

4500
TD225
PSA2
1880

1
J. J. ...

in 181

DEPARTMENT

—FOR—

SUPPLYING THE CITY WITH WATER.

ANNUAL REPORT

—OF THE—

Chief Engineer of the Water Department

—OF THE—

CITY OF PHILADELPHIA,

FOR THE YEAR 1880.

PRESENTED TO COUNCILS MAY 5, 1881.

PHILADELPHIA.

JOHN D. AVIL & CO., TELEPHONE PRINT, 403² MARKET ST.

1881.

COMPLIMENTS OF—

WILLIAM H. McFADDEN,

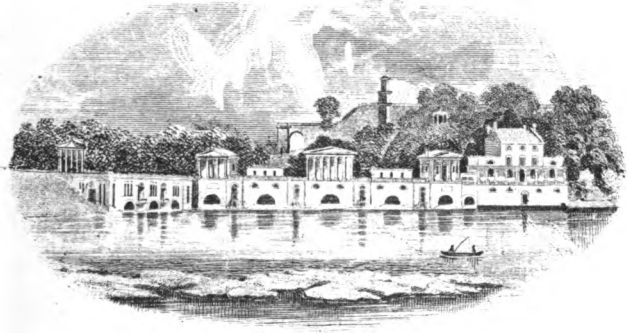
CHIEF ENGINEER.

DEPARTMENT
—FOR—
SUPPLYING THE CITY WITH WATER.

ANNUAL REPORT

—OF THE—

Chief Engineer of the Water Department



—OF THE—

CITY OF PHILADELPHIA,

FOR THE YEAR 1880.

PRESENTED TO COUNCILS MAY 5, 1881

PHILADELPHIA.

JOHN D. AVIL & CO., TELEPHONE PRINT, 403^d MARKET ST.

1881.

Handwritten scribbles or marks, possibly a signature or initials, located in the lower right quadrant of the page.

TD 255
P 5 A 2
1880

CONTENTS.



Errata,	11
City Councils' Committee on Water Works for 1880,	13
Officers and Clerks of the Department for 1880,	13
City Councils' Committee on Water Works for 1881,	15
Officers and Clerks of the Department for 1881,	15
REPORT OF CHIEF ENGINEER,	17
Receipts, Revenue, Expenditures,	18
Table of Receipts and Expenditures since Consolidation,	21
Pumpage,	22
Machinery at the Works,	27
Buildings and Grounds,	32
Extension of Works,	33
Answer to the attack of the Chairman of Finance Committee,	35
RECEIPTS AND EXPENDITURES OF THE DEPARTMENT FOR 1880,	39
Receipts in Detail,	41
Expenditures in Detail,	42
OPERATIONS OF THE REGISTRAR'S DEPARTMENT FOR 1880,	49
Report of Registrar,	51
Receipts at Registrar's Office, 1880,	52
Comparative Statement of Receipts for 1879 and 1880,	53
Fractional Rents,	53
List of Dwellings, etc., charged on Registrar for 1880,	54
Permits issued during the year 1880,	58
Duplicates for the years 1880 and 1881,	59
Purposes for which water is supplied free of charge,	60
OPERATIONS OF THE CHERRY STREET SHOP FOR 1880,	61
Stock account,	63
Work done for the Districts and Machinery,	64
Inventory of Stock on hand January 1, 1881,	65
Stop-cocks, Fire-plugs, etc., delivered in 1880,	68
" " made in 1880,	70

OPERATIONS OF THE WORKS FOR 1880,	- - - - -	71
Table of coal used by various engines in 1880,	- - - - -	73
Comparison of running expenses of steam and water in 1880,	-	74
Percentage of water pumped at each station in the years 1878,		
1879, and 1880,	- - - - -	75
Operations of the Works tabulated,	- - - - -	76
Total gallons of water pumped during 1880,	- - - - -	84
Water pumped by all the Works from 1854 to 1880 inclusive,	-	85
DISTRIBUTION OF THE WATER DEPARTMENT FOR 1880,	- - - - -	87
Recommendations,	- - - - -	89
Service and Supply Mains laid in 1880,	- - - - -	91
Purposes for which pipes were laid in 1880,	- - - - -	100
Statement of Fire-plugs,	- - - - -	101
New Attachments made in 1880,	- - - - -	102
Repairs to Plugs, Stop Mains, etc., 1880.	- - - - -	103
New Stops and Fire-plugs, 1880,	- - - - -	103
Valves raised in 1880,	- - - - -	103
Service Pipe laid during 1880,	- - - - -	104
MISCELLANEOUS TABLES,	- - - - -	105
Rain fall at Philadelphia,	- - - - -	107
Height of Water on Fairmount Dam,	- - - - -	108
Overflow on Fairmount Dam,	- - - - -	109
Population of Philadelphia by Wards,	- - - - -	110
Material on hand at Purveyor's Districts,	- - - - -	111
Rain fall at Lebanon, Pennsylvania,	- - - - -	112
APPENDIX :		
Report of Board of Trade,	- - - - -	1
Supplemental Report to that of 1879 presented by Chief Engineer,		
October 1, 1880.	- - - - -	9
ILLUSTRATIONS,		
Old Valve Box of Simpson Engine, broken Augst 8, 1880,	opp page	28
New Valve Box, - " " - - -	opposite page	28
Pumpage Diagram, - - - - -	" "	26

ERRATA.

Page 25, line 1, for "gallons lifted," read "feet."

Page 27, line 15, for "received," read "renewed."

Page 27, line 13, for "foot vaves," read "foot valves."

Page 28, line 16, for "Katzenstem's," read "Katzenstein's."

Page 28, line 25, for "section pipe," read "suction pipe."

Page 31, line 13, for "Dec. 31, 1879," read "Dec. 31, 1878."

Page 35, line 2, for "arraingment," read "arraignment."

Page 11, line 18 (Appendix), for "connecting," read "Connecting."

Committee on Water Works, 1880.

GEORGE W. BUMM, *Chairman*.
John McCullough, Daniel Blair, David Mouat,
James Evans, Adam Albright, Thomas H. Green,
Frederick Halterman, George Roney, John C. Bickel,
James J. Burr, Walter Rex, Charles K. Merklee,
W. Ellwood Rowan, John Hunter, John Bardsley,
John Flanagan, Wm. B. Irvine, John M. Vanderslice,
Jerome Beaver, Henry Clay, Frank McGrath,
John T. Strickland, Daniel W. Gilbert.
GEORGE A. SMITH, *Ex-officio*. JOSEPH L. CAVEN, *Ex-officio*.

OFFICERS.

Chief Engineer.—WILLIAM H. MCFADDEN.

Assistant Engineers.

JOHN L. OGDEN, CHARLES G. DARRACH, JOHN E. CODMAN.

General Superintendent of Works.

ROBERT MCFADDEN, JR.

Chief Clerk.—J. T. HICKMAN.

William M. McFadden, *Draughtsman*, Wm. J. Innes, *Muster Clerk*.
George W. Eckert, *Assistant Clerk*, W. W. Widdifield, *Pipe Clerk*.
W. H. Mettam, *Telegraph Operator*, Thos. J. Lister, *Messenger*.

Superintendent of City Shop.—JAMES F. NEALL.

Surveyors.

1st District.—John H. Holmes, Wharton, above Eleventh.	4th District.—William Ewing, 810 Corinthian Avenue.
2d " David A. Craig, 918 Cherry.	5th " Henry Dawson, Lyceum Building, Roxborough, and Town Hall, Germantown.
3d " Chas. Shreeve, 1420 Frankford Road.	6th " "

Engineers at Works.

Fairmount—Jos. Moyer, A. C. Bonsall. *Belmont*—Abram Stott, John E. Smith.
Schuylkill—Joshua Bartley, David Pyke. *Roxborough*—W. H. Smith, Lewis Culp.
Delaware—John H. Penn, Jos. Thompson. *Frankford*—G. W. Wright.
Chestnut Hill, Jas. McEnahan, *Assistant Engineer*.

REGISTRAR'S DEPARTMENT.

Registrar.—A. N. KEITHLER.

John S. Warner, *Chief Clerk*, Wm. J. Halliday, *Receiving Clerk*.
John F. Scheidt, *Permit Clerk*, A. Buckhelster, *Registering Clerk*.

Entry Clerks.

George Macaulay, Robert F. Mustin, Jr.

Bill Clerks.

Joseph Fisher, John M. Stacker, Chas. L. Hayden,

Inspectors.

E. S. Higbee, E. D. Thomas, John H. Haines,
James H. Graham, W. H. Hargeshelmer, Thomas Shaffer,
S. D. Woodington, James Carr, Henry Marshall,
Lewis Obermiller, Wm. A. Agnew, William Erwin,
E. M. Rowe, Chas. Lowry.

REPORT.

To the Select and Common Councils of the City of Philadelphia :

GENTLEMEN:—Under the caption of “Water Works,” in the digest of Ordinances, 1869, page 564, Sections 2, 3 and 4, will be found “The head of this department shall be called Chief Engineer of the Water Works; he shall have charge and care of the Water Works of the City of Philadelphia, including mill houses, steam engine houses and their machinery, the reservoirs, pipes, mains, dams, fire-plugs, property and fixtures of every kind connected with the same; he shall exercise general control and oversight over all the officers connected therewith, and assign and direct their duties so as to carry on the details of the Works; he shall attend to the direction of all new works, now or hereafter to be constructed.” “He shall take *immediate measures for the repair of any damage* which may happen to the machinery or fixtures connected therewith. He shall make an annual report to Councils of the condition of the Works under his care, and, if any, what extensions are necessary.”

In accordance herewith I respectfully submit, for the eighth time, the Annual Report of the Water Department, in which will be found the operations of the Works, for the year ending December 31st, 1880, the condition of the Works and the extensions necessary to be made, which demand your immediate attention and co-operation, with a view to their approval and consummation.

RECEIPTS.

The total receipts from all sources amount to \$1,446,341.53, of this sum \$1,441,555.46 was received by the Registrar, and \$4,786.07 by the Chief Engineer.

The total increase over 1879 is \$27,162.46, of said increase \$25,196.33 was received by the Registrar, and \$1,966.13 by the Chief Engineer.

These receipts are deposited daily with the City Treasurer. Those received (\$4,786.07) at the office of the Chief Engineer are to the credit of the Sinking Fund.

REVENUE.

The total revenue for 1880 amounts to \$1,484,357.06, which includes the above receipts of \$1,446,341.53, and \$38,015.53 for water-pipe liens collected by the City Solicitor, as per his weekly, monthly, and yearly returns reported to this department. The amount of water-pipe liens collected by the City Solicitor for 1880 was \$8,430.41 less than for the year 1879.

EXPENDITURES.

From annual appropriation,	\$386,962 12
“ special “ “ (refunds),	2,567 87
“ “ (\$100,000), “ (extension of works),	917 46
“ “ loans, (consolidated balances), “ “ “	992 15
	<hr/>
Total expenditures for 1880,	\$391,439 60
Total receipts “ “	\$1,446,341 53
“ expenditures “ “	391,439 60
	<hr/>
Receipts in excess of all expenditures,	\$1,054,901 93
Total receipts for 1880,	\$1,446,341 53
Less expended from annual and special appropriations,	390,447 45
	<hr/>
Profits of the department for 1880,	\$1,055,894 08
Profits for 1880,	1,055,894 08
Add water-pipe liens collected by City Solicitor,	38,015 53
	<hr/>
Revenue in excess of expenditures,	\$1,093,909 61

SUMMARY OF EXPENDITURES FOR 1880.

Salaries of the engineering department,	\$25,080	32
“ at the pumping stations,	53,332	50
“ “ “ Registrar’s office,	25,716	67
<hr/>		
Total Salaries,	\$104,129	49
Incidentals,	13,502	27
Supplies to works,	75,698	80
Repairs to buildings and grounds, . . \$31,998	11	
“ “ machinery at works,	20,771	40
“ “ distribution,	24,489	81—
		77,259 32
<hr/>		
Total for maintenance,	\$270,589	88

IMPROVEMENTS TO DISTRIBUTION.

Drills,	9,380	00
Labor, laying pipes,	58,992	74
Pipes, fittings, castings and materials,	47,999	50—
		116,372 24
<hr/>		
	\$386,962	12

Expended from annual appropriation,	386,962	12
Merged,	1,127	88
<hr/>		
Total appropriation for 1880,	\$388,090	00

Expended from special appropriation, refunding water rents, &c.,	\$2,567	87
Expended from special (\$100,000) ap- propriation, extending works, . . . \$917	46	
Expended from loans (consolidated bal- ances) extending works,	992	15—
		1,909 61
Expended from annual appropriation,	386,962	12
<hr/>		
Total expenditure for 1880,	\$391,439	60

The water furnished gratuitously for all public purposes and to charitable institutions, by law, at 15 per cent. of the legal rates, would, if paid for, more than pay the interest on all the water loans, were they not already liquidated by the excess of receipts over expenditures, which, since consolidation, amounts to \$5,991,490.74, the difference in excess of the receipts \$21,819,822.54 over the expenditures \$15,828,331.80,

COMPARATIVE EXPENDITURES SINCE CONSOLIDATION.

The average yearly expenditure since consolidation was over 72 per cent. of the receipts.

The average yearly expenditure from 1877 to 1880, inclusive, was 37 per cent. of the receipts, and for 1880 alone only 27 per cent. as exemplified by the table of receipts and expenditures, since consolidation.

The water consumers pay into the City Treasury over one-million dollars in excess of expenditures of the department, which entitles them to water in such quantity, and of such quality as is unexceptional; which can only be done by the action of Councils, and their immediate attention should be given thereto.

Receipts and Expenditures Since Consolidation.

Years.	RECEIPTS.		EXPENDITURES.		Annual Profits.	Per cent. of expenditures on basis of receipts.	
	At Chief Engineer's Office.		From loans for construction.				Totals.
	REGISTRAR'S OFFICE.	Totals.	From annual appropriation.	From special appropriation.			
1855...	\$300,434 38	\$882,036 72	\$168,705 22	\$82,180 15	\$250,805 37	\$131,141 35	
1856...	382,460 11	415,325 91	199,393 60	21,174 42	190,468 02	254,857 89	
1857...	394,789 84	426,778 31	171,439 93	23,145 96	200,605 89	225,172 42	
1858...	420,388 41	457,948 23	175,016 86	12,961 23	187,978 09	269,670 14	
1859...	480,301 13	551,531 06	93,538 83	194,824 44	411,737 09	324,100 03	
1860...	494,124 22	538,531 53	183,528 64	4,767 74	262,506 23	360,235 15	
1861...	498,569 40	533,800 06	161,277 58	1,447 36	238,989 54	371,255 12	
1862...	516,602 93	545,793 06	Decrease.	21,069 81	\$186,650 06	368,669 82	
1863...	538,925 58	569,978 29	11,813 00	154,923 43	217,966 18	358,918 37	
1864...	580,978 71	610,112 57	23,885 23	187,486 49	273,749 20	336,955 76	
1865...	593,746 40	636,388 42	25,181 13	21,325 68	422,337 58	352,125 79	
1866...	631,263 84	670,222 13	40,434 28	251,404 83	616,712 92	392,662 96	
1867...	684,621 06	707,010 59	33,853 71	273,606 24	575,844 49	406,931 35	
1868...	707,646 73	777,010 59	9,559 70	322,935 31	802,217 46	388,937 92	
1869...	747,443 17	813,470 83	9,228 76	368,772 15	593,768 28	372,239 21	
1870...	856,938 06	935,370 96	36,460 24	388,742 15	1,069,103 43	486,769 13	
1871...	810,716 83	963,234 06	121,900 13	445,947 58	1,444,073 51	517,968 85	
1872...	911,790 15	1,054,281 51	27,275 85	430,406 38	1,863,576 28	572,843 56	
1873...	961,286 78	1,082,985 01	91,047 43	471,219 80	1,564,418 48	548,634 56	
1874...	1,023,980 81	1,220,981 38	28,703 50	592,686 89	1,295,102 08	539,355 37	
1875...	1,037,086 61	1,169,666 28	30,088 69	674,093 51	1,838,336 74	459,833 21	
1876...	1,079,025 72	1,227,961 10	28,226 13	484,613 87	1,670,849 88	474,072 12	
1877...	1,148,090 93	1,276,532 05	44,550 95	414,955 45	481,681 68	977,800 20	
1878...	1,317,028 67	1,419,179 07	142,647 02	438,984 72	443,693 68	955,485 39	
1879...	1,365,123 21	1,446,341 53	27,162 46	386,962 12	391,431 60	1,055,864 06	
1880...	1,415,477 56	1,446,341 53					
Total.	\$19,992,901 24	\$21,819,822 54	\$9,055,190 26	\$519,640 39	\$6,253,501 15	\$15,828,331 80	

PUMPAGE.

The total pumpage for the year 1880 amounts to 21,120,792,-386 gallons, an increase over 1879 of 1,226,690,871 gallons, or more than 6 per cent., a daily average increase of 3,351,614 gallons.

The pumpage at Fairmount, by water power, was 7,887,896,-254 gallons, an increase over 1879 of 609,538,766 gallons, or more than 8 per cent., a daily average increase of 1,665,406 gallons.

The daily average pumpage at Fairmount in 1880 was 21,-551,630 gallons.

For the first six months in 1880 the daily average pumpage was 26,868,821 gallons, while for the last six months it was only 16,294,659 gallons, and for the months of September and October it was 9,457,864, and for October alone it was only 7,-783,446 gallons.

This small pumpage was due to the low stage of water in the river, and hence a consequent loss of power to drive the wheels. Had this occurred during July or August the city would have suffered for want of water.

An examination of the rain tables of Lebanon and Philadelphia shows a less rain-fall at the former place than in the latter. In 1880 the rain-fall per report of Pennsylvania Hospital at Philadelphia was 39.68, as per Signal Service 33.58 inches, at Lebanon it was only 37.24.

The water power of the Schuylkill has been highly overrated, as has the reliable water power along the entire Atlantic slope, and the percentage of rain-fall reliably available for water-power purposes has been overestimated by double, as was demonstrated last year by the short supply of water experienced in all the cities along the Atlantic slopes.

The pumpage diagram of the department exhibits graphically the water passing to waste over the Fairmount dam. This waste, calculated and equated into power, demonstrates that the Schuylkill river cannot be relied upon to furnish power to pump a daily average of 50,000,000 gallons, while eminent Engineers have estimated its ability to pump double this amount by water power.

Again, the amount pumped by the machinery at Fairmount,

running 54 per cent. of the time was a daily average of 21,551,630 gallons. Had there been power enough to drive the machinery 100 per cent. or all the time, it could not possibly have pumped more than 40,000,000 gallons per day.

With these facts as a basis we may safely state that the machinery at Fairmount would use and exhaust the power of the river if it was subjected to a steady and equable flow, by impounding the storm waters. Of course duplicate water-power works at Roxborough, by using the power twice, first at Roxborough and a second time at Fairmount, could be made to double this amount. Those Engineers of the largest experience have reduced their percentage of rain-fall that can be safely relied upon for power purposes from 18 to 9 inches, especially along our Atlantic slopes.

The result of all this experience should direct our attention to steampower and divert us from water power as a means for a water supply for large cities.

The pumpage at the Spring Garden or Schuylkill Works was 5,483,661,280 gallons, an increase over 1879 of 1,015,181,258 gallons, an increase of nearly 23 per cent., or a daily average increase of 2,773,719 gallons. The daily average pumpage for 1880 was 14,982,681 gallons, the greatest ever attained at these works. For the first six months of the year the daily average was only 9,497,070, while for the last six months it was 20,387,387 gallons.

This variation in pumpage is due to the fact that when there is ample power at Fairmount, and Belmont is not taxed, then Spring Garden is not needed nor is it required to pump. But when the river is low and Fairmount cannot supply, and when Belmont is taxed or under repairs, then Spring Garden is required to supplement and keep up the supply. At these periods Spring Garden has been taxed to its utmost and forced beyond its boiler power capacity, which is not proportionate to nor adequate for the pump capacity of the machinery.

The same is equally true of Belmont, where the boiler power is not adequate to nor proportionate to the pump capacity, there being less boiler power than will drive all the machinery or pumps, and hence, for the want of this boiler power it was

never possible to develop the full capacity of the pumps when most needed, nor has storage been provided to supplement when the demand was greatest. At the same time the boilers were taxed beyond endurance and safety.

The daily average pumpage, during June, July, August, September and October was 24,538,539 gallons, the full capacity of the works, so far as the boiler power was concerned, though there was more than that capacity of pumps, not available for want of boilers.

The pumpage at the Belmont Works was 3,543,457,439 gallons, a decrease of 411,505,478 gallons, or nearly 12 per cent., a daily average decrease of 1,124,332 gallons, due to a want of boiler power, it being dangerous to force them, by excessive firing, beyond what had already been done to enable a supply of water to be maintained. The daily average was 9,681,577 gallons. The maximum monthly average reached 12,444,567 gallons, during August, September and October.

The pumpage at the Delaware Works was 1,995,974,076, a decrease of 198,496,901 gallons, a decrease of nearly 10 per cent., or a daily average decrease of 542,341 gallons.

The distribution of this district, supplied by the Frankford Works last year, continues to receive the same supply.

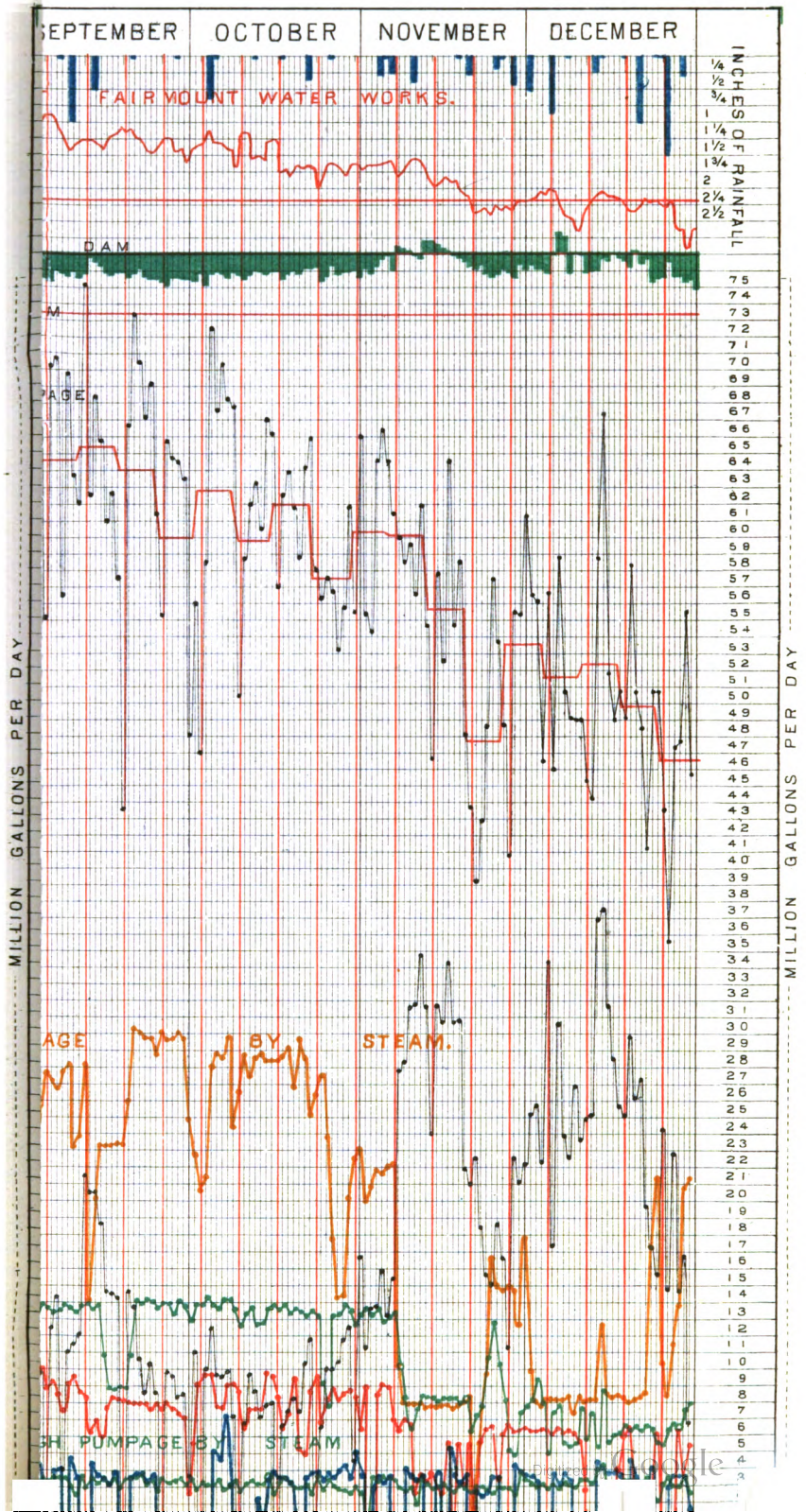
The pumpage of the Frankford Works was 950,649,208 gallons, an increase of 185,097,415 gallons, or nearly 25 per cent., a daily average increase of 505,730 gallons. The daily average for 1880 was 2,597,402 gallons. The pumpage at the Roxborough Works was 1,116,537,109 gallons, an increase of over 2 per cent., a daily average increase of 68,799 gallons.

