

DEPARTMENT

FOR

SUPPLYING THE CITY WITH WATER.

ANNUAL REPORT

OF THE

Chief Engineer of the Water Department

OF THE

CITY OF PHILADELPHIA,

Presented to Councils, February 10,

1870.

PHILADELPHIA:

E. C. MARKLEY & SON, PRINTERS, 422 LIBRARY STREET,

OPPOSITE THE POST OFFICE.

1870.

COMMITTEE ON WATER WORKS, 1869.

Alexander L. Hodgdon, *Chairman*,
Samuel W. Cattell,
John A. Shermer,
David Cramer,
C. Thomson Jones,
Wm. F. Smith,
Samuel G. King,
Geo. W. Plumly,
C. E. Kamerly, M. D.,
Wm. S. Stokley, *Ex-officio*,

Wm. B. Hanna,
Walter Allison,
James Bowker,
Robert M. Evans,
James Jenner,
Jno. C. Martin,
G. B. Stockdale,
Isaac W. Van Houten,
W. F. Miller,
Louis Wagner, *Ex-officio*.

OFFICERS.

CHIEF ENGINEER,
FREDERIC GRAFF.

REGISTER,
GEORGE F. KEYSER.

CHIEF CLERK,
CHARLES D. THOMAS.

ENGINEER'S CLERK,
EDWARD HATCH.

RECEIVING CLERK,
STIRLING BELL.

PERMIT CLERKS,
WILLIAM J. HALLIDAY, ISAAC CREAMER.

GENERAL CLERKS,
GEORGE C. JERVIS,
GEORGE S. MACAULEY,

CHARLES ZELL,
PEIRCE C. DESAUVQUE.

MESSENGER,
T. WEST. BLAKE.

DRAUGHTSMAN,
JOHN L. OGDEN.

INSPECTORS,
Joseph Wimer,
T. M. Pfouts,
Jacob L. Warner,

Wesley Stephenson,
B. Frank Major,
Alex. P. Keyser,

E. Bowlby,
I. S. Walters.

PURVEYORS,
First District, E. B. Cobb, Office, 807 Reed Street.
Second " Samuel M. Fox, " 918 Cherry Street.
Third " Jno. H. Jefferies, " 1420 Frankford Road.
Fourth " Jacob C. Apple, " Corinthian Ave. and Brown St.

ENGINEERS AT WORKS.

Fairmount Works—William Osborne, Joseph Moyer.
Schuylkill Works—William Hodges, Joshua Bartley.
Delaware Works—Benjamin F. Norman, Jos. Thompson.
Twenty-fourth Ward Works—James Buckley, Abraham Stott.
Germentown Works—William Wright, James Drinkwater.
Rozborough Works—Johnson Hughes.

REPORT.

To the Presidents and Members of
Select and Common Councils.

GENTLEMEN:—An annual report of the operations and condition of the works under my charge being required by the ordinance regulating the department, I beg leave to submit the following:—

At Fairmount a very large amount of work has been accomplished; the turbine wheel and pumps commenced in 1868, and fully described in the last annual report, were completed and started to daily work, February 17th, 1869. They are perfectly successful pieces of machinery, and a very valuable addition to our water-power. The work upon the second wheel, of similar character, was delayed in its commencement fully eight months by the failure of Select Councils to pass the appropriation for the purpose; it will, therefore, not be ready to start before March or April next. It will be precisely the same size, form and arrangement, as the one previously put in.

Turbine wheel No. 9, which has been running almost constantly since 1851, was made differently and less perfectly than the new wheel, and requires a new movable wheel and regulating gate. This work will be done during the winter, a sum being included in the annual appropriation for the purpose; its spur and bevel-wheel will also be recogged, it will then be better than

when new. The wheel has done an immense amount of work, running day and night for months together, with comparatively little repairs.

Pump No. 7 was repaired, or rather rebuilt, by using the good pump chambers of the old pump, No. 4 (removed to give place to the new wheel), and is now in good order. The old pump No. 1 is also in good order, and No. 8, though patched, can yet be used. No. 6 is now entirely useless; it is not proposed to attempt its repair, as it should with No. 7 be taken out next summer, and give place to the third and last large turbine.

Nos. 10, 11, 12 will have their gear-wheels recogged during the winter; in other respects they are in excellent order. During the summer all the gate-hoists to them, which were originally defective in design, difficult to repair, and very troublesome, have been taken out and others of improved construction put in.

The grounds about the works are in excellent condition, and all the reservoirs supplied from the water-power are in perfect order.

The efficiency of these works has been much impaired by a drought, which in duration and severity has no precedent since the erection of the dam, nearly fifty years ago. Much difficulty was experienced in keeping up the supply to the city, and great anxiety resulted lest actual failure and consequent disaster should ensue.

Efforts were made in this and other cities, to obtain auxiliary steam-pumps of a size large enough to be serviceable; finally a pair were found upon a large wrecking steamer, which were put into use and rendered valuable assistance until their place was supplied by the purchase of a pair of direct acting engines of considerable size, these were erected temporarily at the foot of the hill in the forebay, and used until the freshet, which occurred on the 4th of October, made them unnecessary.

The demand for water is now so great that nothing but pumps of the largest class could be of much service, and such are scarcely ever made unless to fill an order, and then require

several months' time to construct; the pumps finally purchased, two of 18 inches diameter and 24-inch stroke, were the very largest that could be obtained ready built and of such a form as to be made immediately available.

Through the co-operation of the well-meaning of our citizens, the usual flow from wash-paves and other wasteful fixtures was considerably reduced, and it was only upon the highest ground and the upper stories of our houses, that positive lack of water was experienced.

The drought was followed by a freshet such as has never been experienced before; on the 4th of October, the water rose with great rapidity to the height of 11 feet 5 inches above the level of the dam, but fortunately no material damage resulted to the works.

The following list of freshets that have occurred since the erection of the dam, exceeding six feet, may be interesting:

February 21, 1822, nine feet one inch.

June 26, 1839, ten feet two inches.

February 10, 1840, seven feet.

January 7, 1841, eight feet.

March 14, 1846, seven feet one inch.

July 19, 1850, eight feet.

September 2, 1850, ten feet eleven inches.

August 16, 1867, seven feet four inches.

October 4, 1869, eleven feet five inches.

During the summer whilst the dam was dry, it was carefully examined, and appeared to be in good condition at all points that can be seen; it is believed to be safe for several (possibly four) years, but should not be allowed to remain more than one year without being rebuilt from low tide upward. In my report made November 30th, 1869, attention was called to the subject, and a sum included in the estimate for effecting this important object; when it is rebuilt it should be raised at least two feet above its original level, by which a great saving in the consumption of water upon the wheels can be effected, and their efficiency be much increased.

The raising of the dam, as indicated, would be of vital importance to the Schuylkill Navigation Company; they should, therefore, bear part of the expense.

The work of the greatest importance, at the Schuylkill Works, has been the erection of the side-lever Cornish engine described in the annual report of last year; it was started to daily work November 3d, 1869, and has been doing good duty since; it is a powerful machine, and fully up to my expectations. The side-lever arrangement, as anticipated, is found to be superior to the overhead levers, in every particular. The work has been faithfully executed, from my general design, by Messrs. Merrick & Sons, and reflects credit upon them as mechanical engineers.

The 20-inch forcing main, in the tunnel on Thompson street, was raised some four feet high, and shifted over about five feet on to the top of the adjoining 18-inch mains, without throwing it out of use, or breaking a single joint; this gave place for the 36-inch main used in connection with the Cornish engine. Over eight months' detention was caused by the delay in granting the loan for the construction of new boiler-house and boilers, they are, therefore, only just completed.

The original tubular and flue boilers at the works are so old and dilapidated that they have been condemned, by competent boiler-makers, as dangerous. A sum has been appropriated, and they will be removed during the winter.

It is hoped that Engine No. 2, now almost useless, may be taken out and a side-lever Cornish engine substituted. The last engine of this class is so successful, that it is proposed to follow the same plan, but of increased dimensions, making it 80-inch steam cylinder and 40-inch plunger, instead of 72-inch and 36-inch.

During our greatest troubles from the drought, the original Cornish engine met with a very serious accident, by which the upper valve-chamber of the pump was badly broken; it was at first thought that we would be deprived of the use of the engine, until a new chest could be made, a period of probably three

weeks; the chest was, however, temporarily tied together by a number of wrought iron bars, and in this way it continued to work, though of course with impaired efficiency, until a new one could be constructed and put in. The engine and pump are now in excellent order.

The boilers just erected are three gangs of two-cylinder boilers, each 30 feet long and 54 inches diameter, having two heaters under and parallel to them 22 feet long and 28 inches diameter each. This class of boilers requires less attention than those of the flue or tubular kind, and are believed to be fully as economical; they can be readily cleaned and kept in order, a great advantage in works like ours, that must be always available, and are run continuously day and night. Either or both of the Cornish engines can be worked by the new or old boilers.

To accommodate these boilers, a new boiler-house has been erected. In order to do this, it was necessary to excavate nearly its whole area to an average depth of 15 feet in rock, and afterward to build a retaining-wall, on two sides, about 21 feet high; this made the work costly and slow.

The stand-pipe has been repainted.

The reservoir and adjoining grounds are in excellent repair.

The Delaware Works have required but little repairs to the machinery. The walls of the boiler-house were much cracked, and dangerous on account of settlement of the wharf upon which they are founded. They have been taken down and rebuilt; a new roof has also been placed upon them. The whole works, including the reservoir, are now in excellent order.

The Worthington duplex engine originally purchased and erected as an assistant to the Schuylkill Works, has been removed to the Twenty-fourth Ward Works, and proved a most valuable auxiliary to them; by its use we were enabled to repair the stop between the two old engines, without depriving the ward of water. It has done good service during the summer: in fact, it would not have been possible to have supplied the ward without its aid. The works are now in as good order as is possible,

with machinery of the defective character of that in use. It will have the usual winter repairs.

Engine No. 1, at the Germantown Works, has had a new steam cylinder, the old one becoming useless and wasteful of steam. Engine No. 2 will also require a new cylinder, which will be put in during the winter.

The water in the pool supplying the works was lower during the drought than it has ever been before; it became necessary to lengthen the suction-pipes of the engines, in order to use them. A large spring in the neighborhood was conducted through a 6-inch pipe into the pool, and was of some service in keeping up the supply.

The engine at the Roxborough Works was started on the 5th of April, and run until about 8,860,000 gallons of water were raised into the reservoir, equal to an average depth of 6 feet, when it was found that the reservoir leaked so badly that it became necessary to discontinue pumping. The embankments and bottom clay lining of this reservoir were put in before my connection with the works. It was represented by parties who had seen the work going on to be very badly done, it was therefore decided to take out the clay and repuddle it, a work which was much delayed by want of an appropriation and the recess of Councils. Pumping was not again possible until December, 1869, when, after raising the water in it to the depth of about nine feet, a new leak was discovered, caused, it is believed, by the failure to properly repair a scaffold-pole hole in the side. This was repaired, and pumping again commenced, but the work does not appear yet to be tight. The embankment of the reservoir is made mostly of decomposed mica rock, a very poor material for such purpose. In repairing the bottom, seams of this material were found through the puddle, of sufficient size to cause considerable leakage; and immediately under the clay, black soil and sods were found in several places.

The engine built by Mathews & Moore, from the designs of Mr. Birkinbine, is a creditable job, and worked well during the

time it has been in use. It is quite evident, however, that it will not answer to depend upon one engine for the supply of the district it was designed for, from the very high lift, 334 feet. The character of the engine, and the impossibility of using a stand-pipe, the work will be liable to frequent and probably disastrous accidents. Immediate provision should be made for the erection of a second engine. As the engine and boiler-house were only built large enough to accommodate one engine, a new engine and boiler-house will be necessary. A special report will be made on this subject hereafter.

These works have proved exceedingly expensive, and will be a burden on the department. The defects in their design will be found fully detailed in my annual report for the year 1867. The proper plan would, undoubtedly, have been to have erected two reservoirs and double pumping stations, one high enough to supply Manayunk, from which the water would be raised to a sufficient height to have properly supplied Germantown and Roxborough. It is probable that one reason why this was not done, was the great difficulty and expense of getting distributing mains from the low level reservoir to Manayunk, the ground between being very hilly and rocky, over which there is no public road or suitable location for the mains.

The main leading to Germantown has been laid, with the exception of that portion across the Wissahickon creek; the connections with the reservoirs at either end are complete.

The crossing at the creek will be made by two lines of suspended mains, upon the same plan as was designed by the Chief Engineer, and put into successful operation for crossing the forebay at Fairmount. There will be two lines of 20-inch flange-pipes, forming the top chord of the bridge, braced together by diagonal braces, sustained by wrought-iron suspension links; there will be four spans of one hundred and sixty-five feet each; the piers will consist of four wrought-iron Phoenix columns, based upon a stone foundation; the line of main will be one hundred feet above the ordinary height of water in the creek. The contract for the erection of the bridge has been entered into with

Mr. John W. Murphy, who has designed the details of the work, much of which has already been prepared in the shop, and the stone piers nearly completed.

Twelve thousand two hundred and ninety-five feet of distributing pipe has been laid in Manayunk, and the supply of the place could have been commenced, but for the unfortunate leaky condition of the reservoir.

The work at Belmont reservoir has been much delayed from causes beyond our control; it is believed one section can be put in use next season. The engine-house is almost completed; the boilers are finished; the ascending main all laid with the exception of the few pipes necessary to connect it with the engine. Engine No. 1 is all delivered on the ground, and the work of erecting it commenced.

The descending main, from the reservoir down Belmont avenue to Lancaster avenue, and down the latter to Fortieth street, is all laid except a small portion on Belmont avenue, where it is not yet opened to public use, and at the bridge being built by the Pennsylvania Rail Road, across their road at Girard avenue, both of which works will be accomplished early this season.

An unusually large amount of pipes and mains have been laid, amounting to 22 miles 1,884 feet; the number of new attachments made is unprecedented, and of course much increases the demand for water.

The expenditure of the works for new construction and for maintenance, have reached the very large sum of \$909,768 28.

The receipts from water-rents and pipe have been \$808,508 23, as will be found detailed in the tables attached to the report of the Register. The receipts from all sources were \$813,470 83.

To avoid repetition, a report made to Councils November 30, 1869, upon the proposed extension of the works, is reprinted as an appendix; it is hoped that the suggestions made therein will meet with the approval of Councils, and that appropriations for the commencement of the work will be promptly made.

Since the report named above was made, the Park Commission have concluded to build the River road to the East Park,

over the wharf of the Schuylkill Works ; it will be of considerable width, and raised some twelve feet above the level of our wharf. By the report just referred to, it will be seen that when all the engines contemplated are placed in the works, a new inlet to the forebay will be required. In order that the Park road may not be interfered with hereafter, and the expense of cutting through it be saved, this inlet should be constructed now ; when the report was written, it was thought that the construction of the Park road was more distant ; no estimate was therefore included for this work.

Plans will be prepared, and estimates submitted as early as possible.

