the latter opinion seemed altogether at variance with general experience, yet I was extremely glad of the opportunity of

satisfying myself as to which opinion was the true one, by an extended series of analyses upon a flowing stream like the Passaic. And the opportunity appeared all the more valuable because the main bulk of the impurities in the Passaic is introduced just at one point, and then there follows a long interval, in which the volume of impurities introduced is very small, before another source of impurities is encountered. After a number of conferences, in which Mr. Andrew Clerk, of Jersey City, kindly gave the benefit of his many years of observation of the condition of the Passaic river at various times and seasons, a plan of investigation was decided upon. A map of the river was prepared, the best points for collecting the samples were determined, and the occasion was waited for when the volume of water flowing in the river should be at a minimum. This last point was regarded of great importance, inasmuch as the effect of various sources of impurity, like mill refuse and sewage, would thereby be exaggerated, and the facts of the case would be presented in the worst possible light. The general idea to be followed out in the investigation was to determine the composition of the water before it arrived at Paterson, and then to follow this water down, taking samples at short intervals and at both sides and in the middle of the river, until it reached the intake of the Jersey City Reservoir just at dead low tide. And on the same day to take samples below Newark, and to follow the tide up until it reached the intake of the Newark Reservoir at flood tide. The unprecedented drouth of last Summer enabled the plan to be carried out even more successfully than was anticipated. For so low had the river fallen by the beginning of September that no water whatever was going over the Dundee Dam, and in fact the water stood a foot below the top of the dam. From six o'clock on Saturday night (Sept. 3d,) until six o'clock on Monday morning the case was even worse, so that no water was allowed to flow through the locks and down the river. Since no rain had fallen for many weeks, it was feared that a sudden storm might occur to spoil the above mentioned plan, and at the beginning of September it was thought better to lose no time and to make the collections of the samples at once. Accordingly, on Saturday, the 3d of September, accompanied by my assistant, I made a preliminary survey of the Passaic above Dundee and located the

points at which the samples should be collected on the following Tuesday. This was the more important, since it was not possible for one set of workers to do all the labor, beginning at Little Falls and going down to Newark within one day, while it was possible for it to be successfully accomplished by two sets. And for fear that a storm might arise at the time appointed for the complete survey (the 6th of September), I took occasion to collect samples on the 3d inst. as well. The analyses of this preliminary set of samples will be found in the first third of the accompanying table of results (Samples Nos. 53 to 61).

It so happened that by the time we had arrived at the wharf at Passaic, we encountered the last hour of the up tide and at North Belleville and the Pumping Stations flood time. A comparison of the results thus obtained with those of the following 6th inst., when the corresponding samples were taken on the up tide, shows the decided influence of the up tide on the character of the water.

Upon the 6th of September my assistant went at an early hour to Paterson, and after obtaining help and a carriage began the collecting of samples at the dam above Little Falls. He continued this collection at the points agreed upon until his series joined on with my own, beginning with the river just below the tail-race of the Passaic Mills (No. 70). At the same time, a party consisting of Dr. Southard, Chief Engineer Sites, some other gentlemen and myself, leaving Newark in a small tug-boat, ascending the river, and beginning the collection of the samples with the Saddle river, followed down the stream at such a rate of progress that we arrived at the intake of the Jersey City Reservoir just at dead low tide. Later in the day samples were obtained below Newark, above Newark, and at three points opposite the Jersey City and Newark intakes at high tide.

The various facts brought out by the series of forty-four analyses conducted on the samples collected as above may best be grouped and studied under four heads:

1st. The change from the condition of original purity above the falls, produced by the Paterson refuse, and the extent to which the impurities thus introduced are oxidized and destroyed in the further course of the river. These oxidizing effects are especially noticeable during the flow of seven miles, before the water has

come within the reach of the disturbing influences connected with the mills at Passaic.

2d. The amounts of impurities derived from the town of Passaic and the factories of Saddle river.

3d. The effects due to other establishments located on the river, or its tributaries lower down.

4th. The influence of the return tide, carrying with it the sea water and flowing past the city of Newark, and the distance up the stream to which this influence can be traced.