At the Auxiliary Works the pumpage to Manatowna was 3,061,170 gallons, a decrease of 328,080 gallons, or nearly 11 per cent. The daily average was 8,374 gallons.

The pumpage at Chestnut Hill was 88,555,850 gallons, an increase of 1,203,500 gallons, or over 1 per cent. The daily average was 244,688 gallons.

EXPENSE OF PUMPAGE.

The total pumpage for 1880 into the reservoirs was 21,120,792,386 gallons. This equated into work done amounts to



INCHES OF RAINFALL

75
74
73
72
71
70
69
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2

MILLION GALLONS PER DAY

MILLION GALLONS PER DAY

31,686,275,272 lifted 100 gallons, lifted high, an increase over 1879 of 1,898,445,363 gallons, or more than 6 per cent.

This work was accomplished at a total expense of \$174,-616.46 as against \$169,946.22 in 1879 when the repairs done by the Cherry street shop (\$18,912.62) are included, which by an oversight were omitted in 1879.

The expense of lifting one million gallons 100 feet high in 1880 was \$5.51, as against \$5.70 in 1879. That done by water was 7,887,896,254 at an expense of \$15,677.22 in 1880, as against \$16,176.61 in 1879, when the correction is made. The expense per million, 100 feet high, in 1880 is \$1.99, as against \$2.22 in 1879. A part of the increased expense of pumpage by water power since 1874 is due to the transfer by Councils of the policemen and watchmen from the per diem roll of buildings and grounds to the salary roll of the Fairmount Works.

That done by steam power in 1880 was 23,798,379,018, at an expense of \$158,939.24, as against \$153,769.61 in 1879, when the correction is made. The expense per million in 1880 is \$6.68, as against \$6.83 in 1879.

Some persons, speaking as though with authority, have confounded the pump capacity (called by some the theoretic pumping capacity) with the pumping capacity and thereby given currency to very erroneous notions as to the means at command to keep up the water supply during the dry seasons of summer and when the demands are most urgent.

There is a pump capacity, or a theoretic pumping capacity, in the department of about 135 million gallons.

Of this 37 or 38 millions are lost by want of water in the river to drive the wheels at Fairmount in seasons of drought. In the outlying districts 12 millions are lost for want of large distributing mains to distribute the water from the Roxborough and Frankford basins.

At the Belmont, the Schuylkill and the Delaware Works 30 millions are lost for want of adequate boilers to run the pumps. Thus with a pump capacity of 135 millions we have only a safe and reliable pumping capacity of 55 millions, which is increased to 65 millions by forcing the boilers.

Councils, realizing the peril to the city from an inadequate

supply of water, provided, after much obstruction and a delay of two years, means to furnish additional boilers at Belmont and Spring Garden and another engine at Spring Garden.

This improvement and extension was much needed and was in the right direction. A continuation of this and the means to provide for *subsidence* by the Storage reservoir and one at a proper elevation on the high ground east of the Schuylkill river are the next most important means to provide for, to be followed by enlarged facilities by means of larger main pipes for the better distribution of the water.

BOILERS.

The term horse-power, as applied to boilers, is too indefinite either to accept or adopt as a standard for comparison.

The horse-power must be measured by its application to an engine whereby its power is indicated and ascertained. The rule of boiler-makers for measuring the horse-power of a boiler is ten square feet of heating surface for cylinder boilers, fifteen square feet for tubular, and twelve square feet for flue boilers. The late Mr. Worthington, whose experience in building pumping engines was second to no one in this or perhaps any other country, adopted as a rule 15 square feet of heating surface for cylinder boilers, 22 square feet for tubular boilers, and no doubt would have applied the same increase of 50 per cent. in the case of flue boilers requiring 18 square feet.

This rule no doubt applies to work done, and if an application of the same be made at Belmont and Spring Garden it will be evident how inadequate the boiler power at these Works has been for the work required.

THE PUMPAGE DIAGRAM

Shows graphically the daily rain-fall, the noon temperature at Fairmount, the number of days (220) in which no water passed to waste over the flash boards, and the number of days (146) in which it did pass to waste, from which can be calculated the quantity available for power if stored at the headwaters. It shows also the daily pumpage of each of the works, and the total daily pumpage at all the works, as well as the weekly average consumption.

TELEGRAPH.

The number of messages sent from this office, during 1880, was 2,395. The number received was 2,208, making a total of 4,603. Of these, 195 were in reference to leaks and breaks.

MACHINERY AT THE WORKS.

FAIRMOUNT.

Turbine No. 4.—One of the flanges on the upright shaft connecting the two sections was broken June 4, throwing the shaft out of line and destroying the automatic gate-hoist of the duplex wheel. The broken parts were removed and the shaft repaired, since when the turbine has been run with the outer section alone of the duplex wheel.

Turbines No. 7 and 8.—The valves were replaced by the repaired valves taken out last year.

Turbine No. 9.—The guide buckets of this turbine have all been received, and the tail gate repaired with wrought-iron bands and splice plates.

SCHUYLKILL.

No. 4., Overhead Cornish.—New foot vaves were placed on the air pump.

No. 5., Side Lever Cornish.—This engine could not be repaired. The lack of money in the fall of 1879 prevented any work upon her, and the demand for water early in the spring necessitated her running at a time when she should have been under repairs. The engine is in bad order the steam air-pump and water valves need renewals. The engine has worked badly and threatened danger to the pumping main.

No. 6., Simpson Engine.—This engine was repaired early in the year, as follows: The springs on the high and low pressure pistons were set out, new keys put on the shaft working the valves, all the steam joints were remade, a new screen placed on the inlet, and an air charger attached to the air vessel. The engine worked well on the increased water pressure necessary to supplement the supply of Belmont to the second system, until August 8th, when the inlet valve box of the pump under the fly-wheel end of the beam, burst and com-

pletely disabled the engine. A new valve box casting had been contracted for and ordered early in the spring, and was delivered shortly after the accident. This was immediately fitted up, the old castings removed and the new one placed in position, and the engine started for work September 13, or 36 days after the accident. Illustrations of the broken valve box and the new one replacing it are published with this report.

The new valve box being larger than the old one, the anchors for the bed plate bolts had to be removed and replaced, the pump well enlarged, and an extra (I bar) support and bolts for the new valve box made and erected. The work was continued night and day until; completion so as to extricate the citizen from inconvenience and liability to danger as soon as possible.

No. 7., Cramp Engine.—The rock shaft of the main steam valve was renewed and the valve rods of the high pressure cylinder were packed with Katzenstem's metallic packings. The high-pressure piston was fitted with set blocks, all the brasses and connections adjusted and an additional injection pipe connected to the condenser from the forebay. All broken springs and guard plates in the pumps were renewed with others of brass and the steam pipe joints remade.

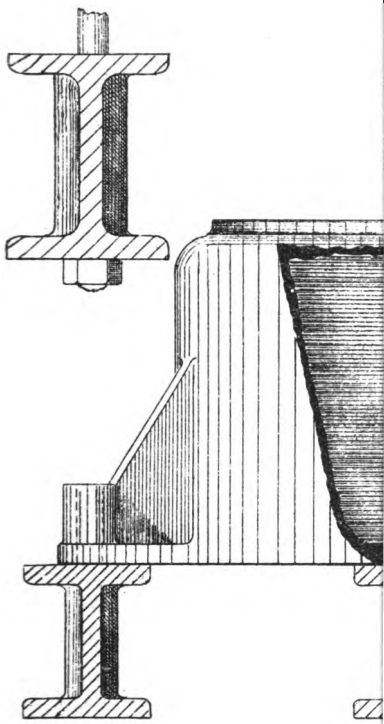
BELMONT.

Engine No. 1, Worthington.—The valve stems of the air pumps were repaired, a new foot valve placed on the main section pipe, all links and brasses adjusted and steam joints made.

No. 2, Worthington.—The slide valves of this engine were planed and the seats faced. New valve rods with adjustable block connections, with keys. The air pump valve stems were renewed, the joints on all the cylinder caps and relief valves remade and the steam stop valves ground in and repaired. The valves in the pumps were provided with cast-iron guards having brass bushings.

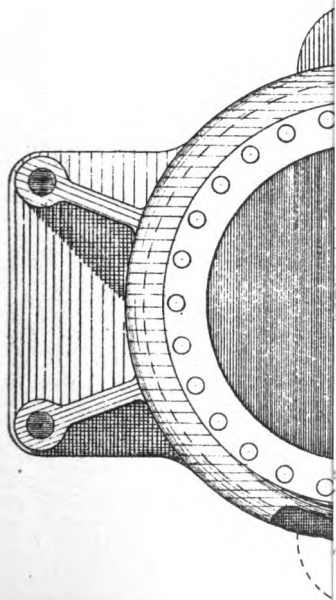
The steam jacket on the low-pressure cylinder of the western engine was found broken August 27th, and was temporarily shored to prevent further damage; bolts and necessary material have been prepared for its repair.

No. 3, Worthington.—The balance valves were faced and turned, the steam-joints renewed on the cylinder caps, and new

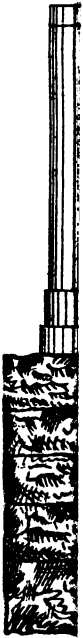


V

No. 6 ENGINE S
BROKEN



No 6 E



springs placed in low-pressure piston-rings. The air pumps repaired with new springs and stems for guard-plates, and the pumps provided with new guard-plates with brass bushings.

After the breaking down of No. 6 engine, at Spring Garden Works, an attempt was made to run the reserve engine at these works, standing idle for want of boilers. Two second-hand upright marine tubular boilers were obtained from Chas. Leech, and erected at the south side of the engine house, under a guarantee that they would stand a working steam-pressure of 35 lbs. Upon a test by hydraulic-pressure the crown-sheet and longitudinal seams failed. These facts explain the water famine in the 28th and 29th wards, and in parts of the 15th, 19th and 20th wards, from August 8th to Sept. 13th.

DELAWARE.

Engines No. 1 and 2 received no repairs, during the past year. The pumps should be overhauled and the valves refitted.

No. 3, Worthington.—The steam joints were remade and the pump valves furnished with new cast-iron guard plates and brass bushings.

FRANKFORD.

The Cramp Engine was repaired as follows: The links and brasses on the rods were refitted and adjusted, the joints on the steam-chest and cylinders renewed. In accordance with the communication of Messrs. Cramp, dated Nov. 28th, 1879, stating that they were ready to test the engine, Councils, by ordinance dated June 12, 1880, appropriated \$750 to make an expert test, upon which report, and the City Solicitor has been instructed, by the committee on water, to bring suit to compel the fulfilment of their contract.

The Worthington Engine.—This engine was thoroughly overhauled, both cylinder-heads were renewed; the air-pump refitted and angle valves placed on the delivery, to prevent the inflow of the tide; the steam-joints were renewed and all stop and safety-valves ground in; the necessary connections and apparatus for the expert trial provided.

ROXBOROUGH.

No. 2, Worthington.—The air-pumps and brasses were repaired

and adjusted, the steam-pipe and cylinder joints remade, new valves and springs put in the pumps, and new feed connections made to the donkey pump in the Cornish engine room.

CHESTNUT HILL.

The Knowles' direct acting pump.—The cylinders of this pump were bored, and new rings made for the piston; the steam valves were faced and an exhaust-pipe connection made.

Engine No. 1, H. P.—New joints were made on the cylinder and steam-chest, and a new piston with springs and rings. New wheels and pinion and connecting-rod have been made and will be put in place early in the spring.

The boilers at these Works are inadequate for the work required of them. The reservoir capacity is so small that any accident occurring to the boilers, or the necessity of blowing them down for repairs, for more than five or six hours, empties the tanks and deprives the citizens of water. By ordinance of Councils, \$5,000 was appropriated to supply the necessary boilers and improve the condition of the Works. It was thought expedient to re-set, at these works, a pair of horizontal tubular boilers, to be removed from the Schuylkill Works. Upon an examination, after cutting through the riveting of these boilers, the workmanship was found so defective as to cause their condemnation. A new tubular boiler of 40 horse power will be erected early in the season, the springs and reservoirs cleaned, the tank repaired, and the buildings and tank-house painted.

MOUNT AIRY.

The citizens of the higher parts of Germantown and Mount Airy are either without any water, or with but a poor supply.

Two methods have been advanced to relieve them, one to turn the old school house at the Mount Airy reservoir into an engine house, establish a pumping station and pump, from the Mount Airy basin, into the distribution.

The other to erect sufficient machinery at the Chestnut Hill Works to supply both Chestnut Hill and Mount Airy. The objections to the latter plan are obvious—there is not sufficient water in the springs at Chestnut Hill to supply, in connection, Mount Airy and the highest parts of Germantown, which neces-

sitates the use of large quantities of water drawn from Mount Airy basin, by which means the value of the springs is partly, if not altogether, destroyed.

The estimated cost for present construction is:

Engines and Boilers, (addition to house) -	\$ 8,000
Distributing Main, 7,000 feet in rock, at \$3,	21,000
Pumping Main, 400, at \$3, - - -	1,200
	\$30,200

Estimated plan for the present consumption to pump at Mount Airy is as follows:

Engine and Boilers, - - - -	\$7,000
Renovations and additions to House, -	3,000
Pipe and Connections, - - - -	1,000
	\$11,000
Total, - - - - -	

By this method the pipe now in the ground, and used solely to supplement the springs at Chestnut Hill in the season of droughts, would be used as the distributing main, and could also supplement the Chestnut Hill distribution in case of need.

BOILERS.

At the Schuylkill Works all the boilers except the tubular boilers running No. 6 engine, were scaled and cleaned. The tubes in the boilers for No. 6 engine were expanded and caulked and a patch put upon one of the shells, the fire front, bridge wall and furnace of one of these boilers was renewed, and new fronts cast and fitted for the remainder of the battery.

The cylinder boilers were cleaned and scaled, patched where necessary, and the bridge walls and furnaces rebuilt in the battery of six next No. 4 engine.

The two Hog-nose tubular boilers and the (4) four cylinder boilers in the room adjoining No. 5 engine were sold under contract to Thos. Gamon & Co., and removed by him.

At the Belmont Works all the boilers and mud-drums were scaled and cleaned, the furnaces rebuilt, and the mouth-pieces renewed, and the water columns were renewed and provided with brass pipes, all the steam pipe-joints renewed, and the safety and stop-valves ground in.

The heavy and continuous firing at these works caused the

necessity for extensive repairs. The cast-iron head of No. 13 was found cracked, early in the season, which, with the first ring of iron adjacent, was immediately taken out and replaced with wrought-iron. The cast-iron head of No. 12 was subsequently cracked.

The fire-sheets of Boilers No. 1, 2, 5, 6, 7 and 8 were all renewed during the summer, having become dangerous. Boilers, Nos. 9, 10, 11, 12, 13, 14, originally of 30 nominal horse power each, were so deteriorated in the mud-drums that the boiler inspector recommended the removal and renewal of those parts, leaving but 20 horse power each of value. These boilers were sold under contract and ordinance to Thos. Gamon, and removed by him.

The boilers at the Delaware Works were cleaned, the furnaces and bridge walls were repaired, the steam-joints renewed, and valves ground in.

At the Frankford Works new grate bearing bars were put in the furnaces and the bridge walls rebuilt; one of the tubes in No. 4 boiler was renewed.

At the Roxborough Works the boilers were scaled and cleaned, the furnaces rebuilt, and the mud-drums of Nos. 1, 2, 3, 4, cylinder boilers cut off and the shells patched; new feed connections were made from the donkey pumps to the boilers.

At Chestnut Hill the boilers were patched, the steam-joints made, and the valves ground in.

BUILDINGS AND GROUNDS.

At Fairmount the roof over the water closets was removed and iron beams bought and placed in position, preparatory to the erection of a new roof. The old floor was taken up and replaced with flagging.

At the Spring Garden Works the boiler house roof over engine No. 4, boilers was covered with felt, pitch and gravel as well as at that portion of the engine house over Nos. 5, and 6 engines, and the tin-roof over Nos. 4 and 7, was repaired and painted. A stop-house was built and covered with I bars and iron gratings in front of the engine house, enclosing the stop, governing all the pumping mains. The stop and valves governing the supply from Belmont was enclosed in a brick stop-house

covered with I bars and grating. The old wooden hand-rail in engine rooms was removed and replaced in brass, with finished iron stanchions.

At Belmont a new track scale 34 feet long, and of 40 tons capacity, was purchased and erected.

At Roxborough Works the boiler house roof was covered with felt, pitch and gravel, and the Worthington engine house floor renewed. All the buildings are in need of repairs and paint.

The railroads and sidings at the various works were put and kept in good order during the year, by contract.

EXTENSION OF WORKS.

NEW ENGINE, BOILERS, ETC.

The balances of loans consolidated Dec. 31st, 1879, was not specifically appropriated until June 29, 1880. Proposals were invited by advertisement July 1st, 1880, to be opened July 6th. The committee, at that time postponed the opening of bids, and ordered a re-advertisement, and an extension of time to July 13th; the bids were then opened and awarded as follows:

For (10) ten tubular boilers to be erected at the Schuylkill Works, for the sum of \$23,963, to John Zeh.

For (7) seven tubular boilers, to be erected at the Belmont Works, for the sum of \$16,775.50, to John Zeh.

For (10) ten million gallon pumping engine, to be erected at the Schuylkill Works, for the sum of \$37,500, to H. R. Worthington.

For the erection of an engine house at the Schuylkill Works, for the sum of \$10,939, to Samuel H. Collom & Co., also for the foundation and conduit per cubic yard.

For the removal and purchase of old boilers, to Thomas Gamon, as follows: Hog-nose boilers, 2½c. per pound; cylinder boilers, 1¼c. per pound.

For the removal and resetting of two cylinder boilers at the Chestnut Hill Works, for the sum of (approx.) \$980.50, to Thos. Gamon.

At a special meeting of the Committee, held July 30th, Mr. Zeh appeared and refused to accept the award for boilers. The Committee directed the Chief Engineer to advertise again for

boilers, which was done, advertisement appearing Aug. 2, bids to be opened August 10th. At that time the proposals were opened, and contracts for boilers awarded to Hilles and Jones, as follows:

Belmont Works, for the sum of	-	-	-	\$23,058
Schuylkill, " " " "	-	-	-	\$32,940

The ordinance authorizing the Mayor to enter into the above named contracts did not become a law until Sept. 20, 1880. The contracts were drawn by the City Solicitor, the securities entered, and signed by the Mayor.

Work was immediately commenced on the excavation and foundations of the new engine house, but discontinued on account of severe weather.

The work of constructing the engines and boilers is progressing rapidly. The boilers will be finished and erected early in the spring, and the engine will be erected as soon as the foundations and house are ready for its reception.

The chairman of the Finance Committee, who is also a member of the Water Committee, made the following arraignment of the Department, when the annual appropriation for 1881 was presented, upon the recommendation of the Water Committee, to the Finance Committee for approval. No opportunity was afforded for explanation or reply, nor would any be now made, did not justice to the department demand it, and that the public may be apprised of the truth in the premises :

“MR. CHAIRMAN :

“Before discussing the different items of this bill I ask the indulgence of the committee for a few moments, that I may make a general statement as to the management of the water department for six years past, as compared with the year 1873, the first year in which the present Chief had charge of the works.

“I hope by so doing we will be better prepared to vote intelligently on each item as it comes before us.

“On examination you will find that the amount of water pumped has increased only 22 per cent., while the salary pay-roll has increased 51 per cent.”

This method of taking the average pumpage for the six years 1879-'8-'7-'6-'5, and 4 in comparison, with the pumpage of 1873, is calculated to mislead.

This average pumpage does not compare with, nor correspond to the pumpage of any other year, yet from this so-called comparison the false conclusion is drawn and published by the Chairman of the Finance Committee.

“That the amount of water pumped has increased only 22 per cent., while the salary pay-roll has increased 51 per cent.”

A division of the pumpage into that by steam and water power, even by this erroneous method; *fairly stated*, shows an increase of 65 per cent. by steam power, and a decrease of about 5½ per cent. by water power, due to the lessened flow of the river not furnishing water to turn the wheels.

A comparison of the pumpage of 1879 with that of 1872 shows an increase of 122 per cent. by steam power, and a decrease of one per cent by water power.

That of 1879 compared with 1873 shows an increase of 129

per cent. by steam power, and a decrease of $16\frac{1}{4}$ per cent. by water power.

The total pumpage of 1879 compared with that of 1872 shows an increase of nearly 53 per cent., while that of 1879 compared with 1873 shows an increase of nearly 40 per cent.

From time to time, previous to and since 1873, the Finance Committee and Councils transferred, to the salary pay rolls, employes previously paid from Loans and other items.

That the salary pay rolls have been increased 51 per cent. is a fact the bare statement of which conceals the truth in withholding the fact of such transfers, and that Loans and other items were correspondingly reduced.

In 1874 COUNCILS reorganized the department and transferred from the per diem roll to the salary roll, the Chief Engineer's Asst. Clerk, three Asst. Engineers, the General Superintendent of Works, the Superintendent of shop and the Purveyors at Germantown and Manayunk; also at the Fairmount Works, two Assistant Engineers, two policemen and one watchman; at the Delaware Works, four firemen; at the Spring Garden Works, one watchman; at the Belmont Works, six firemen, making in all (24) twenty-four men permanently employed; previously paid from Loans and other items, which were in 1875 transferred to the salary pay roll.

Since this time a new pumping station has been put into operation at Frankford, which in 1879 employed nine (9) men. The auxiliary work at Roxborough employed three (3) men. The increased work of the Department added (4) four firemen at Belmont, two inspectors, two draughtsmen, one muster clerk, one pipe clerk and one telegraph operator.

“The average cost of repairs to pipes, plugs, stops, etc., has increased 27 per cent.”

Such is another assertion. What are the facts? \$32,000 was appropriated to keep them in repair for 1873. The increase in the number of miles of pipe to keep in repair in six years was 33 per cent. or about 182 miles. At the same rate as appropriated for 1873, the average appropriation should have been over \$40,000 a year, whereas, less than \$36,000 was expended.

The truth is the expenditure was 10 per cent. less, rather than an increase of 27 per cent.

It is asserted that "the average cost of drilling and making "new attachments has increased 48 per cent."

This is a partial statement, concealing the fact that, by transfers, the shop and other rolls were paid from this item, receiving the sanction and approval of the Controller.

"The cost of pipe laying and fitting fire plugs has increased "from 43 cents per foot in 1873, to one hundred and seventy "cents in 1879, or nearly 300 per cent.,—in other words in 1873 "thirty-nine miles of pipe laying cost \$90,000, while in 1879 "nine miles cost \$81,000."

This upon its face is a startling statement and would be alarming if it were true. In 1873 \$32,411.66 was expended for labor in pipe laying and paid from loans (see report of 1873, pp. 87, 94 and 95) which should be added to that expended from the annual appropriation \$89,964.88, a total of \$122,376.54. In 1879 \$80,892.47 was expended from the annual appropriation. In 1873 \$18,227.26 was expended from the item of pipe laying for the shop rolls, and in 1879 \$21,124.26; which sums must be deducted from the items \$122,376.54 expended in 1873 and \$80,892.47 expended in 1879, to obtain the correct cost of pipe laying in those years.

In 1873 the 39 miles of pipe laid, weighed 8,501,389 pounds, and cost, for labor, \$104,149.28, or 1.23--100c. per pound.

In 1879 the 9 miles of pipe laid weighed 4,815,856 pounds and cost, for labor, \$59,858.21, or 1.24--100c. per pound.

The total cost of pipe laid in 1873, excluding the shop roll, was 4.84--100c. per pound, or \$411,596.16, of which sum \$123,866.-10 was from Loans, while in 1879 the total cost (excluding the shop roll) was 2.64-100c. per pound, or \$127,291.46, there being no loans either to purchase or lay pipe in 1879. It is manifestly unfair to compare feet of pipe with feet of pipe, especially when they differ in thickness and diameter, and to leave out the cost of pipe laying paid from loans, especially when the amount for pipes and pipe laying from loans in 1873 was nearly equal to the whole appropriation for the same purpose in 1879,

“The repairs to buildings, grounds and reservoirs cost in 1873 seventeen thousand dollars, while in 1874, the first year in which the present Chief had control of the appropriation, the repairs cost over seventy-nine thousand, and ever since the average has been over fifty-two thousand dollars, while the present condition of the works is a disgrace to any City.”

