

1903
ONE HUNDRED AND FIRST ANNUAL REPORT

OF THE


BUREAU OF WATER

FOR THE YEAR ENDING DECEMBER 31, 1902

AND

FOURTH ANNUAL MESSAGE

OF

SAMUEL H. ASHBRIDGE

MAYOR OF THE CITY OF PHILADELPHIA

WITH

ANNUAL REPORT

OF

WILLIAM C. HADDOCK

Director of the Department of Public Works

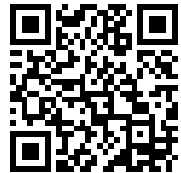
ISSUED BY THE CITY OF PHILADELPHIA
1903

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DUNLAP PRINTING CO., 1332-1336 CHERRY STREET
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ROLLA DANCE

Stenographer

JOSEPH MARCUS

Clerk

WILLIAM WEAVER

FOURTH ANNUAL MESSAGE

OFFICE OF THE MAYOR, CITY HALL,

Philadelphia, April 6, 1903.

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

GENTLEMEN:—I have the honor to transmit herewith to your Honorable Bodies my fourth and last annual message, in pursuance of the provisions of the Act of Assembly of June 1, 1885. I have the honor at the same time to submit for your consideration the reports from the Departments of Public Safety, Public Works and Charities and Correction, together with detailed statements of the various Bureaus under the jurisdiction of each; also reports from the Departments of Receiver of Taxes, City Treasurer, City Controller, Law, Education and Sinking Fund Commission.

It will be my purpose in this, my last official document to your Honorable Bodies, to outline and review briefly the many great improvements which have been completed during my administration, or which have been begun and are now under way. And at the very outset I wish to express my appreciation of the uniform courtesy and consideration which I have received at your hands throughout

the entire four years. Not a single measure which I have called to your attention has failed of your concurrence. Every project for the betterment and advancement of the city has received your full and cordial co-operation.

The past four years have witnessed great strides in our municipal development. Practically every branch of the City government has been given an impetus in the line of progress through the wise and beneficent legislation of your Honorable Bodies, and the past four years, I am sure, will favorably compare with any similar period in the history of our City. What has been done has been done for the best interests of the City, and what has been achieved will be found worthy of approval, both as to conception and completion and with regard to the present and future needs of our City.

The developments of the past four years have shown that in the selection of Abraham L. English as Director of the Department of Public Safety, of William C. Haddock as Director of the Department of Public Works, and of Dr. John V. Shoemaker and his colleagues as Directors of the Department of Charities and Correction, there was made no mistake. All of these gentlemen have worked faithfully and unceasingly for the best interests of the city and have been fully alive not only to the needs of the present, but to the necessities of the future. I cannot speak too highly of the practical and efficient work of my directors.

Among some of the many important steps towards the development of the material interests of the city, during the past four years, to summarize them merely by title, are the following:

Beginning and partial completion of the work for the extension, improvement and filtration of the water system, which, when completed, will furnish the largest and purest water supply in the world.

The installation of the fire pipe line in the business section, thus decreasing the cost of insurance and affording greater protection to life and property.

The framing of new building laws with the view to greater security from fire and the introduction of the same in the General Assembly.

The abolition of the Public Buildings Commission and the taking over of its powers by the Bureau of City Property, thereby saving to the City over five hundred thousand dollars annually in appropriations.

The re-organization of the Bureau of Health, with the responsibility lodged in one person.

The re-organization of the Department of Charities and Correction, with the view to the centralization of power and responsibility.

Relief of the crowded condition of the Philadelphia Hospital by the construction of six consumptive pavilions, a Children's Hospital and a Maternity Hospital.

Relocating hospitals for the insane and almshouse upon ground already owned by the City in the Forty-first Ward, and the commencement of the construction of buildings of modern type, thus settling a subject that has been agitated and discussed for a period of twenty-five years.

The purchase of a new site for the Municipal Hospital, and the awarding of contracts for modern sanitary buildings for the best treatment of contagious diseases.

The further extension and widening of Delaware avenue north of Vine street.

The erection of pleasure pavilions on the Delaware river, which not alone contribute to the health and pleasure of the congested districts, but at the same time, through wharfage leases, bring in a handsome revenue to the City.

The improvement of League Island Park; eighty-seven acres filled to a depth of six feet by means of dredged

material from the Delaware river, thus saving one million dollars to the city.

The deepening of the channels of the Delaware and Schuylkill rivers, and the further improvement of the Schuylkill river by contract just made for expending four hundred thousand (400,000) dollars.

The expenditure of nearly one million dollars in the erection of twenty new bridges, and the letting of contracts for fourteen others.

The construction of 17 miles of main sewers, at a cost of nearly two million dollars, and of 113 miles of branch sewers, at a cost of almost two million dollars, with contracts now being completed for seven miles of additional sewers.

The laying of 190 miles of improved pavement, at a cost of six and a half million dollars, and the macadamizing of fifty miles of country road at a cost of \$465,000.

The erection of eighteen thousand buildings of various descriptions, approximating in value \$100,000,000.

The increase in the general staff at the Philadelphia Hospital by the addition of eminent specialists thereto, and the opening of the hospital to students of all colleges.

The opening of the Municipal Hospital to the students of all colleges, for the study of contagious diseases, thus making the city a greater medical center.

The improvement of materials entering into city work, through the agency of the testing laboratory.

The plotting of a boulevard northeast from Broad street, which will result in many million dollars' worth of improvements which will be subject to taxation.

The boulevarding and widening of Broad street in the southern section of the city.

The plotting of a boulevard from City Hall to Fairmount Park.

The completion of Aramingo canal sewer and avenue

(which incidentally resulted in a loss to the contractor of \$100,000).

The completion and dedication of the new Boys' High School.

The beginning of the new Northeast Manual Training School at Seventh street and Lehigh avenue.

The increase in the value of Philadelphia and Erie stock; four years ago it was worth \$900,000; to-day it is worth \$2,500,000.

The planting of trees on Broad street.

The re-inspection of the water service, whereby the annual receipts of the city are increased \$150,000.

The introduction of competitive telephone service despite violent opposition, which has brought about an improved service at one-half the former rate.

The re-plotting of the survey lines in the southern section of the city whereby grade crossings will be forever avoided.

Legislation for the improvement of the transportation services, whereby subway and elevated systems will be added to the surface lines.

The introduction of a new type of gasoline lamp, whereby much greater illumination is furnished without additional cost.

The extension of the street cleaning service, whereby 150 miles of undedicated streets and alleys are now cleaned by the City, thereby giving greater protection to the public health.

The number of squares (recreation and breathing spaces for the public) improved during the past four years was twenty-four, at a cost of \$447,876; the number of squares improved during the preceding eight years was eight, at a cost of \$104,397.

The saving to the City of the three million dollar

Thomas W. Evans' Dental Institute and Museum by the formation of a corporation under the terms of the will.

Sending to the Puerto Rico sufferers two shiploads of clothing and supplies, the amount exceeding by far that contributed by any other city, and establishing a new high record for Philadelphia's philanthropy.

The debt of the City Jan. 1, 1899, was \$51,241,295.22.

The debt of the City Jan. 1, 1903, was \$59,361,845.22.

Loans issued during the past four years, \$26,800,000; permanent loans paid off during the same period, \$18,753,800; total net increase of debt, \$8,120,550.

Annual interest on loans paid off during the past four years, \$1,071,028; annual interest on loans created since 1899, \$863,250; showing a net annual reduction in interest payments, notwithstanding the increase of debt, of \$207,778.

Real estate owned by the City in 1899 was worth \$55,975,494; this year the City property is worth \$64,520,994, an increase of \$8,545,500.

The assessed valuation of property subject to taxation in 1899 was \$864,516,035; this year it is \$911,968,674, an increase of \$47,452,632, which shows an increase in the annual revenue of the City of over \$800,000.

DEPARTMENT OF PUBLIC SAFETY.

The many Bureaus of the Department of Public Safety have made great advancement under the progressive administration of Abraham L. English. The abolishment of the Public Building Commission and the transfer of City Hall to the Bureau of City Property, the installation of the fire pipe line, the increase of the police force, the many numerous and important occasions when there were

distinguished visitors to the city and when there were great street gatherings calling for police supervision, have all required a high degree of executive ability. Every emergency and every new duty, however, has been promptly met, and not a single casualty of any kind has marred the success of any of the numerous public demonstrations.

Among the many public occasions which attracted to the City vast numbers of people were the dedication of the Grant Monument in East Park; the National Republican Convention, which met here for the first time in thirty years in 1900; the National Export Exposition and the Commercial Congress, 1899, and the visit of Prince Henry of Prussia.

Bureau of Police.

The City has maintained its reputation as being the best policed City in this country, if not in the world. Few crimes of any magnitude have been committed without the almost immediate apprehension and punishment of the criminals. Compared with other large cities, Philadelphia is singularly free from crime. Women can walk abroad in any quarter of the City, almost any hour of the day or night, without being subject to insult or danger, and the public peace has been preserved by a force entirely inadequate to the extent of territory to be covered.

The police force has been increased during my administration by two hundred and sixty-eight men, and should be further increased by at least five hundred men, to afford adequate protection in outlying districts. Seven patrol stations have been equipped, making a total in the city of thirty-two, and leaving but two districts (the Fifth and Eighth) yet to be supplied.

During the past year the Detective Bureau has recovered \$63,410.72 worth of stolen property, and has made seven

hundred and seventy arrests; the Bureau of Police has made sixty-five thousand four hundred and sixty-eight arrests. The total amount of stolen property recovered during the four years has been \$231,680.49.