These four points will be studied in order, by means of the table of results and the diagram accompanying it. The first part of the diagram (Sept. 3) illustrates in the most striking manner the entire change in the character of the water after flowing from a point in the middle of the stream opposite John Lister's wharf, as compared with its composition when it has arrived at the Straight street bridge, Paterson. All of the dissolved constituents have received an enormous increase—so that the curves representing them rise into sharp peaks. Instead of a sweet-tasting, limpid water, we have a blueish-red liquid, disgusting to the taste and smell. The percentage of free ammonia has increased five times. In fact, it is fifteen times greater than that permissible in safe drinking waters. The albuminoid ammonia has increased until it is eight times larger than the allowable amount. And yet these figures represent but a small portion of the increase of these two bodies, since, they have been largely converted into nitrates, as may be seen by the swelling of the percentage of nitrates to six times its original figure. The amount of chlorine has increased three times, the hardness more than twice. These increments are due to increase of various saline chlorides, lime, &c., in solution. Indeed, the addition to the various solids held in solution, enormous as it is, is more remarkable in the case of the mineral matters, which have increased three times, than in the case of the organic and volatile matters, which have increased but twice. Of course, the latter are the more dangerous of the two, being derived in part, as is true also of the chlorine, from the human excreta thrown into the stream.

The third sample, taken opposite the second, on the other side of the river, shows that the water there has almost the same composition as above the falls, and the lines descend to nearly the same levels as they originally rose from.

This general fact has two important exceptions, and exceptions which show the correctness of the method of reasoning employed in interpreting the results of these analyses. The amounts of free and albuminoid ammonia have actually decreased; a decrease not due to a general improvement of the water, but to the oxidation of the ammonia to the condition of nitrate.

The fourth sample, taken at the middle of the current at the

Broadway bridge, shows a general rise of the lines, as might be expected from the mingling of the greatly polluted with the little polluted waters on different sides of the river. But the rise is less than might have been expected. This is more especially true of the total solids and mineral matter, which shows that already a portion of this matter has gone out of solution. The most curious fact is that the nitrates, which are a constituent seldom present in natural waters, are here very large. This indicates the energy with which the nitrogenous bodies are undergoing oxidation. At the wharf at Passaic the percentages of the constituents plainly indicate the influence of the high tide, as is shown by the fact that the chlorine begins to mount in a straight line. It continues to rise, and finally passes out of the table when we have come to a point half-way between the pumping stations of Newark and Jersey City.

The study of the results obtained by analysis of the samples collected on September 6th is far more satisfactory than of those obtained in the preliminary investigation. The enormous differences between the composition of the last sample spoken of above and that of the Passaic in its entirely unpolluted condition may be seen by the manner in which all the lines plunge downward to the points which represent the amounts found above the dam at Little Falls. Here it is of great purity, there being no free ammonia present, and but little matter of any kind held in solution. Immediately below Little Falls it is of nearly the same degree of purity as above, though the effect of the mills is still to be traced in the increased percentages of albuminoid ammonia and organic matter and the lowered percentage of dissolved oxygen. In its passage from this point to one just above the Great Falls at Paterson there is a slight deterioration. Then there is the same mountainous elevation of all the curves at the Straight street bridge as noted September 3d, showing again the shocking pollution. At River street bridge the impurities are far less in amount, and so at Broadway bridge, with the exception of the albuminoid ammonia. We are at a loss to account for this increase, except from the fact that the foul-smelling water for miles above was very shallow, and its surface was covered with fish which had been killed by the chemicals thrown in above, and which were in a stage of

advanced decomposition. If now we follow the line of albuminoid ammonia we shall note that the amount diminishes as we go down the river, rising again to a considerable height at the end of the tail-race at Passaic. It is lower in the Saddle river, the impurities there thrown in not being of a character to raise the amount of this constituent, but is high in the Passaic itself at a point below the outlet of Saddle river. From this point it diminishes until we come to the two bridges near Rutherfurd.