It is very well known to every one familiar with the department, and the pay rolls will demonstrate, that previous to 1873, the bulk of the repairs to buildings, grounds and reservoirs were paid from *loans*, and so long as appropriations are restricted to less than one-half of one per cent. on the cost of the plant, the works cannot be other than in a condition disgraceful to the City.

“In 1873 while the East Park Reservoir, the re-building of Fairmount Dam, and other large and expensive works were in process of construction, we had one Chief Engineer, one assistant, one general superintendent,—while every year since, including the present, when no special new work is being done we have one chief, three assistants, one general superintendent, with the request that next year a clerk be given to them.”

The engineers and superintendents who were employed to take charge of the new works in progress, and paid from the *Loans*, were dispensed with on the completion of each piece of work. Their pay coming from Loans do not appear in appropriations, nor on the salary rolls.

“For seven years past the average cost for repairs to pipes, etc., has been over \$35,000 per year, yet the Chief asks for the year 1881 only \$15,000. As the amount of pipes laid has increased 33 per cent. during these years, how can he get along with only \$15,000, or does he admit that in former years the cost was more than double the amount it should have been?”

The fact is the Chief asked for \$50,000, and the Committee on Water reduced it to \$30,000, dividing it into two items of \$15,000 each.

RECEIPTS AND EXPENDITURES

— OF THE —

WATER DEPARTMENT

— FOR —

1880.

RECEIPTS.

Receipts of the Department and sources whence derived, as exhibited by statement of A. N. Keithler, Registrar, . . .	\$1,441,555 46
Receipts at the Chief Engineer's office, as per the following statement,	4,786 07
	\$1,446,341 53

RECEIPTS AT CHIEF ENGINEER'S OFFICE FOR 1880.

Old boilers,	\$1,315 01
Old iron,	480 36
Brass scraps and turnings,	86 70
Old barrels,	10 55
Rents,	1,020 00
Overdrawn warrants (Stauffer),	269 20
Bergdoll's Brewery, repairs to plug,	5 50
W. C. & P. R. R. Co., plugging water pipe,	3 46
Red Star Line, repairs to stop-cock,	6 20
Yardley & Sutter, repairs to 4-inch pipe,	8 00
Simpson & Neall, repairs to stop,	10 10
Mr. Betz, removing fire-plug,	13 13
Dolan's Mills, making connections to 10-inch pipe,	21 38
Knickerbocker Ice Company, removing fire-plug,	26 44
Philadelphia & Reading R. R. Co., stand-pipe attachment,	60 00
Richard Hey, fire attachment,	88 31
Mr. Poths, fire attachment,	88 09
J. Gardiner & Co., fire attachment,	88 68
Northminster Church, motor attachment,	78 10
Keely & Sons, fire attachment,	78 59
S. & M. Fleisher, fire attachment,	89 95
Mr. Muller, fire attachment,	96 35
Holy Trinity Church, motor attachment,	101 24
W. Johnson, fire attachment,	102 20
Hoopes & Townsend, fire attachment,	110 07
Harrison, Havemyer & Co., fire attachment & repairs to pipe,	291 86
J. Leech & Bros., fire attachment,	79 86
Montague & White, fire attachment,	156 74
	\$4,786 07

EXPENDITURES OF THE DEPARTMENT FOR 1880.

FROM ANNUAL APPROPRIATION.

For Maintenance—Engineering :

Salary of Chief Engineer, Item 1,	\$4,500 00
Salaries of Assistant Engineers, Clerks, Superintendents, Draughts- man, Telegraph Operator, Item 2,	15,180 32
Salaries of Purveyors, (5), Item 3,	5,400 00—\$25,080 02

Pumping Water :

Salaries.

WORKS.	Engineers.	Assistant Engineers or helpers.	Firemen.	Watchmen.			Police- men-	Items.
				Works.	Basins.	Ground.	Ground.	
Fairmount.....	2	9				2	2	" 4, \$10,575 00
Delaware.....	2		11		1			" 5, 9,900 00
Schuykill.....	2	2	8		1			" 6, 9,037 50
Belmont.....	2		14	1				" 7, 11,925 00
Chestnut Hill.....		1	1					" 7½, 1,275 00
Roxborough.....	2		6		1			" 8, } 7,020 00
" Aux.....		1						" " } 7,020 00
Frankford.....	1		2	1	1			" 8½, 3,600 00
								\$53,332 50

Inspecting and collecting rents.

Registrar's Department :

Salary of Registrar, Item 9,	\$2,250 00
Salaries of clerks and inspectors, Item 10,	22,701 67
Salary of Messenger, Item 3,	765 00
	<u>\$25,716 67</u>

Incidentals :

Advertising, Item 11,	\$745 12
Printing reports, Item 11,	1,027 44
Stationery, Item 11,	2,227 27
Fuel and rent of offices, ground rents, cleaning, &c., Item 12,	3,998 55
Gas at Works and Purveyors' offices, Item 14½,	4,478 89
Keep of horse for General Superintendent,	

Amounts carried forward,	\$12,477 27	\$104,129 49
--------------------------	-------------	--------------

Amounts brought forward,	\$12,477 27	\$104,129 49
Item 17,	375 00	
Keep of horse for Chief Engineer,		
Item 23,	650 00	
	<u> </u>	\$13,502 27

Supplies to Works—Coal and Wood :

Delaware, 1,167.15 tons at \$3.02 contr't pr., '79, Item 13—	\$3,526 60	
“ 1,327.10 “ 3.88 “ '80, “ 13—	5,150 70	
Belmont, 5,380.13 “ 2.70 “ '79, “ 13—	14,527 76	
“ 2,226.01 “ 3.35 “ '80, “ 13—	7,457 27	
Roxboro', 1,892.09 “ 3.10 “ '79, “ 13—	5,866 61	
“ 2,143.05 “ 4.37 “ '80, “ 13—	9,366 01	
Sch'ykill, 1,768.04 “ 3.13 “ '79, “ 13—	5,534 47	
“ 2,582.10 “ 4.47 “ '80, “ 13—	11,543 76	
Frankfrd, 1,522.15 “ 3.98 “ '80, “ 13—	6,060 54	
Hauling coal to Roxborough Auxiliary, “ 13—	24 00	
Wood to Works, “ 13—	942 00	
	<u> </u>	\$69,999 72
Tallow and oil, “ 14—	2,999 97	
Small stores, “ 15—	2,699 11	
	<u> </u>	75,698 80

Repairs to Works :

	Material.	Wages.			Item 16.
		Bricklayers and Helpers.	Boiler cleaners.	Machinists.	
Roxborough.....	\$2,200 34				“ “ \$2,200 34
Frankford.....	789 57	9 13			“ “ 798 70
Chestnut Hill.....	605 84				“ “ 605 84
Fairmount.....	622 56				“ “ 622 56
Belmont.....	3,560 53	1,709 42	1,349 35		“ “ 6,619 30
Schuylkill.....	3,863 80	1,624 13	1,303 10	1,470 75	“ “ 8,261 78
Delaware.....	569 13	1 093 75			“ “ 1,662 88
	<u>\$12,211 77</u>	<u>\$4,436 43</u>	<u>\$2,652 45</u>	<u>\$1,470 75</u>	<u>\$20,771 40</u>
Material as above.....	\$12,211 77				\$12,211 77
Wages as above.....		8,559 63			8,559 63

\$20,771 40

Amount carried forward, \$214,101 96

Amount brought forward, . . .

\$214,101 96

REPAIRS.

Keeping buildings, grounds and reservoirs in good order.

Material as per contract, . . .	Item 21	
Swivels and hooks, . . .	"	4 26
Tolls,	"	5 13
Brooms, as per contract, . . .	"	6 88
Machine work,	"	8 05
Gum hose, as per contract, . . .	"	9 10
Lead, as per contract,	"	15 50
Repairs to heater,	"	16 67
Spars,	"	20 00
Stone,	"	45 00
Plants,	"	75 93
Repairs to scales,	"	84 00
Plumbing,	"	156 40
Window glass, as per contract, . . .	"	174 80
Painting materials, as per contract, . . .	"	321 79
New Scale, " " " "	"	425 00
Bricks, lime and cement, per contract, . . .	"	747 31
Dredging Otis St. Dock, " "	"	693 00
Repairs to tracks, " "	"	959 00
New roof, Roxborough and Schuyl- kill works, as per contract,	"	1,105 05
Hardware, " "	"	1,167 90
Lumber, " "	"	1,255 56
		<u>7,296 33</u>

WAGES.

Keeping buildings, grounds and reservoirs in good order.

Clerk,	Item 21	863 50
Hauling ashes and material,	"	3,852 00
Carpenters and helpers,	"	3,674 00
Stonemasons and "	"	2,309 89
Painters " "	"	820 00
Riggers " "	"	106 00
Janitor, 13th and Spring Garden.	"	711 75
Gardeners, (Fairmount,)	"	929 26
Helpers as firemen,	"	1,298 50
Watchmen at Basins,	"	2,105 25
" Office,	"	1,258 25
" Works,	"	1,092 00
Bricklayers and helpers,	"	1,316 75
Helper as Lineman,	"	460 25
Laborers,	"	<u>3,904 38</u>

31,998 11

Amount carried forward,

\$246,100 07

Amount brought forward,

\$246,100 07

REPAIRS.

Keeping the distribution pipes, plugs and stops in good order:

Paving around plugs, as per contract, Item 19	135 10
Measuring over pipe, price fixed by ord. "	154 73
Pressure Inspector,	863 50
Manayunk District, Wages,	1,796 50
Germantown " "	3,576 23
First " "	3,361 50
Second " "	4,316 00
Third " "	4,003 25
Fourth " "	5,133 25
Shop " "	1,149 75

\$24,489 81

Total repairs to works, grounds, pipes, &c. 77,259 32

IMPROVEMENT ITEMS.

Drilling and making new attachments:

First District,	Item 18	1,723 50
Second "	"	1,807 50
Third "	"	1,872 00
Fourth "	"	1,782 00
Manayunk	"	1,527 50
Germantown,	"	667 50

\$9,380 00

For labor in laying pipes, fitting and setting plugs, stop-cocks, etc.,

Repairs to tools,	Item 20	\$9 40
Plumbing,	" "	25 33
Extra work on railroad track,	" "	54 45
Inspecting pipe,	" "	295 76
Measuring over pipe-price fixed by ord,	" "	458 70
Wages, First District,	" "	3,940 50
" Second "	" "	4,213 75
" Third "	" "	4,291 75
" Fourth "	" "	7,793 25
" Manayunk,	" "	3,045 87
" Germantown,	" "	394 50
" Assistant Engineer's Roll,	" "	4,221 00
" Fairmount,	" "	7,337 89
" Shop,	" "	22,910 59

58,992 74

Amount carried forward,

\$338,962 62

Amount brought forward,
For purchase of iron pipes, fire plugs, stop-cocks,
lead, brass and iron castings, and materials:

\$338,962 62

Rent of workshop, hauling of pipes, etc.,		
Lead, as per contract,	Item 22	1 94
Glass, " "	" "	5 67
Powder, " "	" "	21 00
Freight,	" "	30 30
Coke,	" "	33 10
Plumbing,	" "	66 20
Varnish and Cotton Waste, as per contract, "	" "	67 63
Oil,	" "	70 59
Packing,	" "	72 62
Galvanizing,	" "	89 81
Rent of workshops,	" "	125 00
Malleable castings,	" "	174 88
Patent hydrants,	" "	272 19
Repairs to boiler at shop,	" "	362 59
Sponge cloth, as per contract,	" "	550 00
Plug valves,	" "	654 00
Coal and wood for shop } and Purveyors' offices, } as per contract, "		641 07
Inlet valve box,	" "	790 00
Brass fittings,	" "	816 12
Hardware,	" "	852 47
Tubing,	" "	861 73
Hauling,	" "	991 04
Water meters,	" "	1,218 25
Gum goods,	" "	1,264 74
Lumber,	" "	1,356 14
Brass castings,	" "	2,744 34
Iron and steel,	" "	2,782 23
Iron pipe,	" "	2,850 84
Patent valves,	" "	8,250 00
Iron castings for shop,	" "	9,251 67
Special pipe castings,	" "	10,781 34

47,999 50

\$386,962 12

SPECIAL APPROPRIATIONS.

(Approved June 24th, 1880.)

To refund certain twice-paid and overpaid water- rent, and pipe-laying bills,	\$1,828 88
--	------------

(Approved December 31st, 1880.)

To refund certain twice-paid and overpaid water- and pipe-laying bills,	\$738 99
--	----------

EXTENSION OF WORKS.

(Approved June 29th, 1880.)

New Engine house at Schuylkill Works,	\$917 46
---	----------

CONSOLIDATED BALANCES OF WATER LOANS.

(Approved June 14th, 1880.)

Test trial of pumping engine at Frankford Works,	\$745 15
--	----------

(Approved June 29th, 1880.)

Advertising,	\$247 00
------------------------	----------

RECAPITULATION.

Expended from annual appropriation for salaries for engineering, pumping, inspecting and collect- ing rents,	\$104,129 49
Supplies for coal, wood, small stores, tallow and oil, Repairs to buildings and grounds and Reser- voirs for material, 7,296 33	75,698 80
Repairs to machinery at works, 12,211 77	
“ to pipes, plugs, and stops, 289 83	
	<u>19,797 93</u>
“ to buildings, grounds and reservoirs for wages, 24,701 78	
“ to machinery at works for wages, 8,559 63	
“ to pipes, plugs, and stops, “ 24,199 98	
	<u>77,259 32</u>
Incidentals,	13,502 27
	<u>270,589 88</u>
Total for maintenance for 1880,	

Amount brought forward, . . .		\$270,589 88
Improvements:		
Drills, Wages, 9,380 00		
Labor laying pipes, " 58,992 74		
	<u>68,372 74</u>	
Pipes, fittings, castings, etc. materials,	47,999 50	
	<u>116,372 24</u>	
Total for improvements,		116,372 24
" expended from appropriation,		386,962 12
" merging,		1,127 88
		<u>388,090 00</u>
Expended from annual appropriation,		386,962 12
" " special " (Refunding water-rents, &c.,)		2,567 87
" from \$100,000 " (Extension of works,) 917 46		
" from Loans, " " "		
[Consolidated balance,]	992 15	
	<u>1,909 61</u>	
Total expenditures from all sources for 1880,		391,439 60
Receipts from office of Registrar,	\$1,441,555 46	
" " " Chief Engineer,	4,786 07	
	<u>\$1,446,341 53</u>	
Total receipts from all sources,		390,447 45
Expended as per annual and special appro.,		
Profits,	\$1,055,894 08	
Pipe liens collected by City Solicitor,	38,015 53	
	<u>\$1,093,909 61</u>	
Revenue in excess of expenditures,		

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

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

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

OPERATIONS

— OF THE —

REGISTRAR'S DEPARTMENT

— FOR —

1880.

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

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

OPERATIONS

— OF THE —

REGISTRAR'S DEPARTMENT

— FOR —

1880.

DEPARTMENT FOR SUPPLYING THE CITY WITH WATER.

REGISTRAR'S OFFICE,
N. W. Corner Thirteenth and Spring Garden Streets.

Philadelphia, January 1st, 1881.

DR. WM. H. MCFADDEN,
Chief Engineer.

DEAR SIR:—I herewith transmit the report of receipts at this office for the year 1880. The total amount derived from all sources was \$1,441,555.46, which has been paid daily as received into the office of the City Treasurer. This is an increase over the previous year of \$25,196.33.

The collections from water rents for the year 1880 amounted to \$1,218,925.66, an increase over the previous year of \$32,923.97, and the receipts from delinquent rents amount to \$112,728.37, a decrease of \$5,505.78.

The receipts from fractional rents, penalties and other sources, amounted to 83,823.53, an increase of \$2,936.16.

The receipts from water pipe amounted to \$26,077.90, a decrease of \$5,158.02.

Pipe bills to the amount of \$11,854.89 were returned to the City Solicitor for lien, and the amount collected by him was \$38,015.53, as appears of record in that department.

Respectfully referring to the annexed itemized tables, I remain
Yours, very respectfully,

A. N. KEITHLER,
Registrar.

Receipts at the Registrar's office for the year 1881.

MONTHS.	Delinquent rents.	Penalties.	Rents of 1880.	Penalties.	Fractional rents.	Water pipe.	Total.
January.....	\$4,562 95	\$681 00	\$69,775 25	.....	\$5,105 20	\$2,355 34	82,479 63
February.....	4,548 50	677 48	124,604 47	.....	3,676 39	1,237 89	184,744 73
March.....	21,621 42	3,204 57	221,705 28	.....	4,490 03	2,061 65	253,082 95
April.....	26,053 65	3,851 89	613,136 42	.....	4,311 49	1,489 48	648,837 43
May.....	12,532 55	1,873 64	34,669 15	1,742 79	5,247 35	1,896 51	58,161 99
June.....	19,136 05	2,865 96	58,825 14	2,941 87	2,730 51	1,355 89	87,855 72
July.....	9,689 25	1,446 40	11 899 25	1,779 24	5,779 33	3,631 09	34,224 56
August.....	5,146 50	768 86	16,714 75	2,495 10	3,785 37	3,094 48	32,005 06
September.....	3,812 00	569 67	349,01 45	5,183 94	3,027 21	1,788 53	49 292 80
October.....	2,167 75	325 24	18,568 20	2,766 97	3,015 77	1,639 83	28,483 76
November.....	2,619 75	393 10	7,753 00	1,158 96	4,308 19	3,025 40	19,263 40
December.....	838 00	125 71	6,173 00	923 48	2,561 23	2,501 81	13,123 23
Totals.....	\$112,728 37	\$16,783 11	\$1,218,925 66	\$19,002 35	\$48,033 07	\$26,077 90	\$1,441,555 46

52

Amount of claims for water pipe returned to lien in 1880..... \$11,854.89.

Amount of claims for water pipe collected by City Solicitor in 1880.....\$38,015.53.

F. Graeff,

S. Ogden.

H. P. M. Birken-
bine.

Isaac
Cassin.

H. P. M. Birk-
enbine.

Comparative statement of receipts for the years 1879 and 1880.

	Delinquent rents.	Penalties.	Water rents.	Penalties.	Fractional rents.	Water pipe.	Totals.
1880.....	\$112,728 37	\$16,783 11	\$1,218,925 66	\$19,002 35	\$48,038 07	\$26,077 90	\$1,441,555 46
1879.....	118,234 15	17,439 36	1,186,001 69	22,931 31	40,516 70	31,235 92	1,416,359 13
Increase.....			\$32,923 97		\$7,521 37		\$25,196 33
Decrease.....	\$5,505 78	\$656 25		\$3,928 96		\$5,158 02	

Items of receipts under head of "Fractional Rents."

	Rents.	Ferrules.	Re-paving.	Repairs.	Totals.
1880.....	\$35,505 07	\$5,828 00	\$4,482 50	\$2,222 50	\$48,038 07
1879.....	27,606 20	5,890 00	4,678 25	2,342 25	40,516 70
Increase.....	\$7,898 87				\$7,521 37
Decrease.....		\$62 00	\$195 75	\$119 75	

Estimated receipts in statement to City Controller.....\$1,353,000 00
 Actual receipts as above.....1,441,555 46
 Increase over estimate to City Controller..... \$88,555 46

List of Dwellings, Factories, Horse-Power, &c., charged on Registers for 1880.

	WARDS.																															Totals.		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Baths.....	3091	1119	945	596	699	386	2483	2362	1744	2160	405	884	1420	2029	4467	653	540	1245	3702	5685	527	1904	451	4088	1328	2495	1933	3979	5698	2466	1995	63,430		
Bakeries.....	55	35	36	37	32	19	.....	29	21	38	30	29	26	44	81	36	33	41	.....	73	9	13	8	27	.....	42	7	23	49	49	48	920	
Banks.....	.....	.....	.....	.....	5	15	.....	3	.....	.....	.....	.....	.....	2	1	.....	.....	.....	.....	1	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	
Bars.....	165	155	185	193	394	240	78	140	838	156	135	128	121	136	214	145	144	154	258	200	75	47	53	137	156	127	68	113	140	114	168	4,927		
Barber shops.....	35	32	18	18	39	40	25	24	37	15	20	13	28	29	38	25	24	25	40	41	13	9	4	27	15	12	12	20	26	25	27	756		
Biddets.....	.....	.....	.....	.....	2	.....	.....	2	94	.....	.....	.....	.....	.....	16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	146	
Billiard saloons.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
Blacksmith shops.....	4	.....	14	14	3	5	.....	12	8	5	8	7	4	15	11	14	.....	.....	.....	25	26	.....	.....	6	18	15	13	3	.....	.....	.....	17	247
Bleaching establ'ts.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
Bottling ".....	2	4	.....	2	3	3	.....	.....	.....	2	2	2	.....	.....	1	4	.....	3	5	12	3	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62
Boards.....	.....	.....	.....	69	230	.....	.....	425	600	333	100	103	32	.....	.....	.....	.....	.....	.....	45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,934
Boilers.....	60	81	12	4	2	239	31	63	91	36	84	86	35	42	139	106	81	70	176	60	21	54	35	28	68	39	37	23	45	43	117	1,958		
Breweries and dis's.....	.....	1	2	1	1	2	.....	.....	.....	1	.....	7	5	2	1	3	.....	11	2	12	9	1	1	1	4	1	.....	7	15	.....	.....	96	
Brickyards.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	1	1	2	.....	.....	.....	.....	.....	.....	12	1	1	.....	29	
Carriages.....	57	60	55	73	42	3 ²	48	194	187	343	28	214	310	237	364	50	70	130	112	310	24	302	114	114	42	37	162	176	131	74	62	4,145		
Carpenter shops.....	2	1	.....	.....	6	2	6	9	6	.....	.....	3	4	10	22	11	13	6	.....	6	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	152
Car shops.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
Cars.....	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	81	30	117	.....	.....	.....	.....	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	621
Chemical works.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
Churches.....	11	9	7	8	7	10	9	10	7	5	.....	.....	2	9	16	16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	296
Children's Homes.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
Coal yards.....	4	22	2	3	.....	.....	.....	1	.....	.....	.....	.....	.....	7	4	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	103
Cooper shops.....	3	.....	9	14	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38
Coffee roasters.....	2	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
Depots.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30
Droveyards.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4
Drug stores.....	22	15	15	9	11	8	19	18	9	21	5	13	17	14	17	6	10	13	27	30	9	9	7	28	9	17	9	23	27	16	16	469		
Dwell's and hydra's.....	7678	4318	2410	2306	2079	2816	4584	2935	2365	3549	1754	1973	2925	3498	7180	2392	2397	4008	6893	7590	2507	2908	2681	7490	5092	6230	2544	5336	7574	5144	5886	129,022		
..... ^{3/4}	133	64	28	34	15	18	27	44	61	27	16	27	17	46	133	90	119	201	202	72	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,945
..... ^{1/2}	227	1165	1113	1110	549	296	785	430	95	820	785	710	490	480	704	1075	1188	683	176	401	14	14	49	42	205	43	43	29	28	252	113	14,214		
Dye houses.....	1	7	6	3	135
Dye vats.....	52	162
Eating Saloons and Restaurants.....	45	5	4	27	16	24	2	1	5	2	15
Engines.....	50	21	21	3	56	192	17	8	2	3	1	4	38	40	87	41	39	52	131	44	15	47	30	17	48	31	30	21	25	43	79	1,236		

54

List of Dwellings, etc.—Continued.