Compared with any similar period in the history of the City, I am convinced that an unbiased public sentiment will concur in this, that there has been less gambling in its various forms than ever before. There is less gambling and vice in this city than in any other city on the continent of one-half the population.

It is well to note, also, that the assembling of anarchists has been absolutely prevented and the suppression of seditious utterances has been brought about by the vigorous action on the part of the Bureau. This city is freer from this objectionable class of people than any other large city in the country.

Bureau of Fire.

The most important matter in connection with the Bureau of Fire during the past year was the completion and putting into service of the new Fire Pipe Line in the business section of the City. For some years past the Board of Fire Underwriters, recognizing the increasing danger from fire in this section, owing to the change in the methods of building and the increase in the number of department stores, had from time to time raised the rate of insurance, until finally the business men and property owners raised indignant protest. The fire underwriters, however, met these protests by announcing that the protection afforded by the City against danger from fire was entirely inadequate.

The suggestion of an auxiliary service, whereby water for fire purposes only should be rendered immediately available at every point in this district was made, as the only remedy for these conditions.

Two years ago I took the matter up with your Honorable Bodies and a liberal appropriation enabled me to begin the work. This auxiliary service of fire pipe line embraces the territory bounded by Race, Walnut and Broad streets, and the Delaware river front and the Fire Boat Stuart is at all times connected with the system at Race street wharf. The pumps of this boat have a capacity of nine thousand gallons of water per minute, so that in conjunction with the Police Boat Ashbridge the pipe line service is always ready for operation. In connection with the pipe line, electrical attachments have been installed, whereby telephone stations are located close to the hydrants, so that immediate communication may be had with the boat or boats in service.

The system has been entirely satisfactory, as was shown by a test conducted by the Philadelphia Fire Underwriters' Association in September last, at Broad and Sansom streets. The test was most exhaustive and the results were so satisfactory as to bring about a substantial reduction in the rates of insurance, a cause of great gratification to the merchants and property owners of the City.

The service of the pipe line will be still further enhanced by the completion of the pumping station at the southwest corner of Delaware avenue and Race streets. This ground has been condemned and appropriated by the City, the old buildings thereon have been demolished, and the new pumping station is in an advanced stage of construction. Upon its completion the fire boats will be used as auxiliaries and in protecting shipping in the harbor. The operation of this service will be under the efficient direction of the Bureau of Fire.

The Bureau of Fire as at present constituted, is probably, without exception, the best equipped fire department in the world. Two distinguished fire experts, one of them from Europe and the other from Australia, who were tour-

ing the world, inspecting the various fire departments, by orders of their respective cities, pronounced the Philadelphia department as being far in advance of any they had seen either in Europe or America.

A department of the Bureau to which little attention is paid, but which is deserving of notice, is the repair shop. This is thoroughly equipped for the purpose of repairing the fire apparatus used in the department and in addition thereto it builds all the patrol wagons used in connection with the Bureau of Police, the disinfecting and ambulance wagons connected with the Bureau of Health, and the wagons connected with the Electrical Bureau.

Bureau of Building Inspection.

The work of this Bureau was very much extended and advanced in the interest of public safety during this administration, by adding thereto the frequent inspection of department stores, the inspection of buildings in the congested district, and the inspection of elevators.

The inspection of the Department stores was begun at my suggestion in the first year of my administration, when conditions of a serious character were found to exist in many instances, a number of them hazardous in the extreme in the event of a panic or alarm of fire, and many changes were ordered for the safety of the public. Succeeding years have shown a marked improvement in the character of these establishments. Too much credit cannot be given to the Bureau for its work in this connection. House to house inspections are frequent in the district bounded by Walnut street, Vine street, Broad street, and the Delaware river, in conjunction with the Fire Marshal, to ascertain the conditions which exist in this territory regarding danger from fire and the observance of the laws concerning fire escapes. Many conditions

were found which were startling. During the last year alone the Bureau issued eight hundred and twenty-five notices, of which two hundred and forty-nine were for fire escapes, and seven hundred and nineteen for fire escape appliances, while two hundred and twenty-seven notices were served where other dangerous conditions existed.

The records of the Bureau show that during the past four years more buildings of an industrial and manufacturing character were erected than during any previous period in the City's history,—a record which should be gratifying to every thoughtful Philadelphian, showing, at it does, a widening and a strengthening of the City's commercial and material interests.

During the past year upwards of thirty million dollars were expended in the City for improvements, making a total during the four years of about one hundred million dollars. It is interesting to note that one-half of the dwelling houses erected during this period have been built in the four wards west of the Schuylkill river.

The division of elevator inspection which was authorized in 1900, did not become completely organized until the following year. But in the brief period that has elapsed since that time, the utility of this branch of the branch of the City's service has been fully proven.

Boiler Inspection.

The work of the Bureau of Boiler Inspection has been enlarged during my administration by the passing of an Act of Assembly, under which engineers must be examined and licensed by the Chief Inspector. This law went into effect towards the close of 1899, and since then upwards of three thousand engineers have been examined, and this notwithstanding the fact that the force of the Bureau has not been increased, although the work has almost doubled.

The earnings of the Bureau during the four years have exceeded one hundred thousand dollars. The work of the Bureau has been further added to by the ordinance requiring the inspection and licensing of automobiles.

Electrical Bureau.

The Electrical Bureau has kept pace with the growth of the City. During the past year was begun the work of equipping the central office with expensive apparatus to facilitate the transmission of fire alarms. When completed it will be the most perfect equipment of police and fire alarm systems in the country.

An important part of the Bureau work was in connection with the Fire Pipe Line. Communications may now be had from any point along the line with the power house or with the pumping station, so that at whatever point a fire is discovered, the Pipe Line is ready for immediate use. Several thousand poles, and miles of overhead wires have been removed during my administration, and nearly a thousand miles of underground wires have been laid, making a total now in use in this City of 43,010 miles.

The electric lighting service has also been greatly extended, there being a total number of arc lights in the streets of 9,426, so that in all probability Philadelphia is one of the best lighted cities in the country.

Bureau of Health.

Four years ago, at my suggestion, the General Assembly of the Commonwealth transferred all the powers of the old Board of Health to the newly organized Bureau of Health, the head of which was to be appointed by the Mayor, and was to act as an executive, thus placing the entire work of the Bureau under one management. The results have been most gratifying.

The year 1901 and the early part of 1902 witnessed an outbreak of smallpox, caused largely by importation from other places where epidemics existed. The emergency was promptly met and an auxiliary vaccine corps of thirty men was added to the service of the Bureau which systematically disinfected the entire city. The thoroughness of this work has shown itself and its effectiveness is now bearing fruit. The system adopted was favorably commented on by the medical journals of this and other cities.

The total number of deaths in 1902 was 23,907, a decrease of 290 over 1901, making the death rate 17.67 per thousand of population. This rate is lower than that of 1901 and is the lowest since 1879, when it was 17.17 per thousand. It must be a matter of gratification to all citizens to know that the death rate of Philadelphia is lower than that of any other large city in the country.

After many years of agitation on the part of residents of the Twenty-eighth Ward, a new site has been found and its purchase authorized, for the location of the Municipal Hospital, viz., the MacAllister Farm, in the Thirty-third Ward. This property is advantageously located, so far as environment is concerned, as well as accessibility. It is sufficiently large to allow of the location of separate buildings for the various types of contagious diseases, and will permit of the very best modern treatment.

Bureau of City Property.

During the past four years the Bureau of City Property has spent for permanent public improvements, \$1,527,924.48. A very large proportion of this sum was spent for the adornment of the City in the shape of small squares. Four years ago I assumed the attitude that in preference to adding to the number of unimproved plots of ground purchased from time to time for small squares, the City

should devote its attention to the improvement of sites which had already been purchased. The work of improvement, therefore, during the past four years, has been largely along this line. The most notable work has been the improvement of League Island Park, in the southern section of the City. The ground has been filled up, Broad street has been widened and boulevarded, the lakes have been dug, and the work is now far enough advanced to give the general public some conception of the beauty of the scheme of development. There is no question that this work will result in building up the southern section and will add materially to the revenues of the City from taxation. League Island Park will be connected by a series of boulevards running from Broad street to Twenty-third street, and other sections of the City, so that in the course of time a boulevard driveway will enhance the attractions of the City.

Six new bath houses have been erected during the past four years; ten new fire houses were completed and put into service, and one union police patrol and fire house; three combined police patrol houses and one police station were also put up. Summarizing briefly, in the erection of new fire houses, \$263,598 was expended; for the combination police patrol and fire houses, \$226,046; for public bath houses, \$63,238.

An interesting feature on the part of the Bureau shows an increase in the amount of revenue derived from various kinds of real estate. In 1899 the rental from wharf properties was \$32,907.48. Last year this amount was \$40,281.34, making a total of \$150,472.70 for the four years.

Of the ordinary real estate owned by the City the amount of revenue was increased from \$3,475.21, the amount in 1899, to \$15,266.64, the amount in 1902, showing an increase in revenue as between the first and last years of

my administration of \$11,794.43. This good showing was made possible by the appointment of a Superintendent of Docks and Real Estate, whose sole duty it is to give these matters attention.

DEPARTMENT OF PUBLIC WORKS.