The running expenses of all the works have been greater than in former years, in consequence of the "strikes" at the mines, causing a raise in the price of coal, and the constant working of all the steam engines during the drought—in fact all the works have been over taxed—of course increasing the quantity of fuel, oil, tallow, and other supplies.

The Schuylkill Navigation Company have instituted a suit against the city, upon claims arising from circumstances incident to the draught, with the nature of which you are already fully acquainted.

The operations of the machine shop have been very satisfactory ; a very large amount of work has been done for the several works now building, in addition to the construction of all the stop-cocks, fire-plugs, cases, ferrules, and other fixtures required for the distributing pipes and mains, at prices lower than the usual machine shop rates ; the shop shows a nominal profit of \$16,735 60.

A new engine was put in during the year, and it is proposed to add a large lathe, that cocks of the largest size may be finished complete.

The necessity for economy in the use of water, and the diminution of all waste, made it more than ever apparent that the city should immediately commence the use of meters for the measurement of all water supplied to large manufactories, hotels, etc., where the waste is now excessive, and where water is the essential element in conducting their business, it is sincerely hoped that authority for the introduction of these valuable apparatus will be promptly granted by your honorable bodies.

Operations of Fairmount Works for the year 1867.

1867 1868 1869 1870 1871 1872 1873 1874 1875 1876 1877 1878 1879 1880 1881 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900

MONTHS.	Running time.	Number of strokes during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Cubic feet of water pumped per month.	Coal consumed in heating mill-house.				Tallow consumed.	Oil consumed.	Average depth of water passing over dam.	Rain fall during each month.	Average temperature.
						Tons.	Cwt.	Qrs.	Lbs.					
January.....	31	3,172,877	647,636,043	20,891,485	86,478,308	.....	.....	.....	.....	26	158	17-5	4-28	31-23
February.....	28	2,955,399	602,956,643	21,534,166	80,609,150	.....	.....	.....	.....	20	39	17-83	4-76	30-71
March.....	31	2,622,469	551,634,083	17,794,646	73,747,866	.....	.....	.....	.....	20	3	13-03	5-80	39-09
April.....	30	2,615,119	610,382,923	20,346,097	81,601,995	.....	.....	.....	.....	45	34	11-30	2-12	51-25
May.....	31	3,022,684	680,069,140	21,937,714	90,918,334	.....	.....	.....	.....	20	188	9-62	4-23	62-61
June.....	30	3,263,820	749,797,609	24,993,253	100,240,322	.....	.....	.....	.....	20	255	9	5-68	71-62
July.....	31	2,755,337	732,736,189	23,636,661	97,959,384	.....	.....	.....	.....	25	263	4-55	2-88	75-16
August.....	31	2,023,790	511,017,212	16,484,426	68,317,809	.....	.....	.....	.....	45	240	*3-11	1-28	73-09
September.....	30	1,481,091	493,432,285	16,447,743	65,966,883	.....	.....	.....	.....	35	145	*5-93	3-25	66-21
October.....	31	2,664,551	645,088,894	20,809,388	86,241,831	.....	.....	.....	.....	25	255	19	6-32	54-60
November.....	30	2,696,215	677,026,223	22,567,542	90,511,527	.....	.....	.....	.....	40	213	14-6	3-72	43-37
December.....	31	2,431,824	587,833,875	18,962,383	78,587,430	75	.....	.....	.....	25	175	19-68	5-12	32-12
TOTALS.....	365	31,705,176	7,489,611,069	20,519,482	1,001,180,839	75	.....	.....	.....	346	1,968	.....	48-84	.....

Total rainfall for the year.....48-84

Average rainfall for past thirty-two years.....45-81

Rainfall for each quarter of the years 1867-8-9.

First Quarter 1867.....	10-05	1868.....	9-50	1869.....	14-34
Second " ".....	20-65	".....	16-81	".....	11-93
Third " ".....	19-91	".....	15-06	".....	7-41
Fourth " ".....	9-99	".....	10-60	".....	15-16
Total.....	60-60	51-97	48-84		

Highest water over the dam during the year, was 11 feet 5 inches.

* Below comb of dam.

Running Expenses of Fairmount Works.

Salaries of Engineers and Labor, - - - -	\$4,990 04
Gas and Oil for Lighting, - - - -	871 17
80 tons of Coal for Warming Works, - - - -	595 00
569½ gallons of Oil, - - - -	498 24
838 pounds of Tallow, - - - -	129 20
Packing and Small Stores, - - - -	905 00
Repairs, - - - -	8,498 91
	<hr/>
	\$16,487 56

Cost of raising Water into Reservoir per million gallons, - - - -	\$2 20 $\frac{1}{16}$
Cost of raising Water per million gallons one foot high, - - - -	02 $\frac{2}{16}$

Operations of the Schuylkill Water Works during the year 1869.

MONTHS.	Running time.	Number of strokes during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Cubic feet of water pumped per month.	Number of pounds of water raised one foot high per pound of coal.	Coal consumed.				Tallow consumed.	Oil consumed.
	Days.						Tons.	Cwts.	Qrs.	Lbs.	Lbs.	Qts.
January	31	320,107	115,238,520	3,717,371	15,387,705	471,378	104	11	.....	.....	77	28
February	28	535,636	146,486,928	5,231,676	19,583,814	386,369	162	03	.....	.....	113	54
March	31	789,278	137,603,192	4,438,812	18,396,148	272,949	215	12	.....	.....	138	56
April	30	1,264,384	286,228,800	9,540,960	38,265,882	542,228	225	15	.....	.....	190	85
May	31	1,247,874	264,907,248	8,545,395	35,415,407	340,206	333	.....	.....	.....	204	67
June	30	1,237,925	245,793,412	8,193,114	32,860,082	313,700	333	12	.....	.....	216	75
July	31	1,577,179	335,490,960	10,822,289	44,851,732	347,717	412	12	.....	.....	250	73
August	31	1,734,600	359,146,560	11,585,373	48,014,246	285,345	538	05	.....	.....	252	94
September	30	1,649,413	347,422,040	11,580,735	46,446,796	277,221	535	19	.....	.....	291	107
October	31	882,572	227,873,560	7,350,760	30,464,379	278,870	849	09	.....	.....	218	78
November	30	236,565	111,971,400	3,732,380	14,969,438	360,036	133	.....	.....	.....	112	53
December	31	308,640	157,406,400	5,077,626	21,043,636	369,989	181	19	.....	.....	137	75
Totals	365	11,784,173	2,735,569,020	7,494,710	365,699,265	.....	3525	17	.....	.....	2198	845

11

Running Expenses of Schuylkill Works.

Salaries of Engineers, Firemen, etc.,	-	-	-	\$8,299	92
Gas for Lighting Works,	-	-	-	795	89
4,271 $\frac{11}{20}$ tons of Coal,	-	-	-	25,189	41
222 $\frac{1}{2}$ gallons Oil,	-	-	-	224	25
2,515 $\frac{1}{2}$ pounds Tallow,	-	-	-	475	90
Packing and Small Stores,	-	-	-	656	00
Repairs, - - - - -	-	-	-	2,998	82
				<hr/>	
				\$38,640	19

Cost of raising water into reservoir, per million					
gallons, - - - - -	-	-	-	\$14	12 $\frac{3}{10}$
Cost of raising water, per million gallons, one foot					
high, - - - - -	-	-	-	11	$\frac{3}{10}$

Operations of the Delaware Water Works during the year 1869.

MONTHS.	Running Time.	Number of strokes during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Cubic feet of water pumped per month.	Number of pounds of water raised one foot high per pound of coal.	Coal consumed.				Tallow consumed.		Oil consumed.
	Days.						Ton.	Cwt.	Qrs.	Lbs.	Lbs.	Qts.	
January	28	241,760	41,099,200	1,467,828	5,487,942	198,944	86	0	3	16	16	15	
February.....	25	205,104	34,867,680	1,394,707	4,661,455	197,508	75	10	2	09	34	15	
March.....	26	241,551	38,648,160	1,486,468	5,166,866	200,465	80	5	3	26	20	10	
April.....	27	384,986	61,507,760	2,251,398	8,239,904	222,041	115	11	...	23	28	12	
May.....	31	587,389	71,326,934	2,612,804	9,535,686	186,993	158	17	1	19	22	19	
June.....	30	594,986	95,197,760	3,173,259	12,726,973	261,024	151	18	...	04	30	22	
July.....	31	647,119	105,722,430	3,410,401	14,134,015	255,734	172	3	1	06	34	29	
August.....	31	891,023	146,252,610	4,717,826	19,552,488	232,997	261	9	...	03	40	20	
September.....	30	953,160	157,444,600	5,248,153	21,048,743	214,618	305	10	2	26	50	41	
October.....	31	751,141	122,315,339	3,945,656	16,352,318	232,810	218	16	1	20	32	30	
November.....	30	571,738	91,478,080	3,049,269	12,229,689	248,475	153	6	2	17	30	22	
December.....	29	480,190	76,830,400	2,649,324	10,271,443	226,924	141	...	1	06	32	18	
Totals.....	349	6,550,147	1,042,780,953	2,987,911	139,407,612	.....	1,937	...	2	27	368	253

Running Expenses of Delaware Works.

Salaries of Engineers, Firemen, etc.,	-	-	-	-	-	-	-	\$5,666	64
Gas for Lighting Works,	-	-	-	-	-	-	-	248	69
1,811 tons of Coal, -	-	-	-	-	-	-	-	11,998	14
45 gallons Oil,	-	-	-	-	-	-	-	33	75
569 pounds Tallow,	-	-	-	-	-	-	-	96	30
Packing and Small Stores,	-	-	-	-	-	-	-	450	36
Repairs, -	-	-	-	-	-	-	-	2,564	31
								<u>\$21,058</u>	19
Cost of raising water into reservoir, per million									
gallons,	-	-	-	-	-	-	-	\$20	19
Cost of raising water, per million gallons, one foot									
high,	-	-	-	-	-	-	-		18

Operations of the Twenty-fourth Ward Water Works during the year 1869.

MONTHS.	Running time.	Number of strokes during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Cubic feet of water pumped per month.	Number of pounds of water raised one foot high per pound of coal.	Coal consumed.				Tallow consumed.		Oil consumed.
	Days.						Tons.	Cwts.	Qrs.	Lbs.	Lbs.	Qts.	
January	31	660,064	59,404,860	1,916,288	7,932,282	326,826	125	1	1	16	24	4	
February.....	28	638,634	58,513,900	2,089,782	7,822,714	307,116	131	2	1	20	32	8	
March.....	31	666,964	60,026,760	1,936,347	8,024,968	272,814	142	5	.....	.....	39	6
April.....	30	766,340	68,970,600	2,299,020	9,220,600	315,391	150	.....	3	16	36	7
May.....	31	895,395	86,684,418	2,760,788	11,441,767	200,336	182	1	2	24	36	7	
June.....	30	894,189	85,141,922	2,838,064	11,382,609	368,587	163	.....	1	22	36	6
July.....	31	1,018,776	97,838,584	3,156,083	13,080,025	363,840	190	.....	1	22	40	7
August.....	31	1,062,952	101,846,190	3,285,361	13,615,801	334,865	209	4	3	08	60	9	
September.....	30	973,411	92,931,764	3,097,725	12,424,032	341,312	187	6	1	20	50	7	
October.....	31	883,615	83,799,746	2,703,217	11,208,174	286,651	201	2	1	08	40	8	
November.....	30	782,741	73,692,086	2,456,403	9,851,883	348,878	145	6	1	.....	40	8
December.....	31	672,359	60,810,664	1,961,634	8,129,768	279,408	149	14	2	16	40	7	
Totals.....	365	9,915,430	928,561,494	2,544,004	124,129,692	.....	1076	06	3	04	473	79

Running Expenses of Twenty-fourth Ward Works.

Salaries of Engineers and Firemen,	-	-	-	-	-	-	\$4,400	00
Coal Oil for Lighting,	-	-	-	-	-	-	118	44
2,087 $\frac{1}{2}$ $\frac{1}{0}$ tons of Coal,	-	-	-	-	-	-	13,399	82
482 pounds Tallow,	-	-	-	-	-	-	78	54
49 $\frac{1}{2}$ gallons Oil,	-	-	-	-	-	-	39	38
Packing and Small Stores,	-	-	-	-	-	-	375	50
Repairs,	-	-	-	-	-	-	2,492	01
							<u>\$20,903</u>	<u>69</u>

Cost of raising water into stand-pipe, per million gallons,	-	-	-	-	-	-	22	50
Cost of raising water per million gallons, one foot foot high,	-	-	-	-	-	-	12	$\frac{1}{10}$

Operations of the Germantown Water Works, during the year 1869.

MONTHS.	Running time.	Number of strokes during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Cubic feet of water pumped per month.	Number of pounds of water raised for high per pound of coal.	Coal consumed.				Tallow consumed.	Oil consumed.
	Days.						Tons.	Cwt.	Q'trs.	Lbs.	Lbs.	Qts.
January.....	27	1,536,000	13,905,600	515,022	1,856,803	158,579	75	.....	.....	.....	40	12
February.....	24	1,594,000	14,410,400	600,433	1,926,624	171,186	72	.....	.....	.....	38	11
March.....	30	1,866,000	16,905,600	563,520	2,260,107	192,740	75	.....	.....	.....	35	13
April.....	28	1,878,000	16,900,400	606,800	2,271,444	193,755	75	.....	.....	.....	38	12
May.....	29	2,055,000	18,671,000	643,827	2,406,123	212,833	75	.....	.....	.....	39	14
June.....	30	2,384,000	21,642,400	737,413	2,893,369	217,761	85	.....	.....	.....	38	15
July.....	31	2,498,000	22,680,800	731,639	3,032,192	222,972	87	.....	.....	.....	39	15
August.....	31	2,327,000	21,132,200	681,684	2,825,160	228,797	79	.....	.....	.....	39	14
September.....	30	2,224,000	20,204,400	673,480	2,701,123	203,296	85	.....	.....	.....	34	14
October.....	31	2,153,000	19,570,800	631,366	2,616,417	201,571	83	.....	.....	.....	25	12
November.....	30	1,837,000	16,609,200	553,640	2,220,484	202,932	70	.....	.....	.....	21	9
December.....	31	1,665,000	15,507,000	500,222	2,073,128	202,357	65	10	3	11	22	8
TOTALS.....	352	24,017,000	218,229,800	619,971	29,172,874	.....	926	10	3	11	408	149

Running Expenses of Germantown Works.

Salaries of Engineers, Firemen, &c.,	-	-	-	-	-	-	\$3,781	89
Coal Oil for Lighting Works,	-	-	-	-	-	-	19	12
976½ ⁵ / ₈ tons of Coal,	-	-	-	-	-	-	6,689	40
402 pounds of Tallow,	-	-	-	-	-	-	64	93
Packing and Small Stores,	-	-	-	-	-	-	71	21
Repairs, -	-	-	-	-	-	-	788	78
							\$11,415	33

Cost of raising Water into Reservoir, per million								
gallons,	-	-	-	-	-	-	\$52	36
Cost of raising Water per million gallons, one foot								
high, -	-	-	-	-	-	-	22 ⁷ / ₁₀	

Running Expenses of Roxborough Works.

