

ANNUAL REPORT
OF THE
SUPERINTENDENT
OF THE
CITY WATER WORKS,
TO THE
MAYOR OF THE CITY,
FOR THE
FISCAL YEAR ENDING FEBRUARY 1, 1883.

RICHMOND:
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1883.

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COMMITTEE ON WATER.

N. D. HARGROVE, CHAIRMAN.

DR. J. S. WELLFORD,	MAXWELL T. CLARKE.
T. H. ELLETT,	R. B. CHAFFIN,
JAMES HAYES,	J. C. DICKERSON.

OFFICERS.

J. L. DAVIS, SUPERINTENDENT.
J. B. HILL, Assistant Superintendent.
J. W. TOMLISON, Sup't Pumps-Works.
CHARLES BAKER, Keeper New Reservoir.
L. W. ROSE, Keeper Old Reservoir.

ANNUAL REPORT.

OFFICE CITY WATER WORKS,
Richmond, Va., February 1st, 1883.

HON. W. C. CARRINGTON,

Mayor of the City of Richmond :

I respectfully submit this, the Semi-Centennial or Fiftieth Annual Report, of the Water Department of the city, commencing February 1st, 1882, and ending February 1st, 1883.

RECEIPTS.

Water Rents.....	\$73,718 51	
Fractional Rents.....	\$2,869 79	
Sales account (old iron, &c.).....	228 55	
Builders' Permits.....	643 39	
Boat Fees.....	44 02	
	<hr/>	3,785 75
		<hr/>
		77,504 26

DISBURSEMENTS.

Expense Account.....	\$14,178 16	
Construction Account.....	22,963 78	
Water Department.....	18,524 76	
New Reservoir.....	3,003 32	
	<hr/>	58,670 02
		<hr/>
Excess of receipts.....		\$18,834 24

The general condition of the works are as good as usual, taxed as they are, to meet every demand upon them, and that demand daily

increasing. The past year the mains have been extended to a much greater extent than usual, and applications in different parts of the city for more. The Tapping force are daily at work in some part of the city. The greatest difficulty the Department has to contend with is the small mains in many portions of the city; a partial remedy for this will be found in this report.

No accident of any notable character has occurred during the year. A few old mains burst, which were promptly repaired, and no serious inconvenience was the result. A 12-inch main pipe has recently been laid from Main and Beach streets to Broad and Shafer streets, which has greatly improved the supply in this part of the city, many of the old fire-plugs are rusting and wearing out, and often need to be replaced by new ones of a better pattern.

It will be seen in this report that several recommendations are made, all of which are very important, both for the interest of the city and its citizens. In connection with this report will be seen one from Mr. J. W. Tomlinson, Superintendent of the Pump Works, intelligent and comprehensive, containing valuable information. The following part of this report will explain the several recommendations spoken of.

During the year there were laid eight thousand five hundred and twenty-four feet of six-inch, two thousand one hundred and ninety-seven feet of four-inch, and one thousand three hundred and fifty-two feet of three-inch cast-iron pipe, and nineteen double-nozel fire-plugs put in different parts of the city, and two hundred and fifty-three connections made with the street mains for private and other buildings, paying an annual rent of \$3,289.

Total amount in gallons pumped per year.....	2,935,071,300
“ “ “ “ per day.....	8,041,290
“ “ “ “ per hour.....	335,054
“ “ “ “ per minute.....	5,584
“ “ “ “ per second.....	93

USES OF WATER FOR WHICH THERE IS NO CHARGE.

312 Fire Plugs, cost \$50.....	\$ 17,100 00
198 Indigent Families, \$5.....	990 00
42 Churches.....	809 50
9 Asylums.....	370 00
3 City Hall and Markets.....	475 00
6 Engine Houses.....	170 00
14 Public Schools.....	700 00
2 City Jail and Stables.....	200 00
1 Gas Works.....	500 00
1 Washington Hall.....	50 00
2 Almshouses.....	500 00
4 Fountains in Capitol Square.....	500 00
1 Monroe Park.....	100 00
1 Marshall Park.....	100 00
1 Hollywood Cemetery.....	50 00
1 Shockoe Hill “.....	25 00
1 College, Main and 19th streets.....	100 00
1 Regimental Armory.....	50 00
1 Howitzer Armory.....	50 00
1 Colored Armory.....	25 00
Total.....	\$23,104 50

Amongst the improvements necessary to insure a supply of water are none of more importance than an enlargement of the mains on several elevated parts of the city. The old mains, which do not exceed a diameter of four inches, and many only three inches, and greatly lessened in area by rust and sediment, are now totally inadequate to supply the daily consumption from them, to say nothing of their inefficiency in time of fires. Many of these pipes were laid when the Works were first erected, fifty years ago. Then, to have a hydrant in the yard was considered a convenience greatly to be appreciated, and but few water takers. Now, with the improved style of buildings and the numerous water fixtures put in every house, the supply has been so reduced that the water in many places will rise only to the first story in the heat of the day. It will be seen in another part of this report the recommendation of taking up the old mains leading from the old Reservoir through Hollywood Cemetery, and thence to Canal and Madison streets. These, when taken up, can be immediately taken to the several points and laid in one or more streets in place of the small mains, and connected with them at every crossing, thereby

giving a feeder which will to a great extent relieve these points for several years to come. Taking these old supply mains up, which are not lessened in value materially, and substituting them in the place of the small ones will cost much less than new mains of the same capacity. If not used again as soon as taken up, they will occupy a large space, to be handled perhaps more than once. If used for the purpose indicated, they can be hauled immediately to the points needed, and the taking up and relaying could all be done at the same time, thereby materially lessening the first cost. The numerous complaints of water takers now and the improvements in contemplation, renders it actually necessary that some expedient should be adopted at once, and thus relieve the citizens of this great and growing inconvenience.

In the last annual report of this Department it was earnestly recommended that the supply of water to Church and Union Hills becoming more and more inadequate both for daily consumption, and still more for fire purposes, should be speedily increased. Two plans were proposed. One to extend the 16-inch pipe from Broad and Mayo streets, where it at present terminates, to near Twenty-second street, and diverting the old 8-inch main, now supplying Church Hill, into the lower service supply. The other was to erect a stand-pipe or water-tower on the corner of Grace and Twenty-seventh streets, either one of which would add greatly to the supply, and more particularly as an equalizer of pressures in that part of the city. The two combined would make the supply sufficient for years to come.

During the past year the water mains have been extended nearly the whole length of Venable street, and on Twenty-fifth street from Leigh to Venable streets, very largely adding to the area of supply and consumption. This part of the city being built up very largely of wood houses, a fire during a high wind would be exceedingly destructive without a sufficiency of water. This matter should engage the attention of all at once, before some calamity overtakes us. The present supply pipe (8-inch) was put down thirty years ago, during which time no addition has been made to it.

The location of the two mains (10x12 inch, laid in 1831 and 1848) from the Old Reservoir to the city, is one that needs attention. These pipes pass from the Old Reservoir in a straight line through the

city's property and the Soldiers' Cemetery, and thence through the different squares to Canal and Madison streets. Their position is such as to render much of the squares they pass through valueless for building purposes, running in a diagonal direction, which not only leaves an unsightly gap through this rapidly improving part of the city, and materially detracting from the value of the adjoining property. The rights of the city are such as to prevent these lots being built on so long as these pipes remain in their present position. The value of the ground would be greatly increased by their removal, besides adding to the revenue of the city by the improvements that would very soon be made. When the 24-inch main was laid from the Old Reservoir (in 1859) along Reservoir street, the object then was to remove these pipes, either conforming to the streets as now made or dispensing with them. The area of supply from the Old Reservoir can never be enlarged, to any extent, from the fact that the necessary pressure would not be obtained. It is hardly probable that the consumption of water from the Old Reservoir will be materially increased for many years to come. That portion of these pipes passing through the city's grounds and the Soldiers' Cemetery is so situated that it would not pay to take them up; besides, the Cemetery and Hospital grounds are supplied from this source. By commencing their removal on the east side of the Cemetery or Linden street, they could from this point, if found necessary, at a future time be extended into and down Canal street to Seventh street, and form an additional feeder to this part of the city. These pipes, when taken up, could be all used again in other parts of the city, and would cost less than lines of new mains. When they are removed the city's claim to occupation ceases.

In 1866, in view of there being no permanent office for the Water-Works (the one heretofore used being burned at the great fire of the 3d of April, 1865), it was determined by the City Council to erect an office for the Water and Gas-Works jointly. The lot of ground (now Washington Hall) was purchased of Col. Thomas P. Bigger, who then lived in the tenement on the east of this property, and the City Engineer ordered to make plans for a one-story house, the width being sixty feet. The American Jewish Church wishing to have a place of worship, agreed to pay the city so much per annum if the city would

add another story. The Masons wishing to have a hall for their purposes, still another story was added. There being no other stories wanted, the City Engineer was instructed to revise his plan accordingly. In view of this building being used eventually as a fire-engine house, large doors were put in looking to this object, plans and specifications were made and the work ordered, W. L. Walthall being the contractor for the brick work, Fleming & Hopkins for the carpenters' work, and William Mitchell for the painting—the eastern side to be used for the Water and the western for the Gas-Works, and shops and storage house for the Water-Works in the rear. As soon as the house was built that portion intended for the gas office was taken for the fire-engine and hook-and-ladder apparatus, which necessitated a stable for the horses required. In order to accommodate them, and the probability of the city erecting a new City Hall, where all the city offices could be located, a temporary board shop and storage-house was built one-story high, which would have long since fallen down but for a few timely props. This house, now built seventeen years, has become so rotten that, like an old coat, patches can not be made to stay where they are put on, and the top as tight as an ordinary sifter.

So it will be seen that a new shop and storage-house is all-important for the proper security for the tools, as there are a great many of them and other valuable things; also, a place when the men come in wet and muddy, as they frequently do, to dry and thaw themselves out, sometimes at a late hour of the night. This house should be built two-stories high, sufficiently capacious for all purposes, and in case the water office should leave it for other quarters, this, as well as the office, could be turned into the Fire Department. It is earnestly recommended that this work be done at once, and thus save, perhaps, the digging out of some poor fellow that might chance to be caught in the fallen ruins.

In conclusion, I take pleasure in saying that the officers and men have all discharged their several duties with credit to themselves and the interest of the city.

Respectfully submitted.

FEBRUARY 1st, 1883.

J. L. DAVIS,
Superintendent.

REPORT OF SUPERINTENDENT OF PUMP-WORKS.