Never, during the sixteen years of the history of the City under the Bullitt Bill Charter, has the Department of Public Works been called upon to grapple with so many and such stupendous problems affecting not only the present, but future generations. The extension and improvement of the water system, the installation of the Fire Pipe Line, and a new telephone service, the development of the sewer system, the inception of the new scheme of rapid transit, including subway, surface and elevated systems, while the most important, are but a few of the many great works of a public character which have called forth the very best talent and energy of the departmental employees, especially in the Bureau of Surveys and in the Bureau of Water. I cannot commend too highly the Director of this Department, William C. Haddock, and the Chiefs of the Bureaus within his jurisdiction, for their faithful and efficient service during the four years of my administration.

Bureau of Water.

The agitation for an improvement in the present water supply of the City was begun nearly fifty years ago, and was met from time to time by the construction of larger reservoirs and pumping stations. This failed to give satisfaction and the people were constantly stirred up to the need of a better service. To such an extent was this carried that outside capitalists and promoters sought to pro-

cure by lease or sale, the entire plant of the City. While these efforts were unsuccessful, nothing of a definite or positive character was done to improve the service until the advent of my administration. At the very outset I was confronted with the fact that some of the leading business men and financiers of the City were anxious to secure the control of the City's works. At once I took the stand in my inaugural address, and reiterated in my first annual message to your Honorable Bodies, that I was unalterably opposed to the sale or lease of the works. This statement effectually stopped the plans of those who had hopes of securing this valuable franchise, although from time to time attempts have been made to resuscitate the scheme.

I entered the office four years ago, firmly convinced that the only solution of the water problem was to bring the supply from the Delaware river at Tohickon creek and Haycock Run, with subsequent extensions to the waters of Pike County. This had been the recommendation of the departmental engineers in the past, and I had reached the same conclusion after a prolonged study of the subject. However, there was a very wide sentiment at the time in favor of some form of filtration and against the expenditure of the very large amount of money that would have to be expended in bringing the water from a distant source. In deference to this sentiment, and at my request, authority was given to me by your Honorable Bodies in the spring of 1899, to appoint a commission of experts, under which authority I named Rudolph Hering, Joseph M. Wilson, and Samuel M. Gray, all recognized authorities in the matter of water works and water purification. They compressed into a few months' work which should ordinarily have taken years to accomplish, and their final report was presented to your Honorable Bodies on September 21, 1899.

A loan of \$12,000,000, to carry into effect their recommendations, was authorized by the people the following November, and the following January ordinances were passed substantially in the same forms as the original draughts forwarded by me.

A Resume of Filtration Work.

This brief outline will serve to call attention to the comparatively short period during which the work of the improvement has been under way. Less than three years have elapsed since an engineering corps was organized for the improvement, extension and filtration of the water supply, and it is a little more than two years ago since the testing station was placed in operation. During this brief period a prodigious amount of work has been accomplished under the capable and practical management of Chief Engineer John W. Hill. The work, however, is of such a stupendous character that the ordinary layman cannot appreciate the amount of work done without a visit to the scene of operations. A brief resume of the work of the Filtration Corps will be of interest.

The improvement of the water supply of Philadelphia embraces three distinct propositions.

First. The filtration of the entire water supply, assumed in the near future, at 300,000,000 gallons per day of 24 hours.

Second. The transfer of source of water in the districts now supplied from the Fairmount, Corinthian, East Park and Queen Lane Reservoirs from the Schuylkill to the Delaware River.

Third. An adjustment of the water services of all but that portion of the City lying west of the Schuylkill River, comprising the Twenty-fourth, Twenty-seventh, Thirty-

fourth and Fortieth Wards, to adapt them to an economical operation of the Upper and Lower Roxborough and Torresdale Filters.

During 1900 a Testing Station was built and equipped at the Spring Garden Pumping Station for the purpose of studying the Schuylkill River water and the effect on same by slow sand filtration, also the qualities of various local sands and other filtering materials for preliminary filtration.

Plans were completed during the same year for the Lower Roxborough Filter Station, and good progress was made on the plans for the Upper Roxborough, Belmont and Torresdale Filter Stations, the Torresdale Conduit and the Lardner's Point Pumping Station. No contracts for the Filter Stations were awarded during 1900.

During the year 1901 nineteen contracts for work and materials were awarded: the sum limit of same amounting to \$11,647,800. Work was started on all of these contracts and a very large percentage of the work on the Lower Roxborough Filters was completed during the year. The work accomplished on the other filters and reservoirs consisted chiefly of grading preparatory to the laying of puddle and concrete.

During the year 1902 the Lower Roxborough Filter Station has been completed and is now in very successful operation. The Upper Roxborough Filter Station has been completed with the exception of some minor details. Work on the Belmont and Torresdale Filter Stations, the Oak Lane Reservoir, the Torresdale Conduit, Lardner's Point Station No. 2, and the Pipe Distribution System, as well as the minor contracts, has progressed favorably.

The first filter at Lower Roxborough was started in service on August 2d of last year, and your attention is called to the rapidity with which all the filters at this station

have gotten into actual satisfactory service. Within 90 days of placing the filters in operation the effluent showed a turbidity of zero by the silica standard, and rarely has it been in excess of 3; and the bacterial content has very frequently been below 25 colonies per cubic centimeter. This is due to the extreme care in the selection and placing of the filter gravel, sand and underdrains. The operation of these filters indicates that the yield of the filters between scrapings is much greater than has been experienced abroad, and that with preparation of water by preliminary filtration it is expected that the average yield of the filters will be double that of those abroad. This increased yield will reduce that cost of production below the estimate of the Board of Experts, while at the same time, from a hygienic standpoint, will be above criticism and superior to the effluent of the plain sand filters abroad, which operate without preparation of the water either by long sedimentation or preliminary filtration.

During the year 1902 four (4) contracts were awarded, the sum limit of the same amounting to \$668,600.

To illustrate what has been accomplished during the past two years, the following figures might be quoted:

Total cubic yards of material excavated.....	1,642,320
Embankments constructed (cubic yards).....	523,791
Clay puddle laid (cubic yards).....	88,938
Concrete masonry (cubic yards).....	92,350
Cast-iron water pipe laid (tons).....	28,756
Granolithic pavement (square yards).....	11,021
Concrete curbing (feet).....	5,456

Preliminary Filters.

“At the present time,” the Chief Engineer advises me, “the work of construction is more than one-half completed, and assuming that there be no delay in the making of contracts or other causes calculated to impede the rate

at which the work of construction is being forwarded, there is no reason to doubt that all the works now projected can be in successful operation by December 31, 1904. Of course, this assumption of the time required to complete the works is based upon no delays in the making of contracts still required, nor by reason of labor or coal strikes or other causes that will actually prevent or impede progress.

“One problem that has called for very careful and conscientious study and unremitting attention in the conduct of the experiments looking to its solution, is the preparation of the water before it is passed to the sand filters. There is only one instance abroad, and none in this country, where what might be termed double filtration has been resorted to; the single instance is Schiedam, Holland, but there the conditions are not like those here. There the preliminary filters work at a rate of from 2-3 to $\frac{1}{2}$ that of the final filters, and the difference between the filtering materials used and the rates of operation do not put the Schiedam works quite on the same plane as the works here. It is therefore fair to say that Philadelphia is the first City in the world to attempt to raise the rate, which has prevailed for more than forty years abroad, from 3,000,000 gallons per acre per day to 6,000,000 gallons per acre per day.

“The effect of preliminary filters is three-fold:

“First. To raise the rate to twice the rate heretofore prevailing at European stations.

“Second. To prolong the period of operation, or life of the filters from twenty days to twenty-five or thirty days, and sometimes even longer.

“Third. To insure a satisfactory quality of effluent with all conditions of applied water.

“Possibly the latter effect would be sufficient to justify the use of preliminary filters, because after all the great desideratum is to maintain up to the highest established standards the quality of the water supplied. The preliminary filters accomplish in a short time what could only be accomplished in a great length of time by subsiding basins. In short, by preliminary filters the water can be as well prepared for the final filters as would be represented ordinarily by three weeks’ subsidence. Basins of such a capacity as would carry twenty-one days supply for the City, so located that the water can be readily available for sand filters, are wholly out of the question by reason of the enormous cost attending these. Some idea between the cost of preliminary filters and of subsiding basins of equal capacity can be formed when it is stated that the subsiding basins alone would cost upwards of \$45,000,000, aside from the cost of all the other works that would be required with the subsiding basins as with preliminary filters; while the preliminary filters will represent an outlay of about \$2,200,000, or roughly, subsiding basins to perform the same work, constructed anew, and at elevations to supply by gravity to the sand filters, would cost twenty (20) times as much as the preliminary filters doing the same amount of work.”

In this connection it is well to remember that the work of the Commission of Experts has been greatly improved upon by Chief Engineer Hill and his assistants. The Commission, as is doubtless well remembered, worked under great pressure, and had but a limited amount of time at their disposal. Naturally some errors crept into their report and these have been corrected by the careful and exhaustive work of the present Filtration Corps. The experts estimated the cost of the installation of the filter plants to be \$14,569,989, divided as follows:

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Belmont	\$2,277,786 00
Roxborough	1,265,599 00
Queen Lane	2,927,566 00
East Park	2,406,740 00
Frankford	650,000 00
East Park Pipe Distribution System	1,520,000 00
New Pumping Machinery to Supply De- ficiency in Queen Lane District	305,900 00

Errors of Experts.

In the report of the experts on page 81 occurs the following paragraph:

“In connection with the gravity supply from the Delaware river, a new distributing reservoir, near Olneyville, at the point of discharge of the conduit, is proposed. The cost of this reservoir is estimated at \$1,000,000.”

It will be noted that in the experts' estimate they omitted this allowance of \$1,000,000 for a new reservoir. This amount should, therefore, be added to the total of their estimate.