Salaries of Engineer and Firemen, -	-	-	-	-	-	-	\$3,729	54
Oil for Lighting Works,	-	-	-	-	-	-	24	90
298½ ² / ₀ tons of Coal,	-	-	-	-	-	-	1,997	97
43½ gallons of Oil, -	-	-	-	-	-	-	78	30
423½ pounds of Tallow, -	-	-	-	-	-	-	72	27
Packing and Small Stores,	-	-	-	-	-	-	100	00
Repairs, -	-	-	-	-	-	-	980	17
							\$6,983	15

*Amount of Water Pumped by all the Works during the
year 1869.*

MONTHS.	Gallons of water pumped during the month.	Average number of gallons pumped per day.
January, - - -	877,284,223	28,507,994
February, - - -	857,235,551	30,850,764
March, - - - -	804,817,745	26,219,793
April, - - - -	1,044,170,483	35,074,275
May, - - - -	1,120,558,740	36,530,528
June, - - - -	1,197,573,103	39,935,103
July, - - - -	1,294,468,963	41,757,063
August, - - - -	1,139,394,772	36,754,670
September, - - -	1,111,435,089	37,047,836
October, - - - -	1,098,648,339	35,440,337
November; - - -	970,776,989	32,359,234
December, - - -	898,388,339	29,151,189
Totals, - - -	12,414,752,336	34,040,409

*Statement of the Operations of the Shop from January
1st to December 31st, 1869.*

DR.

To Stock on hand January 1st, 1869,	-	-	-	\$5,390	73
295,912 lbs. iron castings,	-	-	-	9,361	48
29,939 " wrought iron,	-	-	-	1,747	25
3,230½ " cast steel,	-	-	-	872	23
22,486½ " brass castings,	-	-	-	5,246	63
17,660 " lead,	-	-	-	1,677	70
7,385 " bolts and washers,	-	-	-	1,107	75
512 " leather,	-	-	-	225	28
379 " gasket,	-	-	-	64	43
14 " listing,	-	-	-	3	50
25 " tallow,	-	-	-	4	50
36,321 feet lumber,	-	-	-	1,585	15
89 tons coal,	-	-	-	621	50
322 spindles covered with brass,	-	-	-	708	40
Machine work,	-	-	-	2,173	92
Hardware,	-	-	-	1,660	06
Wrought iron tubing and fittings,	-	-	-	265	85
Paints, etc.,	-	-	-	936	91
Grindstone,	-	-	-	3	75
Scrap iron from districts,	-	-	-	260	51
Wages paid hands, and incidentals,	-	-	-	13,673	18

CR.

By 8 stop-cocks 3-inch, at \$44 00,	\$352	00
71 " 4-inch, at 48 00,	3,408	00
175 " 6-inch, at 62 00,	10,850	00
4 " 8-inch, at 89 00,	356	00
6 " 10-inch, at 115 00,	690	00
8 " 12-inch, at 141 00,	1,128	00
Amounts carried forward,	\$16,784	00
	\$48,590	71

	Amounts brought forward,	\$16,784 00	\$48,590 71
By	2 stop-cocks 16-inch, at \$196 00,	392 00	
	4 " 20-inch, at 321 00,	1,284 00	
	2 " 23-inch, at 380 00,	760 00	
	2 " 30-inch, at 559 00,	1,118 00	
	4 " 36-inch, at 842 00,	3,368 00	
	600 stop-cock boxes, at 3 50,	2,100 00	
	279 frames and covers, at 7 50,	2,092 50	
	202 fire-plugs, at 36 00,	7,272 00	
	291 " cases, at 18 00,	5,238 00	
	3,700 ferrules, $\frac{1}{2}$ -inch, at 50,	1,850 00	
	431 " $\frac{3}{8}$ -inch, at 50,	215 50	
	50 " $\frac{3}{4}$ -inch, at 50,	25 00	
	Repairs for First District,	1,224 17	
	" Second " .	2,435 38	
	" Third "	2,018 61	
	" Fourth "	2,415 11	
	" Germantown,	701 58	
	" West Phila. Engine House,	646 74	
	" Twenty-fourth Ward reserv'r,	745 53	
	" Belmont Engine House,	216 44	
	" " 30-inch main,	33 00	
	" Schuylkill Works,	552 68	
	" " extension,	913 58	
	" Delaware Works,	119 35	
	" Fairmount "	488 91	
	" " " extension,	3,195 64	
	" Roxborough "	879 48	
	" Buildings and grounds,	705 90	
	" Auxiliary engine,	301 26	
	" Shop fixtures,	352 13	
	New patterns made and repaired,	100 29	
	Scrap iron and brass turnings sold,	429 32	
	Amounts carried forward,	\$60,974 10	\$48,590 71

Amounts brought forward, \$60,974 10 \$48,590 71

STOCK ON HAND.

By 16 sharp thread screws, at \$2 50,	40 00	
15 square " 4-inch, at \$5 00,	75 00	
19 " " 6-inch, at 5 00,	95 00	
2 " " 16-inch, at 8 00,	16 00	
37 spindles, 4-inch, at 6 00,	222 00	
18 " " 6-inch, at 6 00,	108 00	
14 " " 8-inch, at 6 00,	84 00	
10 " " 12-inch, at 8 00,	80 00	
16 square thread spindles, 4-inch, at 5 00,	80 00	
12 " " 6-inch, at 6 00,	72 00	
5 " " 10-inch, at 8 00,	40 00	
2 " " 12-inch, at 10 00,	20 00	
6 " " 16-inch, at 12 00,	72 00	
7 " " 20-inch, at 14 00,	98 00	
1,469 lbs. of bolts and washers, at 15,	220 35	
1,094 " wrought iron forging, " 13,	142 22	
10,347 " wrought-iron, " 04½,	465 61	
625 " cast steel, " 27,	168 75	
10,525 " cast-iron, " 03½,	368 37	
624 " finished brasses, " 40,	249 60	
697 " brass castings, " 25,	174 25	
3,040 feet of lumber (assorted),	121 60	
120 wooden plugs, " 50,	60 00	
4 kegs nails, at \$5 00,	20 00	
144 assorted handles,	21 52	
23 lbs. leather, at 44	10 12	
6 tons coal, at \$7 00	42 00	
2 sets 30-inch stop-castings,	600 70	
40 plug-monkeys (partly finished) 5 00	200 00	
Hardware, shovels, etc.,	125 10	
Paints, etc.,	260 02	
Balance, nominal profit of shop		16,735 60
	<u>\$65,326 31</u>	<u>\$65,326 31</u>

DISTRIBUTION.

Service mains have been laid in the following streets in 1869.

FIRST DISTRICT.

Account of Iron Pipes laid in the First, Second, Third, Fourth and Twenty-sixth Wards.

Street.	Location.	Size.	
		Inches.	Feet.
Hoffman,	From Ninth to Tenth,	4	461
Peirce,	“ Fifth to Sixth,	4	461
Christian,	“ Burnett to Sutherland avenue,	6	970*
Clarion,	“ Wharton to Reed,	4	461
Hershaw,	“ Fitzwater to Catharine,	4	400
Annin,	“ Twenty-first to Twenty-second,	4	467
Connecting Federal with Twenty-first,		6	35
“ “ “ Twenty-second,		6	47
“ Chadwick with Reed,		6	24
Chadwick,	From Wharton to Reed,	4	450
Sanderson,	“ Sixteenth to Seventeenth,	4	460
Watkins,	“ Ninth to Eleventh,	4	920
Morris,	“ Tenth to Passyunk road,	6	855
Eleventh,	“ Morris to Peirce,	6	313
Watkins,	“ terminus to Eleventh,	4	126
Eleventh,	“ Morris to Tasker,	6	450
Fernon,	“ terminus to Eleventh,	4	63
Peirce,	“ “ “	4	54
Latonia,	“ Sixteenth to Seventeenth,	4	460
“	“ Eighteenth to Nineteenth,	4	450
Eighteenth,	“ Latonia (south),	6	150
Ellsworth,	“ Twenty-second to Twenty-third,	6	470
Dean,	“ Wharton (north),	4	270
Hicks,	“ “ to Reed,	4	470
Mole,	“ “ “	4	470

Street.	Location.	Size.	
		Inches.	Feet.
Alter,	From Twenty-second to Twenty-Third,	4	483
Kimball,	“ Twentieth (west),	4	390
Connection for American Button-hole Sewing Machine			
	Company,	4	45
“	“ Fire Plugs,	4	65
Total number of feet of pipe laid,			<u>10,740</u>
Number of feet of new pipe laid, 4-inch,			7,426
“	“ “ “ 6-inch,		<u>3,314</u>
Total number of feet,			10,740
Or 2 miles 180 feet.			

SECOND DISTRICT.

Account of Iron Pipes laid in the Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, Twenty-fourth and Twenty-seventh Wards.

Street.	Location.	Size.	
		Inches.	Feet.
Thirty-fifth,	From Sycamore (north),	12	551
Eighteenth,	“ Cherry to Race,	12	338
Race,	“ east of Eighteenth,	6	167
Lancaster avenue,	“ Forty-fifth to Fifty-second,	6	4,250
Somerset,	“ Haverford to Mary,	6	915
Thirty-eight,	“ Green to Lancaster avenue,	6	1,085
Race,	“ Sixteenth to Seventeenth,	30	450
Cherry,	“ east of Twentieth,	6	280
Market,	“ “ Twenty-first,	6	324
Green,	“ west of Thirty-sixth	6	323
Darby road,	From Chestnut to Thirty-sixth,	1,540	
“	“ “ “ Thirty-eighth to Forty-first.	1,650	
		<u>8</u>	3,195
Connecting Walnut with Darby road,		8	46
“	“ Thirty-fourth with Darby road,	6	45

Street.	Location.	Size.	
		Inches.	Feet.
Warren,	From Thirty-third to Thirty-eighth,	6	2,450
Thirty-ninth,	" Baring (north),	6	356
Warren,	" Thirty-ninth to Fortieth,	6	750
Thirty-ninth,	" Bridge to Haverford,	6	415
"	" Grape to Elm,	6	196
"	" Walnut to Sansom,	6	282
Lombard,	From Twelfth to Thirteenth,	6	475
"	" " " "	4	54
Silverton Ave.,	" Blockley to Forty-second,	6	190
Elm,	" Thirty-sixth to Thirty-seventh,	6	450
Mica,	" Lancaster ave. to Seneca,	6	500
Seneca,	" Mica to Forty-fourth,	6	200
Forty-fourth,	" Seneca to Lancaster ave.,	6	332
Walnut,	" Twenty-second to Twenty-third,	6	350
Race.	" Eighteenth to Nineteenth,	6	430
Sansom;	" Thirty-fourth to Thirty-fifth,	6	430
Bell,	" Powelton ave. to Filbert,	4	396
Preston,	" Hutton to Westminster ave.,	6	394
Sheaff,	" Eleventh to Madison,	4	221
Madison,	" Race (north),	4	67
Tower,	" Twentieth to Twenty-first,	4	550
Cedar Hill Reservoir,		30	432
"	"	20	340
"	"	8	250
Belmont avenue,		20	20
"	"	6	60
"	"	4	27
"	"	20	850
Lancaster ave., from Haverford to Forty-fourth		20	3,512
			<hr/> 26,948
Plug Connections,		4	395
			<hr/> 27,343
Total number of feet of pipe laid,			27,343

Street.	Location.	Size.	
		Inches.	Feet
Number of feet of new pipe laid,		30	882
“ “ “		20	4,722
“ “ “		12	889
“ “ “		8	3,491
“ “ “		6	15,649
“ “ “		4	1,710
Total number of feet,			27,343
Or 5 miles 903 feet.			

THIRD DISTRICT.

Account of Iron Pipes laid in the Eleventh, Twelfth, Sixteenth, Seventeenth, Eighteenth, Nineteenth, Twenty-third and Twenty-fifth Wards.

Street.	Location.	Size.	
		Inches	Feet.
Third,	From Susquehanna to Dauphin,	6	612
“	“ “ “	4	12
Thompson,	“ “ York,	4	1,197
Reese,	“ Dauphin (north of 258 ft.) to York,	4	351
Waterloo,	“ Cumberland to Davis,	4	1,702
Adams,	“ Cedar to Gaul,	6	456
“	“ “	4	12
Susanna,	“ Salmon to Edgemont,	4	279
Tilton,	“ Emery to Huntingdon,	4	450
Ann,	“ Richmond to Belgrade,	6	1,560
“	“ “ “	4	27
Clearfield,	“ E. side of Trenton ave. to Amber,	6	504
“	“ “ “	4	18
Amber,	“ Clearfield to Ann,	6	744
“	“ “ “	4	9
Cumberland,	“ Jasper to Kensington ave.,	6	540
“	“ “ “	4	18

Street.	Location.	Size.	
		Inches.	Feet.
Filmore,	From Cumberland to Huntingdon,	6	576
"	" " "	4	12
Apple,	" Susquehanna to Dauphin,	6	612
"	" " "	4	22
Orianna,	" Norris to Diamond,	4	576
"	" " "	6	12
Jackson,	" Tulip to Sepviva,	4	316
Sepviva,	" Lehigh ave. to Jackson,	6	180
Orkney,	" Diamond to Dauphin,	6	1,260
"	" " "	4	27
Adrian,	" Thompson to Master,	3	540
"	" " "	4	36
Beach,	" S. side High Bridge to Poplar,	6	288
Poplar,	" Front, to E. side of Cohocksink Creek,	6	264
Poplar,	" Front, to E. side of Cohocksink Creek,	4	72
Sellers,	" Unity to Adam,	6	372
Adams,	" Sellers, to 62 ft. E. of Hosiery Mill	6	660
"	" " " "	4	18
Church,	" 114 ft. W. of Walnut to Tacony,	6	1,296
"	" " "	4	12
Tacony,	" Paul to Bridge,	6	6,240
"	" " "	4	129
Orthodox,	" Paul to Jefferson,	6	1,752
"	" " "	4	39
"	" Frankford road to Oakland,	6	1,716
"	" " "	4	36
Penn,	" Arrott to Oxford,	6	696
"	" " "	4	12
Unity,	" Leopard to Sellers,	6	696
"	" " "	4	12
Connecting Coral with Lehigh avenue,		4	144
" Braddock	"	4	108

Street.	Location.	Size.	
		Inches.	Feet.
Connecting Emerald with Lehigh avenue,		6	72
Sellers, from an angle to Johnson,		6	72
Lehigh ave., S. side, from Frankford road to Howard,		6	3,416
“ N. “ “		6	3,416
“ N. “ “		4	63
Cumberland, From Lee to Kensington ave.,		6	324
“ “ “ “		4	12
Palethorp, “ Dauphin to Susquehanna ave.,		4	630
Orianna, “ Diamond “		4	612
Letterly, “ Jasper to Kensington ave.,		6	444
“ “ “ “		4	9
Lehigh ave, S. side, from Germant'n r'd to Orkney,		6	2,532
“ S. “ “ “		4	12
“ N. “ “ “		6	2,352
“ N. “ “ “		4	36
Fountain at Norris Square,		4	54
“ “		3	135
Fox, from Cumberland (north),		4	189
Connection at Vizen Hall and Vizen Frankf'd Mills,		4	36
Repairing main, Orthodox and Frankford road,		6	12
Removing plug, Beach and Brown,		4	9
Repairing main, Filmore and Kensington avenue,		6	12
“ “ Richmond and Harrison row,		6	12
“ “ Richmond and Tioga,		6	12
“ “ Third below Poplar,		10	9
Putting in stop-cock, Girard ave. west of Third,		4	9
“ “ Frankford road and Maiden,		10	9
“ new steam-plug, Kensington Hose House,		4	18
“ “ “ “		6	9
“ “ Columbia Sugar Refinery,			
“ “ Vine below Third,		4	117
Moving fire-plug, Montgomery ave. and Thompson,		4	9
Delaware Water Works,		8	132
Total number of feet of pipe laid,			42,007

	Size. inches.	Feet.
Number of feet of new pipe laid,	10	18
“ “	8	132
“ “	6	33,721
“ “	4	7,461
“ “	3	675
		<hr/>
Total number of feet,		42,007
Or 7 miles 5,047 feet.		