	WARDS.																															Totals.			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				
Offices.....											15				10	5		5	10	28		4	7	24	8	5	21	20	15		2	179			
Openings.....																																			
Oyster houses.....	7	1		13	22	5								4				1	17		3				1		2		4		2	80			
Paint shops.....																																	4		
Paper factories.....											1																						5		
Photo galleries.....		1	1	2	6		5	8	15	5	7	1	5	3	2	1	1	1	3	4	4	2	1	1	1	2	1	6			2	88			
Polishing wheels.....						3	1							2	1	6	1																6		
Pools.....	2				1			1	1	3			2	1							4		1	1	1							1	26		
Potteries.....	1																					2											2	5	
Printing offices.....					1	2		2	9	2											1			1										18	
Rectify'g estab'ls.....							1		3																									4	
Roofing estab'ls.....																																			
Schools.....	6	4	3	4	4	3	8	12	9	7	3	6	4	9	7	4	4	8	9	9	6	9	6	8	8	9	9	8	11	2	5	124			
Scholars.....	1320	1060	1301	1113	100	115	3354	1899	1581	3552	1431	2023	50	235	700	2085	1620	4910	4530	370	1662	2455	1976	2534	2377	3115	534	2000	3746	1730	3900	59,478			
Scouring estab'ls.....												1			2																		4	8	
Shower baths.....									26					151		4	414			1	30	9		1	1			40	19	124	1	822			
Shot towers.....		1																																1	
Shoe factories.....							1				1																							2	
Sinks.....		1		4	29	171	116	701	121	83	26	10	20	22	137					4	79	9	160	1	120		36	304		71	26	2,377			
Skin dressing estab.....				1											2	6																		18	
Slaughter houses.....	45	1												4	14	15	8	58	18	74	14			4	47	22	4		72	18	2	45	465		
Soap factories.....	2		2			1	1				1				2																			18	
Stables.....	116	60	70	76	46	44	150	187	66	161	86	77	56	126	223	62	169	70	91	235	53	104	114	290	31	39	69	31	87	109	132	3,230			
Stalls.....	1034	738	399	667	245	840	590	556	865	853	569	600	740	945	2046	685	700	1490	1320	1799	359	1083	562	2602	584	1081	1402	2026	1652	953	935	30,920			
Steam heaters.....				21	28				6	4				5	4	7																		77	
Steam saws.....						2		5			2			4																				17	
Stills.....										1	2																							5	
Stores and shops.....	25	24	3	15	6	38		6	9	3		2		11	9	66		2	25	20	94	31	10	16	23	34	26	8	9	3	26	27	108	662	
Store houses.....				9		9																4													8
Sugar houses.....	2	2		2		2																													8
Tanneries.....											16						4	5		1															26
Theatre and opera houses.....						2		4	1	1						1																			9
Tin shops.....																																			
Turbine wheels (organs).....								1						1		1	1								2								1		7

Permits issued during the year 1880,

	WARDS.																															Totals.			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				
Dwellings.....	36	18	12	6	3	4	4	15	5	9	5	4	4	8	25	9	9	34	121	37	128	124	93	182	218	106	75	292	183	51	75	1895			
" ½ and ¾.....											6	1					1	1														7	1609		
Baths.....	88	7	11	6	14	2	8	74	4	13	2	1	11	9	31	3	17	23	110	36	47	87	53	129	135	75	109	243	179	39	57	1609			
Wash paves.....	17	3	4	1	3	5	4	23	3	12	5	3	3	6	30	7	5	8	44	39	29	33	37	58	39	27	72	204	101	20	32	877			
Water closets, urinals and biddets.....	20	39	11	1	77	68	19	191	65	36	5	6	16	37	70	10	14	1	44	60	14	63	11	86	37	11	234	216	141	20	5	1701			
Basins, sinks and wash tubs.....	7	7			35	49	21	248	26	49	7	4	28	22	33	5	4	7	35	37	15	37	36	100	6	1	335	97	87	3	3	1344			
Bars.....	2	1	2	2		2		4	7	6	5	2	6	4	8	7	4	4	9	1	4		3	1	15	3		4	2	2	2	117			
Watering horses.....							1			1	2	3	2		2	2	1	1	4	2			1	6	2	3	2	8	6	5	3	3	32		
Stables.....	3	2		1			1	1	1	4	1	1	2	3	1	1	1	1	4	2		1	5	6	2	3	2	8	6	5	3	2	72		
Slaughter houses.....																	1	1	1															7	
Factories.....	1	3			1					2	1	1		4	4	2		2	5		2	4	6	1	3	2		2	1	1	1	8	56		
Boilers and engines.....	7	5			4	10	2	6	4	3	7	3	5	3	7	5	1	2	13	2	3	8	7	2	11	2	1	1	4	1	11	140			
Horse powers.....	161	217			38	125	33		22	35	103	12	20	93	93	33	40	72	94	8	10	64	91	26	107	15	5	12	72½	8	84	1,693½			
Stores, shops and offices.....	2		1	1		7		6	5	8				1	5	1				2	4	3	2		1		2	9	1	3			59		
Hotels and restaurants.....								3																										3	
Fountains.....																																		9	
Breweries and bottling establishments.....												2		1																				9	
Bakeries.....										1	1													1										6	
Hot-houses.....																			1				1											8	
Laundries.....										1													1											2	
Institutions and churches.....					2			1		1				1																				1	
Building purposes.....	5	1	1		2	1	4	12	4	1				1			11	1	2	8	21	10	45	21	3	4	1	1				1	18		
Water ships.....	9	97	18	6	1					13																								11	
Sprinkling streets, etc.....																																			147
Drug stores.....	1																	1	1															27	
Dye houses.....		1																																	6
Photograph galleries.....				1																															8
Barber shops.....									2		1	1	1			1	1																	2	
Total.....	309	401	65	25	178	274	94	576	156	194	152	43	100	192	323	88	99	170	518	238	305	443	357	630	614	258	865	1125	805½	153	201	9,946½			

Amount of Duplicates for the years 1880 and 1881.

Wards.	Jan., 1880.	Jan., 1881.
First.....	\$62,230 75	\$63,089 10
Second.....	36,856 75	36,958 25
Third.....	22,011 73	21,976 18
Fourth.....	22,239 75	22,118 25
Fifth.....	34,684 75	34,299 25
Sixth.....	46,691 78	46,076 28
Seventh.....	44,701 81	43,648 55
Eighth.....	46,982 67	47,991 92
Ninth.....	37,710 05	37,805 60
Tenth.....	41,112 25	41,205 45
Eleventh.....	21,337 35	20,830 25
Twelfth.....	22,526 20	23,933 45
Thirteenth.....	34,408 79	34,668 29
Fourteenth.....	38,590 75	38,768 30
Fifteenth.....	90,837 30	91,408 00
Sixteenth.....	28,443 85	28,584 60
Seventeenth.....	27,988 13	26,935 98
Eighteenth.....	41,481 23	41,889 98
Nineteenth.....	74,449 13	75,524 63
Twentieth.....	84,605 80	84,640 55
Twenty-first.....	18,920 70	19,596 70
Twenty-second.....	31,967 35	33,015 70
Twenty-third.....	19,352 75	20,400 25
Twenty-fourth.....	67,422 20	68,346 35
Twenty-fifth.....	36,303 84	39,079 84
Twenty-sixth.....	47,641 00	48,302 50
Twenty-seventh.....	31,250 91	32,925 16
Twenty-eighth.....	56,145 60	59,535 80
Twenty-ninth.....	82,887 95	84,545 13
Thirtieth.....	46,307 80	46,582 05
Thirty-first.....	50,871 25	50,408 50
	\$1,349,022 17	\$1,364,840 83

Subject to revision by re-inspection.

TABLE E.

Purposes for which water is supplied free of charge.

WARDS.	CITY PROPERTY.				FOUNTAINS.			
	School houses.	Police stations.	Fire stations.	Other buildings.*	Fountain Society.	Society P. C. A.	Other Associations.	City.
First.....	9	1	1		1	1		
Second.....	7				2			
Third.....	6	1			2			
Fourth.....	5		1		2			
Fifth.....	5	2	2	2	11	1	1	
Sixth.....	2	1	1		5			1
Seventh.....	5	1	3		3			
Eighth.....	3	1			12			1
Ninth.....	3	1	1	1	8			
Tenth.....	5	1	1		1			
Eleventh.....	4	1	1					
Twelfth.....	6							
Thirteenth.....	3							1
Fourteenth.....	7	1	1	1	2			1
Fifteenth.....	6	1	2			1	3	
Sixteenth.....	4				1			
Seventeenth.....	3	1						
Eighteenth.....	8	1	1		2			
Nineteenth.....	8		1		3	1		2
Twentieth.....	7	1	1		2			
Twenty-first.....	4	1	2					
Twenty-second.....	7	2			1	1		
Twenty-third.....	5	1	2					
Twenty-fourth.....	10	1	1	2	7	1	1	1
Twenty-fifth.....	10	1	1					
Twenty-sixth.....	5		1	1	3			
Twenty-seventh.....	6	1	1	1	4	1		
Twenty-eighth.....	7	1						
Twenty-ninth.....	8	1	1		3			
Thirtieth.....	5	1			1			
Thirty-first.....	6	1						
East Park.....								13
West Park.....								10
Totals.....	179	26	26	8	76	7	5	30

* Independence Hall and Annexes, New Court House, New Public Buildings, Broad and Market streets; Spring Garden Hall, Park offices, Memorial Hall, Moyamensing Prison, and Philadelphia Almshouse. Water is also furnished, free of charge, for sprinkling Fairmount Park drives and supplying its fountains.

OPERATIONS

- OF -

CHERRY ST. SHOP

- FOR -

1880.

STOCK ACCOUNT.

*Statement of the operations of Cherry street shop, from January 1, 1880, to
December 31, 1880.*

Dr.		
To stock on hand January 1, 1880,		\$13,167 51
356,397 lbs. iron castings,		10,522 17
11,383 " brass castings,		2,316 12
1,745½ " gun metal,		418 86
1,655 " malleable castings,		174 88
4,424½ " steel,		503 76
41,385 " wrought iron,		1,915 91
82 tons coal,		386 73
6,040 feet lumber,		252 43
6 cords wood,		42 00
Bolts and nuts,		867 77
Gum, rings, valves and assorted gum,		1,434 18
Wrought pipe and fittings,		110 38
Hardware,		707 38
Sponge cloths,		550 00
1,360 lbs. gasket,		129 20
Paints and oils,		194 76
Water meters, (assorted,)		1,082 00
Railroad tickets,		505 00
Machine work,		86 51
Wages paid hands,		26,394 59
757 stop boxes,		2,082 20
Brooms and brushes,		7 00
Leather belting,		23 01
Brass fitting,		674 77
Galvanizing		122 12
Building and grounds,		36 96
67 Barton 4-way stops,		8,337 00
Ice,		8 32
Old metals,		184 58
		<hr/>
		73,238 10
Balance,		4,209 20
		<hr/>
		77,447 30

The difference in the balance as compared with 1879 is due to the increased cost of material, the reduction of 20 per cent. on the price for machine work, and the large amount of manufactured stock on hand,

Cr.			
By repairs and supplies,	First District,	.	\$5,838 45
"	"	Second "	11,060 61
"	"	Third "	5,776 50
"	"	Fourth "	11,214 37
"	"	Germantown,	1,302 56
"	"	Manayunk,	768 20
"	"	building and grounds,	200 61
			<hr/>
			\$36,161 30
FAIRMOUNT WORKS.			
By repairs,	.	.	\$808 44
" building and grounds,	.	.	131 00
" improvement,	.	.	113 91
			<hr/>
			1,053 35
SCHUYLKILL WORKS.			
By repairs,	.	.	\$4,177 01
" improvement.	.	.	1,947 57
" building and grounds,	.	.	372 17
" boilers,	.	.	506 67
" pumping main,	.	.	1,162 66
" stop house,	.	.	579 54
" pumping water,	.	.	960 75
			<hr/>
			9,706 37
ROXBOROUGH WORKS.			
By boilers,	.	.	\$263 43
" building and grounds,	.	.	36 94
" improvement,	.	.	64 00
" repairs,	.	.	1,547 38
			<hr/>
			1,911 75
BELMONT WORKS.			
By repairs,	.	.	\$2,505 51
" boilers,	.	.	936 14
" building and grounds,	.	.	414 41
" improvement,	.	.	557 77
			<hr/>
			4,413 83
DELAWARE WORKS.			
By repairs,	.	.	\$1,548 78
" boilers,	.	.	493 91
" pumping main,	.	.	398 19
" improvement,	.	.	469 84
			<hr/>
			2,910 72
Amount carried forward,	.	.	<hr/>
			\$56,157 32

Amount brought forward, \$56,157 32

FRANKFORD WORKS.

By repairs, \$1,437 02
 " boilers, 594 85
2,031 87

CHESTNUT HILL WORKS.

By repairs, \$571 71
571 71
 By water meters, \$1,621 66
 " main office, 75 28
 " empty oil barrels, 4 00
 " old metals, 792 71
 2,935 ferrules, 1,458 50
 Stock on hand, as per inventory, January 1, 1881, 14,734 27
18,686 40
77,447 30

INVENTORY OF STOCK ON HAND, JANUARY 1, 1881.

44	4-inch socket screws,	at	\$5 00	\$220 00	
22	6-inch	"	5 00	110 00	
14	8-inch	"	6 00	84 00	
3	10-inch	"	6 50	19 50	
4	12-inch	"	8 00	32 00	
				<u>465 50</u>	\$465 50
17	4-inch square-top screws,	at	5 00	85 00	
17	6-inch	"	5 00	85 00	
6	10-inch	"	8 00	48 00	
5	12-inch	"	10 00	50 00	
16	16-inch	"	12 00	192 00	
8	20-inch	"	14 00	112 00	
				<u>572 00</u>	572 00
15	4-inch square-top N. S. screws,	at	5 00	75 00	
65	6-inch	"	5 00	325 00	
17	8-inch	"	7 00	119 00	
2	10-inch	"	9 00	18 00	
2	16-inch	"	12 00	24 00	
5	30-inch	"	20 00	100 00	
2	36-inch	"	25 00	50 00	
				<u>711 00</u>	711 00
10	4-inch spindles,	at	5 00	50 00	
23	6-inch	"	5 00	115 00	
11	8-inch	"	5 00	55 00	
5	10-inch	"	5 00	25 00	
7	12-inch	"	5 00	35 00	
				<u>280 00</u>	280 00
Amount carried forward,					\$2,028 50

Amount brought forward,				\$2,028 50
3	4-inch bands,	at	4 00	12 00
24	6-inch "	"	5 00	120 00
10	10-inch "	"	7 00	70 00
17	12-inch "	"	8 50	144 50
2	16-inch "	"	9 50	19 00
2	20-inch "	"	10 50	21 00
				<hr/>
				386 50
3	4-inch stop-cocks,	at	22 00	66 00
9	6-inch "	"	25 00	225 00
10	8-inch "	"	55 00	550 00
2	10-inch "	"	67 00	134 00
6	30-inch "	"	253 20	1,519 20
				<hr/>
				2,494 20
28	fire plugs,	at	28 00	784 00
40	frames and covers,	"	6 00	240 00
41	stop-boxes,	"	3 00	123 00
2	sets of gearing for derrick,	"	50 00	100 00
				<hr/>
				1,247 00
32,813	lbs. cast iron,	at	2 $\frac{3}{4}$	902 35
6,616	" unfinished brass,	"	20 $\frac{1}{2}$	1,356 28
1,147	" finished brass	"	37 $\frac{1}{2}$	430 13
19,450	" wrought iron,	"	4	778 00
1,394	" steel,	"	13	181 22
568	" forgings,	"	12	68 16
70	" malleable castings,	"	10 $\frac{1}{2}$	7 35
				<hr/>
				3,723 49
10	doz. chisels, (assorted)	.	.	90 00
3	" " (with handles)	.	.	45 00
3	" drills, (assorted)	.	.	36 00
1 $\frac{1}{2}$	" caulking and gasket irons,	.	.	13 50
16	hammers,	.	.	16 00
6	sledges,	.	.	24 00
415	lbs. lead,	at	4 35	18 05
				<hr/>
				242 55
1	1-inch water meter,	.	.	26 00
1.1 $\frac{1}{2}$ -inch	"	.	.	45 00
1	2-inch "	.	.	75 00
3	3-inch "	.	140 00	420 00
Finished sides and valves, (assorted)				34 00
				<hr/>
				600 00
50	lbs. brass spring wire,	at	34	17 00
5	doz. brass springs for pumps,	"	50	30 00
130	plug waste valves,	"	75	97 50
				<hr/>
Amounts carried forward,				\$144 50 \$10,722 24

Amounts brought forward, . . .		\$144 50	\$10,722 24
79 lbs. munce metal,	" 40	31 60	
1 6-inch globe valve, (extra heavy)		75 00	
5 8 inch " "	90 00	450 00	
Wrought pipe and fittings,		20 00	
		-----	721 10
1,212 feet lumber, (assorted)		66 44	
369 wood plugs, at 50		184 50	
7 doz. pick handles,		18 55	
14½ " handles, (assorted)		13 60	
3 car jacks, at 12 00		36 00	
1 ball gasket,		7 00	
		-----	326 09
17 plug monkeys complete, at \$6 00		102 00	
166 " frames, " 65		107 90	
45 " screws, " 3 28		147 60	
1,035 ferrules, (assorted) " 50		517 50	
		-----	875 00
Hardware,		322 96	
Bolts and nuts,		425 48	
176 doz. sponge cloths, at 50		88 00	
616 pure gum valves, " 1 90		1,170 40	
72 " rings, " 1 00		72 00	
Leather and sheet gum,		11 00	
		-----	2,089 84
			<u>\$14,734 27</u>

Stop-cocks, stop-cock boxes, frames and covers, fire-plug, cases, lead and gasket delivered from shop, 918 Cherry street, during 1880.

DISTRICTS.	3-inch stop-cocks.	4-inch stop.	6-inch stop.	4-way 6-inch stop.	8-inch stop.	10-inch stop.	12-inch stop.	16-inch stop.	20-inch stop.	23-inch stop.	30-inch stop.	36-inch stop.	Total.	Frames and covers.	Fire plugs.	Plug cases.	Stop boxes.	Lead.	Gasket.
First District.....			24	12										18	66	43	66	1120	2
Second District.....			10	43	1	2		2						45	62	53	144	4291	7
Third District.....		19	26											54	56	84	134		3
Fourth District.....		5	19	12		18		8			4			18	66	69	101		5
Germantown.....			6											12	18	22	49		1
Manayunk and }.....		6	5											5	3	2	5	747	1
Roxborough. }.....																	38		
		30	90	67	1	20		10			4		222	152	271	273	537	6158	19

Stop-cocks, fire plugs and casings, stop-boxes, frames, covers and ferrules, made and fitted up at city shop, from January 1, 1880, to December 31, 1880.

1880.	3-inch stop-cocks.	.....
	4-inch stop.	18	
	6-inch stop.	87	
	8-inch stop.	8	
	10-inch stop.	18	
	12-inch stop.	.....
	16-inch stop.	8	
	20-inch stop.	.....
	22-inch stop.	.....
	30-inch stop.	10	
	36-inch stop.	.....
	Total stop-cocks.	149	
	New fire plugs.	314	
	Fire-plug cases.	173	
	Stop-boxes.	757	
	Frames and covers.	212	
	1/2-inch ferrules.	3174	
3/4-inch ferrules.	200		
1-inch ferrules.	125		
1-inch ferrules.	150		
Total ferrules.	3649		

Inventory of articles manufactured during the year 1880.

18	4-inch stop,	at	\$22 00	.	.	.	.	\$396 00
87	6 " "	at	25 00	.	.	.	.	2,175 00
8	8 " "	at	55 00	.	.	.	.	440 00
18	10 " "	at	67 00	.	.	.	.	1,206 00
8	16 " "	at	100 45	.	.	.	.	803 60
10	30 " "	at	253 20	.	.	.	.	2,532 00
314	fire plugs,	at	28 00	.	.	.	.	8,792 00
173	plug cases,	at	7 50	.	.	.	.	1,297 50
3649	ferrules,	at	50	.	.	.	.	1,824 50
2	6-in. globe valves, ext. heavy		75 00	.	.	.	.	150 00
4	6 " relief "	"	75 00	.	.	.	.	300 00
5	8 " globe "	"	90 00	.	.	.	.	450 00
5	8 " relief "	"	90 00	.	.	.	.	450 00
2	20 " check "	"	197 88	.	.	.	.	395 76
2	30 " check "	"	276 63	.	.	.	.	553 26
Patterns,								358 24
								<hr/>
								\$22,123 86

OPERATIONS

—OF—

THE WORKS

—FOR—

1880.

Actual and comparative amount of coal used by the different pumping engines for the year 1880.

Engines.	Description.	Total gallons of water pumped.	Total tons of coal consumed.	Actual lift in feet, friction included.	Tons of coal required to lift one million gallons into reservoir.	Tons of coal required to lift one million gallons to the height of 100 feet.	Cost of coal to pump one million gallons to height of 100 feet, coal taken at the price at each of the works for the year.	Hours run.	REMARKS.
Schnylkull No. 4.....	Cornish.....	179,933,350	367.6	120	2.05	1.71	6.24	825½	Fires in continuous operation during the time run.
“ “ 5.....	“	791,991,750	1,118.3	120	1.41	1.18	4.30	2,959	Fires in continuous operation during the time run.
“ “ 6.....	Simpson compound.....	2,997,427,000	2,982.6	170	1.42	.84	3.06	6,341	Fires in continuous operation during the time run.
“ “ 7.....	Rotative “	2,415,189,480	2,184.4	120	.90	.75	2.74	3,863	Fires in continuous operation during the time run.
Belmont No. 1.....	Worthington compound.....	1,102,661,400	2,541.5	216	2.30	1.07	2.89	5,245¼	Fires in continuous operation.
“ “ 2.....	“ “	324,436,944	741.9	207	2.29	1.10	2.97	1,511½	“ “ “
“ “ 3.....	“ “	2,116,359,995	4,966.1	207	1.92	.93	2.51	6,054¾	“ “ “
Delaware No. 1.....	Horizontal, high pressure,	1,995,974,076	2,833.9	133	1.42	1.07	3.66	10,010¾	“ “ “
“ “ 2.....	Beam condensing,								
“ “ 3.....	Worthington compound,								
Roxborough No. 1.....	Cornish.....	30,700,674	121.7	346	3.96	1.15	4.15	320	Fires banked every day.
“ “ 2.....	Worthington compound.....	1,135,836,435	4,290.3	346	3.77	1.09	3.93	5,555	“ “
“ “ Aux..	Knowles direct acting pump..	3,061,170	36.0	80	11.76	1.47	* 64.23	414	“ “
Frankford No. 1.....	Rotative compound.....	934,318,461	1,379.8	203	1.47	.73	2.90	2,654¼	Fires in continuous operation during the time run.
“ “ 2.....	Worthington duplex.....	16,330,747	51.0	203	3.13	1.55	6.17	162	“ “ “
Chestnut Hill.....	Horizontal high pressure.....	89,555,859	461.2	125	5.15	4.12	14.83	4,202	Fires banked every day.

* The cost of pumpage at Roxborough Auxiliary for 1879 should have been 71.60 in place of 7.16, as in the report, due to error in placing the decimal. The increased cost of pumpage, as per the above table, due to increased cost of coal.

Comparison of the running expenses of steam and water, 1880.

	Water power.	Per cent.	Steam power.	Per cent.	Total water and steam.	Per cent.
Salaries.....	\$10,575 00	.67	\$15,983 88	.29	\$56,558 88	.32
Coal.....	828 00	.05	77,294 53	.49	78,122 53	.45
Lubricating oil, lights, etc.....	2,843 22	.18	6,618 69	.04	9,461 91	.05
All repairs.....	1,431 00	.10	29,042 14	.18	30,473 14	.18
Total.....	\$15,677 22	100	\$158,939 24	100	†\$174,616 46	100
Gallons water pumped into basin.....	7,887,896,254	.37	13,232,896,132	.63	21,120,791,386	100
Cost per million.....	\$1 987		\$12 01			
Gallons of water pumped 100 feet high.....	7,887,896,254	.25	23,798,379,018	.75	31,686,275,272	100
Cost per million.....	\$1 987		\$6 678			

† This increase, as compared with 1879, due to omission of \$18,912.62, amount of repairs done by Cherry street shop to machinery.

Percentage of water pumped at each station in the years 1878, 1879 and 1880.

WORKS.	1878.		1879.		1880.	
	U. S. Gallons.	Percentage.	U. S. Gallons	Percentage.	U. S. Gallons.	Percentage.
Fairmount water power.....	8,322,288,784	43.569	7,278,357,488	36.58	7,887,896,254	37.35
Schuylkill steam power.....	2,902,600,680	15.196	4,468,480,020	22.46	5,483,661,280	25.96
Belmont steam power.....	4,076,537,188	21.343	3,954,962,917	19.88	3,543,457,439	16.78
Delaware steam power.....	2,133,094,379	11.167	2,191,470,977	11.03	1,995,974,076	9.45
Roxborough steam power.....	1,062,782,483	5.511	1,141,356,720	5.74	1,166,537,109	5.52
Roxborough Auxiliary.....	3,303,060	0.017	3,389,250	0.02	3,061,170	.02
Chestnut Hill steam power.....	78,267,900	0.409	87,532,350	0.44	89,555,850	.42
Frankford steam power.....	532,789,858	2.789	765,551,793	3.85	950,649,208	4.50
Total pumpage.....	19,101,664,332	100.00	19,894,101,515	100 00	21,120,792,386	100.00

Operations of the Fairmount Water Works for the year 1880.