Moreover, the experts had been advised by an official of the Water Bureau that an addition to the reservoir at George's Hill was projected, and upon this statement was based their proposition to pump from the Schuylkill river to George's Hill for sedimentation and then to pump the subsided water to the filters at the present site of the Belmont filters, Belmont avenue and Ford road. As a matter of fact, the project of an additional reservoir in West Philadelphia had only advanced so far as to procure the authority of your Honorable Bodies to float a loan for that purpose. So that while the experts did not include this amount in their total, it is plain to be seen that they should have done so. At that time the estimate of the Bureau of Water for a basin of 85,000,000 gallons capacity was \$500,000, which amount, in fairness, should also be added to the experts' summary.

Another matter which did not enter into the estimate of the experts was the fact that reasonable allowance should be made for filters out of service, being scraped, or undergoing renewal of the sand beds. It has been found by abundant experience that there should be a reserve capacity of from fifteen to twenty per cent. of the net capacity required in proportion to the size of the filter beds, the larger percentage, of course, applying to the smaller works. The report of the experts did not take into consideration the need of this additional filter surface, as is shown by the following table, m. g. d. representing "million gallons daily:"

Station.	Experts Allowance m. g. d.	Number of Filters.	Gross Capacity of filters 3 m. g. d.	Reserve Capacity.
Belmont	27	13	29,025,000	8.33%
Queen Lane	58	27	60,750,000	4.74%
Roxborough	15	8	18,000,000	20.00%
Torresdale	50	24	54,000,000	8.00%

The increase of the estimated cost of the filters to provide a reserve capacity of 20 per cent. for Belmont, 15 per cent. for Queen Lane and 15 per cent. for Torresdale amounts to:

Station.	Estimated cost of filters.	Increased per centage required.	Increased cost.
Belmont	\$490,568	11.67	\$52,852
Roxborough	303,697	.....	.....
Queen Lane	1,009,949	15.26	98,931
Torresdale	904,236	12.00	58,608

The total cost of this additional filter surface amounts to \$210,391, and this should be added, in all fairness, to the experts' original estimate.

Further calculation and investigation showed that the 48 inch and the 30 inch pipe provided by the experts for the delivery of water from the Torresdale Filters to the rising mains of the Frankford Pumping Station would not

deliver the net capacity of the Torresdale filters, viz.: 50,000,000 gallons daily, but would only provide for the delivery of nearly 30,000,000 gallons daily. In view of the fact that the Torresdale Station was to be increased as occasion demanded from 50,000,000 to 300,000,000 gallons daily, it would have been unwise to have literally carried out the plans of the experts with reference to the pipe system. Certainly a capacity much larger than 50,000,000 per day should have been provided for in the early conduit system, because this feature of construction cannot readily be supplemented from year to year. This fact, together with the early decision to carry to the Torresdale Station the capacity proposed by the experts for East Park and later the capacity proposed by them for Queen Lane, brought about the design and construction of the Torresdale conduit. While it would not have been fair to add to the experts' estimate the difference between the cost of the conduit and the cost of the pipe, it is proper to increase the cost of the pipe system from 30,000,000 gallons to 80,000,000 by adding two 48 inch pipes and one 30 inch pipe. The cost of these, at the date of the experts' report, would have been for the 48 inch pipes \$512,400, and for the 30 inch pipe \$109,800, a total of \$622,200. This would give a total conduit capacity of 80,000,000 gallons as against the immediate filter capacity of 50,000,000, the latter to be raised from year to year as the consumption of water increases.

The experts' estimate as revised by the addition of charges overlooked by them, is therefore as follows:

Experts' final estimate	\$14,569,989
Olney avenue (Oak Lane) Reservoir	1,000,000
Belmont Reservoir	500,000
Reserve Filter Surface	210,391
Increased pipe capacity	622,200
15% of this for contingencies	349,889
Total	<u>\$17,252,469</u>

All materials entering into waterworks construction between the period embraced in the past two years and at the time of making estimates for the Experts' Report is more than twenty-five (25) per cent., and the percentage of increase in the cost of labor is as much or more than this. Therefore 25 per cent of the total amount of the experts' revised estimate should be added for the increased cost of materials and labor. This amounts to \$4,313,117, thus making the total estimate of the experts for a supply of two hundred million gallons daily, \$21,565,586, based on the present cost of materials and labor.

In connection with the matter of filtration it must be remembered that ordinary betterments had to be made at the various pumping stations and reservoirs. During the past four years ten pumping engines have been installed, together with an entire new plant at the Frankford High Service Pumping Station, while 98,972 feet of pumping and supply mains have been laid.

Of the experts' revised cost of \$21,565,586, Chief Engineer Hill advises me that it is fair to estimate that three-fourths of this amount is represented by the works made necessary by the adoption of filtration of the water supply, and one-fourth to ordinary betterments, leaving \$16,174,189.50 as the probable amount to be charged to works of water purification.

It must further be remembered that the experts estimated upon a daily supply of 200,000,000 gallons daily. The present plan is for 300,000,000 gallons daily, an increase of fifty per cent., which will involve an increase of cost of probably thirty per cent. of the net cost of the works for water purification, which will amount to \$4,852,257.

Filtration and Ordinary Betterments.

Chief Engineer Hill has prepared the following interesting statement as to the amounts which will be charged respectively to filtration and ordinary betterments upon completion of the work:

Service.	Item.	Charge to Filtration.	Charge to Ordinary Betterments.
Roxborough.....	Filters, etc..... Pipe system, etc.....	\$1,504,898 06	\$528,509 09
Belmont.....	Filters, etc..... Pipe system..... Reservoir..... Pumping station..... Pumping machinery.....	2,448,808 18 184,147 00	878,445 11 698,000 00 74,200 00 169,496 80
East Park.....	Pipe system.....		641,952 51
Torresdale.....	Filters, etc..... Conduit..... Oak Lane Reservoir..... Pipe system..... Lardner's Point Pumping Station..... Pumping machinery..... Electric crane..... Coal handling machinery..... Electrical machinery..... Suction connections..... Removing machinery..... Wentz Farm Reservoir.....	10,248,837 31 1,850,000 00 809,285 00 2,298,250 00	2,298,250 00 1,085,000 00 880,000 00 12,100 00 77,000 00 19,250 00 8,250 00 38,898 88 150,000 00
Queen Lane.....	Pumping station.....		38,827 00
Testing Stations.....		25,245 12	
Shawmont.....	Land.....		14,000 00
Roxborough, Belmont and East Park.....	Repaving.....		81,264 50
Salaries, wages, inspections and expenses.....	(Not including Field Corps on Contracts Nos. 10, 12, 16, 17, 21, 22, 23a, 24, 25).....	620,958 00	204,985 00
		\$19,235,218 62 6,849,923 44	\$6,849,923 44
	Grand total.....	\$26,085,142 06	

Of the \$17,000,000 already appropriated for the work of the extension, improvement and filtration of the water supply, Chief Engineer Hill reports that \$4,194,165.11 has already been expended in laying mains in West Phila-

delphia and throughout almost the entire City, in order to give increased pressure and supply, in installing pumping engines, in erecting pumping houses, and in other work which would have been necessary even though filtration had not been adopted.

As to the value of filtration works to the City of Philadelphia, Mr. Hill makes the following report:

"The value of the works of filtration for the City of Philadelphia is fairly shown by the following tabulation:

"Assuming a reduction in the typhoid fever rate of eighty per cent. when the entire City is supplied with water, such as is coming from the Lower Roxborough filters, then there will be the following annual direct money gains to the population:

400 lives at \$5.00	\$2,000,000
2,000 cases of typhoid fever, 42 days loss of time, at two dollars per day	168,000
2,400 cases of medical attendance avoided, at \$40	96,000
400 funerals avoided, at \$50	20,000
	\$2,284,000

"The above sum capitalized at thirty years, the time the bonds for the construction of the improvement, extension and filtration of the water supply will run, at 5½ per cent. for interest and Sinking Fund charges, amounts to \$33,195,656.00, which I consider as the present money value of the general filtration of the Philadelphia water supply, exclusive of other improvements with a view to increasing pressure or quantity of the supply."

Water Waste.

On a number of occasions I have called the attention of your Honorable Bodies to the necessity for devising means to curtail the waste of water. The necessity for

this has been recently emphasized at the Roxborough filter beds. During a period of extremely cold weather, the consumption of water, which had been averaging 7,000,000 gallons a day, was increased to over 9,000,000 gallons per day, caused largely, in the opinion of the officials of the Water Bureau, by the fact that consumers turned hydrants on all night to prevent freezing. Whether this misuse of the water could be prevented by the introduction of meters, is a matter for decision on the part of your Honorable Bodies. Now that filtered water is being delivered in some localities and will eventually be supplied to the entire City, the necessity for stopping waste is greater than ever.

When the system is fully completed it will be the greatest system of filtration anywhere in the world, furnishing more water, filtered though it be, than is supplied to the City of London or any other City on the globe.

Philadelphia consumes two hundred gallons daily, for each man, woman and child, while London consumes but twenty-two gallons. Fully one-third of the amount supplied to our citizens is wasted. Inasmuch as it costs \$1.25 per million gallons for pumpage, and \$2.75 per million gallons for filtration, making the total cost of supplying filtered water \$4.00 per million gallons, it is readily seen that nearly \$150,000 is wasted annually. This represents a capitalization of approximately \$2,000,000, based on the present consumption of 280,000,000 gallons a day. Unless legislation is promptly enacted against the unwarranted waste that has grown so tremendously in recent years, the City will be confronted with an expense for maintenance beyond all reasonable requirements.