FOURTH DISTRICT.

Account of Iron Pipes laid in the Thirteenth, Fourteenth, Fifteenth, Twentieth, Twenty-first and Twenty-eighth Wards.

Street.	Location.	Size.	
		Inches.	Feet.
Ridge ave.,	From Girard to Stiles,	6	468
Alder,	“ Berks to Norris,	6	522
Hedding,	“ North to Barclay,	4	198
Bucknell,	“ Brown to Parrish,	6	408
Woodstock,	“ Columbia to Montgomery,	6	540
Nassau,	“ Twenty-first (west),	6	204
Jefferson,	“ Sixteenth to Wellington,	6	240
Wellington,	“ Columbia (south),	6	300
Twelfth,	“ Norris to Diamond,	6	552
Warnock,	“ Berks to Norris,	6	564
Seventeenth,	“ Columbia to Oxford,	6	552
“ A,”	“ Twenty-second to Twenty-third,	6	492
“ B,”	“ “ “	6	492
Wright,	“ Twenty-second to Twenty-fourth,	6	960
West,	“ Parrish to Poplar,	6	492
Twenty-second,	“ Ridge ave. to Columbia,	6	312
Eighth,	“ Montgomery to Berks,	6	552

Street.	Location.	Size.	
		Inches.	Feet.
Nicholas,	From Twentieth to Twenty-first,	6	540
Turner,	“ “ “	6	540
Sharswood,	“ Twenty-third to Twenty-fourth,	6	480
Sydenham,	“ Jefferson to Oxford,	4	522
Stewart,	“ Twenty-third to Twenty-fourth,	6	480
Hutchinson,	“ Oxford (north),	6	540
Nineteenth,	“ Oxford to Jefferson,	6	540
“	“ Berks to Norris,	6	540
Plug connections		4	81
Drain at Spring Garden Works,		3	45
Main at Fairmount,		36	1,236
Pumping main, Thompson street,		36	900
Main, Spring Garden Stand-pipe,		30	15

ROXBOROUGH.

20-inch main, connecting Roxborough Reservoir with Germantown Water Works, Water Department property,	20	544
Green Tree lane,	20	504
Livezey's lane,	20	1,106

Total number of feet of pipe laid, 16,620

Number of feet of new pipe laid,	36	2,136
“ “	30	15
“ “	20	2,313
“ “	6	11,310
“ “	4	801
“ “	3	45

Total number of feet of new pipe laid, 16,620

Or 3 miles 780 feet.

MANAYUNK.

Street.	Location.	Size.	
		Inches.	Feet.
Green lane,	From Main to Wood,	12	4,116
“	“ “	6	192
“	“ “	4	90
Baker,	“ Green lane to Centre,	6	472
Centre,	“ High to Hamilton,	6	890
Levering,	“ Main to Cresson,	6	211
Cresson,	“ Levering to Gay,	6	135
Gay,	“ Cresson to Wood,	6	819
Levering,	“ “	6	650
Grape,	“ Main to Wood,	6	762
Colton,	“ “	6	765
Penn,	“ Main to Apple,	6	450
Apple,	“ Penn to Cedar,	4	354
Cedar,	“ Main to Apple,	6	450
Main,	“ Penn to Shur's lane,	6	730
“	“ Cedar to Penn,	6	357
“	“ Penn to Robinson,	6	420
“	“ Robinson to Mechanic,	6	242
“	“ Mechanic to Cotton,	6	190
Total number of feet of pipe laid,			12,295
Number of feet of new pipe laid,		12	4,116
“	“	6	7,735
“	“	4	444
Total number of feet of new pipe laid,			12,295
Or 2 miles 1,735 feet.			

GERMANTOWN.

Account of Iron Pipes laid in Germantown, Twenty-second Ward.

Street.	Location.	Size.	
		Inches.	Feet
Haines,	From Morton (east),	6	471
Cheltenham avenue (east side),	From Hancock (east),	6	261
Coulter,	From Knox to Wayne,	4	530
Wayne,	“ Coulter to Manheim,	4	1,918
“	“ S. E. end of pipe,	3	233
Township line and Manheim relaid,		3	125
Armat,	From Cumberland (west) relaid,	4	150
Osceola,	“ Herman (N. E.) relaid,	3	65
Harvey,	“ Main (east) relaid,	4	73

20-inch Main.

From former terminus on Allen's lane to reservoir,	20	3,510
On west Crease's lane,	20	864
“ east “ “	20	246
Emlen, from Allen's lane (north), waste for 20-inch mains,	6	170
Cresham, from Allen's lane (N. W.), waste for 20-inch mains,	6	163
Plug connections,	4	260
Total number of feet of pipe laid,		9,039
Number of feet of pipe relaid,	4	223
“ “ “ “	3	190
Total,		413
Number of feet of new pipe laid,	20	4,620
“ “ “ “	6	1,065
“ “ “ “	4	2,708
“ “ “ “	3	233
Total number of feet,		9,039
Or 1 mile 3,759 feet.		

Recapitulation of Pipe laid in the several Districts during the year 1869.

WARDS.	3-inch.	4 inch.	6-inch.	8-inch.	10-inch.	12-inch.	20-inch.	30-inch.	36 inch.	TOTAL.
1st Dist., 1, 2, 3, 4, 26.....		7,426	3,314	.....	.....	.....	.....	.....	.....	10,740
2d Dist., 5, 6, 7, 8, 9, 10, 24, 27.....		1,710	15,649	3,491	.....	889	4,722	882	.....	27,343
3d Dist., 11, 12, 16, 17, 18, 19, 23, 25.....	675	7,461	33,721	182	18	.....	.....	.....	.....	42,007
4th Dist., 18, 14, 15, 20, 21, 28.....	45	801	11,810	.....	.....	.....	.....	15	2,136	14,307
Germantown, 22.....	423	2,931	1,065	.....	.....	.....	4,620	.....	.....	9,039
Roxborough.....	.....	.....	.....	.....	.....	.....	2,313	.....	.....	2,313
Manayunk.....	.....	444	7,735	.....	.....	4,116	.....	.....	.....	12,295
Total.....	1,143	20,773	72,794	3,623	18	5,005	11,655	897	2,136	118,044

Being a total of 22 miles 1,884 feet.

Total number of feet of pipe, as per last report,	-	-	-	2,321,870
“ “ “ laid during the year,	-	-	-	118,044

Feet, -	-	-	-	-	-	-	-	2,439,914
---------	---	---	---	---	---	---	---	-----------

Or 462 miles 554 feet.

SERVICE MAINS ORDERED.

Councils have ordered pipe laid in the following streets:

FIRST DISTRICT.

Pipe ordered to be laid in the First District.

Street.	Location.
Morris,	From Front to Otsego.
Dutton,	“ Morris to Mifflin.
Tenth,	“ to Jackson.
Washington ave ,	“ Twenty-third to Twenty-fourth, S. side.
Moore,	“ Seventh to Ninth.
Taylor,	“ Eighth to Ninth.
Twenty-sixth,	“ Park to Gray's Ferry road.
Twelfth,	“ Wharton to Passyunk road.
Reed,	“ Eleventh to Thirteenth.
Moore,	“ Ninth to Broad.
Montrose,	“ Jessamine, west 170 feet.
Pierce,	“ Passyunk road to Thirteenth.
Twenty-third,	“ Shippen to Pemberton.
Ingerson,	“ Christian to Gray's Ferry road.
Wharton,	“ Seventeenth to Eighteenth.
Mount Holly,	300 feet south from Wharton.
Ingerson,	“ Burnett to Gray's Ferry road.
Nineteenth,	“ Federal to Wharton.
Rosewood,	“ Catharine to Fitzwater.
Dudley,	“ 330 feet west from Ninth.
Delaware ave.,	“ South to Davis' landing.

SECOND DISTRICT.

Pipe ordered to be laid in the Second District.

Street.	Location.
Thirty-seventh,	From Garden to Aspen. On a certain street running from Twenty-first to Twenty-second, south of Arch.
Thirty-seventh, Story,	From Centre to Warren. “ Thirty-eighth to Thirty-ninth.
Thirty-fourth, Baltimore ave.,	“ Race to Lancaster avenue. “ Forty-first to Forty-second.
Thirty-eighth, Thirty-second,	“ Haverford road to Elm. “ Chestnut to Walnut.
Arch,	“ Thirty-second to Thirty-third.
Forty-second, Woodland,	“ Silverton avenue to Eadline. “ Chestnut to Forty-first.
Mary, Seneca,	“ Eadline to Forty-second. “ Lancaster ave. to Forty-fourth.
“	“ Mica to Forty-eighth.
Forty-fourth, Manning,	“ Haverford to Seneca. “ Twenty-fourth eastward 60 feet.

THIRD DISTRICT.

Pipe ordered to be laid in the Third District.

Street.	Location.
Toronto,	From Melvale south 806 feet.
Anthracite,	“ Salmon to Almond.
Berks,	“ Front to Germantown road.
Ann,	“ Emerald to Kensington.
Huntingdon,	Between Kensington ave. and Filmore ave.
Wellington,	From Richmond to Cedar.
Adams,	“ Emerald to Kensington ave.
Dickerson,	“ Cedar to Gaul.

Street.	Location.
Hope,	From Morris to Susquehanna.
Philip,	“ Diamond to “
Edgemont,	“ William to Alleghany ave.
Kensington avenue,	“ York to “
Somerset,	“ Kensington ave. to C street.
Clearfield,	“ Amber to Frankford road.
Lehigh ave.,	“ Second to Fifth (by Act of Assembly).
Franklin,	“ Sellers to Unity.

FOURTH DISTRICT.

Pipe ordered to be laid in the Fourth District.

Street.	Location.
Master,	From Twenty-seventh to Twenty-eighth.
Geary,	“ Poplar to Wiley.
Lehigh ave.,	“ Germantown ave. to Eleventh.
“	“ Sydenham to Eighteenth.
Bolton,	“ Twenty-third to Twenty-fourth.
School-house lane,	“ present terminus of pipe about 500 feet westward.
Erdman,	north from Perkiomen.
Twenty-sixth,	“ Brown to Poplar.
Tioga,	“ Seventeenth to Twenty-second.
Wood,	“ Green lane to Cotton.
East street,	Manayunk.
Hutchinson,	“ Jefferson to Oxford.
Dauphin,	“ Eighth to Tenth.
Gratz,	“ Montgomery ave. to Berks.
Twenty-eighth,	“ Poplar to Girard avenue.
North College avenue,	eastward from Twenty-first street, 312 feet.
Jefferson,	“ Sixteenth to Wellington.
Twenty-sixth,	“ Poplar to Girard avenue.
Cresson,	“ Cedar to East street.

GERMANTOWN.

Pipe ordered to be laid in Germantown, Twenty-second Ward.

Street.	Location.
Tioga,	From Seventeenth to Twenty-second.
Township Line road,	to connect with pipe now laid in the Twenty-eighth Ward.
Stenton avenue,	From terminus of pipe to Germantown avenue, thence south-eastwardly on Germantown avenue to Cayuga street, and eastwardly on Cayuga street to Seventeenth.
Wister,	“ End of pipe, 500 feet.
East Walnut street,	from Germantown avenue to Morton.
Linden,	From Green to Wayne.
School lane,	“ End of pipe along School lane to Ridge ave- nue, and along Ridge avenue to Falls bridge, as soon as the connection shall have been made between the Roxborough Water Works and the Mount Airy Reser- voir.

Account of the number of Holes drilled for making new Attachments to Public Mains during the year 1869.

MONTHS.	$\frac{1}{2}$ -inch diameter.	$\frac{3}{8}$ -inch diameter.	$\frac{3}{4}$ -inch diameter.	1-inch diameter.	Total holes drilled and attachments made.	Shut off for repairs to private pipes.	Shut off for repairs to public pipes.
January	80	19	3	1	103	29	15
February.....	128	17	5	1	161	19	27
March	190	17	1	.....	208	19	17
April.....	326	37	3	.....	366	34	15
May	854	89	5	1	899	33	18
June	371	22	10	1	404	32	24
July	331	27	7	1	366	32	19
August	279	32	4	4	319	31	26
September.....	392	57	4	2	455	38	22
October.....	395	63	7	4	469	36	23
November.....	433	38	7	3	481	28	33
December	202	33	6	1	242	30	21
TOTAL.....	3,481	401	62	19	3,963	361	255

The following Attachments were made in the Wards :

WARDS.	$\frac{1}{2}$ -inch diameter.	$\frac{3}{8}$ -inch diameter.	$\frac{3}{4}$ -inch diameter.	1-inch diameter.	Total holes drilled for attachments.	Shut off private pipes for repairs.	Shut off public pipes for repairs.
First District, 1, 2, 3, 4, 26	796	44	1	1	843	50	99
Second District, 5, 6, 7, 8, 9, 10, 24, 27..	664	104	31	6	805	124	.....
Third District, 11, 12, 16, 17, 18, 19, 23, 25,	915	75	13	9	1,011	105	97
Fourth District, 13, 14, 15, 20, 21, 28,...	1,015	175	17	3	1,210	79	53
Germantown.....	91	3	.....	.....	94	3	6
TOTAL.....	3,481	401	62	19	3,963	361	255

The following Table exhibits the number of repairs to Mains, Stops, Plugs, by different Districts, during the year 1869.

DISTRICTS	Repairs to mains.	Repairs to stops.	Repairs to plugs.
First District.....	55	214	484
Second "	17	340	184
Third "	81	602	558
Fourth "	28	218	342
Germantown.....	6	61	81
TOTAL.....	187	1,435	1,649

Account of New Stops and Fire-plugs for 1869.

DISTRICTS.	No. of stops.	No. of fire-plugs.
First District.....	23	19
Second "	31	59
Third "	93	87
Fourth "	16	43
Germantown.....	9	17
TOTAL.....	172	225

PERMITS FOR THE YEAR 1869.