PUMP-WORKS, February 1st, 1883.

MR. J. L. DAVIS,

Superintendent City Water-Works :

DEAR SIR :

I herewith submit my Annual Report to you for the year ending February 1st, 1883.

During the year the bevel-mortised wheel of the turbine pumps was recogged, turbine shaft raised and two new brass valve-seats put in the pumps. The piston cylinders are very much worn from the constant working of the pumps, and I do not think would admit of being rebored on account of the insufficient thickness of the cylinders after being rebored to resist the increased pressure due to the increased diameter. The piston cylinders of Nos. 1 and 2 are very much in the same condition; having been rebored once, will not admit of applying the same method again. If it is proposed to keep this house for its present purposes, I think it would be well to have duplicate cylinders made for the pumps of which I have spoken, so as to be ready for any emergency that might arise. All of the pumps (water power) are in constant use to full capacity, as well as the variable state of the river will permit, last summer the river being too low to get the full speed of the pumps. This winter they have been checked by too much water in the river. The granite walls sustaining the main shaft bearings of water wheels of Nos. 1, 2, 5 and 6 pumps need repairing from foundation up, as the joints above floor line are generally open, and it is quite difficult to keep the blocks of granite from moving when the pumps are in motion. The building badly needs painting, as much for the preservation of the house as for its general appearance; walls of main rooms seriously needs plastering and papering, so as to present a neat appearance.

The new steam-pump is in splendid condition, and does its work faithfully, enabling us to keep a full supply of water in the reservoir at all times.

The new water-power pumps at Three-Mile Locks were worked about ten days, when the head wall at the Nine-Mile Locks was undermined and the water turned out of the forebay. During the time the pumps were at work a speed of sixteen revolutions per minute was obtained, although we did not have the advantage of a full head of water on the wheels, as the height of water in the forebay was thirty-nine inches below high water mark, thereby detracting greatly from the power of the wheel. With a full head of water in the forebay, there will be no difficulty in getting the required speed of twenty revolutions per minute, and more if necessary.

Respectfully submitted.

J. W. TOMLINSON,

Superintendent of Pump-Works.

STATEMENTS.

RICHMOND CITY WATER WORKS.

Number of Gallons of Water Pumped by the Water and Steam-Power Pumps during the Year ending February 1st, 1883, calculated and furnished by Mr. J. W. Tomlinson, Superintendent, from the journal kept by him.

1882-1883.	WATER-POWER PUMPS.						NEW STEAM PUMP.	
MONTHS.	Gallons pumped each month.	Average per day.	Number of hours worked.	No. of hours worked the turbine pumps.	Revolutions of oil pumps per minute.	Revolutions of turbine pumps per minute.	Number of days steam pump worked.	Number of gallons pumped each month.
February.....	136,886,400	4,888,800	442	438	8	7½	9	54,000,000
March	174,079,800	5,615,477	719	602	8½	7¾	10½	62,000,000
April.....	175,030,200	5,834,340	684	646	8½	8¼	6½	39,000,000
May	176,126,400	5,681,497	709	630	8	8½	8½	51,000,000
June	170,764,200	5,692,140	689	607	8½	8	10½	63,000,000
July	177,128,100	5,713,810	680	669	8½	8½	15½	91,500,000
August	176,651,500	5,698,435	678	669	8½	8¼	12	72,000,000
September.....	169,317,000	5,643,900	657	636	9	7½	15½	93,000,000
October	181,051,200	5,840,361	692	690	9	8	14	84,000,000
November	120,973,500	4,032,450	638	267	9	8¾	23½	140,000,000
December.....	143,929,600	4,767,406	661	456	8¾	8	16½	98,000,000
January	155,633,400	5,020,432	663	530	9	7¾	21½	128,000,000
Total.....	1,959,571,300	.....	.....	.....	.....	.....	162½	975,500,000

A STATEMENT

Showing the Receipts of the Water-Works for the year ending February 1st, 1883.

1882—Received in February.....	\$ 3,772 11
“ March.....	5,930 16
“ April.....	6,635 11
“ May.....	5,155 65
“ June.....	8,085 38
“ July.....	6,997 46
“ August.....	5,239 13
“ September.....	7,977 46
“ October.....	7,266 95
“ November.....	5,190 24
“ December.....	7,843 02
1883— January.....	7,411 49
Total receipts.....	\$77,504 06

A STATEMENT

Of Monthly Payments on account of the City Water-Works for the year ending February, 1883.

EXPENSE ACCOUNT.

Paid in February, 1882.....	\$ 873 38
“ March, “.....	518 58
“ April, “.....	1,807 60
“ May, “.....	558 56
“ June, “.....	940 96
“ July, “.....	1,087 02
“ August, “.....	644 01
“ September, “.....	994 27
“ October, “.....	912 25
“ November, “.....	2,197 43
“ December, “.....	1,768 14
“ January, 1883.....	1,875 96
	<u>\$14,178 16</u>

CONSTRUCTION.

Paid in February, 1882.....	734 00
“ March, “.....	1,400 90
“ April, “.....	818 34
“ May, “.....	577 25
“ June, “.....	2,954 62
“ July, “.....	945 81
“ August, “.....	1,344 36
“ September, “.....	3,099 41
“ October, “.....	1,535 32
“ November, “.....	1,775 18
“ December, “.....	2,152 21
“ January, 1883.....	5,626 38
	<u>\$22,963 78</u>

WATER DEPARTMENT.

Paid in January, 1882.....	1,459 54
" February, ".....	1,468 17
" March, ".....	1,679 04
" April, ".....	1,344 80
" May, ".....	1,308 53
" June, ".....	1,306 90
" July, ".....	1,456 71
" August, ".....	1,487 12
" September, ".....	1,919 30
" October, ".....	1,771 39
" November, ".....	1,454 48
" December, ".....	1,668 78
	<u>18,524 76</u>

NEW RESERVOIR.

Paid in February, 1882.....	136 63
" March, ".....	240 32
" April, ".....	364 14
" May, ".....	569 63
" June, ".....	701 71
" July, ".....	338 75
" August, ".....	254 90
" September, ".....	185 13
" October, ".....	192 12
" November, ".....	
" December, ".....	
" January, ".....	
Total disbursements.....	<u>3,003 32</u>
	<u>\$28,670 02</u>

A STATEMENT

*Showing the Disbursements and Receipts of the City Water-Works from
their Commencement, October 7th, 1830, to February, 1st, 1883.*

Total amount of disbursements from October 7th, 1830, to February 1st, 1883.....	\$2,376,220 34
Total amount of disbursements from February 1st, 1882, to February 1st, 1883.....	58,670 02
	<u>\$2,434,890 36</u>

Total amount of receipts from October 7th, 1830, to February 1st, 1883.....	\$1,722,803 41
Total amount of receipts from February 1st, 1882, to February 1st, 1883.....	77,504 06
	<u>1,800,307 47</u>
Balance against the Works.....	<u>\$634,582 89</u>

ELEVATION

*Of Marshall Reservoir above the Following Points of the City. For
Elevation of New Reservoir add 37 feet.*

	Fect.	Inch's
Fifth, between Grace and Franklin Streets.....	19	6
Grace and Fifth streets.....	20	6
Franklin and Second streets.....	20	7
Franklin and Adams streets.....	21	4
Franklin and First streets.....	23	7
Franklin and Fifth streets.....	25	0
Grace and Adams streets.....	25	4
Grace and Lombardy streets (Richmond College).....	25	0
Grace and Second streets.....	25	6
Main and Second streets.....	26	3
Broad and Fifth streets.....	28	4
Marshall and Ninth streets.....	28	9
Franklin and Third streets.....	30	4
Broad and Foushee streets.....	31	6
Broad and Third streets.....	31	9
Marshall and Foushee streets.....	32	0
Broad and Seventh streets.....	30	9
Leigh and Sixth streets.....	36	0
Clay and Tenth streets.....	36	3
Leigh and Eighth streets.....	37	2
Cary and First streets.....	36	3
Broad and Ninth streets.....	34	4
Leigh and Fifth streets.....	33	

Elevation of Marshall Reservoir—Continued.

	Fect.	Inch's
Cary and Second streets.....	40	2
Clay and Eleventh streets.....	40	2
Cary and Foushee streets.....	42	3
Cary and Third streets.....	42	10
Baker and Sixth streets.....	43	0
Marshall and Eleventh streets.....	46	9
Grace and Twenty-second streets.....	46	9
Broad and Eleventh streets.....	47	10
Broad and Twenty-sixth streets.....	47	9
Jackson and Ninth streets.....	48	0
Leigh and Tenth streets.....	48	7
Broad and Twenty-seventh streets.....	48	7
Grace and Twenty-sixth streets.....	49	0
Arch and Third streets.....	53	10
Canal and Third streets.....	54	0
Broad and Sixth streets.....	54	4
Broad and Twenty-fourth streets.....	55	7
Arch and Fourth streets.....	55	7
Cary and Madison streets.....	57	9
Broad and Twelfth streets.....	56	9
Broad and Third streets.....	57	5
Broad and Twenty-second streets.....	65	0
Broad and Thirty-first streets.....	67	9
Broad and Twenty-second streets.....	87	0
Broad and College streets.....	92	4
Broad and Twenty-first streets.....	108	2

Elevation of Marshall Reservoir—Continued.

	Feet.	Inch.
Broad and Jail Alley.....	123	0
Broad and Twentieth.....	133	0
Broad and Nineteenth streets.....	135	0
Main and Fourteenth streets.....	136	7
Cary and Thirteenth streets.....	150	0
Main and Twenty-seventh streets.....	145	3
Broad and eighteenth streets.....	164	0
Cary and Twenty-fifth streets.....	165	7
Broad and Seventeenth streets.....	170	5
Broad and Sixteenth streets.....	177	0
Main and Fifteenth streets.....	177	9
Main and Seventeenth streets.....	187	10

SIZE AND LOCATION

Of Street Mains, Stop-Cocks, and Fire-Plugs laid during the year ending February 1st, 1883.