When we follow it along until we come to the Newark intake, we find that it is far less there than at the middle of the river, and much less at the middle than at the opposite side of the stream. The free ammonia at the Newark intake is almost zero, and an inspection of the diagram and figures will show that it is a most fortunate circumstance that the intake is located where it is, and not upon the opposite side. By a comparison of the results obtained at high tide this superiority of the water on the west bank is confirmed.

With regard to the Jersey City intake the case is different, and from a comparison of the composition of the water on the west and east banks and in the middle, both at high and at low tides, I should advocate the taking of the water at or a little beyond the middle, if possible, rather than from its present inlet.

Let us now follow the line of chlorine. The amount of chlorine receives an increase either from sewage or from factories (and more especially bleacheries), then once more falls away until we reach the Third river (on which there are bleacheries). Finally it rises abruptly at the Newark intake, where the influence of the sea water is very strongly marked. It mounts twice as high again at the Jersey City intake, and when it strikes high tide passes up and out of the table. The chlorine at low tide at the Newark intake is 1.46 grains per gallon; at high tide it is 8.46 grains. At the Jersey City intake it is 3.34 grains at low tide, and 32.59 grains at high tide. If we examine the lines and figures indicating the total solids, we shall note that they rise to their highest limits at the Straight street bridge, Paterson, and do not ascend to so high a point again until we reach the vicinity of the Third river. There the effect of the intermingling of the return tides with the down stream becomes very pronounced. Not only the amount of total

solids, but also of mineral and organic matter, diminishes very rapidly in the flow to the head of the race at Dundee Dam. But the decomposition of the nitrogenous organic matters is not sufficient during this flow of only seven miles to bring the water back into a wholesome condition. The free ammonia has diminished from 0.2075 parts in 100,000 to 0.075 parts, or to about one-third, and the albuminoid ammonia from 0.225 parts in 100,000 to 0.0215, or to about one-tenth. At this rate of purification, by a flow which may be variously estimated at from eleven to twenty-one miles, the waters of the Passaic, if they received no contamination below Paterson, would have returned to their original condition. This is an extremely important matter, and I reiterate the statement that a mean distance of sixteen miles below Paterson, the river, if it received no further contamination, would have returned to the condition of tolerably wholesome drinking water. Even with these impurities there is an approach to this result; for it will be seen that at the Newark intake the amount of free ammonia has fallen to almost zero. But the albuminoid ammonia has not decreased as much—a result due in part to the reinforcement of the amount of nitrogenous organic substances by impurities coming down the river, but also, without question, to impurities coming up the river. And I think this cannot be questioned, when we note the large amounts of free ammonia and albuminoid ammonia, and most of all the organic matter itself, contained in the waters at high tide, both at the Newark and the Jersey City intake, and consider that upward flowing waters must become more or less intermingled with those coming down the stream. Similar views are borne out by the comparison of the curves and figures representing complete analyses of the mineral matter contained in nine of the most important samples.

There is an immense increase in the amounts of lime, iron, alumina and carbonates at Paterson, due to the manufacturing refuse. The lime and carbonates are not entirely thrown out of solution as we go down the river, and a slight permanent increase of hardness results. This increase, however, is not sufficient to make the Passaic *hard* water. As far up as Passaic the influence of the sea is felt, as may be noted by the large increase in the amount of sodium chloride, or common salt, held in solution. And

even at dead low tide this influence may be seen in the figures representing the composition of the mineral matter at the Newark intake, still more at the Jersey City intake at low tide, and most of all at the Jersey City intake at high tide Then the salt in solution amounted to 32.59 grains per gallon, and about 30,000 gallons in every 1,000,000 pumped up were sea water. At the Newark intake about 8,000 gallons in every 1,000,000 were sea water.

In view of the preceding facts, I would state—

1st. That the evil effects of the refuse at Paterson, being largely overcome in a flow of sixteen miles, do not require action so urgently as the impurities introduced lower down.

2d. That if the impurities introduced by the tributaries and at Passaic were kept out, these impurities not having the same opportunity of oxidation and destruction by a long flow, a great improvement would be noted.

3d. That it is imperative to keep back the up tide; and the plan of doing so by a properly located dam appears to be that best calculated to meet the exigencies of the case.

Very respectfully yours,

ALBERT R. LEEDS,

Chemist to the Board.