MONTHS.	Running time.	Number of revolutions during the month.	Total number of gallons pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.	From Pennsylvania Hospital Reports.	
	Days.				Pounds.	Pounds.	Quarts.	Rainfall during month.	Mean temperature.
					Inches.	Degrees.			
January	31	2,443,398	862,037,285	27,807,655	Heating Mill House.	.....	84	2.171	39.12
February	29	2,316,071	814,850,801	28,098,303		.....	132	2.875	39.03
March.....	31	2,364,125	856,033,734	27,613,991		43	120	4.799	39.64
April.....	30	2,656,716	925,633,598	30,854,453		.....	104	2.935	53.10
May.....	31	2,369,410	836,215,785	26,974,702		18	118	578	70.59
June.....	30	1,623,597	593,914,706	19,863,823		.....	134	1.991	75.28
July.....	30	1,456,389	543,010,778	17,516,476		10	110	9.461	77.53
August.....	31	1,138,460	457,917,552	14,771,534		2	93	5.494	75.04
September	28	778,943	333,968,469	11,132,232		.....	58	1.683	73.24
October.....	28	545,339	241,286,823	7,783,446		.....	40	1.242	51.81
November	30	1,769,726	673,924,669	22,464,155		28	109	1.957	39.15
December.....	31	1,903,792	747,102,054	24,100,066		.....	89	4.492	27.93
	Total	Total.	Total.	Average.	Total.	Total	Total.	Total.	
	360	21,365,916	7,887,896,254	21,551,630	403,200	101	1,191	39.678	

Operations of the Schuylkill Water Works for the year 1880.

Months.	Running time.	Number of revolutions during the month.	The number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.				Pounds.	Pounds.	Quarts.
January.....	8	119,113	59,556,500	1,921,179	136,864	182	65
February.....	20	241,002	120,589,260	4,158,250	367,372	429	154
March.....	29	444,776	222,388,000	7,173,806	636,272	800	224
April.....	22	265,176	132,051,900	4,401,730	451,924	525	142
May.....	31	913,966	492,304,130	15,880,800	1,193,477	687	622
June.....	30	1,151,722	703,399,730	23,446,657	1,734,658	1450	547
July.....	31	1,197,785	761,669,770	24,569,702	1,915,997	1794	543
August.....	31	1,092,721	709,880,880	22,899,382	1,763,328	1118	386
September.....	30	1,246,183	787,427,270	26,247,579	2,058,556	1,311	400
October.....	31	1,234,846	791,310,660	25,529,376	2,149,832	1309	391
November.....	30	663,563	373,040,240	12,434,674	1,305,920	989	210
December.....	31	598,248	329,951,940	10,643,611	1,188,598	918	330
	Total.	Total.	Total.	Average.	Total.	Total.	Total.
	324	9,169,106	5,483,661,280	14,982,631	14,902,768	11,444	4,017

Operations of the Delaware Water Works for the year 1880.

Months.	Running time.	Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.							Pounds.	Pounds.	Quarts.
January.....	29	470,819	152,485,805	4,944,706	514,580	10	116
February.....	26	272,756	97,373,892	3,357,720	364,399	19	84
March.....	23	347,004	113,715,023	3,668,227	419,399	11	90
April.....	26	353,808	104,826,873	3,494,229	351,037	24	83
May.....	31	568,996	145,426,017	4,691,162	461,020	46	116
June.....	29	477,484	157,306,721	5,243,557	464,053	11	116
July.....	30	785,049	219,859,661	7,092,247	664,753	40	140
August.....	30	839,171	230,996,064	7,451,486	713,935	49	135
September.....	30	877,766	245,269,030	8,175,634	683,324	35	138
October.....	31	917,563	246,740,489	7,959,370	769,110	41	141
November.....	29	505,019	161,363,741	5,378,791	522,587	6	125
December.....	24	337,845	120,610,665	3,890,666	419,901	9	91
	Total.	Total.	Total.	Average.	Total.	Total.	Total.
	343	6,762,280	1,995,974,076	5,453,481	6,348,098	301	1,391

Operations of the Belmont Works for the year 1880.

Months.	Running time.	Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.				Pounds.	Pounds.	Quarts.
January	31	869,204	312,150,840	11,037,124	1,597,658	454	279
February.....	29	667,862	243,827,184	8,407,884	1,253,593	340	191
March	31	643,949	191,822,808	6,288,800	1,022,621	351	215
April.....	30	830,579	304,607,026	10,153,567	1,545,130	472	233
May.....	31	627,275	275,513,039	8,887,546	1,201,545	219	234
June.....	30	536,884	256,091,600	8,556,488	1,127,924	100	315
July.....	31	661,492	298,368,680	9,624,800	1,261,990	73	361
August.....	31	1,025,841	355,267,922	11,460,255	1,600,776	193	378
September	30	950,801	383,177,820	12,772,594	1,685,227	420	114
October.....	31	1,042,325	406,126,414	13,100,852	1,758,584	432	302
November	30	668,696	278,895,352	9,296,511	1,293,587	314	199
December.....	31	604,119	203,974,784	6,579,832	1,054,449	219	127
	Total.	Total.	Total.	Average.	Total.	Total.	Total.
	366	9,179,027	3,543,457,439	9,681,577	16,463,024	3,587	2,998

Operations of the Roxborough Water Works for the year 1880.

Months.	Running time.	Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.				Pounds.	Pounds.	Quarts.
January.....	31	329,412	97,176,540	3,134,727	867,505	63	82
February.....	29	322,693	95,195,910	3,282,620	800,043	57	84
March.....	30	415,495	100,261,585	3,234,245	831,405	72	91
April.....	30	353,403	100,303,629	3,343,454	817,865	79	93
May.....	31	381,542	112,554,890	3,630,800	904,979	77	92
June.....	30	378,775	111,738,625	3,724,621	921,850	88	91
July.....	31	365,287	107,759,665	3,476,118	815,381	88	105
August.....	31	351,041	103,557,095	3,340,551	799,432	64	95
September.....	30	227,451	67,098,930	2,236,631	770,087	61	93
October.....	31	316,629	93,405,555	3,013,062	747,935	64	99
November.....	30	291,656	86,038,520	2,867,950	769,515	60	88
December.....	31	309,937	91,446,165	2,949,876	837,148	63	93
	Total.	Total.	Total.	Average.	Total.	Total	Total.
	365	4,043,379	1,166,537,109	3,187,260	9,883,145	836	1,106

Operations of the Auxiliary Works at Roxborough for the year 1880.

Months.	Running time.	Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.				Pounds	Pounds.	Quarts.
January.....	3	21,005	315,075	10,163	11,200	3	4
February.....	2	12,066	180,990	6,241	4,480	2	2
March.....	1	10,730	160,950	5,192	2,240	2	1
April.....	3	14,627	219,405	7,313	4,480	2	1
May.....	2	15,641	234,615	7,568	2,240	2	1
June.....	3	18,648	279,720	9,324	6,720	3	2
July.....	3	24,051	360,765	11,637	4,480	3	2
August.....	3	22,926	343,890	11,093	6,720	3	2
September.....	3	17,206	258,090	8,603	8,960	3	2
October.....	2	15,396	230,940	7,449	4,480	2	2
November.....	3	18,797	281,955	9,398	11,200	3	1
December.....	2	12,985	194,775	6,283	13,440	3	3
	Total.	Total.	Total.	Average.	Total.	Total.	Total.
	30	204,078	3,061,170	8,374	80,610	31	23

Operations of the Chestnut Hill Water Works for the year 1880.

Months.	Running time.	Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.	Tallow.	Lubricating and cylinder oil.
	Days.				Pounds.	Pounds.	Quarts.
January	30	383,400	6,805,350	219,527	76,720	55	35
February	29	321,000	5,697,750	196,474	64,960	55	30
March	31	312,600	5,548,650	180,000	69,440	55	35
April	30	297,000	5,271,750	175,725	67,200	55	35
May	31	358,800	6,368,700	205,442	78,960	55	35
June	30	420,000	7,455,000	248,500	88,480	55	30
July	31	497,400	8,428,850	284,400	101,360	55	30
August	31	511,800	9,084,450	293,047	101,360	55	31
September	30	510,600	9,063,150	302,105	98,560	55	30
October	31	518,400	9,201,600	296,825	101,360	54	31
November	30	474,000	8,413,500	280,450	98,560	53	30
December	31	440,400	7,817,100	252,164	86,240	54	31
	Total.	Total.	Total.	Average.	Total.	Total.	Total.
	365	5,045,400	89,555,850	244,688	1,033,200	656	383

Operations of the Frankford Water Works for the year 1880.

Months.	Running time.		Number of revolutions during the month.	Total number of gallons of water pumped during the month.	Average gallons per day.	Coal.		Tallow.		Lubricating and cylinder oil.
	Days.					Pounds.	Quarts.	Pounds.	Quarts.	
January.....	28	339,388	95,413,636	3,077,865	331,404	28	25½			
February.....	23	227,045	74,243,715	2,560,130	245,149	44	18½			
March.....	23	229,699	75,111,573	2,616,500	249,741	28	14			
April.....	21	213,314	69,753,678	2,925,122	230,186	.....	32		
May.....	25	271,068	88,639,236	2,860,000	281,314	4	39½			
June.....	26	255,703	83,614,981	2,788,162	272,932	12	35½			
July.....	22	297,811	83,676,507	2,763,900	287,421	38	16			
August.....	21	262,928	85,977,456	2,773,466	256,327	44	10½			
September.....	21	251,540	68,884,280	2,296,142	229,739	32	10½			
October.....	22	269,737	79,159,841	2,553,543	280,597	54	15½			
November.....	21	223,889	73,211,703	2,440,390	262,368	44	11			
December.....	21	223,126	72,062,202	2,853,670	277,864	42	10½			
Total.	274	3,065,278	950,649,208	2,597,402	3,205,054	370	239			

Total Gallons of water pumped during the year 1880.

Months.	Fairmount Works.	Delaware Works.	Schuylkill Works.	Belmont Works.	Frankford Works.	Roxborough Works.	Roxborough Auxiliary.	Chestnut Hill.	Total of all the Works.	Percentage of consumpt'n	Average per day.	Highest number of gallons in one day.	Lowest number of gallons in one day.
January.....	862,037,285	152,485,895	59,556,500	342,150,840	95,413,836	97,176,540	315,075	6,805,350	1,615,941,321	91	52,127,140	57,450,028	44,227,027
February.....	814,850,801	97,373,892	120,589,260	243,827,184	74,243,715	95,195,910	180,990	5,697,750	1,451,959,502	87	50,067,570	55,080,870	40,929,640
March.....	856,033,734	113,715,028	222,388,000	194,852,808	75,111,573	100,261,585	160,950	5,548,650	1,568,072,328	88	50,582,980	57,228,566	41,651,675
April.....	925,633,598	104,826,873	132,051,900	304,607,026	69,753,678	100,303,629	219,405	5,271,750	1,642,667,859	95	54,755,595	58,346,727	42,440,192
May.....	836,215,785	145,426,017	492,304,130	275,513,939	88,639,236	112,554,890	234,615	6,368,700	1,957,257,312	109	63,187,332	75,320,935	54,514,662
June.....	595,914,706	157,306,721	703,399,730	256,694,660	83,614,881	111,738,625	279,720	7,455,000	1,916,404,043	110	63,880,135	69,598,035	58,030,502
July.....	543,010,778	219,859,661	761,660,770	298,368,690	83,676,807	107,759,665	360,765	8,828,850	2,023,525,986	114	65,275,030	80,515,352	48,924,751
August.....	457,917,552	230,996,064	709,880,880	355,267,922	85,977,456	103,557,095	343,890	9,084,450	1,953,025,309	109	63,000,816	75,058,225	50,882,841
September...	333,968,469	245,269,030	787,427,270	383,177,820	68,884,280	67,098,930	258,090	9,063,150	1,895,147,039	109	63,171,569	75,146,173	55,107,143
October.....	241,286,823	246,740,489	791,410,660	406,126,414	79,159,841	93,405,555	230,940	9,201,600	1,867,562,322	105	60,243,946	72,564,164	53,261,829
November....	673,924,669	161,363,741	373,040,240	278,895,852	73,211,703	86,038,520	281,955	8,413,500	1,655,169,680	95	55,172,323	66,056,777	40,981,188
December....	747,102,054	120,610,665	329,951,940	203,974,784	72,962,202	91,446,165	194,775	7,817,100	1,574,059,685	88	50,776,119	67,289,059	35,764,204
	Total.	Total.	Total.	Total.	Total.	Total.	Total.	Total.	Grand Total.	Aver.	Average.	Average.	Average.
	7,887,896,254	1,995,974,076	5,483,661,280	3,543,457,439	950,649,208	1,166,537,109	3,061,170	89,555,850	21,120,792,386	100	57,707,082	67,471,242	47,226,305

Amount of water pumped by all the Works from 1854 to 1880, inclusive, in U. S. gallons.

YEAR.	FAIRMOUNT.		DELAWARE.		SCHUYLKILL.		TWENTY-FOURTH WARD AND BELMONT.		ROXBOROUGH AND GERMANTOWN.		CHESTNUT HILL.		FRANKFORD.		TOTALS.	
	Total water pumped.	Daily average.	Total water pumped.	Daily average.	Total water pumped.	Daily average.	Total water pumped.	Daily average.	Total water pumped.	Daily average.	Total water pumped.	Daily Average.	Total water pumped.	Daily average.	Total for all the works.	Total daily average.
1854	2,286,402,222	6,264,116	618,178,121	1,693,625	1,366,011,559	3,742,497	.....	.....	.....	.....	.....	.....	.....	.....	4,279,586,902	11,700,238
1855	2,787,736,850	7,637,635	567,804,060	1,555,628	1,525,987,725	4,180,788	9,538,170	26,132	.....	.....	.....	.....	.....	.....	4,891,066,805	13,400,183
1856	2,867,188,965	7,833,850	769,566,040	2,102,639	1,980,637,500	5,411,578	52,577,642	143,655	.....	.....	.....	.....	.....	.....	5,669,970,147	15,491,722
1857	3,659,797,730	8,383,407	811,462,085	2,223,184	2,315,832,461	6,344,746	121,948,840	334,106	.....	.....	.....	.....	.....	.....	6,369,041,116	17,285,044
1858	3,058,418,667	8,379,224	757,187,690	2,074,487	2,819,641,992	7,725,047	204,177,624	559,391	.....	.....	.....	.....	.....	.....	6,839,425,973	18,738,153
1859	3,390,271,757	9,288,416	868,567,100	2,379,636	2,643,736,620	7,243,114	265,456,170	727,277	.....	.....	.....	.....	.....	.....	7,168,031,647	19,638,443
1860	3,612,989,017	9,871,555	872,144,980	2,382,910	2,696,960,210	7,368,744	283,646,970	774,989	.....	.....	.....	.....	.....	.....	7,465,740,277	20,398,197
1861	3,731,785,628	10,224,070	983,805,740	2,695,358	2,527,182,710	6,923,788	353,313,900	967,983	.....	.....	.....	.....	.....	.....	7,596,087,978	20,811,200
1862	3,564,724,753	9,766,369	909,126,440	2,490,757	3,038,527,420	8,324,733	420,507,810	1,152,076	.....	.....	.....	.....	.....	.....	7,932,886,423	21,733,933
1863	5,586,712,091	15,306,060	1,182,539,680	3,239,835	2,203,769,280	6,037,724	525,754,090	1,440,422	.....	.....	.....	.....	.....	.....	9,498,775,141	26,024,041
1864	5,970,801,329	16,313,665	1,090,884,060	2,980,558	1,725,444,660	4,714,330	519,877,800	1,420,431	.....	.....	.....	.....	.....	.....	9,930,007,849	25,428,983
1865	7,082,015,640	19,402,783	1,429,591,700	3,916,690	2,005,038,484	5,493,256	535,923,360	1,468,283	.....	.....	.....	.....	.....	.....	11,052,569,184	30,281,011
1866	7,721,817,582	21,155,665	1,271,841,020	3,484,496	947,652,428	2,596,308	606,665,380	1,662,097	106,369,060	291,422	.....	.....	.....	.....	10,654,345,470	29,189,987
1867	7,990,416,594	21,891,552	427,935,060	1,172,425	1,590,248,454	4,356,845	677,717,190	1,856,759	177,104,200	485,217	.....	.....	.....	.....	10,863,421,498	29,762,798
1868	8,024,530,911	21,924,948	705,442,350	1,927,438	2,337,365,642	6,386,245	727,824,780	1,988,592	190,015,200	519,167	.....	.....	.....	.....	11,985,178,883	32,746,390
1869	7,489,611,069	20,519,482	1,042,740,453	2,856,364	2,735,569,020	7,494,709	928,561,494	2,544,004	218,229,800	597,890	.....	.....	.....	.....	12,414,752,336	34,018,020
1870	8,134,985,170	22,287,631	1,186,131,144	3,249,674	3,003,737,166	8,229,417	*850,011,192	2,328,798	227,946,600	624,511	.....	.....	.....	.....	13,402,811,272	36,720,030
1871	8,861,728,593	24,169,061	1,007,378,521	2,759,941	2,201,294,172	6,030,943	1,054,210,990	2,888,249	413,787,205	1,133,664	.....	.....	.....	.....	13,498,399,481	36,981,916
1872	7,366,632,573	20,127,411	1,474,531,040	4,028,773	2,223,287,070	6,074,555	1,456,756,728	3,980,210	518,811,050	1,417,517	.....	.....	.....	.....	13,040,018,461	35,628,465
1873	7,517,538,594	23,883,667	1,364,106,884	3,737,287	1,508,295,800	4,132,317	1,959,966,670	5,369,772	673,287,495	1,844,623	.....	.....	.....	.....	14,223,198,443	38,967,667
1874	7,749,007,798	21,230,158	1,558,518,765	4,269,914	1,556,505,220	4,209,603	2,969,227,504	8,134,870	720,165,810	1,975,057	.....	.....	.....	.....	14,553,425,097	39,817,603
1875	7,994,234,254	21,902,012	1,839,190,470	5,038,878	1,366,295,950	3,715,879	3,055,507,870	8,371,254	818,339,525	2,242,026	33,592,000	92,063	.....	.....	15,097,160,066	41,363,082
1876	7,547,163,024	23,352,906	2,011,301,489	5,495,359	2,179,733,340	5,955,556	3,748,651,929	10,242,218	935,702,907	2,556,565	50,754,850	138,674	.....	.....	17,473,308,039	47,741,279
1877	9,492,419,433	26,015,985	2,149,106,288	5,865,390	1,729,810,384	6,927,697	3,486,809,917	9,594,170	960,670,580	2,648,008	58,427,850	158,912	.....	.....	17,817,144,792	48,983,958
1878	8,322,288,784	22,800,791	2,139,094,379	5,814,000	2,902,600,680	7,955,070	4,076,537,188	11,170,000	1,056,085,543	2,893,386	78,267,900	214,433	532,789,858	2,090,000	13,101,664,332	52,333,326
1879	7,278,357,488	19,950,213	2,194,470,977	6,012,222	4,468,480,020	12,258,850	3,954,962,917	10,835,515	1,144,745,970	3,136,564	87,532,350	239,815	765,551,793	2,097,402	19,894,101,515	54,507,518
1880	7,887,896,254	21,551,630	1,995,974,076	5,453,481	5,483,661,280	14,982,681	3,543,457,439	9,681,577	1,169,598,279	3,195,624	89,555,850	244,688	950,649,208	2,597,402	21,120,792,386	57,707,082

*The works at Belmont were started October, 1870, at which date Twenty-fourth Ward Works were abandoned.

†Included in the Fairmount pumpage is that of the Worthington Engine, which, in 1872, was 146,540,888; in 1873, 9,711,208; in 1874, 166,984,376; in 1875, 324,225,056; in 1876, 172,505,781 gallons.

‡The Roxborough Works commenced pumping December 21, 1870.

§The record of pumping of the Frankford Works was commenced April, 1878.

¶The Germantown Works were abandoned September 30, 1872.

DISTRIBUTION

— OF THE —

WATER DEPARTMENT

— FOR —

1880.

DISTRIBUTION.

The amount of water pipes, directed to be laid, that remained on our books at the beginning of the year 1880, was 177,530 feet. During the year ordinances were passed by City Councils amounting to 42,980 feet, making a total of 220,510 feet or 41 miles 3,030 feet.

Of this, 20,386 feet were laid during the year, leaving a balance of 200,124 feet, or nearly forty miles.

The re-lays, amounting to 3,571 feet, were the substitution of six and ten inch, for old three and four inch pipes.

1,370 feet of pipes were lowered.

Ten dead ends and twenty-five intersections have been connected.

By a careful revision of the pipes laid and comparison with the Chief Engineer's annual reports, a number of errors have been discovered. These have been corrected and a new table, of the total feet of pipe laid, has been made, which shows the number of feet of each size of pipe laid for each year, and the correct amounts purchased from the Germantown and Chestnut Hill Water Companies.

RECOMMENDATIONS FOR DISTRIBUTION.

1. Substitute larger for all pipes less than six inches in diameter through the entire City.

2. At Twenty-first and Callowhill streets unite the twenty and twenty-two-inch mains from Fairmount with a thirty-inch main to run down Twenty-first street to South street, one twenty-inch branch to run west to Grays Ferry road, thence to Federal street, the other from Twenty-first and South streets to Broad. This will give South street and south of South street an additional feeder, which will be from the Fairmont reservoir—6,000 feet of thirty-inch pipe and 7,700 feet of twenty-inch.

3. At Nineteenth and Poplar streets cut the thirty-inch main, and from it lay a twenty-inch main to connect with the twenty-inch pipe on the north side of Callowhill street, formerly supplied from Fairmount. Distance 4,000 feet of twenty-inch.

At Sixteenth and Spring Garden streets continue twenty-inch pipe south to Callowhill street, and there connect with the twenty-inch pipe on the south side, formerly supplied from Fairmount. Distance 1,050 feet of twenty-inch.

4. Supply the thirty-inch main on Arch street with water from Corinthian avenue reservoir by means of the thirty-inch pipe from that reservoir via Fairmount.

5. Lay a sixteen-inch main on Broad street from Poplar to Callowhill street. Distance 4,000 feet of sixteen-inch.

6. Lay a sixteen-inch main down the centre of Market street.

7. Connect the ten-inch main, supplying the C. T. A. B. Fountain, with the ten-inch pipe on Elm avenue. Distance 1,000 feet of ten-inch pipe.

DISTRIBUTION.

SERVICE AND SUPPLY MAINS LAID IN 1880.

FIRST DISTRICT.

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

Street.	Location.	Size. Inches.	Distance. Feet.
Eagleson,	From Grays Ferry Road to Burnett,	6	267
11th,	" Cross " Tasker,	6	157
Grays Ferry Rd.,	" 34th " W. of 35th,	6	677
Rosewood,	" Fitzwater " Catharine,	6	372
South, S. side,	" Sutherland " 27th,	6	152
13th	" Jackson, South,	6	381
27th	" South St., "	6	70
31st	" house line of Wharton, South,	6	84
36th	" " " "	6	213
Titan	" 16th to 17th,	6	445
Dead end connected	Manilla with 10th.	4	29
Fire connection,	21st and Washington, (Continental Brewery)	4	12
" "	Almond W. of Penn, (Harrison, Havemeyer & Co.)	4	8
Pipe used for fire plug connections,		6	5
" " " " " " " "		4	159
Total number of feet of new pipe,			<u>3,031</u>
Number of feet of new 4-inch pipe laid,			208
" " " " " 6 " " " "			2,823
Total,			<u>3,031</u>
Pipe used for repairs,		3	37
" " " " " " " "		4	191
" " " " " " " "		6	41
" " " " " " " "		10	4
Total,			<u>273</u>

SECOND DISTRICT.

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

Street.	Location.	Size. Inches.	Distance. Feet.
Compromise,	From 17th to Cook,	6	177
Cook,	" Pine " Compromise,	6	368
Amount carried forward,			<u>545</u>

Street.	Location.	Size, Inches.	Distance, Feet.
Amount brought forward,			
Cope,	" Sansom	" Walnut,	6
Gebhard,	" Race, South	" dead end,	6
Lowber,	" Centre	" Filbert,	6
Ludlow,	" E. of 38th	" 39th,	6
33d,	" Haverford	" Story,	6
Woodland,	" 49th	" 104 ft. W. of 50th,	12
Dead end connected Walnut from 24th, East,			
Connection for organ motor 22d, S. of Spruce, (Holy Trinity church)			4
" " " " 35th, S of Baring, (North Minster church)			4
" 16-inch main on South St. with 30-inch pipe on Broad St., (not finished)			16
Pipe used for fire plug connections,			6
" " " " " "			4
Total number of feet of new pipe,			<u>2,806</u>
Number of feet of new 4-inch pipe laid,			
" " " " " 6 " " "	. . . . . 82		
" " " " " 12 " " "	. . . . . 2,123		
" " " " " 16 " " "	. . . . . 577		
Total,			<u>2,806</u>

Relaid.