Feet.	NAMES OF STREETS.	Size—Inches.	Stop Cocks.	Fire Plugs.
345	Baker, between Third and Fourth streets.....	6	....	....
300	Thirtieth north of Main street.....	4	....	....
252	Twenty-eighth north of Broad street.....	4	1	....
355	Water east of Ash street.....	3	1	....
21	Franklin and Twenty-fourth street, fire-plug.....	4	....	1
1219	Twenty-fifth north of Leigh street.....	6	2	3
53	Twenty-fifth north of Leigh street, fire-plug.....	4	....	....
684	Broad west of Hancock street.....	6	1	....
910	From Cary to Beverly in Cherry street.....	6	1	2
3	Sixth and Bragg streets.....	3	....	....
24	Park avenue, between Laurel and Shafer.....	6	....	....
459	Hancock, between Broad and Marshall streets.....	6	1	1
22	Hancock and Marshall streets, for fire-plug.....	4	....	....
383	Monroe, between Broad and Marshall streets.....	6	1	....
168	Howard south of Rowe street.....	4	....	....
156	Charity east of First street.....	4	....	....
194	Creek street east of Brook avenue.....	3	1	....
124	Jinden Alley, between First and Second streets.....	3	....	....
294	Pine, between Cumberland and Beverly streets.....	6	....	....
335	Marshall, between Eighteenth and Nineteenth streets.....	4	1	....
22	Cary and Third streets, for fire-plug.....	4	....	1
89	Byrd, between First and Second streets.....	4	....	....
672	Venable, between Eighteenth and Mosby streets.....	6	1	1
14	Venable and Mosby streets, for fire-plug.....	4	....	....
636	Twenty-fifth street from O to Venable streets.....	6	1	1
664	Venable from Twenty-fifth to Pink street.....	6	....	3
51	Venable, Twenty-fifth and Pink streets, for fire-plugs.....	4	....	....
392	St. James from Charity to Federal streets.....	6	....	1
367	Laurel, between Spring and China streets.....	6	....	1
12	Laurel and China streets, for fire-plug.....	4	....	....
1076	Seventh from Canal to Tredegar streets.....	6	4	3
426	Pulliam west of Adams streets.....	4	1	1
512	Pulliam south of Leigh street.....	3	1	....
254	Park avenue east of Cherry street.....	6	....	....
110	Leigh, between Marshall and Gilmer streets.....	6	....	....
276	Truicart Alley, bet. Locust Alley and Fifteenth street.....	4	1	....
93	Taylor's Alley south of Pulliam street.....	3	....	....
2 miles and 1,501 feet.			19	19

SUPPLY MAINS FROM THE RESERVOIRS TO THE CITY.

5,550 feet 10-inch pipe from the Old Reservoir through Hollywood Cemetery, alongside the 12-inch pipe to Cary and Madison streets, and connected with the 20-inch main in Cary street. Laid in 1832.

5,550 feet 12-inch pipe from the Old Reservoir through Hollywood Cemetery, alongside the 10-inch pipe to Cary and Madison streets, and connected with the 20-inch main in Cary street. Laid in 1848.

2,140 feet 24-inch pipe from the Old Reservoir along Reservoir street to Main and Beach streets, where it connects with the 20-inch main from the New Reservoir. Laid in 1861.

2,481 feet 24-inch pipe from Reservoir street east along Cary street to Madison street, where it connects with the 20-inch main for supplying the lower service. Laid in 1875.

9,031 feet 30-inch pipe from the New Reservoir north to Main street, down Main street to where it connects with 24-inch main in Beach street. At this point the service divides into an upper and lower, the connections between the two being closed. Laid in 1875.

LOCATION AND SIZE OF PUMP MAINS.

2,500 feet 12-inch pipe from Pump No. 1 to Old Reservoir.

2,500	"	12	"	"	2	"
2,500	"	8	"	"	3	"
2,500	"	8	"	"	4	"
2,500	"	8	"	"	5	"
2,500	"	8	"	"	6	"
9,700	"	24	"	"	7 and 8	to Old and New Reservoirs.

Pumps Nos. 1 and 2 can be worked into either Reservoir.

STREET MAINS.	Inch's	Feet.
HOLLY STREET.		
Belvidere south of Holly street.....	4	120
Pine to Belvidere street.....	6	406
Church to Belvidere street.....	4	242
Church street east to R. & A. R. R.....	3	332
ROWE STREET.		
Belvidere to Howard or First street.....	4	486
ARCH STREET.		
Fourth street, west.....	3	204
Seventh street, west.....	3	187
Seventh street east.....	3	376
BYRD STREET.		
On tow-path of James River and Kanawha Canal (R. & A. R. R.) west of Va. Armory to Tredegar Works.....	3	1000
Inside Armory lot.....	4	200
Sixth street west along the tow-path of James River and Kanawha Canal (R. & A. R. R.) to west Armory building (Armory Iron Works).....	4	825
Sixth to Twelfth streets.....	4	1875
Fire plug, Eighth and Byrd streets.....	4	27
Twelfth street south to Haxall Mills.....	4	225
Third to Fourth streets.....	4	400
Second street, west.....	4	267
ALBEMARLE STREET.		
Pine street east into the Penitentiary lot.....	6	333
Pine to Laurel street.....	6	368
CANAL STREET.		
Adams to Jefferson street.....	4	297
First to Adams street.....	4	606
First to Third street.....	4	675
Fourth to Fifth street.....	4	330
Fifth to Seventh street.....	3	700
Ninth street to fire-plug.....	3	18
Tenth to Thirteenth street.....	4	637
Fourteenth to Virginia street.....	3	220
Fifteenth on Dock street to Gas Works.....	3	466

STREET MAINS—CONTINUED.	Inch's	Feet.
CARY STREET.		
Cherry street, east.....	6	90
Madison to Seventh street.....	20	300
Jefferson to First street.....	6	90
Jefferson street, west.....	6	60
First to Second street.....	4	32
Second street, east.....	4	12
Third street, west.....	6	180
Third to Fourth street.....	6	32
Fourth to Fifth street.....	12	320
Fifth street, east.....	12	320
Sixth street, east.....	4	12
Seventh to Ninth street.....	6	60
Ninth to Twenty-second street.....	3	3
Seventh to Thirteenth street.....	16	176
Thirteenth to Twenty-fourth.....	12	323
Twenty-fifth, west.....	6	50
Third street, south to fire plug.....	4	22
WATER STREET.		
Ash street, west.....	4	472
Ash street, east.....	3	355
MAIN STREET.		
Reservoir to Belvidere street.....	24	1760
Jefferson street, west.....	6	608
Belvidere to Third street.....	24	2700
Jefferson to First street.....	10	970
First to Thirteenth street.....	6	3900
Thirteenth to Eighteenth street.....	4	2100
Eighteenth to Twenty-fourth street.....	3	2010
Twenty-fourth to Twenty-seventh street.....	8	1012
Pear to Ash street.....	6	1275
Ash street, east on Lester street.....	6	1578
Williamsburg avenue, east to Elm.....	4	675
Williamsburg avenue east to City Gas Works.....	3	650
Monroe Park Fountain.....	3	104
Twenty-ninth street, east.....	4	353
Hague street, south.....	3	263
Thirtieth street, north.....	4	300
FLOYD STREET.		
Cherry to Beach street.....	6	696
Beach street, west.....	6	40
PARK AVENUE.		
Laurel to Shafer street.....	6	610
Shafer to Linden street.....	6	375

STREET MAINS—CONTINUED.	Inch's	Feet.
GROVE AVENUE.		
Linden street, west.....	6	384
FRANKLIN STREET.		
Jefferson to Shafer street.....	6	2529
Two fire plugs.....	4	30
Third to Jefferson street.....	12	1612
Third to Ninth street.....	6	1687
Third to Ninth street.....	12	300
Bank, east of Ninth street.....	3	290
Bank, Eleventh to Twelfth street.....	6	100
Twelfth street, east.....	4	100
Thirteenth street, west.....	4	5800
Thirteenth to Twenty-ninth street.....	4	21
Twenty-fourth street, fire plug.....		
GRACE STREET.		
Shafer street, west.....	6	209
Shafer to Adams street.....	6	2762
Adams to First street.....	4	637
First to Fifth street.....	6	1312
Fifth to Ninth street.....	4	1312
Ninth street, east through the Capitol Square.....	6	1087
Ross, east of Governor street.....	6	616
Seventeenth street, west.....	4	207
Seventeenth to Eighteenth street.....	4	340
Eighteenth to Nineteenth street.....	3	330
Twenty-second street, west.....	3	233
Twenty-second to Twenty-eighth street.....	4	1875
Twenty-eighth to Twenty-ninth street.....	4	329
BROAD STREET.		
Hancock street, west.....	6	684
Hancock street to Ninth street.....	6	6416
Hancock and Broad streets, fire plug.....	4	35
Third to Mayo street.....	16	3675
Ninth to Mayo street.....	4	1575
Mayo to Twenty-second street.....	8	4575
Twenty-second to Thirtieth street.....	4	998
MARSHALL STREET.		
Hancock street, west.....	6	50
Hancock to Henry street.....	6	1905
Henry to Adams street.....	4	1275
Adams to Twelfth street.....	6	4200
Twelfth street, east.....	3	350
Jail Alley to Seventeenth street.....	4	1075
Seventeenth street, east.....	4	198
Twenty-fourth street, west.....	6	125

STREET MAINS—CONTINUED.

	Inch's	Feet.
Twenty-second to Twenty-eighth street.....	6	1911
Eighteenth to Nineteenth street.....	4	335
Hancock and Marshall streets, for fire plug.....	4	22
CLAY STREET.		
Norton to Brooke Avenue.....	6	3310
Brooke Avenue to Adams street.....	4	600
Adams to Second street.....	6	1153
Second street, east.....	4	56
Third street, west.....	3	110
Third to Seventh street.....	4	1200
Seventh to Tenth street.....	6	1125
Tenth to Twelfth street.....	3	600
Twelfth to Seventeenth street.....	4	337
CATHERINE STREET.		
Henry to Gilmer street.....	4	914
Henry street, east.....	4	100
LEIGH STREET.		
Munford street, west.....	6	110
Munford to First street.....	6	2483
First to Second street.....	4	335
Second to Sixth street.....	4	1312
Sixth to Seventh street.....	3	330
Seventh to Ninth street.....	6	675
Ninth to Tenth street.....	4	337
Twenty-fifth to Twenty-sixth street.....	6	298
VENABLE STREET.		
Seventeenth to Eighteenth street.....	4	536
Eighteenth to Mosby street.....	6	672
Pink to Twenty-fifth street.....	6	664
JACKSON STREET.		
St. Peter's to Second street.....	6	1490
Third to Fourth street.....	6	261
Fourth street, east.....	6	108
Fifth street, west.....	3	184
Ninth street, east (M street).....	4	216
Jackson and Fourth, fire plug.....	4	12
DUVAL STREET.		
Price to First street.....	4	834
Second to Third street.....	4	327
Fourth to Sixth street.....	4	660

STREET MAINS—CONTINUED.