WARDS.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21 & 28	22	23	24 & 27	25	26	TOTALS.
Dwellings.....	365	44	10	8	2	5	54	33	17	34	6	4	3	13	252	19	27	122	814	805	143	88	72	470	85	548	4,043
“ ½ and ¾.....	3	1						3						4	10		8	4	13	9							55
Baths.....	57	25	14	9	3	7	76	76	18	39	9	9	11	17	200	10	24	62	305	556	124	69	23	305	10	167	2,225
Wash paves.....	38	11	18	4	11	6	42	46	20	40	12	7	18	27	131	16	19	30	100	535	112	10	34	205	7	113	1,712
Water-closets and urinals.....	8	1	6	6	20	44	101	104	73	76	8	25	25	16	153	8	1	1	20	211	73	48	3	225		7	1,263
Basins, sinks and tubs.....	2		2		7	38	144	184	92	68	7	11	15	17	132	2	2	3	6	260	45	62	7	200		2	1,308
Steam engines.....	3	1			5	6	1	1	3	3	5		1	3	2	4	1	1	12	2	2	1	4	3			64
Horse-power of engines.....	24	5			58	41	3	5	50	20	33		2	41	22	29	10	13	191	13	20	5	63	23			671
Distilleries.....	2	2		2						1	2			1	5	1				1	1	1				2	21
Breweries.....																											1
Stables.....	10	2	3	3			2	2	4	3	1		2	1	12	5	3	5	17	9	2		2	3	2	10	103
Churches and schools.....	1							1		1																	6
Rectifiers.....	1								1																		26
Fountains.....	1				2	1	1		2	3				1	3	1				4							7
Building permits.....	24	1		1	1	2	7	2	2	10	2	2		3	31	3	1	6	51	72	10	39	7	70	4	23	374
Stores, shops and offices.....	7	5			6	4	1	3	10	6	4	1	3	2	7		3	2	5	5	2	3	5			4	90
Barber-shops.....	1	2		2	1	1		1				1		2		1		1		1	1			2		1	17
Slaughter-houses.....	1											1			1					2	2				1		8
Hotels and bars.....	3	1	3	2	3	2	1	1	5	3	1	2	2	1	6	2	6	3	16	5	1			7	7	6	89
Skating parks.....	1																					2					3
Bakeries.....	1													2	1	1		1	1	2						2	11
Dye-houses.....	1	1												1	1				2								6
Brick-yards.....																					4	3			3		10
Water for ships.....	1	1																									2
Watering horses.....	1				1										1		1		2	1			2	2	2	1	14
Market-houses.....				1											1												2
Watering streets.....				1	5	5		4	2					1	2							1	2				23
Sugar-houses.....				1	1																						1
Foundries.....					1														1								2
Factories.....							2	1	1	1				1	1	2			1	5	2			1			18
Photographers.....													1														1
Hot-houses.....															1						1		1				4
Total.....	531	98	56	37	70	122	440	463	250	288	59	62	81	112	954	76	96	243	1464	2487	520	323	161	1505	124	882	11,504

RECEIPTS AND EXPENDITURES.

RECEIPTS.

The gross receipts for the year have been \$813,470 83. The sources from which this amount has been received will be exhibited by the statement of the Register, George F. Keyser, Esq.

Of the above sum, \$4,962 60 has been received at the Engineer's office.

The following amounts have been received at the Chief Engineer's office, and paid to the City Treasurer :

For rents, - - - - -	\$1,045 00
“ old iron and brass, - - - - -	896 47
“ stone and cement barrels, - - - - -	1,245 09
“ repairs to private fire-plugs, - - - - -	98 07
“ removing plugs, - - - - -	69 95
“ ice cutting, - - - - -	90 00
“ grass, - - - - -	276 76
“ iron pipe, - - - - -	38 48
“ wharfage, - - - - -	17 60
“ old balustrade railing, - - - - -	50 00
Reading Railroad Company for 4-inch attachment,	223 48
George W. Childs & Co., “ “ -	152 55
M. W. Baird & Co., “ “ -	331 76
Rogers & Mitchell, “ “ -	147 15
E. S. Richards, “ “ -	134 00
J. E. Kingsley & Co., “ “ -	146 24
	<hr/>
	\$4,962 60

Expenditures of the Department for the year 1869.

Salaries of Chief Engineer, Register, Clerks, &c.,	\$27,765	52
Office expenses, - - - - -	3,988	37
Salaries of Engineers, Firemen, &c., at works, -	30,868	03

Supplies to works, viz.:

Coal and wood, . - - - - -	59,869	74
Tallow, oil and gas, - - - - -	3,940	48
Small stores, packing, &c., - - - - -	2,492	86

Repairs to works, viz.:

Fairmount Works, - - - - -	\$8,498	91
Delaware " - - - - -	2,564	31
Schuylkill " - - - - -	2,998	82
Twenty-fourth Ward Works, -	2,492	01
Germantown " - - - - -	788	78
Roxborough " - - - - -	980	17
	<hr/>	18,323 00

Keeping grounds in order:

Hardware, - - - - -	\$43	85
Gutter box, - - - - -	9	00
Plants, - - - - -	30	00
Wages, - - - - -	2,896	78
		2,979 63

Buildings, grounds and reservoirs:

Lumber, - - - - -	3,386	45
Slating, - - - - -	492	75
Tin roofing, - - - - -	1,415	76
Vault cover, - - - - -	440	40
Fence, - - - - -	1,265	00
Plastering, - - - - -	497	62
Hardware, - - - - -	353	22
Painting and glazing, - - - - -	433	12
Bricklaying, - - - - -	2,106	28

Amounts carried forward,	\$10,390 60	\$150,227 63
--------------------------	-------------	--------------

Amounts brought forward,	- \$10,390 60	\$150,227 63
Plumbing: - - -	220 80	
Castings, - - -	383 74	
Hose, - - -	264 25	
Bolts, - - -	178 46	
Sash and frames, - - -	157 87	
Copper rope, - - -	75 00	
Paints, - - -	102 41	
Paper hanging, - - -	83 40	
Sawing lumber, - - -	172 50	
T rails, - - -	75 20	
Stoves, - - -	44 00	
Lime, - - -	80 30	
Flag-stone, - - -	34 12	
Machine work, - - -	37 00	
Wages, - - -	9,821 60	
Sundry bills, - - -	349 69	
	<hr/>	22,470 94

Iron pipes, fire-plugs, and other fixtures
and materials for laying pipes, etc. :

Iron pipes, - - -	90,058 37	
Iron castings, - - -	9,183 21	
Brass castings, - - -	2,558 51	
Lead, - - -	6,927 27	
Wrought-iron and steel, - - -	1,399 26	
Wood, - - -	45 00	
Hardware, - - -	1,751 76	
Coal, - - -	693 00	
Bolts and washers, - - -	1,131 53	
Leather, - - -	229 35	
Lumber, - - -	1,839 51	
Gasket, - - -	880 68	
Rents of yards, - - -	156 00	
Paints and oils, - - -	501 94	
	<hr/>	
Amounts carried forward,	\$117,355 39	\$172,698 57

Amounts brought forward,	-	\$117,355 39	\$172,698 57
Machine work,	-	763 34	
Belting,	-	63 98	
Covering spindles,	-	792 65	
Oils,	-	341 92	
Tubing,	-	129 96	
Inspecting mains,	-	544 83	
Cordage,	-	267 68	
Tin work,	-	152 88	
Measuring pipe,	-	1,043 01	
Felting,	-	104 40	
Lathe,	-	1,500 00	
Bricklaying,	-	280 30	
Hauling pipes,	-	510 00	
Bricks,	-	488 00	
Tallow,	-	32 25	
Sundry bills,	-	421 03	
			<u>124,791 62</u>
Labor, laying pipe, setting plugs, etc., and for fitting up stop-cocks, etc., viz.:			
First District,	-	\$2,472 80	
Second "	-	8,079 48	
Third "	-	9,954 37	
Fourth "	-	5,231 34	
Germantown,	-	1,708 07	
Manayunk,	-	4,632 23	
			<u>32,078 29</u>
Shop, viz.:			
Wages,	-	\$13,530 39	
Surveyors, for measuring pipe,	-	2,134 24	
Pipe plans,	-	1,502 52	
Dressing tools,	-	80 16	
Hauling pipe,	-	348 50	
Sundry bills,	-	296 39	
			<u>17,892 20</u>
Amount carried forward,	-	-	<u>\$347,460 68</u>

Amount brought forward, - -	- \$347,460 68
Keeping pipes, plugs, stops, and fixtures in good order, viz.:	
Wages, First District, - -	\$4,251 75
“ Second “ - -	5,924 20
“ Third “ - -	9,448 18
“ Fourth “ - -	5,751 84
“ Germantown, - -	1,200 18
Paving around plugs, - -	1,288 00
Plumbing, - -	50 05
Sundry bills, - -	82 93
	<hr/>
	27,997 13
Drilling and making new attachments, viz.:	
Wages, First District, - -	\$1,399 50
“ Second “ - -	1,356 50
“ Third “ - -	2,058 00
“ Fourth “ - -	2,358 75
“ Germantown, - -	327 25
	<hr/>
	7,500 00
Iron railing at Fairmount, - - - -	252 72
Carriage hire, and keep of horse for use of Chief Engineer, - - - -	531 62
Germantown Water Company, - - - -	5,000 00
Substituting turbine wheels at Fairmount, in place of old breast-wheels Nos. 2 and 3, viz.:	
Turbine wheel, - - - -	\$7,206 11
Towing, etc., - - - -	23 00
	<hr/>
	7,229 11
Surveys for a better supply of water, - -	38 50
Bills of twice paid and over paid water-rents, etc., 1868, 1869, - - - -	158 37
Schuylkill Navigation Company, - - - -	25,000 00
	<hr/>
Amount carried forward, - -	- \$421,168 13

Amount brought forward, -	-	- \$421,168 13
Assisting to keep up the supply of water, 1869:		
Wages, - - -	-	\$1,235 09
Pumps (Knowles' patent), -	-	4,980 82
Wrought-iron pipe, - -	-	203 10
Hire of boilers, - - -	-	1,624 00
Lumber, - - - -	-	188 22
Mains, - - - -	-	504 00
Brickwork, - - - -	-	7 25
Coal, - - - -	-	157 50
Towing, - - - -	-	32 00
Wharf-bolts, - - - -	-	65 00
White-lead and oils, - -	-	64 44
Machine work, - - - -	-	100 55
Suctions, - - - -	-	548 65
Auxiliary engine during drought,	10,000 00	
Paid to firemen (Fire Dept.), -	-	270 92
Sundry bills, - - - -	-	91 95
		<hr/> 20,073 49
		<hr/> <hr/> \$441,241 62

EXTENSIONS OF WORKS.

AMOUNTS PAID FROM WATER LOANS.

Item 1.

For Cornish engine, boilers and connections, viz.:

Pressure gauges, - - -	\$191 25	
Connecting " - - -	64 35	
Wages, - - -	83 25	
	<hr/>	\$338 85

Item 4.

For reservoir, viz.:

Check valves, - - -	\$566 57	
Cement, - - -	18 90	
Coal, - - -	99 08	
Lumber, - - -	171 78	
Barrows, - - -	102 00	
Hardware, - - -	53 08	
Puddling clay, - - -	100 00	
Wages, - - -	4,601 07	
Sundry expenses, - - -	7 11	
	<hr/>	5,719 59

Item 7.

For incidentals, viz.:

Fire blocks and clay, - - -	135 00	
Pump, - - -	405 00	
Lantern, - - -	5 00	
Coal, - - -	75 40	
Gauges, - - -	8 50	
Wrought pipe, - - -	10 41	
Repairs to jack, - - -	16 50	
	<hr/>	
Amounts carried forward,	\$655 81	\$6,058 44

Amounts brought forward,	-	-	\$655 81	\$6,058 44
Felting,	-	-	226 77	
Barrows,	-	-	9 50	
Hardware,	-	-	38 71	
Hauling,	-	-	20 00	
Sundries,	-	-	10 50	
			<hr/>	961 29

Item 8.

For Cornish engine, boilers and connections, viz.:

Dressing tools,	-	-	110 52	
Lumber,	-	-	574 15	
Hardware,	-	-	21 72	
Lime,	-	-	49 70	
Sash and frames,	-	-	23 34	
Painting,	-	-	50 00	
Pump,	-	-	8 00	
Machine work,	-	-	175 79	
Wages,	-	-	4,362 50	
			<hr/>	5,375 72

Item 9.

For engine house, foundations and stack, viz.:

Sash and frames,	-	-	820 00	
Painting,	-	-	252 50	
Stone,	-	-	176 80	
Bricklaying,	-	-	47 75	
Pump,	-	-	250 00	
Dressing tools,	-	-	122 00	
Sundry bills,	-	-	35 60	
Wages,	-	-	5,188 27	
			<hr/>	6,892 92

Item 10.

For reservoir:

Tolls,	-	-	-	13 21
				<hr/>
Amount carried forward,	-	-	-	\$19,301 58

Amount brought forward, - - \$19,301 58

Item 13.

For incidentals:

Hardware,	-	-	-	365	00
Clay,	-	-	-	67	25
Mason work,	-	-	-	10	49
Pipe,	-	-	-	7	20
					<hr/>
					88 59

Making and sinking a crib in front of Fairmount dam through the deep water, and placing an oak apron upon it, viz.:

Lumber,	-	-	-	222	34
Wages,	-	-	-	287	49
					<hr/>
					509 83

For the purchase and laying mains, viz.:

Item 1.

For the purchase and laying a 16-inch, 12-inch, and 10-inch main for Manayunk:

Wharfage,	-	-	-	100	00
Hauling,	-	-	-	20	80
Powder,	-	-	-	59	00
Wages,	-	-	-	1,197	83
Sundry bills,	-	-	-	10	27
					<hr/>
					1,387 90

Item 2.

For the purchase and laying a 20-inch main to connect the Roxborough Water Works with the Germantown Water Works, viz.:

Lead,	-	-	-	5,320	60
Gasket,	-	-	-	231	50
					<hr/>
Amounts carried forward,				\$5,552	10
					<hr/>
					\$21,287 90

Amounts brought forward,	-	-	\$5,552 10	\$21,287 90
Hauling mains,	-	-	810 00	
Storage of mains,	-	-	120 00	
Dressing tools,	-	-	41 17	
Machine work,	-	-	995 54	
Hardware,	-	-	109 57	
Lime,	-	-	1,255. 50	
Pipe bridge on acct. contract,	-	-	4,026 29	
Mason work,	-	-	160 12	
Lumber,	-	-	42 83	
Cement,	-	-	18 00	
Powder,	-	-	29 25	
Castings,	-	-	130 35	
Wages,	-	-	13,696 35	
Sundry bills,	-	-	29 75	
			<hr/>	27,016 82

Item 3.