Street.	Location.	Size, Inches.	Distance, Feet.
Decatur,	" Jayne to Market, (formerly 3 inch)	6	336
Evelina,	" 3d " Levant,	" 3 "	6
Jayne,	" 6th " 7th,	" 3 "	6
Levant,	" Spruce " Pear,	" 3 & 4 "	6
Library,	" 4th " 5th,	" 3 "	10
Sansom,	" 20th " 21st,	" 4 "	6
Pipe used for fire plug connections.			6
" " " " " "			4
Total feet of pipe relaid,			<u>2,734</u>

Decatur St. laid in 1828, 3 inches, 273 ft., should have been	336
Evelina " " " 1826, 3 " 100 " " " "	228
Jayne " " " 1828, 3 " 373 " " " "	454

Intersections Connected, Barton stop used.

Location.	Size. Inches.	Distance. Feet.
2d and Race,	6	19
4th " "	6	11
" " Cherry,	6	11
" " Walnut,	6	14
" " Pine,	6	7
" " Lombard,	6	13
7th " Cherry,	6	15
" " Market, N. S.	6	16
" " Market, S. S.	6	13
9th " Market, N. S.	6	22
" " Market, S. S.	6	19
10th " Market, N. S.	6	9
" " " S. S.	6	9
12th " " N. S.	6	9
" " " S. S.	6	2
13th " " N. S.	6	9
" " " S. S.	6	9
17th " " S. S.	6	3
" " Pine,	6	4
19th " Cherry,	6	1
33d. " Powelton,	6	2
34th " "	6	9
38th " Baring,	6	14
" " Haverford,	6	11
Total,		<u>251</u>
Pipe used for repairs,	3	5
" " " "	4	49
" " " "	6	51
" " " "	8	6
" " " "	12	5
" " " "	16	6
Total,		<u>122</u>

THIRD DISTRICT.

*Iron Pipes laid in the Eleventh, Twelfth, Sixteenth, Seventeenth,
Eighteenth, Nineteenth, Twenty-third, Twenty-fifth and
Thirty-first Wards.*

Street.	Location.	Size. Inches.	Distance. Feet.
Birch,	From Salmon to Edgemont,	6	331
"	" N. house line of Edgemont', N. W.	6	96
Collar.	" Wildey, N. W.	6	109
Emerald,	" Somerset, S. W.	6	271
"	" Willard to N. E. of Westmoreland,	6	530
5th	" Butler, N.,	6	348
Hancock,	" Lehigh Ave., North,	6	340
Jasper,	" Hart Lane to Somerset,	6	312
Livingston,	" Clearfield, S. W.	6	98
Master,	" Frankford Road to Adrian,	6	121
Oxford, S. S.	" " " " Howard,	10	877
St. Ann's,	" Jackson " Tucker,	6	227
Somerset,	" Frankford Road " Coral,	6	227
Tacony,	" " " " Thomas,	6	284
Dead end connected	Adrian from Master, South,	4	20
Fire connect.	Adam, N. W. of Sellers, (Whittaker's factory)	4	23
"	" Emerald, N. E. Hart La., (Lodges' "	4	25
"	" (2) Howard S. of Berk, (Chatham Mills)	4	42
Private "	On 5th and 6th Sts. N. of Fairmount Avenue for Girard Estate,	4	43
Connect. 6-in. main	on Cumberland St. with 36-in. main on American,	6	12
" 6 "	" " " " Huntingdon St. with 36-in. main on American,	6	14
" 10 "	" " " " 6th St. with 30-in. main on Lehigh Avenue,	12	60
Pipe used for fire plug connections,		4	156
Total number of feet of new pipe,			<u>4,563</u>
Number of feet of new 4-inch pipe laid,		306	
" " " " " 6 " " "		3,320	
" " " " " 10 " " "		877	
" " " " " 12 " " "		60	
Total,			<u>4,563</u>

Relaid.

Street.	Location.	Size. Distance.	
		Inches.	Feet.
Edward, from Hancock to 2d (formerly 4-inch)		6	<u>432</u>
Pipe used for repairs,		4	139
" " " "		6	81
" " " "		8	4
" " " "		10	7
" " " "		36	4
			<hr/>
Total,			<u>235</u>

FOURTH DISTRICT.

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

Street.	Location.	Size. Distance.	
		Inches.	Feet.
Carlisle,	From Susquehanna to Dauphin,	6	560
Darien,	" Columbia " Montgomery,	6	567
15th,	" Susquehanna " Dauphin,	6	578
Ingersoll,	" 25th, West,	6	228
Park Ave.,	" Lehigh Ave., North,	6	250
Somerville,	" 11th to Warnock,	6	201
26th,	" Cumberland " Huntingdon,	6	556
31st,	" S. side of Jefferson St. North,	6	127
32d,	" Thompson to Master,	10	433
Dead end connected	Cumberland, from 26th, West,	6	30
" " "	Cambria, " W. S. Broad, East,	6	58
" " "	Carlton, " 11th, West,	4	31
" " "	Montgomery, across Ridge Ave., (two)	6	116
" " "	Virginia, from 23d, West,	6	12
" " "	Warnock, " Somerville, North,	6	23
Fire connection	Biddle, E. of 25th, (Star Braid Works)	4	20
" "	Buttonwood, E. of Broad, (Hoopes & Townsend),	6	26
" "	N. W. cor. 31st and Jefferson, (Poth's Brewery)	4	27
" "	N. E. cor. 31st and Jefferson, (Miller's Brewery)	4	33
" "	32d, below Master, (Bergner & Engle Brewery)	6	26
			<hr/>
Amount carried forward,			3,907

Street.	Location.	Size. Inches.	Distance. Feet.
Amount brought forward,			3,907
Connection to Fountain in Park, Ridge Avenue, N. of			
	Dauphin,	6	444
"	No. 6, Spring Garden main to Belmont main,	30	154
	Relief valve on No 6 main, Spring Garden Works,	8	12
	Overflow at Belmont Reservoir,	36	116
	Pipe used for fire plug connections,	6	103
"	" " " " " "	4	39
Total number of feet of new pipe,			<u>4,775</u>

Number of feet of new 4-inch pipe laid,	155
" " " " " 6 " " "	3,905
" " " " " 8 " " "	12
" " " " " 10 " " "	433
" " " " " 30 " " "	154
" " " " " 36 " " "	116
Total,	<u>4,775</u>

Relaid.

Street.	Location.	Size. Inches.	Distance. Feet.
Heath from 13th to Ontario,	(formerly 4-inch)	6	372
Fire connection 20th av. Willow	" "	6	16
Pipe used for fire plug connections,		6	17
Total feet of pipe relaid,			<u>405</u>

Lowered.

York between 22d and 23d,	6	300
<i>Intersections connected, Barton Stop used.</i>		
13th and Wallace,	6	13
Pipe used for repairs,	4	26
" " " "	6	70
" " " "	20	2
" " " "	36	10
Total,		<u>108</u>

GERMANTOWN DISTRICT.

Iron pipes laid in the Twenty-second, Twenty-fifth and Twenty-eighth Wards.

Street.	Location.	Size.	Distance.
		Inches.	Feet.
Church,	From Germantown Ave. to Chew,	6	1,745
Hancock,	" Centre " High,	6	781
Jefferson,	" Wakefield " Mercer,	6	1,000
Meehan Ave.,	" Germantown Ave. " Musgrove,	6	538
Mt. Airy,	" " " N. E.,	6	792
Stenton,	" Chew to Costello,	6	765
Pipe used for fire plug connections,		4	247

Total number of feet of new pipe, 5,868

=1 mile 558 feet.

Number of feet of new 4-inch pipe laid,	247
" " " " " 6 " " "	5,621

Total, 5,868—1 M—588 ft.

Lowered.

Allen Lane, S. W. of Germantown Ave.,	10	<u>225</u>
Pipe used for repairs,	4	12
" " " " " " " "	10	2
" " " " " " " "	16	8
Total,		<u>22</u>

MANAYUNK DISTRICT.

Iron pipes laid in the Twenty-first and Twenty-eighth Wards.

Street.	Location.	Size.	Distance.
		Inches.	Feet.
Fairview,	From 35th to Norristown R. R.	6	576
Ripka,	" Washington, " Winchester,	6	426
River Rd,	" S. S. Shawmont Ave., North,	4	420
From 4-inch pipe supplying Engineer's houses at Shawmont to River Rd. and Shawmont Ave.,		4	306
Amount carried forward,			<u>1,728</u>

Street.	Location.	Size. Inches.	Distance. Feet.
Amount brought forward,			1,728
Sunnyside, from 35th, S. W.,		6	206
Dead end connected Winchester from Ripka, N. W.,		4	25
Fire connection Main St. S. E. of Shur's Lane, (Richard Hey),		4	17
" " Shur's La. E. of Ashland, (Leech & Bro.)		4	15
Pipe used for fire plug connections,		4	51
Total number of feet of new pipe,			<u>2,042</u>
Number of feet of new 4-inch pipe laid,		834	
" " " " " 6 " " "		1,208	
			<u>2,042</u>

Lowered.

Leibert, from Cotton to Mechanic,		6	100
Levering between Tower and Fleming,		6	520
Jefferson, East of Fowler,		6	225
Total,			<u>845</u>
Pipe used for repairs,		4	9
" " " "		6	12
Total,			<u>21</u>

Recapitulation of pipe laid in the several districts during the year 1880.

Districts and Wards.	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	30-inch.	36-inch.	Totals.
First District, 1, 2, 3, 4, 26 and 30.....	208	2,823							3,031
Second district, 5, 6, 7, 8, 9, 10, 24 and 27.....	82	2,123			577	24			2,806
Third district, 11, 12, 16, 17, 18, 19, 23, 31 and part of 25.....	306	3,320		877	60				4,563
Fourth district, 13, 14, 15, 20, 29 and part of 28.....	155	8,905	12	433			154	116	4,775
Germantown, 22 and part of 25 and 28.....	247	5,621							5,868
Manayunk, 21 and part of 28.....	834	1,208							2,042
Totals.....	1,832	19,000	12	1,310	637	24	154	116	23,085

	Feet.	Miles.	Feet.
Pipe as per last report.....	3,855,571	= 730	1,171
Pipe laid during 1880.....	23,085	= 4	1,965
Total.....	3,878,656	= 734	3,136
As per corrected table, including 1880.....	3,938,997	= 746	117

Recapitulation of pipe used for repairs, relays, etc., in the several districts during the year 1880. .

	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.	16-in.	20-in.	36-in.	Total.
Pipe used for repairs.....	42	426	255	10	13	5	14	20	14	761
Pipe relaid.....		20	3,101		450					3,571
Pipe used for connections at intersections.....			264							264
Pipe lowered.....			1,145		235					1,370
Totals.....	42	446	4,765	10	688	5	14	2	14	5,986

Purposes for which pipes were laid during the year 1880.

	4 inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	30-inch.	36-inch.	Totals.
On street for supply.....	420	18,079	.....	433	577	.....	.....	.....	19,509
Connections to close dead ends.....	105	279	.....	.....	.....	.....	.....	.....	384
Connections for fire plugs.....	687	120	.....	.....	.....	.....	.....	.....	807
Connections for fire purposes.....	224	52	.....	.....	.....	.....	.....	.....	276
Connections for motors.....	47	.....	.....	.....	.....	.....	.....	.....	47
Connections for Girard Estate.....	43	.....	.....	.....	.....	.....	.....	.....	43
Connection for fountain in Park.....	.....	444	.....	.....	.....	.....	.....	.....	444
Connections at Works and overflow into reservoir.....	.....	.....	12	.....	.....	.....	154	116	282
Connections to supply mains.....	306	26	.....	.....	60	24	.....	.....	416
Duplicate supply main.....	.....	.....	.....	877	.....	.....	.....	.....	877
Totals.....	1,832	19,000	12	1,310	637	24	154	116	23,085

Statement of the number of fire-plugs in the city by districts and by wards during 1880.

	First District.						Second District.					Third District.				Fourth District.			Germantown.		Manayunk.		Total.			
	Wards.					Total.	Wards.				Total.	Wards.			Total.	Wards.	Total.	Wards.	Total.							
	1	2	4	26	30		5	7	24	27		19	23	25						31	20	28		29	22	21	28
Prior to 1880.....						1,007					1,524					1,652				1,028		365		243	5 819	
During 1880.....	5	1	2	6	3	17	1	1	2	1	5	2	1	7	3	13	1	5	3	9	21	21	2	3	5	70
Totals.....						1,024					1,529					1,665				1,037		386		248	5,889	
Taken out 1880.....											2					3									1	6
Totals in city.....						1,024					1,527					1,662				1,037		386		247	5,883	

Number of attachments for fire purposes previously reported	188
Made during 1880—First District.....	2
Made during 1880—Third District.....	3
Made during 1880—Fourth District.....	5
Made during 1880—Manayunk District.....	2 — 12
Total.....	<u>200</u>

*Number of holes drilled for making new attachments to public mains
during the year 1880.*

MONTHS.	$\frac{1}{2}$ -in. diameter.	$\frac{3}{8}$ -in. diameter.	$\frac{3}{4}$ -in. diameter.	1-in. diameter.	Totals.	Shut-off.
January	50	5	.....	5	60	32
February	86	.....	1	2	89	19
March	253	9	5	6	273	43
April	256	15	2	3	276	57
May	236	16	7	15	274	59
June	249	10	2	7	268	43
July	247	12	11	5	275	35
August	218	13	6	6	243	46
September	362	10	2	9	383	66
October	318	9	2	9	338	44
November	354	18	8	14	394	80
December	58	1	3	8	70	25
Totals	2,687	118	49	89	2,943	549

Table of attachments in Wards and Districts.

WARDS.	$\frac{1}{2}$ -in. diameter.	$\frac{3}{8}$ -in. diameter.	$\frac{3}{4}$ -in. diameter.	1-in. diameter.	Totals.	Shut-off.
First District, 1, 2, 3, 4, 26, and 30.....	458	4	2	9	473	76
Second District, 5, 6, 7, 8, 9, 10, 24, and 27.....	403	74	21	30	528	131
Third District, 11, 12, 16, 17, 18, 19, 23, 31, and part of 25.....	748	13	14	28	803	147
Fourth District, 13, 14, 15, 20, 29, and part of 28..	713	22	6	18	759	169
Germantown, 22, and part of 25 and 28.....	206	5	6	4	221	21
Manayunk, 21, and part of 28.....	159	.....	.....	.....	159	5
Totals	2,687	118	49	89	2,943	549

Repairs to plugs, stops, and mains, and plugs and stops taken out during 1880.

DISTRICTS.	PLUGS.		STOPS.		Repairs to mains.
	Repairs	Taken out.	Repairs.	Taken out.	
First.....	307	.....	229	.....	55
Second.....	362	2	380	6	23
Third.....	268	3	283	.....	83
Fourth.....	486	.....	324	.....	87
Germantown.....	47	.....	4	.....	8
Manayunk.....	82	1	27	.....	20
Totals.....	1,552	6	1,247	6	276

Account of new stops and fire-plugs for 1880.

DISTRICTS.	STOPS.			PLUGS.
	Two-way.	Barton, four-way.	Total.	
First.....	12	.....	12	17
Second.....	14	27	41	5
Third.....	40	.....	40	13
Fourth.....	17	5	22	9
Germantown.....	13	.....	13	21
Manayunk.....	10	.....	10	5
Totals.....	106	32	138	70

Number of valves raised in the different districts during the year 1880.

DISTRICTS.	3-inch.	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.	36-inch.	Totals.
	Second.....	7	1	8	
Third.....	9	11	.....	.....	.....	.....	.....	.....	.....	.....	22
Fourth.....	13	28	.....	6	1	.....	.....	1	.....	.....	49
Total for 1880.....	7	23	47	8	1	.....	.....	1	.....	.....	87
" 1879.....	9	16	60	1	3	2	.....	.....	1	1	93
" 1878.....	27	22	100	3	1	.....	.....	1	1	.....	155
" 1877.....	12	6	50	.....	1	.....	.....	1	.....	.....	70
" 1876.....	3	17	49	.....	3	.....	.....	1	.....	.....	73
" 1875.....	17	56	120	4	12	2	4	1	2	.....	217
" 1874.....	13	32	111	6	6	3	3	.....	.....	.....	174
Total for seven years.....	88	171	537	11	36	9	7	4	5	1	869

Account of service pipes laid during 1880, and the receipts therefor.

	Pipe laid.		Frontage.		Frontage.		Amount		Amount	
	Feet.	Ins.	Feet.	Ins.	Dollars.	Cts.	to be paid.		for.	
							Dollars. Cts.		Dollars. Cts.	
Total feet of pipe laid.....	23,085	00								
Intersections, connections, etc., not chargeable with frontage.....	5,948	00 ³ / ₄								
Balance.....	17,136.	11 ¹ / ₄								
Single fronts, charged at \$1.00 per foot.....				222	00	\$231	38			
Double fronts, charged at \$2.00 per foot.....				16,914.	11 ¹ / ₄	33,829	87			
Amount of frontage in feet.....				17,136.	11 ¹ / ₄					
Amount of frontage in Dollars.....						34,061	25			
Corner allowances deducted.....						2,300	87			
Net amount of frontage to be collected,.....								\$31,760	36	
Amount received by Registrar in 1874.....										\$66
“ “ “ “ 1875.....										18
“ “ “ “ 1876.....										254
“ “ “ “ 1877.....										50
“ “ “ “ 1878.....										46
“ “ “ “ 1879.....										49
“ “ “ “ 1880.....										14
Amount sent to lien during 1880.....										16,585
Amount remaining on books.....										24
Total amount.....										7,722
Overpaid.....										23
Amount.....										7,026
										47
										31,781
										44
										21
										08
										31,760
										36

.....	7121
.....	7122
.....	6241
.....	7123
.....	7124
.....	7125
.....	7126
.....	7127
.....	7128
.....	7129
.....	7130
.....	7131
.....	7132
.....	7133
.....	7134
.....	7135
.....	7136
.....	7137
.....	7138
.....	7139
.....	7140
.....	7141
.....	7142
.....	7143
.....	7144
.....	7145
.....	7146
.....	7147
.....	7148
.....	7149
.....	7150
.....	7151
.....	7152
.....	7153
.....	7154
.....	7155
.....	7156
.....	7157
.....	7158
.....	7159
.....	7160
.....	7161
.....	7162
.....	7163
.....	7164
.....	7165
.....	7166
.....	7167
.....	7168
.....	7169
.....	7170
.....	7171
.....	7172
.....	7173
.....	7174
.....	7175
.....	7176
.....	7177
.....	7178
.....	7179
.....	7180
.....	7181
.....	7182
.....	7183
.....	7184
.....	7185
.....	7186
.....	7187
.....	7188
.....	7189
.....	7190
.....	7191
.....	7192
.....	7193
.....	7194
.....	7195
.....	7196
.....	7197
.....	7198
.....	7199
.....	7200

MISCELLANEOUS TABLES

TABLE A.

Rain-fall at Philadelphia, from Pennsylvania Hospital Reports.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.	Reading, Pa.	Lebanon, Pa.
1810.....													32.66		
1811.....													34.97		
1812.....													39.30		
1813.....													35.63		
1814.....													43.14		
1815.....													34.67		
1816.....													27.95		
1817.....													36.01		
1818.....													30.13		
1819.....													23.35		
1820.....													39.61		
1821.....													32.18		
1822.....													29.86		
1823.....													41.85		
1824.....													38.74		
1825.....	0.84	3.26	4.63	.83	1.72	3.59	2.06	3.70	2.61	1.25	1.36	3.72	29.67		
1826.....	1.11	2.13	5.80	3.87	.19	4.656	3.68	2.75	2.00	5.83	1.85	1.28	36.145		
1827.....	2.86	3.55	1.23	2.83	2.50	2.09	2.97	5.75	.79	5.91	4.76	3.26	38.50		
1828.....	2.06	2.75	3.36	3.82	3.49	2.69	5.33	1.51	4.62	1.39	6.71	.26	37.97		
1829.....	5.37	3.76	2.87	4.99	2.68	3.44	4.35	4.61	2.01	2.30	3.97	1.51	41.85		44.22
1830.....	1.63	2.06	4.115	1.815	3.75	5.99	4.07	3.87	2.93	4.31	5.35	1.58	45.07		43.83
1831.....	6.22	2.44	3.97	5.20	1.07	3.56	4.17	5.39	5.33	4.51	1.88	1.20	44.94		41.47
1832.....	4.58	2.66	1.90	2.98	5.40	1.55	2.62	5.69	1.40	3.41	2.59	5.09	39.87		37.31
1833.....	3.97	1.24	2.22	.70	5.88	5.28	4.16	3.39	3.82	10.06	2.18	5.67	48.55		44.78
1834.....	2.49	2.22	2.02	2.83	3.52	3.99	4.36	.62	3.57	3.29	3.01	2.33	34.24		34.49
1835.....	2.75	1.81	3.83	4.33	1.99	6.27	6.55	2.05	2.63	1.22	3.19	2.68	39.30		37.62
1836.....	7.62	2.99	1.75	3.47	2.28	7.31	2.91	1.97	1.82	3.59	3.34	3.61	42.06		39.82
1837.....	2.50	3.58	3.76	2.83	4.86	2.83	5.89	4.06	2.28	.66	3.23	2.56	39.04		36.97
1838.....	2.20	2.19	3.171	3.586	3.577	6.600	2.376	2.780	9.519	4.896	3.350	1.044	45.23		35.65
1839.....	5.037	3.424	1.504	1.507	6.073	3.922	2.516	4.644	2.919	2.831	3.160	6.262	43.78		37.73
1840.....	1.841	3.009	2.626	6.827	2.688	5.948	4.538	5.554	2.602	5.734	2.486	3.647	47.40		30.86
1841.....	7.837	1.387	5.821	6.456	3.269	3.114	3.280	9.102	1.895	1.198	4.224	5.917	55.500		38.87
1842.....	1.458	4.265	2.835	5.307	5.865	3.192	11.805	3.786	1.269	1.712	3.487	3.657	48.53		39.84
1843.....	1.340	2.640	4.415	4.723	2.045	1.686	4.543	9.255	4.856	3.220	4.148	4.041	46.912		44.12
1844.....	4.052	1.449	4.430	1.354	3.091	3.351	5.284	2.399	4.034	5.025	2.951	2.753	40.173		32.19
1845.....	3.760	4.738	2.415	2.580	1.599	3.725	2.763	7.298	2.155	2.529	2.500	3.959	40.021		33.28
1846.....	4.680	3.330	4.598	2.112	3.444	3.300	4.604	4.272	2.249	2.444	4.970	3.347	44.390		46.61
1847.....	4.730	4.569	4.700	.585	1.567	3.305	2.765	3.182	8.070	3.000	2.836	5.785	45.094		50.60
1848.....	2.030	1.443	2.756	1.541	4.902	4.433	3.281	1.714	1.805	3.747	2.343	5.007	35.002		33.42
1849.....	.730	2.610	5.470	1.752	3.995	2.195	2.933	6.975	1.404	5.595	2.600	5.836	42.095		35.16
1850.....	4.770	2.870	4.750	2.665	6.500	2.030	5.970	8.329	7.732	1.092	3.320	4.515	54.543		64.17
1851.....	1.230	3.110	3.475	4.565	4.817	3.438	2.524	2.555	1.130	3.025	3.356	2.275	35.500		35.50
1852.....	2.011	2.710	4.270	6.445	3.034	4.030	4.060	4.400	1.293	2.267	6.055	5.174	45.749		43.90
1853.....	1.845	4.440	2.462	3.835	5.173	1.100	6.296	3.088	4.463	3.470	2.320	2.165	40.657		43.11
1854.....	2.331	4.203	1.615	7.750	6.935	2.390	3.024	.842	3.798	1.545	2.834	2.910	40.180		37.58
1855.....	2.337	2.352	1.684	2.050	2.965	7.949	6.400	2.786	4.000	4.111	2.077	5.425	44.096		53.63
1856.....	4.537	1.237	2.232	3.515	2.595	1.986	1.508	6.000	4.014	1.296	2.030	2.937	33.927		32.55
1857.....	3.532	.790	1.831	6.786	5.547	7.500	3.915	7.590	1.105	2.690	1.450	5.550	48.286		52.61
1858.....	2.595	2.285	1.087	4.640	5.015	4.495	1.345	4.941	1.492	1.842	5.615	4.500	39.852		43.28
1859.....	6.675	3.660	6.985	5.610	2.250	6.013	4.071	4.736	7.681	3.132	3.820	3.490	58.123		53.70
1860.....	3.225	2.755	1.415	3.800	3.817	2.885	.985	8.401	2.850	4.590	6.130	3.310	44.093		51.60
1861.....	5.245	2.065	3.925	3.705	6.640	3.880	2.560	3.137	4.402	3.797	4.875	2.092	46.440		45.02
1862.....	4.750	4.640	3.553	4.160	2.308	6.975	2.465	.925	3.980	4.770	4.790	1.650	45.011		38.64
1863.....	4.720	4.680	5.885	7.015	4.510	4.250	6.009	1.447	.875	2.465	2.700	4.633	49.189		56.74
1864.....	1.705	.551	5.170	3.795	6.685	2.345	3.770	1.920	7.165	1.820	3.930	5.145	46.001		38.43
1865.....	3.610	5.825	4.710	2.830	7.210	4.750	2.970	3.770	7.960	3.050	3.960	5.610	56.255		46.52
1866.....	3.145	6.615	2.150	2.930	4.680	2.960	2.520	2.181	8.705	4.145	1.760	3.465	45.256		39.46
1867.....	1.762	3.892	5.465	1.810	7.320	11.025	2.387	15.816	1.720	4.320	2.940	2.730	61.187		48.47
1868.....	3.620	2.520	3.360	5.440	7.005	4.370	3.514	2.056	8.908	1.737	5.280	3.595	51.405		37.30
1869.....	4.280	4.760	3.305	2.120	4.235	5.585	2.885	1.280	3.250	6.320	3.725	5.115	48.860		43.40
1870.....	4.075	2.532	4.060	5.605	6.280	2.895	3.947	5.115	1.710	3.895	2.102	1.889	44.105	50.45	40.98
1871.....	3.466	3.086	5.814	1.829	3.383	3.773	6.811	5.971	1.772	4.863	4.203	2.259	47.320	46.27	41.49
1872.....	1.267	1.185	3.377	2.497	2.808	4.223	11.215	8.319	3.820	5.363	3.381	3.662	51.117	41.24	37.00
1873.....	6.048	5.607	2.242	4.191	4.783	.887	5.553	12.289	4.045	5.869	4.995	1.757	58.286	58.49	54.57
1874.....	4.218	2.823	1.995	7.509	2.697	2.664	2.759	6.531	3.987	1.650	2.229	2.249	40.911	36.71	35.06
1875.....	2.360	3.284	3.925	1.360	1.575	5.258	4.174	6.584	3.035	1.827	5.544	2.918	41.844		42.15
1876.....	2.023	3.680	5.605	1.999	5.189	2.209	6.223	1.215	7.776	1.210	9.025	3.169	49.323		41.82
1877.....	2.893	1.550	5.097	2.962	1.215	5.512	6.196	1.007	3.882	6.963	6.507	1.363	45.147		43.25
1878.....	4.566	2.172	3.641	2.541	4.329	4.750	5.313	4.803	1.418	2.391	2.891	4.873	43.718	37.23	36.46
1879.....	2.814	1.750	2.505	6.687	1.315	7.858	4.575	8.435	1.297	447	1.615	6.351	44.649	32.22	34.54
1880.....	2.171	2.875	4.799	2.935	0.578	1.991	9.461	5.494	1.683	1.242	1.957	4.492	39.678	31.46	37.24

Height of gauge at Hospital, 50 feet above the level of the sea.
The observations from 1810 to 1824, inclusive, were taken at Spring Mills, Penna.