The following table shows the population supplied and the consumption of water in fifteen of the largest cities in the United States:

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CITIES.	Population Supplied.	Daily Gallons.	Per Capita Gallons.
Philadelphia.....	1,254,000	287,188,000	229
Chicago.....	1,698,600	323,000,000	190
St. Louis.....	400,000	63,530,000	159
Cleveland.....	420,000	66,900,000	159
Detroit.....	306,055	44,800,000	146
Boston.....	560,900	80,000,000	143
Cincinnati.....	325,900	39,600,000	121
New York.....	2,049,000	245,700,000	120
Minneapolis.....	202,718	18,813,000	93
Brooklyn.....	1,110,000	95,900,000	86
Milwaukee.....	300,000	24,000,000	80
Indianapolis.....	169,164	13,400,000	79
San Francisco.....	342,800	25,000,000	73
Providence.....	187,300	10,130,000	54
New Orleans.....	287,104	13,820,000	48

Cost of Improvements Elsewhere.

For purposes of comparison, Chief Engineer Hill has investigated the cost of water improvements in other cities, and in his report to me, he says:

“The Boston metropolitan improvements provide for an addition to the supply of 110,000,000 gallons daily, at an estimated cost of \$19,045,800—\$171,600.00 per million gallons of new supply for a population of 984,300 people—\$19.36 per capita. This work embraces some re-adjustment of the large mains within the limits of the City of Boston and other cities to be supplied from the Wachusetta Dam and Aqueduct, now under construction.

“In Cincinnati, the estimated cost of these works is \$8,500,000 for a daily supply of 80,000,000 gallons—\$106,000.00 per million gallons for an estimated population of 400,000 people—\$20.00 per capita.

“In St. Louis the estimated cost of developing the new Meramec Spring source of supply is \$31,000,000 for a daily supply of 200,000,000 gallons—\$155,000.00 per million gallons for a population of 600,000 people—\$51.70

per capita. The ultimate population to be supplied is estimated at 1,820,000 people—\$17.03.

“The cost of the last New York Aqueduct and Jerome Park Reservoir to 1898 is \$48,977,041.00 for a daily supply of 290,000,000 gallons—\$168,886.00 per million gallons for a population of 2,500,000 people—\$19.59 per capita.

“In San Francisco, on page 151 of the appendix of “Municipal Reports, San Francisco, 1900-1901,” the Chief Engineer of the Spring Valley Water Company estimates the cost of a works to supply 30,000,000 gallons of water per day at \$30,000,000—\$1,000,000 per million gallons for a population of about 400,000 people—\$75 per capita. On page 163 of the City Engineer’s report, the estimated cost of the works is \$39,531,000.00 for a daily capacity of 30,000,000 gallons—\$1,317,700.00 per million gallons for a population of about 400,000 people—\$98.83 per capita.

“In London, England, the new Welsh supply proposed by Sir Alexander Binnie, based upon a daily consumption of 500,000,000 U. S. gallons per day, is estimated to cost \$200,000,000 for supply of population of 9,200,000 people—\$22.00 per capita.

“The estimated cost of the Philadelphia system is \$26,000,000.00 for a daily supply of 300,000,000 gallons—\$86,666.00 per million gallons for a population of 1,400,000 people—\$18.50, or based upon the projected population of 3,300,000 people, with an allowance of 150 gallons per capita (meter measure) per diem—\$7.88 per capita.”

Bureau of Surveys.

The Bureau of Surveys has laid during the past four years 17 miles of main sewers and nearly 113 miles of branch sewers. During the same period \$864,627 has been spent in the construction of bridges, the most important

of which were those at Gray's Ferry, completed during the first year of my administration, Rhawn street, Coulter street, Frankford road, Old Front street, which changed the course of Frankford creek and straightened the line of Frankford avenue and opened up a much needed entrance to Frankford; Allegheny avenue, Luzerne street, Olney avenue, High street, Chew street, Washington lane, each of the last five abolishing a grade crossing.

The most important improvement, however, effected by the Bureau of Surveys during my administration, was the completion of the widening of Delaware avenue, this work being finally completed in June, 1900. The advantage of this widened avenue to the commerce of the port is already apparent, and in the settlement of damages, several hundred feet of water front have been acquired by the City, adjacent to the City piers, largely increasing the wharfage facilities belonging to the municipality.

In 1899 the pavilion pier at the foot of Chestnut street was completed; in 1901 that at the foot of Race street was completed, at a cost of \$102,523. In this connection it is well to note that by the lease of wharfage privileges to various steamship lines, the City is in receipt of a revenue from these piers exceeding six per cent. on the total cost, so that practically these healthful resorts are being maintained by the City without cost. Free wharfage is also afforded the City's police and fire boats.

The improvement of the channels of the Delaware and Schuylkill rivers has been continued, with consequent benefit to the commerce of the port, the total amount expended being \$300,000. The sum of \$400,000 has been recently made available by your Honorable Bodies to continue the work in the Schuylkill river. With this amount the improvement of the Schuylkill will be carried to such a distance from the mouth as to provide adequate facilities for the navigation of large vessels which come into the

river, and will prevent the expense and delay due to the enforced lighterage of a portion of their cargoes.

The 1901 contract, under which the sum of \$250,000 was expended, contained a provision that the dredged material should be placed over the banks within the limits of League Island Park. This work was completed last September and resulted in raising the grade of 87 acres of League Island Park an average of six feet, a work which would have cost \$1,000,000 for filling in by the ordinary process.

The Pennsylvania Avenue Subway, a public work which commands the respect of engineers everywhere, was thrown open to travel on September 25, 1899, and after being in operation three years, the absence of complaint from the Reading Railway Company in regard to operating facilities, and from property owners affected by the radical change in their work, and from the public daily using the subway, furnishes ample proof of the complete success of this great public improvement.

The testing laboratory has been so expanded during the past four years by the addition of new machinery and apparatus for testing different materials, that it is now recognized by engineers in all the American cities, and its deductions and its methods have been made a source of study and a matter of inquiry from many foreign cities. Through it, the standard of materials entering into various public works have been maintained at a high plane, with a corresponding improvement of the public work into which those materials enter.

Bureau of Highways.

During the past year 27 miles of improved pavement were laid by the City, making a total during the past four years of 55.27 miles of new paving laid, and 134.59 miles of repaving, the total amount of improved pavement being

189.86, at a total cost of \$6,629,430. The total mileage of improved pavement in the City is 890, of which 491 miles were laid by the City, so that the present administration has laid three-fifths of the entire amount of improved pavement contracted for by the municipality, an item which is of interest as showing in one Bureau only, the amount of work undertaken and carried to completion during the past four years.

Bureau of City Ice Boats.

During the past four years the City Ice Boats assisted sixteen vessels that were aground in the Delaware river and bay and in great peril, besides convoying and cutting out of the ice numerous other vessels. The boats were in active commission during this period 176 days, and in commission with a half crew 150 days longer. Plans are now being prepared for the rebuilding of Boat No. 2.

To the Chief of the Bureau, great credit should be given, because in addition to his duties as Superintendent of the City Ice Boats he also acts as inspector for the police and fire boats and makes many repairs himself, thus saving many thousands of dollars to the City.

Bureau of Gas.

The Bureau of Gas was organized under the terms of the lease of the United Gas Improvement Company during the first year of the present administration, and is operated without cost to the City, its duties being directed almost exclusively towards the enforcement of the terms of the contract and the maintenance of the supply of gas of a superior quality and which shall at all times be equal in illuminating power to twenty-two standard sperm candles. Frequent tests by the Bureau evidence the fact that the City is now provided with a gas supply that, for illumina-

tion, heating, or motive power, has admirably fulfilled the requirements of our citizens, notwithstanding the phenomenal increase in consumption incident to the depleted fuel supply, thus contributing immeasurably to the relief of many who, without the aid of sufficient gas for heating and illumination, would have been in a condition almost intolerable.

Bureau of Lighting.

During the past year, with the concurrence of your Honorable Bodies, a system was introduced whereby an improved form of gasoline lamp was introduced in the outlying sections, vastly increasing the power of the light without any additional cost to the City. The figures of the Bureau show that during the present administration 1,184 gas lamps have been erected and 2,020 re-located; 1,586 gasoline lamps erected and 1,415 re-located.

Bureau of Street Cleaning.

While the work of the Bureau of Street Cleaning, through the expansion of the City has been increased by the addition of upwards of 17,000 new buildings, and more than one hundred and fifty miles of private alleys, it has been maintained at a high degree of efficiency and with less complaints from the public than heretofore.

Among the many improvements instituted during the present administration, the following might be mentioned: A fixed number of men are now constantly employed during the business hours on certain streets and bridges crossing the Schuylkill river; the removal of waste paper and dry house waste is now separate from ashes and garbage; street cleaners, ash collectors and garbage collectors are now uniformed; dry street sweepings are removed in dust tight bags, and wet dirt in metal carts; all private alleys are cleaned by the City.

DEPARTMENT OF CHARITIES AND CORRECTION.