For the purchase and laying a 36-inch ascending main, from the Schuylkill Water Works to the Spring Garden Reservoir, viz.:

Mains,	-	-	-	\$8,489 45
Lumber,	-	-	-	365 01
Lead,	-	-	-	2,133 60
Brickwork,	-	-	-	248 25
Gasket,	-	-	-	124 10
Hauling mains,	-	-	-	199 00
Flagging,	-	-	-	281 25
Machine-work,	-	-	-	527 61
Lanterns,	-	-	-	14 00
Oil,	-	-	-	21 64
Rope,	-	-	-	15 12
Sundry bills,	-	-	-	57 49
Wages,	-	-	-	8,546 16
			<hr/>	21,022 68
Amount carried forward,	-	-	-	\$69,327 40

Amount brought forward, - - - \$69,327 40

Item 4.

For the purchase and laying a 30-inch ascending,
and a 20-inch descending main for the Twenty-
fourth Ward Water Works, viz.:

Mains, - - -	-	33,764	34
Lead, - - -	-	5,842	33
Gasket, - - -	-	610	35
Inspecting mains, -	-	229	64
Hauling " - - -	-	861	30
Wharfage, - - -	-	19	20
Dressing tools, -	-	71	50
Lumber, - - -	-	85	05
Machine work, -	-	418	30
Rope, - - -	-	72	54
Wages, - - -	-	4,971	47
		<hr/>	
			46,946 02

For continuing the construction of the Twenty-
fourth Ward Reservoir, viz.:

Mains, - - -	-	\$1,201	01
Dressing tools, -	-	295	00
Hardware, - - -	-	30	50
Oil, - - -	-	33	00
Cedar tank, - - -	-	32	00
Rope, - - -	-	19	25
Bricks, - - -	-	3,761	05
Barrows, - - -	-	78	00
Sundry bills, -	-	5	00
Wages, - - -	-	10,108	41
		<hr/>	
			15,563 22

Amount carried forward, - - - \$131,836 64

Amount brought forward,	-	-	-	\$131,836 64
For the purchase and location of a pumping engine, to be used at the Schuylkill Water Works to assist in keeping up the supply of water during the progress of extensions at Fairmount and Schuylkill Works, viz. :				
Hauling engines,	-	-	-	\$50 00
Wages,	-	-	-	271 42
Bolts, etc.,	-	-	-	4 52
				<hr/>
				325 94

Item 1.

For engine-house, foundations, stack, wharf, tunnel,
coal sheds, scales, boiler-setting, grading, etc.,
Belmont Water Works, viz. :

Wood work,	-	-	-	\$1,098 44
Lumber,	-	-	-	3,935 68
Stone,	-	-	-	3,765 39
Bricks,	-	-	-	1,344 20
Hardware,	-	-	-	261 85
Bolts,	-	-	-	448 40
Towing,	-	-	-	1,347 75
Dressing tools,	-	-	-	584 45
Building blocks,	-	-	-	96 00
Sand,	-	-	-	235 70
Lime,	-	-	-	778 25
Brickwork,	-	-	-	8,441 35
Fire-bricks,	-	-	-	510 00
Cement,	-	-	-	150 00
Machine work,	-	-	-	120 32
Flag-stones,	-	-	-	39 25
Glazier work,	-	-	-	80 05
Muriatic acid,	-	-	-	28 54
Soil-pipe,	-	-	-	29 75
				<hr/>
Amounts carried forward,	-	-	-	\$23,295 37 \$132,162 58

Amounts brought forward,	- \$23,295 37	\$132,162 58
Wrought-iron beams, .	-	37 21
Repairs to scow, -	-	399 92
Tin work, -	-	94 50
Marble dust, -	-	15 00
Hauling mains, -	-	35 00
Belting, -	-	32 80
Sundry bills, -	-	249 36
Wages -	-	13,988 28
		<u>38,147 44</u>

Item 2.

For boilers and connections, Belmont Water Works:		
Boilers, -	-	\$7,925 00
Brickwork, -	-	162 68
Fire-blocks, -	-	270 00
Bricks, -	-	2,005 50
Wages, -	-	1,919 42
		<u>12,282 60</u>

Item 3.

For reservoir, Belmont Water Works viz.:		
Lumber, -	-	633 11
Wheelwrighting, -	-	258 50
Coal and lime, -	-	2,562 30
Stone -	-	6,449 63
Gravel, -	-	710 80
Machine work, -	-	859 69
Dressing tools, -	-	1,066 85
Hardware, -	-	86 41
Cordage, -	-	23 48
● Tubing, -	-	204 19
Sundry bills, -	-	38 00
Wages, -	-	54,162 03
		<u>67,054 99</u>
Amount carried forward, -	-	<u>\$249,647 61</u>

Amount brought forward, - - \$249,647 61

Item 4.

For a 20-inch main on Lancaster avenue, from Belmont avenue to Fortieth street, viz.:

Mains, - - -	- \$15,982 03	
Inspecting main, - - -	236 50	
Gasket, - - -	220 76	
Machine work, - - -	408 95	
Wages, - - -	3,620 68	
	<hr/>	20,468 92

Item 5.

For the completion of the Cornish engine, boilers and connections, Roxborough Water Works, viz.:

Cornish engine, on account, -	\$21,935 31	
Machine work, - - -	818 55	
Hardware, - - -	11 20	
Wages, - - -	231 84	
	<hr/>	22,996 90

Item 6.

For the completion of engine-house, grading, fences, scales, coal-sheds, etc., Roxborough Water Works, viz.:

Lumber, - - -	\$292 71	
Stone, - - -	36 00	
Mason work, - - -	187 40	
Hardware, - - -	35 50	
T rails, - - -	104 73	
Rail road siding, - - -	118 65	
Machine work, - - -	181 13	
Scales, - - -	760 00	
Towing, - - -	75 00	
Roofing, - - -	78 82	
	<hr/>	

Amounts carried forward, \$1,869 894 \$93,113 43

Amounts brought forward,	\$1,869 94	\$293,113 43
Sundry bills, - - -	4 02	
Wages, - - -	998 79	
	<hr/>	2,872 75

Item 7.

For repairs to Mount Airy reservoirs, viz.:		
Lumber, - - -	\$66 03	
Bricks, - - -	65 60	
Bricklaying, - - -	82 75	
Barrows, - - -	39 50	
Wages, - - -	1,181 95	
	<hr/>	1,435 83

Item 8.

For engine, boilers and connections, boiler-house, and alterations and additions to engine founda- tions, Schuylkill Water Works, viz.:		
Cornish engine (balance), -	-\$21,849 96	
Boilers, on account, -	6,750 00	
Lumber, - - -	924 23	
Glazier work, - - -	209 20	
Wood work, - - -	192 35	
Brickwork, - - -	1,506 55	
Lime, - - -	615 22	
Columns, - - -	104 52	
Hardware, - - -	82 08	
Machine work, - - -	1,451 92	
Fire brick, - - -	592 90	
Powder, - - -	223 00	
Bolts, etc., - - -	385 97	
Roofing, - - -	498 00	
Bricks, - - -	1,609 00	
Tin work, - - -	275 48	
Sundry bills, - - -	164 75	
Wages, - - -	7,746 47	
	<hr/>	45,181 60
Amount carried forward, -		<hr/> \$342,603 61

Amount brought forward, - - \$342,603 61

Item 9.

For substituting turbine wheel in place
of old breast-wheels, Nos. 4 and 5,
Fairmount Water Works, viz.:

Turbine wheel (on acct.), -	- \$44,940 72
Stone, - - -	- 5,027 13
Granite, - - -	- 2,166 25
Lumber, - - -	- 3,296 13
Iron girder, - - -	- 1,205 33
Iron railing, - - -	- 1,025 95
Flume, gates, etc., - - -	- 8,720 48
Mains, - - -	- 8,211 15
Inspecting mains, - - -	- 148 00
Castings, - - -	- 297 84
Hardware, - - -	- 276 57
Lime, - - -	- 179 17
Cement, - - -	- 3,566 46
Dressing tools, - - -	- 366 11
Sash, frames, etc., - - -	- 558 69
Check valves, - - -	- 116 13
Coal, - - -	- 843 50
Bricks, - - -	- 437 50
Brickwork, - - -	- 1,177 40
Wrought-iron beams, - - -	- 5,022 98
Machine work, - - -	- 5,142 80
Iron and steel, - - -	- 450 23
Sand, - - -	- 283 95
Roofing felt, - - -	- 60 00
Cordage, - - -	- 342 24
Powder, - - -	- 121 25
Tin work, - - -	- 177 22
Gum, - - -	- 130 50

Amounts carried forward, \$94,291 68 \$342,603 61

Amounts brought forward,	-	-	\$94,291 68	\$342,603 61
Bolts, etc.,	-	-	29 43	
Sundry bills,	-	-	193 46	
Wages,	-	-	31,358 53	
			<u> </u>	125,873 10

Item 10.

For incidentals:

Muslin,	-	-	-	17 20
Car fares,	-	-	-	5 25
Sundry bills,	-	-	-	27 50
			<u> </u>	49 95
				<u> </u>
				<u>\$468,526 66</u>

RECEIPTS AND EXPENDITURES SINCE
CONSOLIDATION.

YEARS.	Received by Register for water-rents and percentage.	Received by Chief Engineer for rents, old iron, scraps, and private fire-plug attachments.	Total receipts from all sources.	Yearly increase.	Total expenditures.
1855.....	\$381,410 17	\$626 55	\$382,036 72	.....	\$250,895 37
1856.....	351,936 49	960 11	352,896 60	Decrease.	160,368 02
1857.....	425,661 94	802 20	425,964 14	\$73,067 54	200,605 82
1858.....	457,518 48	129 75	457,648 23	31,684 09	187,978 09
1859.....	548,128 19	3,051 89	551,180 08	93,531 85	411,737 09
1860.....	557,121 76	1,409 77	558,531 53	7,351 45	252,506 23
1861.....	533,094 76	885 30	533,980 06	Decrease.	238,989 54
1862.....	544,767 25	1,025 82	545,793 07	11,813 01	177,271 69
1863.....	568,740 60	937 69	569,678 29	23,885 22	213,750 20
1864.....	609,257 28	855 29	610,112 57	40,434 28	253,968 75
1865.....	629,887 47	6,500 95	636,388 42	26,275 85	422,337 58
1866.....	666,294 95	3,927 18	670,222 13	33,833 71	616,712 92
1867.....	761,559 45	5,891 44	767,450 89	96,228 76	575,844 49
1868.....	772,605 76	4,404 83	777,009 59	9,558 70	802,217 46
1869.....	808,508 23	4,962 60	813,470 83	36,461 24	909,768 28

Length of Pipe laid since Consolidation.

YEARS.	MILES.	FEET.
1855	6	44
1856	10	2079
1857	12	324
1858	13	3484
1859	22	784
1860	19	224
1861	11	2368
1862	9	954
1863	10	4161
1864	6	4287
1865	8	4754
1866	12	2964
1867	15	4971
1868	15	148
1869	22	1884
Total, - -	196	1,750

The amount of pipe laid may be considered as an index of the rapid increase of the city and consequent demand for water.

FREDERIC GRAFF,

Chief Engineer Water Department.

DEPARTMENT FOR SUPPLYING THE CITY WITH WATER,
 Register's Office, No. 104 S. Fifth street.
 PHILADELPHIA, *January, 1870.*

FREDERIC GRAFF, ESQ.,
Chief Engineer Water Department.

DEAR SIR:—I respectfully submit the following statement of the operations of this office for the year 1869.

The tabular statement presents to you in detail a full report of the financial operations of the office.

The estimated receipts from all sources, for the year 1869, were \$300,000. By reference to the tabular statement, you will find they amount to \$808,508 23, an increase over the total receipts of the year 1868 \$35,902 47.

Annexed are the amounts of the duplicates, arranged by wards, for the years 1869 and 1870, showing the increase; also a schedule of permits granted in the several wards during the year, and a tabular statement of the several appliances for water as charged in the registers for 1870.

The total amount of delinquent pipe bills returned to Survey Department for lien, during the year, was \$24,866 43.

The almost daily occurrence of violations of the ordinances of the city, by plumbers and others, convinces me of the absolute necessity of some stringent legislation by which the department can be protected, and thereby prevent the positive injury and loss to which it is subjected.

I also desire to call your earnest attention to the fact, that the large increase of business in the office demands additional clerical force, and from the rapid extension of the city to distant points, requires additional inspectors to insure the department proper and full returns.

Yours, very respectfully,
 GEORGE F. KEYSER,
Register.

LIST OF DWELLINGS, FACTORIES AND FIXTURES THEREIN, AS CHARGED ON REGISTERS OF 1869.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21 & 28	22	23	24 & 27	25	26	TOTALS.	
Dwellings.....	5035	3629	1854	1814	2745	2760	3439	2671	2442	2718	2353	1900	2559	3078	5449	1987	2084	3172	5869	7659	619	924	284	2104	729	4929	74,806	
Three quarter dwellings.....	83	223	110	104	28	32	125	41	76	74	232	42	61	167	973	149	148	478	471	283	3	.....	.....	53	72	60	4,088
Half dwellings.....	397	1350	1282	1471	515	293	1220	534	435	991	735	711	558	638	393	1223	529	591	628	494	11	7	3	74	239	490	15,812	
Baths.....	1089	844	659	382	804	.....	1825	1865	1180	1530	398	773	1631	1537	3077	386	258	473	510	4463	480	738	73	955	97	1250	27,177
Basins.....	10	40	59	66	1231	12-9	1000	1933	1795	823	139	220	398	254	2034	96	25	28	130	1606	110	426	45	335	12	115	14,189	
Water closets.....	28	31	44	54	1066	1183	900	1545	1195	688	123	98	288	178	1295	38	17	11	94	960	283	485	7	490	11	143	11,255	
Urinals.....	.....	6	1	6	173	189	13	133	126	22	11	12	.....	2	17	.....	.....	.....	23	.....	.....	.....	.....	38	.....	.....	776
Wash-tubs.....	.....	.....	8	3	8	18	50	199	186	28	.....	6	7	19	104	8	.....	.....	.....	15	.....	134	.....	26	4	5	828
Bidets.....	.....	.....	.....	.....	3	25	26	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	5	.....	.....	.....	.....	64
Bakeries.....	25	37	28	21	13	19	10	7	25	9	13	16	12	15	40	30	17	13	81	41	4	6	3	24	4	26	539	
Horse stalls.....	401	807	295	438	513	396	625	1447	1335	683	682	629	592	665	1702	637	174	434	910	1592	50	.....	104	982	109	625	16,827
Hor-e power of Engines.....	542	567	81	190	548	926	324	125	817	237	361	231	227	501	1855	1129	394	520	1293	461	27	317	138	349	68	388	12,616	
Bars.....	84	136	75	184	248	148	80	91	150	53	252	98	68	44	189	119	.....	67	184	165	3	11	6	88	51	146	2,740
Drug stores.....	.....	.....	2	.....	.....	.....	3	20	6	4	5	5	7	20	8	.....	.....	.....	42	5	.....	.....	1	18	3	10	159
Photographers.....	.....	.....	1	.....	6	11	.....	8	21	2	5	2	6	2	1	.....	.....	.....	18	2	.....	1	.....	5	.....	.....	91
Barber-shops.....	.....	15	13	.....	21	15	.....	7	39	7	.....	11	10	17	18	20	22	9	52	12	.....	2	3	15	3	.....	308
Fountains.....	.....	.....	.....	10	13	2	14	25	16	.....	.....	5	4	9	25	3	.....	2	.....	16	.....	12	1	45	.....	3	205
Dye-tubs.....	.....	.....	7	.....	6	.....	35	1	.....	14	.....	.....	3	.....	61	41	42	20	52	5	.....	8	.....	.....	16	15	326
Bottling establishments.....	1	1	1	1	27	2	35
Wash paves.....	274	301	214	106	531	303	972	1023	862	955	170	417	885	1012	2210	258	203	313	537	3357	447	305	114	502	92	603	16,994	
Watering horses.....	.....	8	9	8	14	.....	.....	18	.....	.....	.....	.....	1	4	7	.....	23	9	62	4	.....	.....	6	24	5	45	273
Meat packers.....	4	1	1	2	8
Foundries.....	6	6
Factories.....	2	5	.....	2	.....	26	17	.....	35	6	.....	12	11	25	.....	30	34	.....	88	8	.....	4	.....	28	.....	.....	333
Breweries.....	1	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.....	3	5	17	.....	.....	32	.....	3	.....	.....	3	1	70
Sugar houses.....	1	2	3
Distilleries.....	3	3	9
Slaughter-houses.....	1	5	11	28	46
Hot houses.....	10	12
Malt-houses.....	3	3
Brick-yards.....	5

Amount of Duplicates of 1869 and 1870.