	Inch's	Feet.
BAKER STREET.		
Brooke Avenue, east.....	4	407
Shook's Alley, south side Baker to 4 inch east of St. Paul street.....	6	1191
Second street, west.....	4	1127
Third street, west.....	4	162
Third to Fourth street.....	6	343
Fourth to Seventh street.....	4	988
Seventh street, south.....	4	168
ABIGAIL STREET.		
Ninth street, east.....	1 1/2	150
CHARITY STREET.		
First street, east.....	4	156
CREEK STREET.		
Brook avenue, east.....	3	194
PULLIAM STREET.		
Adams to Taylor's alley.....	4	426
Taylor's to Leigh street.....	3	512
Taylor's alley, south of Pulliam street.....	4	93
ORANGE STREET.		
First street, west.....	4	146
HOSPITAL STREET.		
Second street, east.....	4	341
CROSS STREETS.		
CHERRY STREET.		
Main to Beverly street.....	6	1426
Beverly street, south (from 10-inch pipe).....	4	635
Main to Floyd street.....	8	526
Floyd street to Park avenue.....	6	261
HANCOCK STREET.		
Broad to Marshall street.....	6	459
SHAFER STREET.		
Franklin to Park avenue.....	6	339

STREET MAINS—CONTINUED.

	Inch's	Feet.
LAUREL STREET.		
Franklin street, south.....	6	663
Albemarle to China street.....	6	932
MUNFORD STREET.		
Marshall street, north.....	3	195
PINE STREET.		
Cary to Holly street.....	6	2947
Holly streets, south.....	4	372
BELVIDERE STREET.		
Holly to Rowe street.....	6	372
Main street, north.....	3	334
Rowe street, north.....	6	60
Holly street, south.....	4	78
HENRY STREET.		
Marshall to Catherine street.....	4	611
Catherine street, north.....	4	120
MONROE STREET.		
Grace to Franklin street.....	4	392
Broad to Marshall street.....	6	388
Marshall to Clay street.....	4	373
MADISON STREET.		
Marshall street, south.....	3	297
Clay street, south.....	4	192
BROOKE AVENUE.		
Marshall street to Bacon Quarter Branch.....	6	2788
Marshall street, south.....	6	150
JEFFERSON STREET.		
Main to Franklin street.....	12	412
Franklin to Grace street.....	8	412
ST. PETER'S STREET.		
Jackson street, south.....	6	180
Jackson street, north.....	6	48

STREET MAINS—CONTINUED.

	Inch's	Feet.
PRICE STREET.		
Jackson to Duval street.....	4	250
Leigh to Jackson street.....	4	350
ADAMS STREET.		
Cary street, north.....	6	207
Franklin to Broad street.....	12	778
Broad to Leigh street.....	4	1275
ST. JOHNS STREET.		
Duval to Baker street.....	4	338
FOUSHEE STREET.		
Franklin street, south.....	3	107
Grace street, south.....	1 1/2	300
Grace street, north.....	4	244
Leigh street, south St. James street.....	4	431
Duval to Baker, in St. James street.....	4	337
Baker street, north.....	4	283
Charity to Federal street.....	6	392
FIRST STREET.		
Rowe street, south.....	4	168
Rowe street, north.....	4	254
Canal street, south.....	4	85
Canal to Main street.....	4	525
Main to Jackson street.....	10	2287
Jackson to Duval street.....	8	460
Duval to Orange street.....	4	1917
SECOND STREET.		
Main to Byrd street.....	4	1185
Main to Franklin street.....	6	375
Franklin street, north.....	6	200
Grace street, north.....	4	231
Broad to Hospital street.....	4	3942
Hospital and Second street (waste).....	3	19
THIRD STREET.		
Cary to Byrd street.....	4	1194
Cary to Broad street.....	16	1575
Cary and Third street (connection).....	16	30
Broad to Marshall street.....	6	412
Clay to Leigh street.....	6	522
Leigh to Baker street.....	4	1350

STREET MAINS—CONTINUED.

Inch's Feet.

FOURTH STREET.

Arch to Cary street	4	1200
Cary to Main street	1½	300
Main street, north	1½	200
Main street, south	6	175
Franklin to Broad street	6	751
Broad street, north	1½	250
Marshall street, south	4	80
Marshall to Baker street	4	2250
Baker street, north to Colored Almshouse	4	1048

FIFTH STREET.

Byrd street, south	3	260
Byrd to Canal street	3	400
Canal to Cary street	3	412
Cary to Main street	4	412
Main to Broad street	6	1200
Broad to Marshall street	1½	380
Marshall to Baker street	4	2227
Baker street, north	4	519

SIXTH STREET.

Byrd street, south	4	354
Canal street, south	3	180
Canal to Cary street	4	406
Cary street, north	6	70
Main street, south	1½	258
Main to Grace street	6	787
Grace to Broad street	4	412
Pink alley, Sixth to Seventh street	4	337
Pink alley, north on Marshall street	4	150
Broad to Leigh street	3	1350
Fish alley, east	5	200
Fish alley to fire plug	3	69
Leigh street, north	4	540
Duval to Baker street	4	352

SEVENTH STREET.

Canal to Tredegar	6	1076
Arch street, east to Railroad bridge	4	300
Main to Canal street	6	900
Main to Grace street	4	566
Grace to Broad street	6	412
Broad to Leigh street	12	1350
Leigh street, north	6	574
Baker street, north	4	470
Baker street, south	4	168

EIGHTH STREET.

Byrd to Arch street	4	375
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STREET MAINS—CONTINUED.

Inch's Feet.

Arch street to Railroad bridge	3	95
Cary street, south	3	248
Main to Cary street	6	412
East, between Main and Cary, in alley	3	158
Main street, north	4	43
Franklin street, south	4	250
Grace street, south	8	200
Broad to Leigh street	4	1350
Clay and Leigh streets (waste)	3	40
Leigh street, north	4	726

NINTH STREET.

Byrd street, south	4	429
Byrd street, north	3	367
Cary to Broad street	6	1585
Broad to Marshall street	2	340
Marshall street, north	1½	186
Marshall street, south	6	214
Clay to Leigh street	6	428
Leigh to Abigail street	4	912

TENTH STREET.

Byrd street, south	1½	362
Canal street, south	4	225
Cary street, south (Basin, R. & A. R. R.)	16	108
Cary to Main street	6	412
Bank to Main street	4	216
Broad street, south	4	180
Broad to Clay street	4	766
Clay to Leigh street	4	523
Leigh to Jackson street (M.)	4	375

ELEVENTH STREET.

Main to Cary street	4	403
Main to Bank street	4	266
Marshall street, north	4	339
Clay street, south	4	36
Clay street, north	6	284

TWELFTH STREET.

Cary to Canal street	4	412
Cary to Franklin street	6	834
Broad to Capitol street	4	250
Broad to Clay street	4	766
Clay street, north	3	364

GOVERNOR STREET.

Capitol to Franklin street	4	550
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STREET MAINS—CONTINUED.	Inch's	Feet.
THIRTEENTH STREET.		
Cary to Canal street.....	4	412
Shoekoe Slip, south Thirteenth street.....	3	384
Main street, south.....	3	342
Cary street, north.....	6	70
Main to Franklin street.....	4	412
Tobacco alley, Thirteenth to Fourteenth street.....	4	395
FOURTEENTH STREET.		
Cary street, south.....	3	375
Virginia street, south of Cary street.....	1 1/2	375
Cary street, north.....	6	70
Main street, south.....	3	380
Lombard alley, east of Fourteenth street.....	3	270
Main street, north.....	3	218
Exchange alley, west of Fourteenth street.....	3	243
Trueheart alley, east of Locust alley.....	1 1/2	480
Franklin to Ross street.....	6	375
COLLEGE STREET.		
Broad street, north.....	4	300
From fire plug, north.....	1 1/2	210
NEW STREET.		
Franklin street, south.....	4	166
MAYO STREET.		
Main to Broad street.....	3	1200
JAIL ALLEY.		
Marshall to Broad street.....	4	412
FIFTEENTH STREET.		
Cary to Dock street.....	3	250
Cary street, north.....	6	79
Trueheart Alley, from Locust Alley to Fifteenth street.....	4	276
Main street, south.....	3	342
Main to Franklin street.....	3	395
Franklin street, north.....	3	473
Creek Alley, east of Fifteenth street (waste).....	3	448
Spruce Alley, south of Creek Alley.....	1 1/2	121
Alley west, between Main and Cary street.....	1 1/2	254
Marshall street, north.....	4	376
SIXTEENTH STREET.		
Marshall street, north C. & O. R. R. tank.....	8	207
Cary street, into Talbott's Foundry.....	3	198

STREET MAINS—CONTINUED.	Inch's	Feet.
SEVENTEENTH STREET.		
Cary to Dock street.....	1 1/2	320
Cary to Main street.....	6	416
Main to Venable street.....	4	2250
Venable to C. & O. R. R. shops.....	4	3370
Creek Alley, west.....	4	96
Walnut Alley, east.....	1 1/2	80
West Seventeenth, south of Franklin street.....	1 1/2	208
Alley south of Franklin, between Seventeenth and Eighteenth street.....	1 1/2	75
Cary street, south into Talbott's Foundry.....	3	62
EIGHTEENTH STREET.		
Cary to Dock street.....	1 1/2	200
Cary street, north.....	6	70
Main street, south.....	3	330
Franklin street, south.....	3	310
Franklin to Venable street.....	4	2035
NINETEENTH STREET.		
Cary to Franklin street.....	6	800
Franklin to Broad street.....	4	766
East into Lottier's Tobacco Factory.....	3	99
Broad street, north.....	4	603
TWENTIETH STREET.		
Franklin to Main street.....	6	400
Cary street, north.....	6	70
Franklin street, north.....	1 1/2	350
Broad street, south.....	6	375
TWENTY-FIRST STREET.		
Cary street, north.....	6	70
Main street, south.....	4	330
Main to Franklin.....	4	412
Franklin street, north.....	4	242
TWENTY-SECOND STREET.		
Cary street, south (waste).....	6	50
Cary street, north.....	6	70
Broad to Main street.....	4	1160
TWENTY-THIRD STREET.		
Main street, north.....	1 1/2	290
Broad to Marshall street.....	6	395

LOCATION OF FIRE PLUGS.
And their Street-Main Connections.

Those marked * are cross street mains.