TABLE B.

Average daily height of water above the comb of the old dam, and the average daily overflow over the flash boards.

DAYS OF MONTH.	HEIGHT ABOVE THE LEGAL COMB OF DAM.												OVERFLOW OVER FLASH BOARDS.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	26	28	25	27	31	18	12	12	13	11	16	16	4	6	3	5	9	4	-10	-10	-9	-11	-6	-6
2	27	28	24	26	28	23	14	16	12	14	14	16	5	6	3	4	6	6	-11	-10	-10	-8	-6	-6
3	26	26	24	25	27	23	14	14	13	10	16	16	4	4	3	5	5	5	-11	-10	-9	-12	-6	-6
4	25	22	24	26	26	23	8	14	13	14	18	14	0	0	2	4	4	4	-11	-11	-9	-8	-6	-6
5	26	24	24	31	24	21	18	16	11	15	20	20	5	5	9	9	9	9	-11	-11	-7	-7	-6	-6
6	27	25	25	30	24	17	50	20	15	14	16	29	5	5	3	3	3	3	-11	-11	-6	-6	-6	-6
7	33	24	24	23	23	18	26	16	14	14	25	28	11	2	2	6	1	1	-11	-11	-6	-6	3	6
8	31	23	26	26	24	17	21	15	13	15	23	14	9	1	4	4	2	5	-11	-11	-7	-7	1	6
9	30	23	27	26	23	17	17	16	15	14	22	21	3	1	5	4	1	5	-11	-11	-7	-8	0	1
10	29	23	26	27	23	17	16	14	12	12	20	20	2	1	4	5	1	5	-11	-11	-10	-10	-2	-2
11	27	22	26	26	23	17	15	16	14	14	20	14	0	0	4	4	1	5	-11	-11	-8	-8	-2	-2
12	27	23	26	24	22	18	18	20	20	15	27	15	5	5	1	4	2	0	-11	-11	-7	-7	5	7
13	27	27	25	24	21	19	16	14	18	15	27	15	5	5	15	3	2	-1	-11	-11	-4	-4	5	7
14	26	23	25	23	19	21	16	15	17	14	26	19	4	2	3	1	-3	-1	-11	-11	-5	-8	4	-3
15	25	22	26	23	16	18	14	14	15	15	23	19	3	20	4	1	-6	-4	-11	-11	-7	-7	1	-3
16	24	24	23	22	19	17	22	15	15	15	23	21	2	12	13	0	-3	-5	-11	-11	-7	-7	1	-1
17	24	33	37	23	17	17	17	13	15	12	21	19	2	11	15	1	-5	-5	-11	-11	-9	-10	-1	-3
18	24	30	33	25	16	21	15	14	15	14	21	18	2	8	11	3	-6	-1	-11	-11	-7	-6	-1	-4
19	26	29	31	24	20	19	17	14	13	15	19	16	4	7	9	2	-2	-3	-11	-11	-9	-7	-3	-6
20	26	29	34	24	17	17	14	11	14	14	16	22	4	7	12	2	-5	-5	-11	-11	-8	-8	-6	0
21	24	27	32	25	19	17	34	14	16	16	16	17	2	5	10	3	-3	-5	-12	-12	-8	-6	-6	-5
22	25	27	33	24	17	16	28	11	13	16	18	19	3	5	7	2	-5	-6	-11	-11	-9	-6	-4	-3
23	31	27	27	23	17	16	28	13	13	16	14	12	9	5	5	1	-5	-6	-11	-11	-9	-6	-8	-10
24	28	26	27	23	20	16	24	14	13	11	13	13	6	4	5	1	-2	-6	-11	-11	-9	-6	-9	-11
25	27	26	27	23	18	16	20	13	11	13	14	13	5	4	5	1	-4	-6	-11	-11	-9	-11	-9	-8
26	26	26	26	23	17	15	18	13	10	17	16	17	4	4	4	1	-5	-7	-11	-11	-9	-12	-5	-6
27	26	26	26	23	17	15	17	12	12	15	15	13	4	4	4	1	-5	-7	-11	-11	-10	-7	-7	-9
28	34	25	35	23	16	17	20	11	12	16	13	13	12	3	13	1	-6	-5	-11	-11	-10	-6	-9	-9
29	33	25	33	22	15	15	15	11	12	16	16	11	11	3	11	0	-7	-7	-11	-11	-10	-6	-6	-11
30	31	29	29	25	16	14	15	16	12	16	16	12	9	7	7	3	-6	-8	-11	-11	-10	-6	-6	-10
31	29	27	20	20	14	13	12	9	7	7	7	9	7	5	5	-2	-2	-8	-9	-10	-10	-10	-13	-13

This table represents the height of the water above the comb of the Old Fairmount Dam or the legal comb, and the water wasted over the flash board on the new dam, which is now twenty-two inches above the old comb.

TABLE C.

Showing the number of days in each month of 1880 when the inches of water wasted over the Flash Boards of Fairmount Dam were the same.

Inches.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1.....	4			9	4	3					3		23
2.....	4	2	5	5	3		1						20
3.....	3	3	4	4							1		15
4.....	8	5	7	5	1		1				1		28
5.....	6	3	5	2	1						2		19
6.....	2	2		1	1		2					1	9
7.....	1	2	2									1	6
8.....	1	1		1									3
9.....	3		1	1	1								6
10.....			1										1
11.....	2	1	2										5
12.....	1	1	1				1						4
13.....			2										2
15.....	1	1											2
20.....		1											1
21.....		1											1
28.....							1						1

TABLE D.
Population of Philadelphia by Wards.

Wards.	1860.	1870.	1876.	1880.
First.....	30,886	25,817	38,794	43,069
Second.....	29,123	30,220	28,242	28,527
Third.....	19,929	19,149	20,255	18,279
Fourth.....	23,461	20,852	20,545	18,864
Fifth.....	24,792	18,736	18,972	16,368
Sixth.....	14,882	12,064	12,070	10,006
Seventh.....	31,267	31,558	33,067	31,310
Eighth.....	27,770	22,286	23,868	19,558
Ninth.....	17,196	16,629	15,915	12,439
Tenth.....	21,849	23,312	24,786	23,367
Eleventh.....	16,681	14,845	14,345	12,942
Twelfth.....	16,681	15,171	15,394	14,694
Thirteenth.....	20,045	19,956	20,027	18,690
Fourteenth.....	24,258	22,643	23,385	22,369
Fifteenth.....	32,091	44,650	48,472	47,373
Sixteenth.....	20,067	19,256	18,903	17,802
Seventeenth.....	23,264	21,347	21,279	20,452
Eighteenth.....	20,441	26,366	28,286	29,364
Nineteenth.....	38,828	45,240	40,604	43,894
Twentieth.....	29,963	56,642	41,854	43,228
Twenty-first.....	17,159	13,861	18,097	19,667
Twenty-second.....	17,173	22,605	28,482	31,888
Twenty-third.....	23,985	20,888	25,299	26,675
Twenty-fourth.....	23,738	24,932	41,310	46,058
Twenty-fifth.....		18,639	28,648	36,059
Twenty-sixth.....		36,003	27,905	35,145
Twenty-seventh.....		19,385	22,457	23,232
Twenty-eighth.....		10,370	24,381	34,441
Twenty-ninth.....			33,974	40,805
Thirtieth.....			28,937	29,095
Thirty-first.....			28,895	31,327
Totals.....	565,529	674,022	817,448	847,542

Twenty-fifth Ward was formed from the Twenty-third and Nineteenth.

Twenty-sixth	"	"	First.
Twenty-seventh	"	"	Twenty-fourth.
Twenty-eighth	"	"	Twenty-first.
Twenty-ninth	"	"	Twentieth.
Thirtieth	"	"	Twenty-sixth.
Thirty-first	"	"	Nineteenth.

TABLE E.

Statement of material on hand in the several Purveyors' Districts, Jan. 1, 1881.

	DIAMETER IN INCHES.													
	3	4	6	8	10	12	16	18	20	28	24	30	36	48
Bands.....	9	2	16	5	3	4	14	.....	12	.....	2	6	21	68
Bevel Hubs.....	13	142	9	11	3	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bonnets.....	16	19	12	.....	.....	1	1	4	.....	.....	7	2	2	.....
Pipes.....	13	430	1740	990	275	193	40	3	62	.....	3	84	35	216
Pipes, curved.....	11	7	.....	.....	.....	6	6	.....	15	.....	.....	22	12	1
Pipes, O. G.....	50	168	41	44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Saddles.....	25	81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sleeves, whole.....	23	64	236	156	104	123	21	16	16	.....	.....	20	9	3
Sleeves, half.....	.....	43	48	45	45	.....	.....	.....	.....	.....	.....	1	1	.....
Stops.....	.....	71	.....	19	1	12	.....	.....	7	1	.....	4	8	.....
Quarter Turns.....	.....	52	42	23	25	19	8	.....	1	.....	.....	.....	.....	.....
Plugs for Bells.....	3	42	8	1	3	.....	.....	.....	.....	.....	.....	.....	.....	.....

Fire Plugs.		Goosenecks.		Meter.	Lead.	Clay.	Gasket.	
	Old.	New—4 in.	New—6 in.	6 in.				
Steam.....	36	51	132	118	1	14,440 lbs.	1,100 lbs.	144 lbs.
Hill's.....	82	.....	.....	.....	.....	.....	.....	.....

	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{1}{10}$
Branches, Single.....	.....	7	.....	91	84	63	18	25	34	48
Branches, Double.....	.....	49	.....	103	195	11	60	51	10	55
Breeches Pipes.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Reducers.....	20	.....	5	32	.....	5	18	.....	8	40

	$\frac{8}{10}$	$\frac{10}{10}$	$\frac{1}{12}$	$\frac{6}{12}$	$\frac{8}{12}$	$\frac{10}{12}$	$\frac{12}{12}$	$\frac{1}{16}$	$\frac{6}{16}$	$\frac{12}{16}$
Branches, Single.....	6	15	68	29	10	10	11	7	.....	.....
Branches, Double.....	16	32	10	47	24	33	51	.....	2	.....
Breeches Pipes.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Reducers.....	27	.....	.....	14	10	3	.....	.....	.....	3

	$\frac{16}{16}$	$\frac{6}{16}$	$\frac{18}{16}$	$\frac{4}{20}$	$\frac{6}{20}$	$\frac{8}{20}$	$\frac{12}{20}$	$\frac{16}{20}$	$\frac{18}{20}$	$\frac{20}{20}$
Branches, Single.....	1	.....	1	2	1	.....	2	.....	.....	.....
Branches, Double.....	1	2	.....	.....	9	1	2	.....	.....	3
Breeches Pipes.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
Reducers.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....

	$\frac{6}{30}$	$\frac{12}{30}$	$\frac{16}{30}$	$\frac{20}{30}$	$\frac{30}{30}$	$\frac{30}{30}$	$\frac{36}{30}$	$\frac{36}{30}$	$\frac{36}{30}$
Branches, Single.....	.....	.....	.....	.....	.....	4	.....	.....	.....
Branches, Double.....	3	3	1	1	3	1	.....	.....	.....
Breeches Pipes.....	.....	.....	.....	.....	.....	.....	.....	5	1
Reducers.....	.....	.....	.....	1	.....	.....	.....	.....	.....

TABLE F.

Monthly rain-fall at Lebanon, Pennsylvania, observed by S. B. Lehman, from 1829 to 1880, inclusive. Elevation, 495 feet above tide-water.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1829.....	5.09	2.60	2.24	3.40	4.34	3.79	0.78	3.87	2.62	3.62	3.31	2.56	44.22
1830.....	2.80	.65	5.57	2.63	5.49	5.13	1.42	2.23	3.03	3.74	5.99	4.65	43.33
1831.....	4.64	2.75	2.07	3.60	1.17	4.86	6.26	3.40	5.84	3.38	2.18	1.32	41.47
1832.....	4.42	4.96	1.80	1.54	4.76	1.85	1.36	4.18	2.68	3.22	2.30	4.24	37.31
1833.....	2.74	.56	1.66	.57	4.58	9.00	5.97	1.07	4.14	6.97	2.34	5.18	44.78
1834.....	3.37	2.04	1.86	2.19	3.98	5.78	3.98	.98	2.39	2.89	2.18	2.85	34.49
1835.....	2.26	1.50	3.80	5.45	2.03	4.17	3.78	3.79	3.98	1.85	3.71	1.30	37.62
1836.....	4.40	3.05	1.45	2.80	3.32	6.32	2.00	3.47	1.18	4.10	3.37	4.36	39.82
1837.....	1.90	1.78	4.94	2.25	4.32	4.33	4.41	3.52	3.88	2.16	1.31	2.17	36.97
1838.....	3.89	1.41	3.18	2.38	5.64	3.89	.40	2.71	3.20	3.62	4.20	1.13	35.65
1839.....	4.22	2.70	.59	3.78	4.40	3.71	5.67	2.98	3.99	1.14	2.27	3.30	37.73
1840.....	1.59	2.39	2.68	4.12	2.77	2.58	1.89	1.54	1.40	3.75	2.87	3.28	30.86
1841.....	4.39	.90	3.87	4.62	4.90	3.64	2.45	2.07	2.97	1.47	2.94	4.65	38.87
1842.....	1.23	2.53	2.00	5.13	3.93	3.95	6.47	3.58	2.00	2.77	3.38	2.82	39.94
1843.....	3.04	2.61	6.18	2.15	2.68	2.02	2.76	4.39	7.30	4.55	3.60	2.84	44.12
1844.....	4.15	2.15	3.55	1.43	4.60	2.55	2.15	1.71	2.56	3.40	1.80	2.14	32.19
1845.....	2.27	2.16	2.57	.76	2.49	5.22	.83	2.38	2.11	7.27	3.07	2.15	33.28
1846.....	2.38	3.50	3.78	2.40	9.38	4.67	3.19	3.20	2.23	3.58	5.10	3.20	46.61
1847.....	3.70	3.35	3.43	1.00	3.36	3.86	6.04	2.04	7.46	4.46	5.22	6.68	50.60
1848.....	2.61	1.62	2.88	.69	2.26	2.81	6.00	2.17	1.76	1.69	3.83	5.10	33.42
1849.....	1.61	1.88	4.98	1.37	4.56	3.96	.39	1.51	.71	6.81	2.38	5.00	35.16
1850.....	5.61	4.70	3.97	2.09	5.92	6.45	10.14	5.46	8.75	4.61	1.98	4.49	64.17
1851.....	1.09	4.42	3.25	5.67	4.36	3.30	1.85	2.50	1.36	1.50	4.05	2.15	35.50
1852.....	2.45	2.45	4.45	4.79	2.61	3.75	3.21	5.47	1.47	1.55	6.65	5.05	43.90
1853.....	1.55	4.65	1.62	4.25	5.53	.49	5.91	7.82	4.28	3.70	1.79	1.52	43.11
1854.....	3.08	5.05	2.11	4.43	3.76	4.62	2.92	.80	.92	2.04	5.47	2.38	37.58
1855.....	3.82	3.45	2.03	2.18	2.98	8.50	10.29	3.17	5.34	5.49	.93	5.45	53.63
1856.....	2.53	1.30	1.32	4.30	2.93	4.85	2.16	4.46	1.97	1.46	2.56	3.71	32.55
1857.....	3.07	1.40	1.72	5.19	9.80	10.05	4.94	4.91	2.52	1.58	2.65	4.78	52.61
1858.....	2.23	1.00	1.09	3.48	9.35	4.52	1.81	4.78	2.00	3.12	4.73	5.17	43.28
1859.....	3.80	3.48	5.92	5.25	3.37	4.85	4.90	2.43	10.20	3.19	2.42	3.89	53.70
1860.....	3.06	3.55	1.33	4.45	10.65	5.18	.93	7.63	2.44	4.51	4.95	2.92	51.60
1861.....	3.57	1.97	2.86	4.09	4.18	1.60	6.28	5.49	4.23	5.47	4.03	1.25	45.02
1862.....	5.31	1.86	3.45	3.86	2.17	9.22	3.23	1.62	1.10	3.34	2.62	.86	38.64
1863.....	4.86	3.17	5.25	4.45	3.68	4.54	11.43	.89	4.93	4.33	3.79	5.42	56.74
1864.....	2.08	.61	3.46	4.06	5.75	2.43	1.87	3.27	6.05	1.77	3.24	3.84	38.43
1865.....	3.92	1.84	6.65	2.81	5.61	4.95	4.61	1.70	5.38	3.20	2.35	3.50	46.52
1866.....	1.74	4.39	1.21	2.37	2.98	4.87	3.74	4.28	5.51	2.83	3.34	2.20	39.46
1867.....	2.00	4.41	4.16	2.48	7.06	3.93	2.86	12.91	2.41	1.57	.70	3.08	48.47
1868.....	2.82	1.81	1.76	4.30	5.15	4.12	3.06	1.48	4.81	2.13	3.49	2.37	37.90
1869.....	3.17	2.80	3.62	2.83	3.70	4.55	3.92	1.46	2.57	7.39	2.26	5.13	43.40
1870.....	3.52	3.75	3.04	4.24	4.24	4.70	3.61	4.17	3.27	2.59	1.71	2.10	40.98
1871.....	2.43	2.68	5.50	2.54	2.93	4.18	7.03	5.48	2.27	2.02	3.10	1.33	41.49
1872.....	.99	1.11	1.79	2.52	2.79	3.12	3.09	8.63	3.86	3.79	2.54	2.77	37.00
1873.....	3.69	3.22	3.05	4.24	4.01	2.67	7.82	9.43	3.42	7.79	3.28	1.95	54.57
1874.....	2.85	2.86	2.20	5.94	2.79	1.21	6.25	3.28	2.32	.52	2.42	2.42	35.06
1875.....	2.79	2.79	4.68	2.97	1.86	3.93	2.96	8.24	2.41	3.39	3.49	2.64	42.15
1876.....	1.70	3.21	5.31	2.13	3.06	4.22	4.56	1.59	8.63	2.38	2.77	2.23	41.82
1877.....	2.78	2.09	4.33	3.69	1.54	5.73	4.43	1.92	3.67	6.64	5.53	1.30	43.25
1878.....	3.47	2.76	3.61	3.62	5.12	3.60	1.24	1.99	.91	3.33	2.89	3.92	36.46
1879.....	2.17	2.21	2.30	2.54	2.76	3.90	3.39	4.26	2.93	1.49	1.77	4.82	34.54
1880.....	3.59	3.61	3.34	3.74	1.37	4.43	3.28	2.80	3.69	2.08	2.98	2.33	37.24

APPENDIX.

THE
Philadelphia Board of Trade,

MERCANTILE LIBRARY BUILDING,

Tenth Street, above Chestnut.

At a meeting of the Executive Council of the Board of Trade on the evening of February 16th, 1880, the following Resolution, offered by Mr. Allen, was referred to the Committee on Domestic Productions :—

“ *Resolved* :—That the inadequate supply of water in the business Wards of the City, and more especially in the Fifth and Sixth Wards, involves great danger to very valuable property, and “should be promptly remedied.”

The Committee, taking up the subject of this Resolution, found that it embraced so wide a field that it would be necessary to confine its inquiry to the main part of the Resolution, particularly the deficient supply of water furnished to the Fifth and Sixth Wards, and ascertain in what way a better supply could be furnished to this District.

To intelligently understand the subject, the Committee have, from time to time, called in the aid of the Chief Engineer of the Water Department, Wm. H. McFadden; his assistant engineer, Charles G. Darrach; Mr. John Hunter, of City Councils' Committee on Water Works; President Jacob Loudenslager, and Chief Engineer John R. Cantlin, of the Fire Department. These gentlemen have listened patiently to the many questions of your Committee, and have rendered valuable aid by their answers and suggestions.

There is probably in the Fifth and Sixth Wards, and in the few squares immediately West of the boundaries of these Wards, an amount of valuable real estate and merchandise property that will count in excess many millions of dollars more than in any other section of the City embracing the same number of acres. The Committee know that this section is not properly supplied with water—that great hazard impends from this deficiency, and that urgent necessity exists for immediate action by the City Councils to remedy this glaring evil.

The Committee do not find that the water supply to this District has been increased in the last seven years, but remains about the same as in 1873, when your Committee, of which Mr. Frederick Fraley was Chairman, reporting upon the condition of the Fire Department, examined into this same matter. The third Resolution of that Report asks for:—“Immediate and abundant appropriations for increasing the water supply of the City, and making its distribution more complete and full by additional and powerful steam pumps for raising it, and by conduit pipes of large capacity to be used either as reinforcing or supplying mains.” This Resolution is more needed to-day than when the Council adopted it in 1873, because of increased consumption.

In our examination we find that an Ordinance [June, 1877] exists which provides for the removal of small water pipes, and replacing them with pipes of larger capacity, at any time when a street is repaved. Nine thousand seven hundred and twenty-three feet have been laid as per above Ordinance.

The want of water in the Fifth and Sixth Wards could be improved by laying a sixteen-inch main from Juniper street to Second street, on Market street. There is now but two six-inch pipes passing through this street, a capacity for distribution entirely inadequate and a fact admitted by all familiar with the subject. The sixteen-inch main which has been suggested, would give ample distributing power, but we are here met with the question, how can this main be supplied with water? The belief was that the water could be supplied from attachments to be made from the thirty-inch main coming from Corinthian Reservoir, passing through Broad street, and attachments to be

made from the thirty-inch main from Fairmount Reservoir, passing through Arch street to Second street. While this could be done, we are assured it would take the supply from other Districts that are not now over abundantly supplied with water. This surmise has led the Committee to propound a series of questions to Dr. Wm. H. McFadden, Chief of the Water Department. The answers to these questions are pertinent to the subject, and we believe fully cover the whole matter embraced in the Resolutions referred to the Committee.

QUESTIONS AND ANSWERS.