Nowhere has there been such a radical change of methods and such marked improvement as in the Department of Charities and Correction. Under the efficient management of the present directors, headed by Dr. John V. Shoemaker, all of whom were appointed during my administration, it was early seen that it was in urgent need of re-organization. At the outset a large portion of the work of the Department was transacted in dingy quarters on Seventh street, near Filbert street, and lax management in both the Almshouse and House of Correction was discovered as the result of divided responsibility. The work of these two great institutions was looked after by committees of the Board of Directors, with the responsibility lodged in no one of them. The first great step in the re-organization was the abolishment of the committees of these two Bureaus and the establishment of the Bureau of Charity and the Bureau of Correction, thus bestowing upon the respective superintendents greater power as well as greater responsibility. The board of Directors was thus in one step made what the Bullitt Bill Charter clearly contemplated, a Board of Supervisors over the administration of responsible executives.

A further consolidation was effected of the various branches of departmental work by making the departmental office a sort of clearing house for the two Bureaus. The dingy Seventh street offices were vacated and the work in the alimony cases was transferred to City Hall, and payment in all support cases being made by check. The result of this was that the Department and the City Solicitor's office were brought into closer relationship, so that information was more promptly at hand and collections were made more speedily.

Prior to the inauguration of the new methods of the present administration, bids for the various supplies were advertised for as needed and in numerous different schedules, so that there was great opportunity to favor certain bidders at the expense of others who might offer greater advantage to the City, but whose attention the advertisements had escaped. This has been abolished by the action of the Board in directing that all proposals shall be asked for in one advertisement, and that bids shall be opened quarterly, on regular days. Under this system, bidders who desire to make proposals on any of the many lines of materials used by the Bureaus of Charities and Correction, know the exact time when bids will be opened and have no complaint to make therefore, that the advertisements have escaped their notice.

Bureau of Charities.

Within the jurisdiction of the Bureau of Charities are the Philadelphia Almshouse, the Philadelphia Hospital and the Insane Department of the Philadelphia Hospital. For many years the association of these three institutions has aroused great criticism. For many years, also, the crowded condition of all three has justly aroused the condemnation of journalism, laymen and specialists alike. Space, however, has been so cramped at the present location, that the needed extension and alterations were impossible.

It was early seen that separate provision should be made for the care of consumptives. Sufficient money was appropriated by your Honorable Bodies, plans were drawn and contracts were let for the construction of pavilions of the most modern and approved type for the care of this unfortunate class of sufferers. These buildings are now well under way. Meanwhile, with an eye to the relief forever of the problems incident to the con-

gested houses, a diligent search was conducted for another location, whereon could be placed some of the three institutions now unfortunately housed under one roof. After visiting many sites, and giving much study to the subject, the directors finally selected a portion of the House of Correction grounds on the upper Delaware river, and an ordinance has recently passed your Honorable Bodies to remove the Philadelphia Almshouse and Insane Department of the Philadelphia Hospital, to this new site. The ground is owned by the City and the location is ideally healthful. At the same time, the names of these institutions have been changed to the Philadelphia Hospital for the Indigent, and the Philadelphia Hospital for the Insane. Sufficient money is available to erect new buildings, and this change will afford abundant room for the adequate extension of the Philadelphia General Hospital along modern lines, so that the indigent sick can receive proper medical care and attention under the best conditions. Last year, separate buildings were completed for the treatment of maternity and venereal cases and for children's diseases.

Under the wise and progressive administration of the present directors, the medical staff of the Philadelphia Hospital has been enlarged by the addition of a staff of dental surgeons, orthopædics, pediatricists and examiners in insane cases, while clinical and bedside teaching has been made free to all students of medicine registered at Philadelphia Medical Colleges.

The importance of this last regulation can hardly be over-estimated, inasmuch as it cannot fail to attract to the City of Philadelphia young men who desire to study medicine under the very greatest advantages. Moreover, during the last two years the Municipal Hospital for the treatment of contagious diseases has also been open for visita-

tion by medical students, thereby presenting a rare opportunity to study such diseases.

In addition to this the Board has also changed the method of appointment of internes at the Hospital. The staff of resident physicians is now apportioned equally among all the medical schools of the City.

Bureau of Correction.

At the very outset of my administration, I discovered on the occasion of several visits to the House of Correction, as well as from reports that I received from time to time, that the management there was lax in the extreme, the methods of asking for proposals were loose, and proper care was not afterwards exercised as to the control of the stores. In addition to this, it came to my knowledge that the institution was hardly regarded by those committed thereto as a place of correction, but rather as an asylum where they could seek shelter in wintry weather or until such times as they desired freedom again. Little care was exercised as to the character of the visitors to the inmates and no regulations governed the frequency of visits. Steps were at once taken to correct these matters. Visitors were absolutely refused admission to the institution unless upon the presentation of a special pass procured under suitable conditions. Punishment was inflicted in proportion to the frequency of commitment, so that old offenders were compelled to do the hardest work, and not, as theretofore, given lighter tasks owing to their greater experience. Furthermore, the indiscriminate discharge of inmates was effectually stopped and new rules were adopted, thus insuring a more rigid discipline at the institution.

The effect of these rules soon became apparent. Old-time offenders, who jauntily took a sentence of commitment to the House of Correction as others would take a

summer holiday, now dread a commitment to that institution as much, almost, as if to a prison, so that a very large percentage of decrease in the population has resulted.

DEPARTMENT OF EDUCATION.

The work of the Board of Education during the past year has been rendered notable by two events of more than passing importance. The first was the dedication of the new Boys' High School, on which occasion the President of the United States was present and delivered an address. The second was the transfer, at my suggestion, from the Department of Public Works, of the square of ground at Seventh street and Lehigh avenue to the Board, for the location thereon of a new Northeast Manual Training School, which cannot fail to be of great advantage to ambitious boys who desire equipping themselves for entrance into manufacturing life.

CITY CONTROLLER.

The report of the City Controller, which is elsewhere given in detail, shows that the City finances are on a sound basis. A study of his reports during the past four years shows that notwithstanding the large amounts of loans issued, the fixed interest charge this year is less than in 1899. The indebtedness on January 1, 1899, was \$51,241,295.22. The indebtedness on January 1, 1903, was \$59,361,845.22. During the past four years the total amount of loans issued was \$26,800,000. The total amount of loans paid off was \$18,753,800, of which \$740,000 was three per cent. loans, \$1,600,000 four per cent. loans, and \$16,413,800 six per cent. loans. Of these

loans, the bond holders for \$34,350 have not called for their money, which is, however, awaiting them in the City Treasury. These loans required an annual payment of \$1,710,028 in interest. Of the loans issued during the past four years, \$9,800,000 was placed at three per cent.; \$12,000,000, taking into consideration the premium, at three and four-tenths (3.4) per cent.; and \$5,000,000, with the same consideration in view, at 3.225 per cent., showing a fixed interest charge of \$863,210. This indicates a difference in the City's favor of \$207,778, although the amount of indebtedness had increased \$8,120,550.

FREE LIBRARY.

The efficiency of the Philadelphia Free Library is certain to be increased through the munificent gift of Andrew Carnegie, made through John Thomson, the librarian. Mr. Carnegie's gift contemplates the establishment of thirty branch libraries, and provides the sum of \$1,500,000 for the erection of buildings, coupled with the condition that the City furnishes the sites and the funds to maintain them after erection.

A systematic effort was made during the past year to secure a proper location for the central library under the terms of the Ordinance of Councils, whereby one million dollars was borrowed for the purchase of a site and the erection of a building thereon. The investigation disclosed the fact that ground of a suitable size and in a desirable location could not be procured for the price fixed.

The strike of the coal miners and the resultant scarcity of fuel increased the expenses of the City very materially. As the result of repeated conferences with railroad and mining officials, I was enabled to procure sufficient coal

for the institutions in care of the City, such as the Almshouse, Philadelphia Hospital, House of Correction and Public Schools, at rates, which while exorbitant, were considerably below the ruling market prices. Contests between capital and labor are always to be dreaded, especially in a case where is involved a commodity such as coal, so necessary to the health and comfort of the people.

Efforts on the part of myself and others failed to bring about any basis of compromise between the opposing interests, and only the intervention of the President of the United States saved the people of the country from what would have been a most frightful calamity.

The most important event of a public character during the past year was the reception of Prince Henry of Prussia, the brother of the Emperor of Germany, who arrived in this City on March 10th. A committee of representative citizens was appointed by me and a reception was given the distinguished visitor in the reception room of the office. He was taken on a visit to several of the large industrial establishments of the City.

Last year the Crown Prince of Siam was also the recipient of Philadelphia's hospitality.

Another occasion of interest to the people of Philadelphia was the Charleston, South Carolina, Inter-State and West Indian Exposition, at Charleston, South Carolina. Through authority given by your Honorable Bodies, the Liberty Bell was sent to the Exposition under a suitable escort, and was given an ovation all along the route, both on the way to Charleston and on the return to Philadelphia. The greatest care was exercised in preserving this historic relic, which was brought back uninjured and none the worse for its long trip. Such occasions cannot fail to develop a spirit of patriotism among all people, and necessarily tends to the cementing of all sections of the country.

During my administration the people of Philadelphia

were twice called upon to contribute to the relief of the distressed in other places. In this work the Citizens' Permanent Relief Committee did valuable work. In 1899 food and clothing were sent to Porto Rico, and in 1900 the frightful disaster at Galveston again appealed to the sympathy of Philadelphia.

The City maintained its reputation as the city of conventions. In 1899 the Thirty-third National Encampment of the Grand Army of the Republic was held in September, and was followed by the National Export Exposition under the auspices of the Commercial Museum.

The Twelfth National Republican Convention, at which William McKinley was nominated for President and Theodore Roosevelt was nominated for Vice-President, was held in June, 1900, and was the occasion for a great Republican demonstration.