No.	Street	Width	Depth
1	Tredegar Foundry	3	inch
2	"	4	"
3	Holly and Church streets	6	"
4	Holly and Pine streets	3	"
5	Holly and R. & A. R. R.	3	"
6	Spring and Pine streets	6	"
7	Belvidere and Rowe streets	6	"
8	Howard and Rowe Lane	6	"
9	Church and Maiden Lane	3	"
10	Spring and China streets	6	"
11	Spring and Laurel streets	3	"
12	Albemarle and Cherry streets	6	"
13	Albemarle and Cherry streets	6	"
14	Armory Iron Works	3	"
15	Tredegar and Seventh street	4	"
16	Arch and Eighth streets	3	"
17	Centre and Sixth streets	4	"
18	Centre and Seventh street	6	"
19	Arch and Seventh streets	12	"
20	Arch and Third streets	6	"
21	Albemarle and Pine streets	6	"
22	Pine and China streets	6	"
23	Beverly and Cherry streets	6	"
24	Beverly and Cherry streets	4	"
25	Beverly and Pine streets	4	"
26	Virginia Penitentiary	4	"
27	"	4	"
28	"	4	"
29	"	4	"
30	Byrd and Second streets	4	"
31	Byrd and Fourth streets	4	"
32	Byrd and Fifth streets	4	"
33	Byrd and Seventh streets	6	"
34	Byrd and Eighth streets	6	"
35	Byrd and Ninth streets	4	"
36	Byrd and Twelfth streets	4	"
37	Cumberland and Cherry streets	4	"
38	" and Pine streets	4	"
39	Canal and Jefferson streets	4	"
40	" Adams streets	4	"
41	" First streets	3	"
42	" Second streets	6	"
43	" Third streets	3	"
44	" Fourth streets	6	"
45	" Sixth streets	3	"
46	" Seventh streets	3	"
47	" Ninth streets	3	"

LOCATION OF FIRE PLUGS—CONTINUED.

No.	LOCATION OF FIRE PLUGS—CONTINUED.	
48	Canal and Tenth streets.....	4 inch *
49	" " Virginia streets.....	3 " *
50	City Gas Works.....	3 " *
51	Cary and Cherry.....	6 " "
52	" " Laurel streets.....	6 " "
53	" " Pine streets.....	6 " "
54	" " Madison streets.....	6 " "
55	" " Jefferson streets.....	6 " "
56	" " Adams streets.....	6 " "
57	" " Foushee streets.....	6 " "
58	" " First streets.....	4 " *
59	" " Third streets.....	6 " *
60	" " Fifth streets.....	3 " *
61	" " Sixth streets.....	6 " *
62	" " Seventh streets.....	6 " *
63	" " Eighth streets.....	6 " *
64	" " Ninth streets.....	6 " *
65	" " Tenth streets.....	6 " *
66	" " Eleventh streets.....	3 " *
67	" " Twelfth streets.....	6 " *
68	" " Thirteenth streets.....	6 " *
69	" " Thirteenth streets.....	3 " *
70	" " Shockoe Slip street.....	4 " *
71	" " Fourteenth streets.....	6 " *
72	" " Fourteenth streets (alley).....	3 " *
73	" " Fifteenth streets.....	3 " *
74	" " Fifteenth streets (alley).....	3 " *
75	" " Sixteenth streets.....	3 " *
76	" " Seventeenth streets.....	3 " *
77	" " Eighteenth streets.....	6 " *
78	" " Nineteenth streets.....	6 " *
79	" " Twentieth streets.....	6 " *
80	" " Twenty-first streets.....	3 " *
81	" " Twenty-second streets.....	6 " *
82	" " Twenty-fourth streets.....	12 " *
83	" " Twenty-fifth streets.....	6 " *
84	Water and Ash streets (O. D. Co.).....	4 " *
85	" " Ash streets (O. D. Co.).....	4 " *
86	" " Hague streets.....	3 " *
87	Main and Reservoir streets.....	24 " *
88	" " Cherry streets.....	24 " *
89	" " Pine streets.....	6 " *
90	" " Monroe streets.....	6 " *
91	" " Jefferson streets.....	10 " *
92	" " Second streets.....	6 " *
93	" " Fourth streets.....	6 " *
94	" " Sixth streets.....	6 " *
95	" " Seventh streets.....	6 " *
96	" " Eighth streets.....	6 " *
97	" " Ninth streets.....	6 " *
98	" " Tenth streets.....	6 " *
99	" " Twelfth streets.....	6 " *
100	" " Thirteenth streets.....	6 " *
101	" " Fourteenth streets (west).....	4 " *
102	" " Fourteenth streets (east).....	4 " *
103	" " Fifteenth streets (west).....	4 " *
104	" " Seventeenth streets (west).....	4 " *
105	" " Seventeenth streets.....	6 " *
106	" " Eighteenth streets.....	4 " *

LOCATION OF FIRE PLUGS—CONTINUED.

No.	LOCATION OF FIRE PLUGS—CONTINUED.	6 inch *
107	Main and Nineteenth streets.....	4 " *
108	" " Seventeenth streets.....	4 " *
109	" " Twentieth streets.....	4 " *
110	" " Twenty-first streets.....	4 " *
111	" " Twenty-second streets.....	6 " *
112	" " Twenty-fourth streets.....	6 " *
113	" " Twenty-fifth streets.....	6 " *
114	" " Twenty-sixth streets.....	6 " *
115	" " Twenty-seventh streets.....	6 " *
116	" " Pear streets.....	6 " *
117	" " William-burg Avenue.....	6 " *
118	" " Ash streets.....	4 " *
119	Lester and Gillie's Creek (east).....	3 " *
120	" " Hague streets.....	4 " *
121	" " Nicholson streets.....	4 " *
122	William-burg Avenue and Elm.....	4 " *
123	City Gas Works.....	6 " *
124	Main and Twenty-ninth streets.....	6 " *
125	" " Thirtieth streets.....	6 " *
126	Franklin and Halifax streets.....	6 " *
127	Floyd and Beach streets.....	6 " *
128	" " Linden streets.....	6 " *
129	Grove Avenue and Harvie street.....	6 " *
130	" " Beach street.....	6 " *
131	Park Avenue and Shafer street.....	6 " *
132	Franklin and Laurel streets.....	12 " *
133	" " Belvidere streets.....	10 " *
134	" " Monroe streets.....	16 " *
135	" " Jefferson streets.....	6 " *
136	" " Adams streets.....	6 " *
137	" " First streets.....	6 " *
138	" " Third streets.....	4 " *
139	" " Fourth streets.....	6 " *
140	" " Fifth streets.....	6 " *
141	" " Sixth streets.....	6 " *
142	" " Seventh streets.....	6 " *
143	" " Eighth streets.....	4 " *
144	" " Ninth streets.....	6 " *
145	Bank and Twelfth streets.....	4 " *
146	" " Eleventh streets.....	4 " *
147	Franklin and Thirteenth streets.....	4 " *
148	" " Fourteenth streets.....	4 " *
149	" " Fifteenth streets (east).....	4 " *
150	" " Seventeenth streets.....	4 " *
151	" " Eighteenth streets.....	3 " *
152	" " Nineteenth streets.....	1 " *
153	" " Twenty-third streets.....	4 " *
154	" " Twenty-fifth streets.....	6 " *
155	" " Twenty-seventh streets.....	6 " *
156	" " Twenty-fourth streets.....	6 " *
157	" " Twenty-eighth streets.....	6 " *
158	Grace and Laurel streets.....	6 " *
159	" " Shafer streets.....	6 " *
160	" " Pine streets.....	6 " *
161	" " Henry streets.....	6 " *
162	" " Madison streets.....	6 " *
163	" " Jefferson streets.....	6 " *
164	" " Jefferson streets.....	6 " *

LOCATION OF FIRE PLUGS—CONTINUED.

No.	Location	6 inch
165	Grace and Adams streets	4 "
166	" Foushee streets	4 "
167	Main and Locust Avenue	4 "
168	Grace and Second Avenue	4 "
169	" " "	4 "
170	" " "	4 "
171	" " "	4 "
172	" " "	4 "
173	State Capitol (west)	4 "
174	" " (south)	4 "
175	" " (east)	4 "
176	Governor, above Ross street	4 "
177	Ross and Fourteenth streets	4 "
178	" " "	4 "
179	Grace and Seventeenth streets	4 "
180	" " "	4 "
181	" " "	4 "
182	" " "	4 "
183	" " "	4 "
184	" " "	4 "
185	Broad and Twenty-second streets	4 "
186	" " "	4 "
187	" " "	4 "
188	" " "	4 "
189	" " "	4 "
190	" " "	4 "
191	" " "	4 "
192	Broad and First streets	4 "
193	" " "	4 "
194	" " "	4 "
195	" " "	4 "
196	" " "	4 "
197	" " "	4 "
198	" " "	4 "
199	" " "	4 "
200	" " "	4 "
201	" " "	4 "
202	" " "	4 "
203	" " "	4 "
204	" " "	4 "
205	" " "	4 "
206	" " "	4 "
207	" " "	4 "
208	" " "	4 "
209	" " "	4 "
210	" " "	4 "
211	" " "	4 "
212	Marshall and Graham streets	4 "
213	" " "	4 "
214	" " "	4 "
215	" " "	4 "
216	" " "	4 "
217	" " "	4 "
218	" " "	4 "
219	" " "	4 "
220	" " "	4 "
221	" " "	4 "
222	" " "	4 "

LOCATION OF FIRE PLUGS—CONTINUED.

No.	Location	6 inch
223	Marshall and Fifth streets	4 "
224	" " "	4 "
225	" " "	4 "
226	" " "	4 "
227	" " "	4 "
228	" " "	4 "
229	" " "	4 "
230	" " "	4 "
231	" " "	4 "
232	" " "	4 "
233	" " "	4 "
234	" " "	4 "
235	" " "	4 "
236	" " "	4 "
237	" " "	4 "
238	" " "	4 "
239	" " "	4 "
240	" " "	4 "
241	" " "	4 "
242	" " "	4 "
243	" " "	4 "
244	Clay and Norton streets	4 "
245	" " "	4 "
246	" " "	4 "
247	" " "	4 "
248	" " "	4 "
249	" " "	4 "
250	" " "	4 "
251	" " "	4 "
252	" " "	4 "
253	" " "	4 "
254	" " "	4 "
255	" " "	4 "
256	" " "	4 "
257	" " "	4 "
258	" " "	4 "
259	" " "	4 "
260	" " "	4 "
261	" " "	4 "
262	" " "	4 "
263	" " "	4 "
264	" " "	4 "
265	" " "	4 "
266	Catherine and Gilmer streets	4 "
267	" " "	4 "
268	" " "	4 "
269	Leigh and Munford streets	4 "
270	" " "	4 "
271	" " "	4 "
272	" " "	4 "
273	" " "	4 "
274	" " "	4 "
275	" " "	4 "
276	" " "	4 "
277	" " "	4 "
278	" " "	4 "
279	" " "	4 "
280	" " "	4 "

LOCATION OF FIRE PLUGS—CONTINUED.