WARDS	1869.	1870.
First, - - -	\$26,945 25	\$30,435 50
Second, - - -	30,072 00	31,366 25
Third, - - -	17,426 25	17,774 50
Fourth, - - -	18,562 50	18,737 75
Fifth, - - -	28,455 25	31,445 25
Sixth, - - -	36,363 25	36,752 55
Seventh, - - -	35,313 00	36,190 25
Eighth, - - -	35,693 75	36,788 50
Ninth, - - -	30,246 50	34,828 50
Tenth, - - -	30,194 75	30,898 00
Eleventh, - - -	18,260 75	18,440 25
Twelfth, - - -	19,335 25	19,494 75
Thirteenth, - - -	27,486 00	28,012 00
Fourteenth, - - -	31,059 75	31,585 25
Fifteenth, - - -	61,752 25	64,852 50
Sixteenth, - - -	22,255 50	22,275 25
Seventeenth, - - -	20,630 50	20,744 50
Eighteenth, - - -	27,140 25	28,208 50
Nineteenth, - - -	43,097 50	50,674 00
Twentieth, - - -	70,319 75	79,827 75
Twenty-first, } -	5,476 50	7,189 00
Twenty-eighth, } -		
Twenty-second, -	11,194 00	12,263 00
Twenty-third, -	1,973 50	2,946 50
Twenty-fourth, } -	22,397 50	27,353 25
Twenty-seventh, } -		
Twenty-fifth, -	5,865 25	6,468 75
Twenty-sixth, -	33,532 50	38,850 75
TOTALS. - - -	\$711,049 25	\$764,403 05

Statement of Receipts at Register's Office, from January 1, to December 31, 1869.

MONTHS.	Delinquent Rents.	Penalties.	Rents, 1869.	Penalties.	Permits.	Pipe.	TOTALS.
January	\$6,375 25	\$726 26	\$31,061 25	.....	\$2,184 25	\$7,086 64	\$47,423 65
February.....	2,485 75	253 36	69,634 75	.....	3,754 00	2,442 42	78,570 28
March.....	2,086 75	256 64	108,828 50	.....	3,279 00	3,727 79	118,178 68
April.....	1,340 25	132 97	332,814 00	.....	5,340 75	2,199 25	341,827 22
May.....	787 50	69 36	26,122 00	\$1,240 85	5,335 25	3,103 28	36,658 24
June.....	356 75	44 89	31,826 25	1,527 07	4,855 30	5,927 42	44,537 68
July	350 25	32 89	6,440 25	829 78	4,298 50	8,065 17	20,016 84
August.....	173 00	16 58	9,219 75	1,245 66	2,849 68	11,422 73	24,927 40
September.....	1,682 25	221 90	29,266 50	3,953 84	4,020 00	5,397 33	44,541 82
October.....	761 50	88 88	10,723 50	1,483 21	3,046 40	2,611 49	18,714 98
November.....	721 00	60 47	8,184 00	1,033 17	2,970 00	4,083 66	17,052 30
December.....	536 25	24 90	6,588 00	871 36	3,040 75	4,997 88	16,059 14
TOTALS.....	\$17,656 50	\$1,929 10	\$670,698 75	\$12,184 94	\$44,973 88	\$61,065 06	\$808,508 23

APPENDIX.

November 30th, 1869.

To the Presidents and Members of
Select and Common Councils.

GENTLEMEN:—The recent unprecedented drought has directed attention to the most important deficiencies in the works now supplying the city with water.

When water works depend for their supply upon a single line of aqueduct of great length, it is positively necessary that the reservoirs at the terminus of the conduit should be large enough to retain sufficient water to admit of repairs being made to the line should accident occur to it.

When mechanical power is employed, very large distributing reservoirs are not so essential, for if the works are provided with a superabundance of entirely reliable power, they may answer with a limited amount of storage capacity (or in fact where stand-pipes are used without any storage at all); but if the power be limited, or uncertain, the reservoir area must be increased accordingly.

Unfortunately our works are suffering from both these deficiencies.

When I had the honor in March, 1867, to again take charge of the works, I found that during the eleven years which had elapsed since my former connection with the department, the only material changes to supply the deficiencies referred to, was the addition of three turbines at Fairmount, the increase in the

contents of Corinthian avenue reservoir, and the erection of a stand-pipe at Delaware Works, intended to assist and increase the capacity of the engines there.

Much of the power of the works was found to be in the most dilapidated condition. At Fairmount only one of the breast-wheels and its pump (Wheel No. 1) could be said to be in reasonably good order,—the pumps were cracked, patched, leaky, and inefficient; the wheels, breastings and head-gates were rotted, unsafe, and required daily attention and repair to keep them moving at all.

Three years previously, Mr. Birkinbine, in his report for 1864 states “that all the pumps require renewal, and that Wheels Nos. “4, 5, 6, 7 and 8 should be taken out and replaced by others. “Some repairs were made to No. 9 (turbine wheel) this season; “it is now in good working order, and is the only wheel and “pump in satisfactory condition in the old mill-house.” It is not likely that they had improved by three years more work, and in fact Mr. Birkinbine in his last report, for the year 1866, says “it is almost impossible to keep some of the old pumps in “running order.”

At the Schuylkill Works Engine No. 1 had not been used at all for more than a year, and was so much dilapidated as to make it impolitic to expend money upon it. The other engines were in moderately good order, but much overtaxed on account of their limited power.

One engine and pump at the Delaware Works was in excellent order, the other engine was in fair condition, but its pump was entirely disabled by a broken valve-chamber, which had been removed, and its place not then supplied.

The engines at Twenty-fourth Ward Works were in the most dilapidated condition. It will be remembered that at these works there is no reservoir, a stand-pipe being used as a substitute; it is therefore necessary that one engine should be kept constantly at work, or the supply to the ward immediately ceases; on this account, and the broken and useless condition of

the stops intended to divide the two engines, no adequate repairs could be effected except by depriving the entire ward of water for a number of days.

The whole of the reservoirs connected with the works were found to be in good order.

It was obvious that my first efforts should be directed to the most defective part of the works—the power, and all my energies have been used to get that in such condition as would enable us to keep up the actual daily wants of our citizens.

With this view, I asked for and obtained an appropriation for renewing the power at Fairmount, by the substitution of turbine wheels for the dilapidated and almost useless breast-wheels. The appropriation for the first turbine and pumps was promptly granted, and it has been doing good duty since February 9th, 1869.

The appropriation for the second wheel was, however, arrested in its passage through Select Council, and a delay of over eight months occurred. This delay also affected the improvement of the Schuylkill Works, and prevented the erection of the boilers and boiler-house required there.

Engine No. 1, at these works, referred to above as being useless, has been removed, and its place supplied by a Cornish engine of more than double its capacity.

At the Twenty-fourth Ward Works, the purchase and erection of a ready-made Worthington duplex engine has enabled us to make the necessary repairs to the old engines, without depriving the ward of water, and also to keep up an ample supply during the summer, which would have been utterly impossible to have done without the aid of the auxiliary engine.

The unprecedented drought of the summer has developed the want of an auxiliary to our ordinarily reliable water-power, which, I believe, may yet be implicitly depended upon for at least eight, and probably ten months of any year, particularly if improved by raising the dam in the manner hereafter referred to.

In considering the subject of auxiliary steam-power, we are somewhat embarrassed by a doubt as to the proper location of

the engines, that they may be available for all of the present reservoirs, and any new and larger ones that may be erected.

Fairmount has been named as the proper position for them, under the supposition that they should be so arranged as to be useful to pump from below the dam, should that structure meet with disaster.

Whilst that position would have that single advantage, it would have the following objections:—

First. The water below the dam is contaminated by the tide bringing up, upon its rise, much of the sewerage of the city on the Schuylkill side, and the waste from the city gas works.

Second. If the engines were ordinarily made to take their supply from the forebay, which now supplies the wheels, it would be a serious disadvantage to the latter, by drawing down the level of the water in the forebay.

Third. If Cornish engines are employed, they could not be arranged to pump from both above or below the dam, as occasion might require, without great disadvantage.

Fourth. If the engines are placed in or upon the site of the old engine-house (the only available place, if they are to raise the water from both above and below the dam), the inconvenience of supplying them with coal, except by boats, would be considerable.

Fifth. It would be difficult and expensive to carry the pumping mains to the highest, largest and most important of our reservoirs, or to any new ones to be built.

Sixth. To provide for such a contingency as the destruction of the dam, would require the erection and keeping in order of a considerable number of engines and boilers of the largest class.

That some idea may be formed of the number of engines required to supply all the water now wanted on the east side of the Schuylkill, the following statement is submitted.

The supply of July last from the Schuylkill, delivered on the east side of the river, was an average of 37,875,710 gallons daily—the capacity of the largest of our Cornish engines (the one just

erected) is 7,000,000 gallons per day—it would therefore require more than five engines of the same size to do the work; as it would not answer to be without reserve power, seven engines would be necessary to meet the present demand, and within two years at least one more; all of which would have to be constantly kept in perfect running order, waiting the destruction of the dam, a catastrophe which may never and which should never occur.

The dam has withstood the force of all the freshets in the river for nearly fifty years, and I believe with proper precautions and the rebuilding of that part of it above low tide, we may feel safe from fear of destruction.

I therefore recommend the erection of auxiliary steam-power at the Schuylkill Works, for the reason that it is a great advantage to have all the steam-power concentrated at one point.

The works are now provided with an ample forebay, which only requires a new inlet from the river to make it suitable for the supply of double the number of engines now drawing from it.

The coal can be delivered to great advantage, as it is now, from the Reading Railway, by dropping it from the bottom of the cars directly into the coal shutes, close to the boiler-house doors; or, if any accident occurs to the railway, it can be put upon the wharf from boats.

From this point the highest of our reservoirs can be easily reached by mains of moderate length, and the larger reservoir proposed to be built can also be readily supplied.

And finally, auxiliary power can be erected here, and made available very much sooner than at Fairmount.

It is proposed to take out Engine No. 2, which with its boilers have been in almost constant use for over twenty-four years, and erect in its place a duplicate of the side-lever Cornish engine just erected; and as soon thereafter as possible, remove Engine No. 3, and replace it by one of much increased power and improved construction. This will fill the old engine-house, and will probably be sufficient for several years.

It is then proposed to erect a new engine and boiler-house on the western side of the forebay, between the present coal shutes and the river, and place therein engines of adequate power to pump through a stand-pipe, to be placed upon a rocky bluff behind the proposed house, into any new reservoir which may be erected within a reasonable distance.

A new engine is positively necessary at the Delaware Works, as the supply to the section of the city fed from them could not have been kept up this summer, except by considerable aid from Fairmount Works; this will require a new ascending main, and the raising of the stand-pipe erected here four years since, which was unfortunately, through error, made too short, and is now only partially useful as an assistant to the engines.

The west side of the river will have ample engine-power and reservoir storage, when the new works now erecting are finished.

The water-power at Fairmount may be improved, should the dam be rebuilt at a level of say two feet above its present height; the wheels could then be run with the expenditure of about twenty-five per cent. less water than at present. Such raising of the dam would also be of great value to the Navigation Company, by enabling them to abandon their towing path, and use steam tugs to bring their boats down from Manayunk; and would also save them very large annual expenses for dredging out the channel of the river, now absolutely necessary—they should therefore join in the expense.

The third turbine should be erected in the mill-house, completing all the large turbines contemplated at the works.

The providing of additional reservoirs presents some difficulties; what we have to seek for is, positions whereon they can be erected of sufficient size, at the proper altitude to supply the highest ground, within as short a distance as possible of the pumping power, and yet not too far removed from the centre of distribution; to find a site combining these four requisites, is no easy matter.

The city owns lots of ground adjoining the Schuylkill, Corinthian avenue and Delaware Works, upon which additional reser-

voirs may be built of about the same capacity as the present ones, but would be very expensive, as it is difficult to obtain earth in sufficient quantities to form the embankments within a reasonable distance of either of them; this method of increasing our storage is therefore not recommended, except in the case of the Delaware Works.

Neither of them is high enough to command the high ground of the Twentieth and Twenty-eighth Wards, which are improving with great rapidity, and call loudly for a better supply than can now be furnished them; as these wards are suffering the most, the means of supplying them will be first considered.

The following plans have been suggested to effect the desired end:

First. To continue the 20-inch main now laid from the Roxborough Reservoir to near Green Lane, Manayunk, to say Ridge avenue and Jefferson street, which may be considered as the centre of distribution of the ward, and is near the highest curb in it.

Second. To lay mains from the reservoir now building near George's Hill, across either the Girard avenue or the old Columbia Rail Road bridge.

Third. To construct a reservoir upon some point on the west side of the Schuylkill, for the special supply of the high ground on this side of the river.

Fourth. To construct a new reservoir at Strawberry Mansion, upon the east park.

Fifth. To use engines to pump into stand pipes, taking their supply from the present or new reservoirs.

The total area of ground covered by the Twentieth Ward, is eleven hundred and seventy-four square acres, and the Twenty-eighth about thirty-seven hundred acres, together forty-eight hundred and seventy-four square acres. Of the Twentieth Ward, about five hundred and seventy-four acres are at a lower level than forty feet below the surface of the reservoirs, which at present supply that part of the city, and can therefore be fully

supplied now—leaving six hundred acres above that level, of which one hundred and seventy-five acres are above a level of one hundred feet. Twenty-eighth Ward has nearly twenty-eight hundred acres above one hundred feet, and some thousand acres in the immediate vicinity of Germantown, are at a level exceeding one hundred and twenty feet.