A little more than a year afterwards, September 19, 1901, Philadelphia was called upon to share with the rest of the nation, the grief at the assassination of the President. A great outpouring of the people at the Academy of Music testified to the affection which Philadelphia always bore towards William McKinley.

The dawn of the Twentieth Century was celebrated by Philadelphia in a manner which attracted attention throughout the country. The First Brigade of the National Guard of Pennsylvania turned out at midnight, and as the new century was ushered in, fired a salute. Thousands of people were attracted to Philadelphia and the impressive sight will never be forgotten by those who witnessed the spectacle.

In conclusion I can again but reiterate my deep appreciation of the courteous co-operation which I have always received at the hands of your Honorable Bodies. None of the great improvements undertaken during my administration would have been possible without your cordial

assistance, and while this message marks the conclusion of our official relations, I beg leave to express the hope that the personal relations of friendship, which have been established between myself and the individual members of your Honorable Bodies, may continue when the cares of office have been laid aside.

Very respectfully,

SAMUEL H. ASHBRIDGE,

Mayor.

ANNUAL REPORT
OF THE
DEPARTMENT OF PUBLIC WORKS
FOR THE
YEAR ENDING DECEMBER 31, 1902

ANNUAL REPORT
OF THE
DEPARTMENT OF PUBLIC WORKS
FOR THE
YEAR ENDING DECEMBER 31, 1902

OFFICERS
OF THE
DEPARTMENT OF PUBLIC WORKS

Director:
WILLIAM C. HADDOCK.

Assistant Director:
HARRY W. QUICK.

CHIEF CLERK—WILLIS SHEBLE.
CLERK—ERNEST T. HANEFELD.
ASSISTANT CLERK—ANDREW L. TEAMER.
STENOGRAPHER AND CLERK—HARRY A. STOY.
STENOGRAPHER AND TYPEWRITER—ROSCOE C. LOCKWOOD.
GENERAL INSPECTOR—ROBERT C. HICKS.
MESSENGER—J. J. JOHNSON.

Superintendent of City Ice Boats:
JAMES S. JEFFERSON.

Chiefs of Bureaus:
GAS—DR. N. WILEY THOMAS.
HIGHWAYS—WILLIAM H. BROOKS.
LIGHTING—JOHN J. KIRK.
STREET CLEANING—SYLVESTER H. MARTIN.
SURVEYS—GEORGE S. WEBSTER.
WATER—FRANK L. HAND.
FILTRATION—JOHN W. HILL.

SIXTEENTH ANNUAL REPORT
OF THE
DEPARTMENT OF PUBLIC WORKS

WILLIAM C. HADDOCK, Director

Philadelphia, January 2, 1903.

HON. SAMUEL H. ASHBRIDGE,
Mayor of the City of Philadelphia.

DEAR SIR:—As required by the law constituting the Department of Public Works, I have the honor to present the report of the operations of this Department for the year ending December 31, 1902—the Sixteenth Annual Report of this Department.

In presenting this report, I congratulate you on the prosperous condition of the City and the splendid showing made by the several Bureaus of this Department as set forth in their reports. The past year has been a busy one and rapid strides have been taken; many needed improvements have been made, although still more remains to be done.

This report will be more general in its nature than otherwise; the details may be found in the reports of the Chiefs of the several Bureaus herewith submitted and their careful perusal will well repay anyone desiring familiarity with this branch of our City Government. While the work of some Bureaus was not so great as in previous years, yet

the work performed by the Department, as a whole, was largely in excess of that done in any previous year by the City.

The large number of permanent improvements made during the year, were essential to the welfare and comfort of our citizens and without a doubt, contributed largely to the business prosperity of the City.

The expenditures of the Department for the past year for maintenance, amounted to \$4,318,791.98, and for permanent improvements and extensions \$7,882,487.54, making the total expenditures for the year \$12,201,279.52. The receipts for the same period from all sources amounted to \$3,759,304.62.

During the year a change was made in the organization of this Department by placing the work of the Improvement, Extension and Filtration of the Water Supply under a temporary Bureau, called the "Bureau of Filtration." This was done under authority of an ordinance of Councils approved July 18, 1902. The Bureau was organized August 1, 1902, with John W. Hill as Chief Engineer; all other employes engaged in this important work were continued and assigned to the new Bureau. All work done under the direction and supervision of this Bureau, also bills for materials and supplies, as well as the salaries and wages of those employed, are paid from appropriations made to the Bureau of Water.

The work of the new Bureau is referred to in its proper place in this report and covers the full period of one year, although for the first seven months of the year, the work of the Improvement, Extension and Filtration of the Water Supply was done in conjunction with the Bureaus of Water and Surveys.

The most serious matter which confronted the Department during the past year was the scarcity of coal during the strike in the anthracite coal fields. This strike was

inaugurated May 10, 1902, and immediately the several coal companies furnishing anthracite coal to the pumping stations of the Bureau of Water, notified the Department that in accordance with the strike clause in their contracts, they would discontinue the shipment of coal.

In order to keep the pumping stations in operation, it was necessary to go into the open market and procure bituminous coal. The price paid for this coal was largely in excess of that paid for anthracite under the old contracts and has added largely to the cost of pumping. Notwithstanding these trying circumstances, the Department, by strenuous effort, procured sufficient coal to keep all the pumping stations in continuous operation and maintained the usual supply of water.

Bureau of Surveys.

The duties and responsibilities of this Bureau during the past few years have largely increased. The rapid development of the City, the demands for better avenues of communication from one section to another, the growth and improvement of the railroad systems and the extensions of trolley lines have added largely to the work.

The Chief Engineer and his corps of able assistants have promptly met every requirement and the work of the Bureau has been performed in an efficient and satisfactory manner.

The expenditures of the Bureau of Surveys during the past year were \$1,963,372.87, of which \$1,697,678.63 were expended for permanent improvements and \$265,694.24 for current expenses. The receipts for the year were \$126,095.91, being a decrease of \$18,906.05 from the previous year.

Main Sewers.

The work accomplished in perfecting the main sewer systems and thereby improving the sanitary conditions and opening up large areas of territory for improvement, has

been pronounced. Comprehensive plans have been followed in allotting appropriations so that the greatest good could be accomplished and avoid, as far as possible, the construction of short sections of main sewers here and there, that would be of little use in aiding the development of the City.

By reason of the many pressing demands for main sewers, Councils appropriated during the past year \$1,150,000 for this work; \$350,000 by ordinance of December 30, 1901, and \$800,000 by ordinance of June 27, 1902. The money provided by the latter ordinance was not apportioned until July 19, 1902, hence many of the main sewers, all of which were promptly placed under contract, have not been completed. It is to be regretted that frequently ordinances authorizing such important work, are not passed by Councils until late in the season, making it impossible to place the sewers under contract until late in the summer or even in the early fall, thus crowding the work into a few weeks' time and in a season of the year when the weather conditions are not only changeable but frequently unfavorable for continuing operations.

It is important in the interest of good work and the convenience of residents on the streets where sewers are necessary, that appropriations for their construction be made available early in the season so the work may begin early in the spring and finished, as far as possible, before the advent of winter weather.

The total number of main sewers under construction, some of which were carried over from last year, was thirty-seven; of this number nineteen were completed, aggregating 25,302 linear feet, covering a distance of 4.79 miles.

The reconstruction of the Cohocksink sewer on Norris street, Eleventh street, Diamond street and Twelfth street

to a point 205 feet 8 inches North of Diamond street, was completed.

The policy pursued by the Department in reconstructing the portions of the old Cohocksink sewer, which were worn out, has resulted in giving the City practically a new sewer for the greater part of its length. The advantages of this policy are shown by the fact that no breaks occurred during the year, although there were frequent excessive rainfalls of great intensity and long duration.

The following main sewers placed under contract prior to and during the year 1902, are being constructed and the work progressing in a satisfactory manner :

- Shackamaxon street, from Delaware river to Thompson street.
- Rosehill street, from Allegheny avenue to the Connecting Railway.
- Cohocksink Relief sewer extension in Germantown avenue, from Thompson street to Montgomery avenue.
- Cohocksink Relief sewer in Thompson street, from Shackamaxon street to Germantown avenue.
- Disston street, from Mason to Keystone streets.
- George's Run sewer extension on Bryn Mawr avenue, from present terminus north of Wynnefield avenue to Woodbine avenue, on Woodbine avenue to Fifty-first street, and on Fifty-first street to City avenue.
- Indian Run sewer in Sixty-sixth street, from City avenue to Sherwood avenue and Sixty-eighth street, thence on Sixty-eighth street to Malvern avenue, and on Malvern avenue to creek at Sixty-ninth street.
- Intercepting sewer extension (main stem), from present terminus at Nixon's Mills, Northeast of Fountain street, on private property to Shawmont avenue, and on Shawmont avenue to Eva street.
- Jackson street, from the Schuylkill river eastward.
- McKean street relief sewer extension, from Third street westward.
- Orthodox street, from Delaware river eastward.
- Princeton street, from Delaware river to Hegerman street.
- Shunk street system extension on Shunk street, from present terminus west of Shelby street to Front street, and on Front street to Porter street, and on Porter street westward.
- Thomas Run sewer extension in Pine street, from Conestoga

street to Allison street, on Allison street to Locust street, and on Locust street westwardly to terminal of present sewer near Fifty-ninth street.

Thomas Run sewer extension in Fifty-seventh street, from Florence avenue to Beaumont avenue, on Beaumont avenue to near Fifty-ninth street, and thence on private property to Cobb's creek.

Wingohocking creek sewer extension on Anderson street, from north of Chelten avenue to Price street, on Price street to Crittenden street, and on Crittenden street to Haines street. York street, from Tulip to Emerald street.