No.	LOCATION OF FIRE PLUGS—CONTINUED.	
281	Leigh and Eighth streets.....	6 inch
282	" Seventh streets (north).....	6 "
283	" Eighth streets (north).....	4 "
284	" Twenty-fourth streets.....	6 "
285	" Twenty-fifth streets.....	6 "
286	" Twenty-sixth streets.....	6 "
287	" Twenty-eighth streets.....	6 "
288	Venable and Seventeenth streets.....	4 "
289	" Eighteenth streets.....	4 "
290	" Mosby streets.....	6 "
291	" Pink streets.....	6 "
292	" Rose streets.....	6 "
293	" Twenty-fifth street.....	6 "
294	Pendleton and Twenty-fifth streets.....	6 "
295	Otis and Twenty-fifth streets.....	6 "
296	Nelson and Twenty-fifth streets.....	6 "
297	Mason and Twenty-fifth streets.....	6 "
298	Jay and Seventeenth streets.....	4 "
299	Washington and Seventeenth streets.....	4 "
300	Christian and Seventeenth streets.....	4 "
301	Lownes and Seventeenth streets.....	4 "
302	Balding and Seventeenth streets.....	4 "
303	Accommodation and Seventeenth streets.....	4 "
304	Jackson and St. Peters streets.....	6 "
305	" Adams streets.....	6 "
306	" St. James streets.....	6 "
307	" Third streets.....	4 "
308	" Fourth streets.....	6 "
309	" Ninth streets (M).....	4 "
310	" Ninth streets (M) north.....	4 "
311	" Tenth streets (M).....	4 "
312	Duval and Brooke Avenue.....	6 "
313	" Clark streets.....	4 "
314	" First streets.....	4 "
315	" Second streets.....	4 "
316	" Third streets.....	4 "
317	" Fourth streets.....	4 "
318	" Sixth streets.....	4 "
319	Baker and Brooke Avenue.....	6 "
320	" Brooke Avenue (north).....	6 "
321	" Hickory streets.....	6 "
322	" Tyler streets.....	6 "
323	" St. Paul streets.....	6 "
324	" St. John streets.....	4 "
325	" St. James streets.....	4 "
326	" Third streets.....	4 "
327	" Fifth streets.....	4 "
328	" Sixth streets.....	4 "
329	" Seventh streets.....	4 "
330	Charity and Second streets.....	4 "
331	" St. James streets.....	6 "
332	Federal and First streets.....	4 "
333	" St. James.....	6 "
334	Courts and First streets.....	4 "
335	" Second streets.....	4 "
336	Orange and First streets.....	4 "
337	City Almshouse and Hospital street.....	4 "
338	" Hospital street (inside).....	4 "

LOCATION OF FIRE PLUGS—CONTINUED.

No.	LOCATION OF FIRE PLUGS—CONTINUED.	
339	Colored Almshouse and Fourth streets.....	4 inch
340	Preston and Fourth streets.....	4 "
341	" Seventh streets.....	4 "

A BRIEF HISTORY

*Of the Origin and Erection of the Water Works of the City of
Richmond, Va.*

As this is the Semi-Centennial Report of this Department, a history may not be out of place. Prior to the introduction of city water. Springs and wells were the sources of supply, of which there were an abundance in almost every low part of the city. There were numerous springs and the most of them most excellent water, the most important of which were Mr. William C. Allen's spring, on the south side of Franklin between Sixth and Seventh streets, used by him for the supply of his many teams. This spring being a very bold one, and accessible to the street, supplying a large area of citizens, Mr. Allen's gate was always open for the public to get a refreshing draught. Goddin's Spring (now St. Francis de Sales) was another spring largely resorted to by the inhabitants of the neighborhood for their family supply. The City Spring, north of Leigh between Seventh and Eighth streets, was used to a great extent by the residents of the place. The shot tower on Bullock's Spring, on the south side of Grace between Eighth and Ninth Streets, was used by many families immediately around it. In 1837, when the Franklin Paper Mill was built, the water from this spring was conducted by a three-inch iron pipe south into Franklin and Ninth streets, thence along the west sidewalk of Ninth street to Cary street, thence west diagonally across Cary street to the east side of Eighth across through the basin, and thence along the eastern sidewalk of Eighth street to the paper mill, and still used in the manufacture of paper. There are two springs in the Capitol Square—one on the east and the other on the west of the Capitol

building. The water of these springs were conducted by iron pipes to the lower parts of the grounds (now the fountains), where these pipes were raised above the ground and a constant flow of cool water for all passers by. In 1850, when the western fountain was put in and attached to the Water Works, the old spring hydrant here was taken up and the water was conducted by a lead pipe through the Square into Bank street, thence diagonally across Bank and connected with the three-inch pipe from the shot tower spring on the western sidewalk of Ninth street, as an additional feeder of clear water for the paper mill. The hydrant on the eastern side was removed when the second fountain was built and the pipe conducted to Franklin and Twelfth street, where there is still a font for man and beast.

There was another spring, or rather well, east of the Governor's house and immediately on the side of Governor street, that was largely used by the residents. The water of this spring was conducted by means of wooden pipes down Governor, along Franklin to Twelfth street, and thence south to Cary street, where it was used by the merchants and others. A stone font stood at one time for several years near now Messrs. Shanks and Barrett's plumbing house; another spring under Bird's Warehouse, now the Exchange Hotel, which was used almost exclusively by the patrons of the warehouse, when our country friends used to roll their hogsheds of tobacco on the ground, old Taurus being the motive power.

The Basin Spring, near the corner of Canal and Eleventh streets, was noted for its excellent water. This spring is still to be seen. There were several springs in the old Armory building noted for their cool water, as this place was visited by a great many, particularly on Sunday evenings, to hear Blind Edwards with his fife and Lafayette with his drum, and at the same time to see the beautiful bronze cannon made a present to the United States by France, besides mortars and iron guns, and piles of shot and shells. Where are they now?

Echo answers, where? The Pine-Apple Spring, corner of Grace and Eighteenth streets, and the Elm Spring, near the corner of Nineteenth and Broad streets, were notorious in their day for their pleasant and refreshing waters. Lipscomb's Spring, corner of Main and Twenty-fifth streets (stove works), was one that supplied a number of people with water. Currie's Spring, as it was sometimes called, near Cary and Pear streets, was quite useful in its day. Bloody Run Spring, made notorious, it is said, by a battle which took place between two Indian tribes, making the hillsides run with blood, hence its name. This spring being a very bold one, situated near Broad and Thirty-first streets, the waters of which were conducted by Mr. Russell Dudley, an old and honored builder of this city, in wooden pipes southward to Main or Williamsburg avenue, and west along this avenue and Main street as far as the old Bell Tavern, now St. Charles Hotel, and was extensively distributed over the lower parts of the city. The use of this water was abandoned in 1837 or '38. Later at one time, by means of iron pipes laid by E. C. Pleasants, Esq., the City Gas Works and a portion of Rocketts were supplied from this source. When the Church Hill Tunnel was built it became necessary to remove a portion of this pipe, and it never has been replaced. The Gas Works is now being supplied by the City Water Works. The Penitentiary Spring, so called, on the south side of Main between Jefferson and Madison streets, has been used for perhaps fifty years for the supply of that institution. This becoming insufficient, the city water was introduced in 1872. Bargamin's Spring, as it is called, on the corner of Canal and Foushee streets, is a bold running stream, and supplies many families in the neighborhood. This spring with others near will, it is presumed, be used by the ice factory now being erected on the corner of Canal and Adams streets. There are other springs outside of the city then, but within the city limits now, that call for more than a passing remark. Buchanan Spring, near the corner of Clay and Hancock streets, was a notorious place in olden time. It

was here where the military used to have their dinners after the usual parade of the 22d of February and 4th of July (now almost forgotten), their guests, generally learned and eloquent men, would make speeches with such oratorical powers as to entertain the gathering until a late hour of the night. Clarks Spring, now a part of the small-pox hospital grounds, was another place of great resort for the citizens. It is here that Judge Marshall, Thomas Ritchie and other distinguished gentlemen met in the afternoon to pitch quoits and indulge in other innocent amusements. A semi-circle of small brick houses were built around the spring as a shelter in case of rain. It was here that Sambo with his fiddle, short-kneed breeches and euc, if he could pull out his hair far enough to make one, was called upon to discourse the pigeon-wing and Old Virginia reels for the old gentlemen to dance, which they did with a vim.

Many of the springs spoken of here have been long since arched over and their waters passed into the city sewers by drain pipes. Not a pebble in many cases has been left to designate the spot. There was a great many notorious wells in the city; suffice it to say, that only a few will be named. Ratherfoord's Well, now filled up, was at the corner of Franklin and Adams streets, near the angle of the northwest curbstone. Another well, long since filled up, called Foushee's Well, was in Marshall street near Foushee street. At one time the city hay scales covered this well. Another was Anderson's Well, corner of Seventh and Marshall streets, and many others notorious, scattered over the city, very nearly all of which has been filled up or made cesspools of since the introduction of the City Water Works. It should have been mentioned, in connection with the springs of the city, the Poor House Spring, as it is usually called, at the north end of Second street. This spring being on one of the main avenues to the city, is made notorious by its life-giving waters to man and beast. Federal Spring may also be mentioned, near the corner of Federal and St. John's streets, as one that supplied a large area of

families. These springs and wells, from the growth of the city and the numerous deep cesspools dug by parties in building new residences, the percolation of which into the wells and springs so contaminating the water for almost every purpose, that the citizens commenced to discuss the practicability of introducing water into the city from the James river.