To supply the upper stories of a first-class dwelling, requires an altitude above the curbs of from 32 to 39 feet.

The highest regulation curb in the Twentieth Ward is at Twenty-first and Sharswood streets, $111\frac{81}{100}$ feet, and the highest in the Twenty-eighth Ward at Twenty-eighth and Indiana street, 143 feet; the minimum height of water in our reservoir should therefore be for the Twentieth Ward, $143\frac{81}{100}$ feet, for the Twenty-eighth Ward 175 feet.

The next consideration is the quantity of water required for the wards.

The average amount supplied to the whole city in the month of July, 1869, reached 41,508 gallons, about 54 gallons per day for each man, woman and child of the population; as the amount named is the average supply for the whole month, it is evident that on some days in the month it must have been considerably greater.

The consumption of water increases in greater ratio than the population, and it is demanded at a higher level than formerly; the appliances necessary for modern convenience have multiplied considerably in the past twenty years; then wash-pavement pipes were almost unknown; baths were seldom placed higher than the second story of the back buildings; and stationary wash-basins and water-closets were but seldom found. Now it is quite usual for houses to have three or four baths and water-closets, sometimes in the very uppermost stories of the houses, wash-basins in every chamber, stationary wash-tubs in the kitchens, and the universal wash-paye.

It will therefore be safe to assume that the maximum demand will in a few years reach at least 75 gallons per head per day, at

which rate the Twentieth Ward will require 4,500,000 gallons, assuming its population now to be 60,000, and the Twenty-eighth Ward will consume 225,000 gallons, taking its population at 3,000.

In view of the rapid increase and probable future wants of these wards, we should calculate for a supply of 10,000,000 gallons per day, and our distributing main from the reservoir should be large enough to deliver this quantity.

With this basis, we now take up the plans proposed in the order they have been named.

First. That proposed by my immediate predecessor, the extension of the 20-inch main intended to supply Manayunk, from its present termination near Green Lane, to Ridge avenue and Jefferson street.

The objections to this plan are—

The great distance of the reservoir from the point to be supplied.

The inadequacy in the size of the main proposed.

The great loss of head produced by the friction in so long a line of main, and the necessity of raising the water high enough to overcome it.

The limited amount of steam-power in use at the works.

The small size of the reservoir.

The great waste of power and fuel to raise the water to a height which would be unnecessary, if the reservoir were situate nearer the centre of distribution.

The distance from the reservoir to Ridge avenue and Jefferson street, is 36,151 feet, nearly $6\frac{1}{2}$ miles, and the fall from the surface of the water in the reservoir to the highest curb in Twentieth Ward is 257 feet; but even with this great fall, on account of its length, it would only discharge 7,690,494 gallons per day, and therefore be too small to deliver the amount we have assumed as being finally necessary.

If the reservoir is placed at Strawberry Mansion, a head of about $59\frac{1}{2}$ feet would produce the same daily flow through the

same sized main; it will, therefore, be seen that to supply from Roxborough will require the water to be raised 197½ feet higher than if the reservoir be placed at Strawberry Mansion.

Again, the height to which the water will be raised to supply the last named reservoir will be about 145 feet, whilst at Roxborough it is raised 334 feet. An engine capable of raising 10,000,000 gallons per day into the reservoir at Strawberry Mansion, would only be able to lift 4,341,317 gallons into Roxborough.

The unnecessary increase of the annual cost for fuel for pumping (more than double), and the greater strength, weight, and cost of machinery required for this additional lift, must be obvious.

The present engine at the Roxborough Works is only capable of raising about 2,500,000 gallons per day, all of which will soon be required by Roxborough, Manayunk and Germantown.

Four additional engines of the same size would therefore be required to raise 10,000,000 gallons.

The Roxborough reservoir will contain, when full, 11,407,567 gallons, or a little more than one day of the assumed supply.

I think it will be seen, from the above statement, that this plan need not be further considered.

The plan of supplying from the new reservoir now erecting for the west side of the river, is open to some of the same objections, but to a much less extent. The distance to the centre of distribution is but 18,000 feet, and the height of the water-level above the curb at Ridge avenue and Jefferson street but 101 feet.

In other respects it is more feasible. The pumping power will be 10,000,000 gallons per day. The engine-house is calculated to receive one more engine capable of raising 5,000,000 additional per day, with which, and an additional ascending main, we should have sufficient power to supply the Twenty-fourth, Twenty-seventh, Twentieth and Twenty-eighth Wards for several years.

The capacity of the reservoir will be over 40,000,000 gallons, which can be somewhat enlarged; or a new reservoir can be

erected upon a site near the present one, by placing a dam across a valley situate somewhat nearer to the engine-house than the reservoir now building, and capable of holding at least 80,000,000 gallons.

A serious objection to using reservoirs upon the west side of the river, at present is, that the mains would require to be carried over the river upon either the Girard avenue or Reading Rail Road bridges, both of wood, and, of course, much exposed to destruction by fire, thus jeopardizing the whole supply to the ward. A special bridge would therefore have to be built to make this source of supply certain.

If permission can be obtained from the Reading Rail Road Company, a main can be suspended upon cast-iron brackets extended upon the up-stream side of the stone piers of the bridge, but detached from the wooden superstructure, where it would be comparatively safe from injury, should the wooden bridge be burned.

The high ground in the Twentieth and Twenty-eighth Wards can be supplied sooner and at a higher level by this reservoir than by the plan next proposed, and in this respect the plan is more desirable than reservoirs on the east side of the river, but would not afford as much storage, unless a new reservoir be erected in the valley before named.

The next plan is the construction of an embankment reservoir at Strawberry Mansion.

For the Twentieth Ward, this point is high enough, but there are parts of the Twenty-eighth Ward, adjacent to Germantown, that are too high to be reached from this point; these may, however, be supplied from Germantown, or by small engines placed at the Strawberry Mansion reservoir, pumping their supply from it through a stand pipe. This latter plan would be cheaper to raise all the water required for the whole of the two wards at a height only necessary for a small population occupying the high ground above named, a considerable portion of which is now farms, gardens and cemeteries. The proper plan by which a supply may be insured to the highest localities, is to provide

for them a distinct system of distributing-pipes ; otherwise, if the reservoir is placed high enough to supply the highest points, the lower section of the city will draw the supply away from the higher, for the reason that the additional head at the low points will cause every running hydrant to discharge a much larger quantity of water in the same time than those upon the high points ; therefore, when the differences in level are considerable, they can only be equalized by separate systems of pipes.

A storage capacity on Strawberry Mansion property of about 89,130,000 gallons, can be secured at a point much nearer the centre of distribution than by any other plan proposed ; but a little further removed from the pumping power than either of the reservoirs just named, on the west side of the river, a water level of 150 feet above city datum can be obtained, which will give a head when the reservoir is full, of 39 feet above the highest curb in the Twentieth Ward.

The position selected for this reservoir is otherwise satisfactory ; it lies within the limits of the park—the ground is therefore the property of the city ; it can readily be supplied from the Schuylkill Works by a main of about seven thousand five hundred feet in length, and the distributing main to the centre of the ward will be about eight thousand five hundred feet.

No reservoir of the same size could be built outside the limits of the park without the vacation of a considerable number of the public streets running in both directions, which would of course be very objectionable. A reservoir at a higher level could be obtained if it was not for this objection, and another more serious, that is, it would be too far removed from the pumping power ; and to build new pumping stations nearer to it would not be advisable, for the reason that they would have to be situated at a point much too near the contaminations thrown into the river from Manayunk and Wissahickon.

Twent
years
At a reservoir capable of storing 635,704,200 gallons upon the eastern park, having a water level of at least 130 feet above datum, and therefore high enough to supply the whole of the

city, except the Twentieth, Twenty-first, Twenty-second, and Twenty-eighth Wards; it will be ten feet higher than Corinthian avenue and Schuylkill reservoirs, and can be supplied from the Schuylkill Works through ascending mains not exceeding three thousand feet long. For the present it could be connected with the distributing mains now leading from Corinthian avenue reservoir; this position is the most desirable within the limits of the city, it is recommended that a reservoir of the capacity named be erected here.

The plan of supplying all the ground in Twentieth and Twenty-eighth Wards (too high to be fed now), by engines and stand-pipes placed at the present reservoirs, would not be advisable on account of the small amount of storage in them, and for other reasons. But for supplying comparatively small areas of very high ground, in the Twenty-eighth Ward, such method is admissible, and can be employed with economy for situations not readily reached from the Germantown mains. New York, Boston and Cambridge, Mass., have adopted this method of supplying their high service.

A reservoir capable of holding 13,398,475 gallons may be erected upon the lot of ground owned by the city west of the Delaware reservoirs. The district now supplied from the Delaware Works, which includes Frankford, is rapidly increasing and requires attention, as it contains a large manufacturing interest.

It is believed that earth for the construction of the embankment can now be obtained from the high ground at no very considerable distance; as the lots in the neighborhood are being rapidly built upon, this will soon be impossible, the commencement of the work should therefore not be delayed.

If all the reservoirs described are built, the entire storage capacity in them and the old ones on the east side of the river, excepting Roxborough and Germantown, will be 821,603,311 gallons, equal to about 24 days' supply at the average rate of delivery in July, 1869, or 22 days longer than at present.

The erection of two new engines in the old engine-house of

the Schuylkill Works will make the maximum capacity, then 30,096,000 gallons per day, being 20,746,080 gallons more than their capacity in July, 1869.

The vital importance of such increase of power and storage must be apparent to any one who will remember the difficulties encountered during the drought of the past summer.

The Germantown Works were originally erected by a private company with limited means; most of the pipe laid is now too small; a sum is included in the estimate for laying a main of increased size, from the Mt. Airy reservoir down the Main street as far as Wistar street.

A sum is also included for erecting small engines and stand-pipe at the Roxborough reservoir, to pump the water into Mt. Airy reservoir.

The two engines purchased for use during the drought may be used for the purpose.

On account of the inadequate height of the Roxborough reservoir, these engines will sooner or later, undoubtedly, be necessary. A main of thirty inches diameter has been put through the embankment of the reservoir for the purpose of supplying these engines when they are required.

Our estimates would be incomplete unless they included a sum for the purpose of rebuilding Fairmount dam from low water upward. The present dam was rebuilt from low tide up, twenty-seven years since; a close examination made on several occasions when it was dry, during the drought, did not result in the detection of any serious defects. But as no risk should be incurred, I do not think it would be safe to allow it to stand more than one season, the next summer may be employed in collecting the material necessary for its reconstruction.

The estimate is made for the erection of a new dam in front of the present one, upon the cribs sunk there in 1864; and (as the cribs are somewhat defective) for sinking new cribs in front of the new dam. It is proposed to raise the new dam two feet higher than the present dam was when it was rebuilt. The amount for damages which may be claimed by the riparian

owners above the dam is not included, as it cannot now be ascertained.

Much of the land on both sides of the river will have been purchased by the Park Commission, a large amount of the damages may, therefore, be considered as settled.

A sum is included for putting in the third turbine wheel and pumps, and completing the mill-house at Fairmount.

As some of the estimates are necessarily made without the benefit of fully detailed plans and surveys, they are approximate only, but are believed to be ample for the accomplishment of the work.

When Belmont reservoir was commenced its area had to be confined within the limits of the public streets of the city, as it is now situate entirely within the limits of the park, this necessity no longer exists, and it can be enlarged to great advantage and cheaper than at any future time, an amount is included to effect this object.

In making the estimate, my object has been to include all matters required for properly increasing the works on a scale commensurate with the future requirements of our growing city. The works proposed will require not less than three years for their accomplishment.

APPROXIMATE ESTIMATE.

For all the Work described in the foregoing Report.

Reservoir for part of Fifteenth, Twentieth and Twenty-eighth Wards, on Strawberry Mansion property, to contain about 89,120,000 gallons.....	\$425,000		
“ on East Park, for storage for all the city, except wards above named, and the Twenty-first and Twenty-second Wards, now provided for, contents about 635,704,200.....	1,164,407		
“ adjoining the present reservoir of the Delaware Works, contents about 13,398,475 gallons.....	160,000		
To enlarge size of the reservoir now building at Belmont.....	80,000		
Total, for all the reservoirs,			\$1,779,407
For 36-inch ascending main, from Schuylkill Works to reservoir at Strawberry Mansion, 7,800 feet, at \$18 00.....	\$140,400		
“ 36-inch ascending main, from Delaware Works to reservoir, 13,350 feet at \$18 00.....	240,800		
“ 36-inch ascending main, from Schuylkill Works to large reservoir, 3,200 feet, at \$18 00.....	57,600		
For all the ascending mains,		\$438,800	
“ 36-inch descending main from large reservoir, to connect with the Schuylkill and Corinthian avenue mains, 5,300 feet, at \$18 00.....	\$95,400		
Amounts carried forward	\$95,400	\$438,800	\$1,779,407

Amounts brought forward,	\$95,400	\$438,300	\$1,779,407
For 30-inch descending main from reservoir, Strawberry Mansion, to Ridge avenue and Jefferson street, 10,000 feet, at \$12 50....	125,000		
For all descending mains,		220,400	
“ 30-inch and 24-inch mains, for the rearrangement of Twentieth and Twenty-eighth Wards.....	\$50,000		
“ New mains from Mount Airy reservoir, Germantown, to Main and Wistar streets.....	60,000	110,000	
For iron mains of all kinds			768,700
New Cornish engine, Schuylkill Works, in place of No. 2, with foundation, etc., etc.....	\$72,000		
“ Cornish engine, Schuylkill Works, to replace No. 3, with foundation, etc.....	75,000		
“ Engine-boilers, foundation and suction main, Delaware Works.....	64,850		
“ Engine and house, with stand pipe at Roxborough reservoir.....	10,000		
For engines of all kinds,			221,850
New turbine wheel at Fairmount, and finish of the mill-house.....			145,000
Rebuilding the dam from low tide.....			215,000
			<u>\$3,129,957</u>
As the Strawberry Mansion reservoir will not be high enough to supply the higher parts of the Twenty-eighth Ward, it may be thought better to supply these grounds from the Belmont Water Works, instead of by the Strawberry Mansion reservoir. This will make the following modification of the above estimate:—			
Deduct the cost of the reservoir and ascending mains of the Strawberry Mansion reservoir.....		690,400	
Amount carried forward.....			<u>\$2,439,557</u>

Amount brought forward.....		\$2,439,557
Add—		
For 36-inch ascending main to Belmont reservoir...	\$91,800	
“ 30-inch descending main to Ridge avenue.....	216,000	
“ an additional engine and fixtures.....	50,000	
“ Suspended 36-inch main across the river, founded upon the pier of the Reading Rail- road bridge.....	80,000	
	<hr/>	437,800
		<hr/>
		<u>\$2,877,357</u>

Making a saving of \$252,600.

The estimated receipts of the Water Department for the next year are \$872,000; by a small increase in the water-rents now charged, this may readily be increased \$200,000, without hardship to any one. The water-rents of this city are considerably lower than those of any large city in the United States.

Very respectfully,

FREDERIC GRAFF,

Chief Engineer of the Water Department.