Question.—Why is the water supply insufficient in certain portions of the old City, especially in the Fifth and Sixth Wards?

Answer.—The causes are three:—

FIRST.—During three or four months in the year there is not sufficient water in the river to drive turbines, nor sufficient steam machinery, engines and boilers, to supply more water than is now consumed.

SECOND.—There are 150,000 feet of pipes, four inches or less in diameter, which have been laid many years, and are more or less clogged with rust and mud, and these mains are not properly connected at the intersections of the streets.

THIRD.—The Fairmount basins, from which the supply is obtained, are too low to give a sufficient head for the increased draught upon these small mains.

Question.—Do you consider the two six-inch mains on Market street ample under any circumstances?

Answer.—I do not. There should be in addition a large main down the centre of the street, of say 16 inches diameter, which with proper connections would improve the *facilities* for

a better supply, which supply however must be maintained by increased pumping machinery.

Question.—What would such a main cost?

Answer.—I would estimate, including stop-valves and connections, five dollars per foot.

Question.—Will this main obviate the necessity of relaying the small pipes in the old city proper?

Answer.—It will not. If supplied from a higher elevation than Fairmount, and connected with the thirty-inch main on Arch street, it will give an adequate supply for Market street, and improve the supply from the small pipes *immediately adjacent*.

Question.—How could you increase the head or force of water in the District?

Answer.—By supplying it from the Corinthian Basin, which is twenty-six feet higher than the Fairmount Basins.

Question.—What will it cost to relay the small pipes?

Answer.—With the proper connections, three dollars and one-half per foot.

Question.—With what pipe would you relay those streets which now have pipes of one, two, three and four inches diameter?

Answer.—Upon these streets stores and warehouses have been built containing an immense amount of valuable property, for the protection of which I would recommend pipes twelve (12) inches diameter, costing three and one-half dollars per foot, including the proper valves and connections.

Question.—How do you propose to supply the water for the increased consumption which would be induced by these facilities for an adequate supply?

Answer.—By additional steam pumping machinery.

Question.—Will not the East Park Reservoir answer the purpose better and at a less cost?

Answer.—It will not. To make the East Park Reservoir available as a storage for but 11,000,000 gallons per day for two weeks, \$523,000 would be required.

Question.—Do you then consider the East Park Reservoir of no value?

Answer.—It could be made of great value as a subsiding basin for the low service distribution, and would be in the nature of a luxury.

Question.—From what source can the money be obtained to furnish these requirements?

Answer.—FIRST.—Councils have been asked to authorize the Department to lay certain pipes North of Callowhill street, which will give the *facilities* for a better supply on Broad street, and Spring Garden street, as well as one of the pipes which must be laid before the old city proper can be properly supplied from the Corinthian Basin. The money for this work to be taken from the annual appropriation of 1880.

SECOND.—There is now lying in the City Treasury \$170,000, being the consolidated balances of loans created for the “Extension of the Water Works,” but which, for want of specific appropriation, cannot be used. This money would provide sufficient boilers at Spring Garden and Belmont Works, to run all the engines, and provide in case of accident a duplicate engine and engine house, foundations, pipe and inlet complete, increasing the available pumping capacity 10,000,000 gallons per day, and providing a reserve of 10,000,000 gallons.

THIRD.—The Water Department returns annually \$1,400,000, besides supplying all water for municipal uses (including fire) free, and many other gratuities.

If \$600,000 of the income of the Department were set aside as interest on the plant, and \$400,000 be appropriated annually for the maintenance of the Department, there would remain \$400,000 that could be annually expended in laying larger pipes, providing large mains as feeders, machinery as power, and basins for subsidence.

Question.—Is not the amount asked for extensions excessive?

Answer.—For the immediate present it is not. The Department has been run for the past few years upon such a close

THE
Philadelphia Board of Trade,

MERCANTILE LIBRARY BUILDING,

Tenth Street, above Chestnut.

At a meeting of the Executive Council of the Board of Trade on the evening of February 16th, 1880, the following Resolution, offered by Mr. Allen, was referred to the Committee on Domestic Productions:—

*Resolved:—*That the inadequate supply of water in the business Wards of the City, and more especially in the Fifth and Sixth Wards, involves great danger to very valuable property, and “should be promptly remedied.”

The Committee, taking up the subject of this Resolution, found that it embraced so wide a field that it would be necessary to confine its inquiry to the main part of the Resolution, particularly the deficient supply of water furnished to the Fifth and Sixth Wards, and ascertain in what way a better supply could be furnished to this District.

To intelligently understand the subject, the Committee have, from time to time, called in the aid of the Chief Engineer of the Water Department, Wm. H. McFadden; his assistant engineer, Charles G. Darrach; Mr. John Hunter, of City Councils' Committee on Water Works; President Jacob Loudenslager, and Chief Engineer John R. Cantlin, of the Fire Department. These gentlemen have listened patiently to the many questions of your Committee, and have rendered valuable aid by their answers and suggestions.

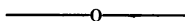
There is probably in the Fifth and Sixth Wards, and in the few squares immediately West of the boundaries of these Wards, an amount of valuable real estate and merchandise property that will count in excess many millions of dollars more than in any other section of the City embracing the same number of acres. The Committee know that this section is not properly supplied with water—that great hazard impends from this deficiency, and that urgent necessity exists for immediate action by the City Councils to remedy this glaring evil.

The Committee do not find that the water supply to this District has been increased in the last seven years, but remains about the same as in 1873, when your Committee, of which Mr. Frederick Fraley was Chairman, reporting upon the condition of the Fire Department, examined into this same matter. The third Resolution of that Report asks for:—"Immediate and abundant appropriations for increasing the water supply of the City, and making its distribution more complete and full by additional and powerful steam pumps for raising it, and by conduit pipes of large capacity to be used either as reinforcing or supplying mains." This Resolution is more needed to-day than when the Council adopted it in 1873, because of increased consumption.

In our examination we find that an Ordinance [June, 1877] exists which provides for the removal of small water pipes, and replacing them with pipes of larger capacity, at any time when a street is repaved. Nine thousand seven hundred and twenty-three feet have been laid as per above Ordinance.

The want of water in the Fifth and Sixth Wards could be improved by laying a sixteen-inch main from Juniper street to Second street, on Market street. There is now but two six-inch pipes passing through this street, a capacity for distribution entirely inadequate and a fact admitted by all familiar with the subject. The sixteen-inch main which has been suggested, would give ample distributing power, but we are here met with the question, how can this main be supplied with water? The belief was that the water could be supplied from attachments to be made from the thirty-inch main coming from Corinthian Reservoir, passing through Broad street, and attachments to be

made from the thirty-inch main from Fairmount Reservoir, passing through Arch street to Second street. While this could be done, we are assured it would take the supply from other Districts that are not now over abundantly supplied with water. This surmise has led the Committee to propound a series of questions to Dr. Wm. H. McFadden, Chief of the Water Department. The answers to these questions are pertinent to the subject, and we believe fully cover the whole matter embraced in the Resolutions referred to the Committee.



QUESTIONS AND ANSWERS.



Question.—Why is the water supply insufficient in certain portions of the old City, especially in the Fifth and Sixth Wards?

Answer.—The causes are three:—

FIRST.—During three or four months in the year there is not sufficient water in the river to drive turbines, nor sufficient steam machinery, engines and boilers, to supply more water than is now consumed.

SECOND.—There are 150,000 feet of pipes, four inches or less in diameter, which have been laid many years, and are more or less clogged with rust and mud, and these mains are not properly connected at the intersections of the streets.

THIRD.—The Fairmount basins, from which the supply is obtained, are too low to give a sufficient head for the increased draught upon these small mains.

Question.—Do you consider the two six-inch mains on Market street ample under any circumstances?

Answer.—I do not. There should be in addition a large main down the centre of the street, of say 16 inches diameter, which with proper connections would improve the *facilities* for

a better supply, which supply however must be maintained by increased pumping machinery.

Question.—What would such a main cost ?

Answer.—I would estimate, including stop-valves and connections, five dollars per foot.

Question.—Will this main obviate the necessity of relaying the small pipes in the old city proper ?

Answer.—It will not. If supplied from a higher elevation than Fairmount, and connected with the thirty-inch main on Arch street, it will give an adequate supply for Market street, and improve the supply from the small pipes *immediately* adjacent.

Question.—How could you increase the head or force of water in the District ?

Answer.—By supplying it from the Corinthian Basin, which is twenty-six feet higher than the Fairmount Basins.

Question.—What will it cost to relay the small pipes ?

Answer.—With the proper connections, three dollars and one-half per foot.

Question.—With what pipe would you relay those streets which now have pipes of one, two, three and four inches diameter ?

Answer.—Upon these streets stores and warehouses have been built containing an immense amount of valuable property, for the protection of which I would recommend pipes twelve (12) inches diameter, costing three and one-half dollars per foot, including the proper valves and connections.

Question.—How do you propose to supply the water for the increased consumption which would be induced by these facilities for an adequate supply ?

Answer.—By additional steam pumping machinery.

Question.—Will not the East Park Reservoir answer the purpose better and at a less cost ?

Answer.—It will not. To make the East Park Reservoir available as a storage for but 11,000,000 gallons per day for two weeks, \$523,000 would be required.

Question.—Do you then consider the East Park Reservoir of no value?

Answer.—It could be made of great value as a subsiding basin for the low service distribution, and would be in the nature of a luxury.

Question.—From what source can the money be obtained to furnish these requirements?

Answer.—FIRST.—Councils have been asked to authorize the Department to lay certain pipes North of Callowhill street, which will give the *facilities* for a better supply on Broad street, and Spring Garden street, as well as one of the pipes which must be laid before the old city proper can be properly supplied from the Corinthian Basin. The money for this work to be taken from the annual appropriation of 1880.

SECOND.—There is now lying in the City Treasury \$170,000, being the consolidated balances of loans created for the “Extension of the Water Works,” but which, for want of specific appropriation, cannot be used. This money would provide sufficient boilers at Spring Garden and Belmont Works, to run all the engines, and provide in case of accident a duplicate engine and engine house, foundations, pipe and inlet complete, increasing the available pumping capacity 10,000,000 gallons per day, and providing a reserve of 10,000,000 gallons.

THIRD.—The Water Department returns annually \$1,400,000, besides supplying all water for municipal uses (including fire) free, and many other gratuities.

If \$600,000 of the income of the Department were set aside as interest on the plant, and \$400,000 be appropriated annually for the maintenance of the Department, there would remain \$400,000 that could be annually expended in laying larger pipes, providing large mains as feeders, machinery as power, and basins for subsidence.

Question.—Is not the amount asked for extensions excessive?

Answer.—For the immediate present it is not. The Department has been run for the past few years upon such a close

margin that its immediate requirements are greater than a natural increase of consumption would demand.

W. H. McFADDEN,
CHIEF ENGINEER,
Water Department.

In conclusion, your Committee would say that the more they examine this subject the more impressed are they with its importance. A bountiful supply of water is an absolute necessity, not only for domestic purposes, health, and prevention of fires, but for that of business.

Philadelphia is essentially a manufacturing city; in some particulars the largest in the world; her manufactures are constantly increasing, and this increase necessitates an additional supply of water, and this supply has not kept pace with the demand.

Situate as we are between two noble rivers, there should never be any lack of water for all purposes.

This whole subject was very fully treated by the commission of engineers appointed by the Mayor under Ordinance approved June 5, 1875.

Your Committee deem it beyond their province to make any specific recommendations as to the mode of increasing the supply, but they are deeply impressed with the necessity, and look with great favor upon the proposition to make a great distributing reservoir, say at or about Mount Peace, and to complete the East Park Reservoir to be used for subsiding or distributing purposes.

We are aware that the question at once arises, where is the money to come from?

Chief McFadden answers this in part:—

First.—When he speaks of an amount of \$170,000 lying in the City Treasury, being the consolidated balances of loans created for the extension of the water works, but which for want of specific appropriations cannot be used.

Second.—The Water Department returns annually \$1,400,000, besides supplying all water for municipal uses (including fire) free, and many other gratuities, and he adds, if \$600,000

of this income were set aside as interest on the plant, and \$400,000 be appropriated annually for the maintenance of the Department, there would remain \$400,000 which could be used, and he further says it will be impossible to continue to extract nearly four times as much from the Department as is furnished for its maintenance.

Surely for a necessity like water, a way can be found to supply the balance of money wanted.

Philadelphia must retain her well-earned reputation as a city of homes, as well also that of the greatest manufacturing city of the country, and a wise expenditure of money for municipal purposes, we feel assured, would be heartily approved by the great body of our citizens.

Your Committee offer the following:—

Resolved.—That the Philadelphia Board of Trade are deeply impressed with the necessity of an additional water supply for the City, and for large distributing mains and pipes, particularly for the business wards, and that City Councils are urgently requested to give this subject their earnest attention, and to adopt such measures as in their judgment seem best to accomplish these ends.

Resolved.—That the Secretary be directed to forward a copy of this Report and Resolutions to the Select and Common Councils of the City.

Your Committee desire to tender their thanks to Chief Engineer McFadden, Assistant Engineer Darrach, John Hunter, of Common Council, President Loudenslager and Chief Cantlin, of the Fire Department, for the valuable aid and assistance given them whilst engaged upon this subject.

BENJ. S. JANNEY, JR.,
 J. B. LIPPINCOTT,
 HENRY C. BUTCHER,
 WM. MASSEY,
 CHARLES H. CRAMP,
 JAS. SPEAR,
 LOUIS C. MADEIRA.

SUPPLEMENTAL REPORT.

PRESENTED OCT. 1, 1880.

To the Select and Common Councils of the City of Philadelphia :

GENTLEMEN:—To provide an adequate supply of *subsided* water for all parts of the city, I would respectfully submit the following report for your immediate consideration:

Repeated experiments prove that a six or seven days' subsidence is required to clear the Schuylkill water when riled by the fine mud which comes from the upper Schuylkill and its tributaries, the Perkiomen, Skippack, etc.

This was demonstrated by the rainfall of July 5th, 1880, when the supply to such parts of the city as obtained the water directly from the river was little better than liquid mud, while that supplied to the inhabitants of the 21st ward was generally clear and but once slightly murky.

The Roxborough basin has a capacity of 12,000,000 gallons and supplies 20,000 people. Allowing 80 gallons to each individual as a daily summer consumption, it will be seen that a subsidence of seven to eight days was obtained for the 21st ward with the above satisfactory result.

Apply this rule to West Philadelphia, and we obtain by *restricting* the Belmont basin to the west side of the river the same subsidence as at Roxborough. With a basin capacity of 40,000,000 gallons, and a population of 70,000, we would have a seven or eight days' subsidence at the rate of 80 gallons to each individual in the district.

The water takers, in the 23d ward, in most of the 25th ward,

in the 31st ward, and in part of the 18th ward, are about 50,000, and are supplied with Delaware water from the Wentz Farm Reservoir, which is pumped at the Lardner Point Works. The capacity of this reservoir is 36,000,000 gallons, which gives a subsidence of nine to ten days.

From these statements it will be seen that ample facilities can be provided to furnish *subsided* water for the next ten years to the 24th and 27th wards. The other wards, as the 21st, 23d, 25th, 31st and part of the 18th, are already provided with subsidence if their districts of distribution be not enlarged. To complete subsidence in all the above wards, \$10,000 only need be expended at the Belmont basin and works, to subside the water for the 24th and 27th wards; provided the Belmont basin be restricted in its distribution to the west side of the river Schuylkill.

The only remaining considerations for these wards are *power* to maintain an adequate supply and *main pipes* for the proper distribution of the water. The demand for these will depend upon the growth of these sections.

For *safety*, Roxborough requires a duplicate engine and boilers, and Frankford a duplicate engine.

To provide for Chestnut Hill and Mount Airy, both in the 22d ward, auxiliary works should be constructed.

The estimated cost of this work, which is here recapitulated, is as follows:—which we will call

ITEM 1.

BELMONT.

At stop house, change inlets to outlets,	
At basin, carry inlets over the top of basin,	
At works, improvements to forebay, including gates,	
Total for 24th and 27th wards,	\$10,000

ROXBOROUGH.

Duplicate engine, boilers, and	
Improvements to forebay,	
Total for safety for 21st and 22d wards,	67,500
	\$77,500

Amount brought forward,	-	-	-	-	-	77,500
FRANKFORD.						
For safety, duplicate engine and foundations,	-	-	-	-	-	42,500
CHESTNUT HILL AND MOUNT AIRY.						
Engine and boilers, standpipe,						
Engine and boiler, houses, etc.	-	-	-	-	-	30,000
<hr/>						
Cost of the improvements recommended for the 21st,						
22d, 23d, 24th, 27th and 31st wards, and parts						
of the 18th and 25th wards,	-	-	-	-	-	\$150,000

ITEM 2.

The section of the city bounded by Spring Garden street on the South, by Broad street from Spring Garden to Jefferson, by Ninth from Jefferson street to Susquehanna avenue, and by the North Pennsylvania Railroad on the East, by the foot-hills of Germantown on the North, and by the Fairmount Park on the West, includes a part of the 14th, the 15th, 19th, 20th, 28th and 29th wards.

It is traversed by Broad street, the Ridge Road, the Reading' connecting, and other railroads.

The facilities thus afforded for rapid transit make it a desirable locality for homes, easy of access to the business centres and containing some of the finest residences of modern design, insuring rapidity of growth in population, which has increased in ten years from 136,000 to 210,000.

To provide any but an abundant supply of clear water to such a district, or to lower the standard of water pressures would be, in my judgment, not only unwise but unjust, inasmuch as the citizens willingly pay for such a necessity.

The standard of water pressures in other American cities is not less than 20 pounds as an average, and ranges as high as 40 to 50 pounds.

To provide subsided water to this district I would recommend the construction of a subsiding basin, at an elevation of 170 feet city datum, in the neighborhood of 30th and Cambria streets, and the necessary mains to and from it.

This location is central, not over two miles from its limit of distribution, on an isolated high point, and can be made to control the

lower levels of Manayunk in the 21st ward, thereby diminishing the costly pumpage at the Roxborough Works by a limitation of its distribution to the higher levels.

The water will be pumped from the Schuylkill river at the Spring Garden Works by an engine now under contract and being built to supply this district, and to be supplemented by additional engines as the demand for water increases.

The estimated cost of Item 2 is as follows:

Subsiding Basin, - - - - -	\$225,000
Pumping Main, - - - - -	150,000
Distributing Main, - - - - -	75,000
	<hr/>

Total for a part of the 14th, the 15th, 19th, 20th,
28th and 29th wards. - - - - - \$450,000

Another method to furnish subsided water to this district may be suggested:

Finish a section of the East Park Reservoir, pump the water into it from the Spring Garden Works, erect another pumping station at the East Park Reservoir, re-pump the water from it into the mains to the required height or under the pressure necessary for distribution.

The objections to this method are obvious:

1. The expense of maintaining and operating an additional works and the further complicating of that which needs simplifying.

2. The necessity for the erection of two engines in the future, one at the Spring Garden Works and the other at the proposed East Park Reservoir Works, when, by the plan recommended, one at the Spring Garden Works would suffice.

3. The extra expense in fuel as well as an additional engine, of small capacity, for night pumpage. The estimated cost of this method is as follows:

To finish small section of the East Park Reservoir,	\$100,000
Pumping main from Spring Garden Works to E. P. R.,	33,000
For additional lift—two engines, boilers, etc.,	125,000
Engine and boiler houses, etc., foundations, standpipe, } Inlets and connections,	75,000
Distributing main to 33d and Jefferson, - - - - -	32,000
Cost of maintenance, additional fuel and small engine, capitalized, - - - - -	235,000
	<hr/>
	\$600,000

Amount brought forward, - - - - -	600,000
For a proper comparison of plan recommended add cost of distributing main, - - - - -	75,000
	<hr/>
Total estimated cost of suggested method, - - -	\$675,000
“ “ “ plan recommended, - - -	450,000

The objections presented and the increased cost make it hardly worth while to consider this method further, and I have presented it here only for the purpose of comparison.

ITEM 3.

To provide better *facilities* for the distribution of water in the older sections of the city, where the supply is inadequate, caused by the increased consumption upon the small mains laid many years ago.

These sections comprise the old city proper, the districts of Southwark and Moyamensing—south of South street, the districts of the Northern Liberties and Kensington—east of Sixth street, and a portion of the district of Spring Garden. These embrace the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 16th, 17th, a part of the 18th, the 26th and 30th Wards.

The supply of water in these districts is insufficient, the average pressure is not over twelve pounds, and in some portions of them much less. They contain a population of 400,000 supplied from four basins,—Fairmount, Spring Garden, Corinthian, and Delaware, with a combined capacity of 100,000,000 gallons, capable of providing only three days' subsidence, which is not enough.

To raise the standard of water pressure, and thereby increase the supply, it is proposed as follows:

1. Complete the circulation of the water by laying larger mains and connecting the pipes where they cross each other at the intersections of the streets.
2. Relay with larger pipes where at present those of four inches and less are in use.
3. Supply the old city proper from Corinthian Avenue Reservoir, and help the supply of the 26th and 30th Wards from the Fairmount basin.

Detailed estimate of above item No. 3.

1. 20-inch main on South street from Delaware to and along Grays Ferry road to Federal street, -	\$80,000
20 inch main on Market street from Front to 22d, -	45,000

Amount brouhnt forward,	- - - - -	\$125,000
20 " " 9th street from Jefferson to Callowhill,		30,000
16 " " Broad street from Poplar to Callowhill,		20,000
		<hr/>
		\$175,000
2. Relays in old city proper and other older districts,	- - - - -	375,000
3. Supply old city proper from Corinthian ave., and help 26th and 50th Wards from Fairmount, 16-inch main 20th street from Green to Callowhill street,	- - - - -	7,500
20-inch main on 16th st. from Green to Callowhill,		7,500
30 " " 21st " Callowhill to Tenth,		60,000—75,000
		<hr/>
		\$625,000

ITEM 4.

To furnish the *low levels* with subsided water and to remedy the insufficient subsidence at present, it is proposed to complete the East Park Reservoir.

For a population of 400,000 the entire basin completed would furnish a subsidence of twenty days; two sections of it about ten days, while the small section of only a day and a third.

The estimates are as follows:—

1. For the entire Basin of 3 sections,		\$700,000
Pumping Mains from the Engines at Spring Garden,	- - - - -	100,000
Distributing Main to Broad street,	-	180,000
" " Spring Garden Basin,		120,000
		<hr/>
Total,	- - - - -	\$1,100,000
	or	
2. For two sections of the Basin,	-	\$400,000
Pumping Mains as above,	- - -	100,000
Distributing " "	- - -	300,000
		<hr/>
Total,	- - - - -	\$800,000
	or	
3. For the small section of the Basin,	-	\$100,000
Pumping Main from one Engine,		33,000
Distributing Main,	- - - - -	120,000
		<hr/>
Total,	- - - - -	\$253,000

ITEM 5.

To provide subsidence and mains for Germantown, and mains for West Philadelphia.

The Mount Airy Basin furnishes subsidence of only two days to the people of the 22d ward, which contains a population of over 30,000. To complete the subsidence and provide for a future increase, an enlarged Basin should be constructed :

The estimated cost of Basin, - - - \$100,000

To give an adequate supply, a 20-inch Main should be laid from the Mount Airy Basin to Tulphocken street.

The estimated cost of Main, - - - 40,000

The growth of the 24th and 27th wards demands an additional Main from the Belmont Basin.

The estimated cost of Main - - - 65,000

“ “ “ on Woodland Avenue, 30,000

Total, - - - - \$235,000

RECAPITULATION.

Item 1. Subsidence and power for the suburban Districts and West Philadelphia, - - - \$150,000

2. Subsidence for the medium level, a part of the 14th, the 15th, 20th, 28th, and 29th wards, 450,000

3. *Facilities* for a better distribution of the water, 625,000

4. Subsidence for the *low levels* from the East Park Reservoir, either for three sections, \$1,100,000, or for two sections, - - - 800,000

5. Subsidence for Germantown, and Mains for West Philadelphia, - - - 235,000

Total, - - - - \$2,260,000

To put in operation these suggestions, with a view to their consummation, I would recommend that councils specially appropriate, yearly, 50 per cent.—at present \$750,000,—of the receipts of the Department, to be expended as follows:

For Maintenance,	-	-	-	-	\$350,000
“ Improvements,	-	-	-	-	150,000
“ Extensions,	-	-	-	-	250,000
					<hr/>
					\$750,000

Yours, very truly,

WM. H. McFADDEN,

Chief Engineer Water Department,

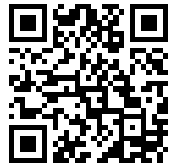
Office of the Department for Supplying the City with Water,

Phila. Oct. 1st, 1880.

This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

<https://books.google.com>



TD
225
P5A2
1880

UC-NRLF



B 2 981 768