It may be mentioned here, in connection with the water supply, that in 1829, Spotswood D. Crenshaw, of the Columbian Hotel, corner of Cary and Thirteenth streets, and the merchants from Eleventh to Fourteenth streets on Cary, formed themselves into a company to lay iron pipes from the Basin along Cary street from Eleventh to Fourteenth street, and north from Cary along Thirteenth to Main street. This pipe was inserted into the Basin at Eleventh street and run north along Eleventh street to the middle of Cary street, then down Cary with six-inch iron pipe to Thirteenth, then with five-inch pipe along the same street to Virginia street, and thence to the end at Fourteenth street with four-inch pipe, the pipe from Cary to Main street being three inches in diameter. Fire plugs, or hydrants, as they were used as such, were placed at Eleventh, Twelfth, between Twelfth and Thirteenth, at Thirteenth and at Fourteenth street. There were placed also two at Main and Thirteenth streets, one on the southeastern and one at northeastern corners. These various hydrants were suffered to run a small stream all the time for the accommodation of the public. This pipe was later extended on Cary east of Fourteenth street to a fire plug, and then into Philip Rahm's foundry, now the Centre Warehouse, all of which still remain in the streets. In consequence of the filling up of the Basin by the Richmond and Alleghany railroad for their depot this pipe has been rendered useless.

In 1829 the subject of supplying this city with water from James river by means of pumps and reservoirs was duly discussed by the citizens and in public meetings. The late Joseph Mayo, Esq., former Mayor of the city, was perhaps the first or amongst the first to advo-

cate the undertaking. There were many other citizens who took a very active part in the matter. Thomas Samson, Esq., an old and highly honored citizen, and still living on the corner of Canal and Sixth streets, was very active in his endeavors to accomplish the object. Being a thorough practical mechanical engineer, his opinion weighed very heavily with the citizens. A petition was gotten up by the citizens to the Legislature, asking that a charter be granted for this work, and during the session of 1829-'30 it was granted. A Committee on Water was appointed, consisting of John G. Williams, chairman, James Rawlings, Samuel P. Parsons, John A. Lancaster, Samuel Sublett, John Basher, and Charles H. Hyde, and their first meeting was held at the City Hall, July 23d, 1830.

The next object in view was to secure the services of some competent hydraulic engineer to plan and construct the works, and to ascertain their probable costs. Mr. Albert Stein, a Prussian engineer, who was engaged on the Philadelphia Water Works, was employed for this object. Mr. Stein came on immediately, examined the grounds, and made the necessary surveys and plans, the cost of which was about one hundred thousand dollars. A poll was opened to ascertain whether the appropriation should be made, and it was decided in the affirmative, and Mr. Stein ordered to proceed with the work. The first thing to be done was the purchase of the necessary right to the land, and the right of way through other lands through which to pass the pipes, supply and discharge. One hundred feet of land was purchased (now a part of the present site of the pump buildings) from General J. B. Harvie, as the land between the James River and Kanawha Canal and the river and up nearly to Rutherford's Mills was the property of General Harvie. At the time of the purchase of the land for the Pump-House a contract was entered into with General Harvie to furnish a certain quantity of water for propelling the pumps, he building the necessary dam, head-gates and race-way at his own expense, and charging the city a stipulated amount per annum. This

contract continued until 1839, when the city purchased from General Harvie all his right, title and interest to the land west of the Pump-House and nearly to Rutherford's Mills (which is still the property of the city). Another purchase of land was made from Major John Clark for the site of the Reservoir, and to show the approval of Major Clark to the plan, he gave the right of way through his land (now the small-pox hospital grounds) for the passage of any lines of pipes that should become necessary, on the condition that the city furnish him forever a supply of water free of charge. In 1858 the city purchased from the legatees all the land that formerly belonged to Major Clark.

The land, right of way and other matters being consummated, Mr. Stein commenced, October 7th, 1830, to erect the works. Contracts were made with William Young for the excavation, William Mountjoy for the stonework, William C. Allen for the brickwork of the Pump-House and Reservoir, and James Griffins for the carpenters' work, all of which was done in a workmanlike manner and to the satisfaction of the engineer. Contracts were made by the engineer for the pump and all necessary piping, the pump being made in New York, and the pipe-valves and fire plugs in Philadelphia, and the work of construction commenced by the engineer, the pump to have a capacity of four hundred thousand gallons of water in twenty-four hours, and the reservoir to hold four millions of gallons, which was elevated twelve feet above the highest curb in the city when full. In the influent and effluent compartments were placed filter beds of gravel and fine sand to the depth of five feet. From practical experience they proved to be of little or no advantage to the water. Mr. Stein labored most assiduously, and completed the work in 1832, all of which is now in use and stands as a monument to his memory. When the works were finished and passed from him to the Committee on Water, they passed a resolution highly complimentary to him as an engineer.

On the completion of Mr. Stein's contract with the city, Mr. Robert

L. Staples was appointed Superintendent of the Works, and remained as such until January 1st, 1837, when Garland Hanes, Esq., was elected to fill his place. It should have been said that the second pump (No. 4) was put in in 1834. The main for this pump having been laid when the first was put in, nothing was done to the works worthy of notice until 1843, when the old wooden dam built by General Harvie, in 1831, becoming so torn to pieces by the heavy floating masses of ice during the winter, that its security was a matter of grave doubt. In view of this fact, friend Micajah Bates, the old and honored Surveyor of the city, was requested to make such plans for a permanent stone dam as he might deem necessary. He very promptly secured all the data necessary, made his plans and estimates and submitted them to the committee, which was approved, and the work ordered to be done under the inspection of Mr. Bates. Warner F. Guy, Esq., a gentleman then engaged very largely in stonework, was given the contract for the work, and in about one year finished the entire dam. Parts of the old wooden dam may be seen now when the river is very low.

The great freshet of 1870 materially injured this dam near its junction with the race-way. About one hundred feet of the coping was carried away, besides the foundation was much damaged. A new stone coping was cut and furnished by Samuel Green, Esq., and the other stone necessary was quarried in the river near the spot, and the work of repairs, superintended by Mr. James McGiffin, a practical stonemason, was properly done, since which time it has remained a solid structure. An island just above the dam was removed so as to throw the immense volume of water during freshets farther out into river, thereby more equally distributing it over the whole dam.

In 1844 the demand upon the works becoming so great that an additional reservoir was all-important, not only to increase the storage capacity, but more elevation was very necessary, and in view of this, plans and specifications were made increasing the elevation six feet

higher and enlarging its capacity to ten millions of gallons. Samuel Sublett, Esq., a member of the Committee on Water, was appointed to superintend the entire work. The additional reservoir was built on the north side of the old one, thereby forming two compartments which, however, never amounted to anything in consequence of the improper arrangements of the effluent mains, the embankments of the old reservoir being raised the same height as the new, making the elevation above the highest curb in the city eighteen instead of twelve feet. The contractors for the earthwork were Messrs. William and Edward Sydnor, and the brickwork by Messrs. Glenn, Davis & Co. This work was finished early in the spring of 1845, and had the desired effect in the city at the time.

In 1848 the rapid growth and expansion of the city, and the consequent demand for water, both for private and other uses, and the introduction of numerous water-closets, which are about the greatest sources of waste, it was apparent, from the loss of head in the city, that a new and larger main should be laid, the old ten-inch being then the only supply. This work was ordered, and the pipe connected with the reservoir and thence alongside the ten-inch to Main and Jefferson to Franklin streets, thence down Franklin to Third street, connecting with the smaller mains in the different streets.

As some sixteen years had elapsed since an increase of the pumping power was made, the demand upon the two old pumps was fast becoming more than their capacity. Consequently, in 1850 two more pumps were added to the Works, the same capacity as the original ones, and pipes laid to the reservoir. These pumps were built by the Tredegar Company, under the supervision of Charles Campbells, Esq., now doing most effective service. It is to be regretted that these pumps were not made larger, but, like many other improvements, miscalculated, and the magnitude of the growth of the city forgotten.

At the first election under the new State Constitution in May, 1851, James L. Davis (present superintendent) was elected in place of Gar-

land Hanes, Esq., and on the first day of July entered upon the duties of the office.

As soon as the Committee on Water assembled and organized, the superintendent was instructed to examine carefully all parts of the works, as to what repairs or other work was necessary to insure the permanency of the works. The superintendent reported at the next meeting of the committee that a portion of the works required immediate repairs. The pumps were much worn and out of order, not doing anything like the work they should do under the speed they were then running; new valves were necessary; the wheels needed new buckets and soling, besides being without many essential bolts; the old wood-gates taken out and iron ones put in their places; the front yard and ground floor of pump-rooms paved with hard bricks or cement; the race-wall, head-gates and dam needed more or less repairs; a new bridge was necessary for the convenience of the works across the race-way opposite the pump-house; the pipes needed protection from frost leading to the reservoir, and a new fence around the reservoir, and the pavement suitably repaired. This part of the work being considered the most essential, a report was made accordingly, and the expense estimated at \$2,800. The committee asked the Council for this appropriation, which was readily given, and the work all done in a satisfactory manner, and a report made to the committee on the completion of the same.

The superintendent was then ordered to report upon the supply and distributing mains; and, in accordance with the same, many places, particularly on the more elevated parts of the city, was tested as to the elevation the water would rise, and it was found that at several points no water could be obtained scarcely at all during the day, the area of the supply mains being much larger than the distributing ones leading from them. In view of this and to meet the then wants of the city as well as to provide for a prospective increase when other mains should be laid from the reservoir, a sixteen-inch

pipe was recommended to be laid in Third street, and connecting with the supply main (twelve-inch) from the reservoir terminating at this street, commencing at Cary street and running north to Broad street, down Broad east to Mayo street, and from thence along Broad to Twenty-seventh street, and south to Grace and Twenty-seventh. This sixteen-inch pipe reduces to an eight-inch at Mayo street, and with that size to the terminus for Church Hill, which had only a four-inch pipe laid in 1848 from Franklin street north along Twenty-second street to Grace, and east along Grace to Twenty-seventh street, where the connection of the eight-inch was made with it.

This sixteen-inch pipe was connected with nearly all the street mains by branching much larger in area than the mains leading from it. The twenty-four-inch main pipe put down in 1859 connects with it in Main and third streets. A twelve-inch pipe was laid from the sixteen in Broad street and north along Seventh street to Leigh street which added greatly to the supply in that part of the city. The report was made promptly to the committee and an appropriation asked for of \$30,000, which was very readily made, and the entire work was completed within a few dollars of the appropriation.

The continued enlargement of the city and a material increase in its business and growing demands for water over many parts that were not before supplied, showing very plainly, from the amount of labor that the pumps had to perform, that no time should be lost in the erection of more and larger pumps to meet the increasing consumption of water, plans and estimates were made, and in the summer of 1854 the work was ordered to be done. The stonework was done under the supervision of Washington Gill, Esq., City Engineer, by the city, and two pumps, twelve inches in diameter and six foot stroke, and the necessary water wheels (Nos. 1 and 2) were contracted for by Messrs. Talbott & Bro., finished and put to work in May, 1855, and stand to-day as an emblem of their superior workmanship. In order to make the force-mains always accessible, a

heavy iron bridge, twenty-five feet wide, (Boldman's patent) was ordered to be built, the Tredegar Company being the constructor, was erected across the James River and Kanawha Canal for the passage of all the pump-mains, which were then under the canal. Four of the six pump-pipes were laid in this bridge. From the constant ram or thrust of the pumps and the testing of heavy cannon just below the pump-house, it was discovered that the stone pier or support of the bridge on the canal bank was giving evidence of its dangerous condition. No foundation could be obtained for this heavy mass of stone but the tow-path of the canal, which was thought by judges to be secure with a broad foundation of stone.

As soon as the fact was made known to the Committee on Water, they immediately summoned several engineers to examine and report upon its condition. They reported that it was very unsafe, and the only reliable security to the city was to erect a tunnel under the canal, and thus give the pipes a good foundation and make them at all times accessible. This plan was recommended to the Council by the Committee on Water, and in the spring of 1857 the work ordered to be executed, and Washington Gill, the then City Engineer and the Superintendent of the Water Works, were empowered to purchase the necessary tools, derricks and other things, employ the labor, and without delay to proceed with the work, which was completed in about one year. All the pump-mains were then passed through the tunnel, the bridge being all taken down and the bridge and stone-pier removed and the pipes connected again in Hollywood Cemetery, thereby relieving the pump materially of several very objectionable angles.

This tunnel has never cost the city anything since its construction, and reflects credit upon Mr. Gill as an engineer.

During the summer of 1858, the Committee on Water, in view of having some established plan for all the prospective improvements to the Water Works, Mr. Charles Ellett, Jr., a celebrated engineer, who

was then living in Washington City, was employed for this object. Prior to the arrival of Mr. Ellett, and to have all the information possible for Mr. Ellett, several surveys and plans were made by the City Engineer and Superintendent of the Water Works looking to the same object, the first of which was to construct a reservoir in the cavity or branch, now the southern part of the small-pox hospital grounds, and immediately alongside the pump-mains a stone dam across this branch sufficiently high as to back the water up nearly to what is now called Harviatown, which was estimated to contain when full about ninety millions of gallons of water, and all the pump-pipes branched into it, so as supply either this or the other reservoir, and to pass a main-pipe of sufficient size through Hollywood Cemetery to and down the James River and Kanawha canal on the berme side to the city and connected with the street mains in such a manner as to supply the lower portions of the city exclusively, the top of this reservoir or lake being about forty feet below the present reservoir.

Another plan was to erect a reservoir on Oregon Hill, as at this time but few buildings were there. This reservoir was intended to occupy a space of about five acres of ground, with a depth of water of twelve feet above the surface, which would be about twenty-five feet below the present reservoir, and a pipe of large size leading down and along the canal on the berme side, and connected in the same manner as was proposed in the first plan.

There was another plan proposed to supply that part of the city below or east of Fourteenth street. It was to erect a steam-pump works where the sumac mills are now—just below or east of the present City Gas Works. This plan was intended to utilize the water of Gillie's creek, which supplied about seven million gallons of water daily, and to build pumps sufficient for the then wants of that portion of the city, including Church Hill and Union Hill, and to pass the pump-main to the summit of Chimborazo Hill, which was

not a great distance, owing to the rapid ascent off the hill, and to erect there a water-tower of boiler iron forty feet in diameter and eighty feet high, so as to be enabled to supply the highest points of these hills, from which a pipe was to be laid, commencing with a twenty-inch pipe and ending with a sixteen-inch at Fourteenth street and connected with all the street mains in its passage. At Fourteenth street it was proposed to divide the city into two separate works—eastern works and western works. No estimate of costs was made of this work.

When the stream came to be more thoroughly examined it was found to be composed of several small streams along which were vegetable gardens and other crops, and the land highly fertilized by various compounds, which were very deleterious to the water for a city supply, and consequently the project was abandoned. These several plans were all made before Mr. Ellett came on. When he came on he was shown over the works and the surrounding country. The various plans that had been made were submitted to him for his inspection, none of which he favored to any extent, possibly because they were made by others. He then submitted a very elaborate plan looking to the James River and Kanawha canal, as he called it a natural reservoir, to be enlarged at the foot of Oregon Hill by an excavation in that hill to form a subsiding basin, and to pass the pipes from it along the berme side of the canal to the lower parts of the city and connecting with the old mains in its passage through the streets. This plan was decidedly the most objectionable of all, using the water from the canal, and that, too, in the city limits, besides, at such a reduced head as to render it totally impracticable as a source of supply, head being a prerequisite. This plan was printed and duly submitted to the City Council by him. After a proper discussion of the merits of the plans, it was laid on the table and indefinitely postponed.

Mr. Ellett, the City Engineer, and the Superintendent of the Water

Works were instructed to make a joint report, and to recommend such improvement as were then necessary, deferring any action regarding the prospective improvements. After a proper investigation was made by those instructed to do so, a new main from the reservoir was considered of the most importance, and a report made to the Committee and Council in accordance.

This was one of the plans proposed before Mr. Ellett came on. He was engaged in this work perhaps about thirty days, for which he charged the city \$2,500. The committee, however, agreed to pay him \$1,500, which he accepted in full for his services.

In 1859, in view of the rapid growth and enlargement of the city, and the increased consumption of water in the city, a twenty-four-inch main iron pipe was ordered to be laid from the reservoir, along Reservoir street to Main, and east along Main to Third street, as a permanent supply main, as the old ten and twelve-inch supply mains passing through and very much disfiguring the beauty of the lots, and ultimately to be taken up, or conform them to the streets as laid off in the plan of Sidney. When this pipe was laid down it was attached to the old waste-pipes, as that was the only connection that could conveniently then be made. In 1872 a syphon pipe of twenty-four inches diameter was put over and through the northern embankment, and curving east attached to this pipe, thereby giving it its full area of water way.

During the war, or from 1862 to 1866, very little was done except to lay a few small mains in the city.

In 1871 plans were made by the City Engineer looking to the erection of a new and more elevated reservoir, and to dividing the city into an upper and lower service; and in view of that, Mr. J. J. Heindl, a hydraulic engineer, was employed to make such plans for the enlargement of the works as he might think necessary. Mr. Heindl made an elaborate report on the subject, but in consequence of the great costs of his plans and the various alterations he proposed

to make, nothing was done with it except to receive it and lay it on the table.

In view of dividing the city into an upper and lower service when a new high-service reservoir should be built, a twenty-inch main was laid in Cary street in 1872 connecting with the two (ten and twelve-inch) at Madison street, thence down Cary street to Seventh street where it reduces to a sixteen-inch pipe, thence down Cary street east to Thirteenth street where it again reduces to twelve inches, and down Cary to Twenty-fourth street, and north along Twenty-fourth street to Main where it connects with the eight-inch in Main street. This line of pipe connects with every cross street below Sixth street, except Virginia and Eleventh street, and a double branch, twelve by twenty inches, in Cary and Fifth streets. There is also a twelve inch blow-off cock at Jefferson, one at Fourth street, and one at Twenty-second street, all of which pass the water immediately into the city sewers. From the size of this pipe and area of supply it will be ample for some years to come.

In the latter part of 1872, when the Cary street main was put in operation, the need of more pumping power was plainly to be seen. The great increase in new buildings and the numerous additional water fixtures in new and old houses was adding daily to this necessity; and in view of this fact, Mr. Emile Geyelin, a hydraulic engineer of Philadelphia, was employed to furnish plans and estimates for two new pumps and one turbine wheel sufficiently powerful to propel both pumps, of seventeen inches diameter and six foot stroke, both pumping into one twenty-four-inch pipe and passing along the old pumps to the old reservoir and then into the reservoir, with branches and stop-cocks for changing the supply into the new reservoir when constructed.

These pumps were built by Messrs. Talbott & Sons, the gearing by Messrs. Joseph Hall & Co., and the turbine wheel by Messrs. R. D. Wood & Co., of Philadelphia, all of which was very creditably executed. They were finished and put to work in September, 1874.

The stonework was done by the city, under the supervision of Mr. John P. Tyler, superintendent of the pumping machinery of the works, and performed their duty most satisfactorily until an extension of the twenty-four-inch pump-main was made to the new reservoir, about seven thousand feet farther and thirty-seven feet higher. This so increased the strain upon the machinery that it caused the valve seats and valve chambers to give way which necessitated them to be made much stronger to meet the increased pressure, and have been more or less a source of trouble since. The lift of the pumps into the old reservoir is one hundred and sixty-six feet and that of the new two hundred and three feet. The pump works are two thousand five hundred feet from the old reservoir. When the new works now in progress are finished they will be turned back into the old reservoir.

In 1873, surveys and plans were made by Col. W. E. Cutshaw, City Engineer, as to the best location for the high service or new reservoir; and in view of the erection of pumping machinery at the Three-Mile Locks of the old James River and Kanawha Company, now Richmond and Alleghany railroad, the Omohundro property was selected as the site for this structure. The grounds are spacious and sufficiently remote from the city to prevent contamination of any sort. This reservoir contains when full forty millions of gallons, and divided into two compartments with gates so that either one can be used at a time to supply the city. The top water line of this reservoir is one hundred and sixty-two feet above the pumps now erecting at the locks. The supply pipe to this reservoir connects with the pump pipes on the east side of the old reservoir, thence north about fifty feet east of the fence of the reservoir to Ashland street, then curving west along Ashland street to the south side of the new reservoir where it enters the influent well. A thirty-inch outlet main passes from the effluent well, thence along the avenue to Main street, thence east down Main street to Beach street (Morton's Corner), where it

connects with twenty-four-inch formerly supplied from the old reservoir, at this point dividing the supply of the city into an upper and lower service. In order to effect a separation of the two reservoirs, a twenty-four-inch pipe was laid down Cary from Reservoir street to Madison street where it connects with twenty-inch main. The old connection between the high and low service still remains, as the lower service, if need be, can be supplied from the upper.

The rest of the improvements not being finished, no further description will be made, as there is no doubt that when they are completed a proper report will be made.

It should have been said in the proper place that the new reservoir was filled December, 1875, and the water turned into the city on the first day of January, 1876.

RICHMOND, VA., February 1st, 1883.