Reconstruction of Cohocksink sewer on Montgomery avenue, from a point east of Ninth street, and on Ninth street northward.

The following work in connection with the Intercepting System was completed during the year:

Lincoln avenue extension from Sedgwick street to Cresheim avenue, and on Cresheim avenue to Mt. Pleasant avenue (main sewer).

Lincoln avenue sewer extension on Cresheim road, from Mt. Pleasant avenue to Allen's lane (main sewer).

Although there was no direct appropriation in 1902 for the purpose of constructing connections to the intercepting sewer, a number of extensions have been made under specific ordinances and paid for out of the branch sewer item. These comprise eight contracts and the extensions built cover a distance of about two miles; they are as follows:

Ainslie street, from Cresson to Conrad streets.

Berdan street, from Sharpnack to Weaver street, and Sharpnack street, from Berdan street to Germantown avenue.

Coulter street, from Wissahickon avenue to the Pennsylvania R. R. bridge.

Lauriston street, from Ridge avenue to Righter street, and on Righter street, from Lauriston to Hermit street.

Mt. Pleasant avenue, from Cresheim road to Germantown avenue.

Schuyler street, from 150 feet south of Roberts avenue, and on Roberts avenue, from Schuyler to King street.

Wayne avenue, from Pennsylvania R. R. bridge to 100 feet north of Lincoln avenue.

Wissahickon avenue, from Roberts avenue to Deacon street, and on Deacon street, from Wissahickon avenue to King street.

The extension of the main intercepting sewer from the American Pulp Works to Shawmont avenue, on Shawmont avenue to the new filter plants at Roxborough, is now under construction.

There was placed under contract on the Wingohocking system:

1st. The extension of the outlet section in Courtland street, from present sewer west of Seventh street, to Seventh street and Ansbury street, thence on Ansbury street to North Penn Branch, Philadelphia & Reading Railway.

2d. East branch in Ogontz avenue, from Eighteenth street and Bellfield avenue to Olney avenue.

3d. The extension of the East branch on Anderson street, from terminus northwest of Cheltenham avenue, to Price street, on Price street to Anderson street, to Crittenden street, on Crittenden street to creek northwest of Haines street.

This branch is under construction and the work progressing satisfactorily.

4th. Extension of west branch on line of proposed Bellfield avenue, from present terminus on Sharpnack street to Sprague street, and on Sprague street to Mt. Pleasant avenue.

This section was completed and the drainage of a considerable territory will be provided for by emptying branch sewers into this main at Mt. Pleasant avenue.

A beginning was made in the construction of the Frankford intercepting system by placing under contract, the outlet section of the sewer on Wakeling street, between

Frankford creek and the Philadelphia & Trenton Railroad. It is urgent that this work be continued.

The sewer in McKean street and that on Porter street should be extended as rapidly as possible to Broad street, to furnish much needed relief in the lower section of the City.

Additional funds should also be provided for the sewer now under contract on Jackson street, between the Schuylkill river and Twenty-ninth street.

The work upon the outlet for the Aramingo Canal main sewer, which has been in progress for two years, was finally completed.

Following upon the completion of this work, the street covering the bed of Aramingo canal, known as Dyott street, was filled in and paved. The completion of this work admitted of numerous improvements in the locality, including the actual vacation of streets east of Richmond street and North of Dyott street, of the widening of Richmond street, the placing of railroad and railway tracks upon the street and repaving to the revised elevations.

A large relief sewer has been under construction in York street, between Aramingo avenue and Emerald street, which is intended to remedy the overflows at the latter point. The work upon this relief sewer is approaching completion.

Liberal appropriations for the work of relieving the Cohocksink sewer, by the construction of the sewer in Shackamaxon street and Thompson street, thence on Germantown avenue to Berks street, and on Berks street to Ninth street, have resulted in placing several sections of this sewer under contract, the construction of which is progressing rapidly.

For the year 1903, an additional sum of \$100,000 has been provided for the continuation of this relief sewer and will complete it to Ninth and Berks streets.

The Chief Engineer, in his report, calls attention to the fact that the Philadelphia Hospital and Home for the Indigent are proposed to be placed upon property adjacent to the Torresdale filter beds. These institutions, together with the County Prison and House of Correction, will ultimately discharge a considerable quantity of sewage into Pennypack creek, the outlet of which is near the new intake of the Delaware river water supply and it is imperative that the City should plan to collect the sewage from these institutions by means of an intercepting sewer, and treat it by approved methods, before allowing the sewage to enter the river.

Attention is also called to the increasing pollution of the Schuylkill river below Fairmount dam, and it is advisable that measures be taken to remedy the existing conditions. Preliminary studies have been made for intercepting the sewers on both sides of the Schuylkill river and carrying the sewage to the low lands near the mouth of the river. With the rapid development of the land in the vicinity of League Island and the Boulevard projects adjoining the sections on both sides of the river, there will soon be an increased demand for this improvement.

By reason of the rapid increase in building operations and the consequent development and improvement of property, there is urgent demand for increased drainage facilities. Numerous tracts of land in different sections of the City are ripe for development and only await the construction of a sewerage system before being built upon. The increase in the number of real estate developments brings immediate return to the City in the shape of taxes. In view of these facts, the Department recommends the construction of the following main sewers:

- Extension of main sewer on Sixty-third street, from Market to Chestnut street, and on Chestnut street to Cobb's creek.**
- Extension of Orthodox street sewer, from a point east of Bath street to Richmond street.**

- Extension of Porter street sewer, from Front street westward to Broad street.**
- Extension of Pratt street sewer, from Frankford avenue northwest.**
- Extension of Ogontz avenue sewer, from Olney to Cheltenham avenue.**
- Extension of Wakeling street sewer, from a point north of Tacony street to Valley street.**
- Extension of Courtlund street sewer on Ansbury street, from point north of Sixth street to North Penn. R. R.**
- Reconstruction of sewer in Forty-second street, from Haverford street to Powelton avenue and on Powelton avenue to Market street.**
- Twelfth street relief sewer, from Lombard to Walnut streets.**
- Extension of McKean street relief sewer, from point east of Twelfth street to Broad street.**
- Indiana avenue sewer, between Ormes and Fifteenth streets.**
- Extension of Jackson street sewer from point west of Schuylkill avenue to Thirtieth street.**
- Rock Run system on Ashdale street, from Newtown Railroad westward to Fifth street.**
- Reconstruction of sewer in York street, from American to Fifth streets and on Fifth street, from York to Cumberland streets.**
- Extension of Cresheim Branch Connection on Germantown avenue from near Moreland avenue to Moreland avenue and on Moreland avenue northeast to a drainage street.**
- Extension of Wissahickon High Level sewer from Hartwell avenue to Rex avenue.**
- Wissahickon High Level Intercepting sewer cut off, from Twenty-fourth and Indiana avenue to Bittenhouse street.**

The relief sewer which is designed to carry the drainage of Germantown and Chestnut Hill on a high level, from the water shed of the Wissahickon to the water shed of the Delaware river, which was urgently recommended in the last annual report, still awaits an appropriation before anything can be done.

Appropriations for main sewers for the year 1903, amount in all to \$325,000—\$100,000 for the Market street main sewer; \$100,000 for the Cohocksink relief sewer; \$25,000 for the McKean street sewer, and \$100,000 for

other main sewers. This appropriation provides principally for the relief necessary in closely built up sections of the City, but does not provide sufficiently for the drainage of outlying territory where the necessity is urgent.

Branch Sewers.

Under the term "branch sewers" is included all sewers of less than four feet in diameter. To these are made house and street connections and they discharge into the main sewers, which, in turn, carry the sewage to the rivers. There was available during the past year for the construction of branch sewers and inlets, the sum of \$300,000. The contracts executed for branch sewers numbered 226, of which 180 were completed. 20.95 miles of branch sewers were constructed by the City and 4.17 miles at private expense.

For the reconstruction of inlets, the sum of \$5,000 was appropriated; nine contracts were entered into for the construction of new inlets, the reconstruction of inlets, curved curbing, laterals, manholes, etc. The expenditures for this purpose amounted to \$58,000. There were constructed or reconstructed 544 inlets, not included in sewer contracts; 5,785 feet of curved and straight curb were placed in connection with these inlets, and 16,387 feet of lateral sewer connections were laid.

Two hundred and eighty drain connections were made with the Manayunk Intercepting Sewer and its branches. Other sewer connections to 5,281 buildings were authorized during the year. These do not include about 2,175 buildings connected to sewers built at private expense.

The total length of sewers built prior to 1899 was:

Main sewers	135.46	miles
Branch sewers	603.89	"
Branch sewers at private cost	64.87	" 804.22 miles

Sewers built during the past four years:

Main sewers	16.72	miles
Branch sewers	113.16	"
Branch sewers at private cost	16.95	" 146.83 miles
		<hr/>
Total length of sewers		951.05 "

Bridges.

During the past year there was available for the construction of bridges, the sum of \$542,375.15; all of the available appropriation was placed under contract. There was expended during the year on account of construction, \$386,484.92.

Work has been in progress upon the following bridges:

Continuing the work on bridges and retaining walls on the line of Thirty-third street over Connecting Railway and Philadelphia & Reading Railway.

Bridges over Frankford Creek on the lines of Frankford avenue and Old Front street, which includes changing the course of Frankford Creek, between Kensington avenue and Frankford avenue.

Allegheny avenue under North Pennsylvania R. R.

Luzerne street under North Pennsylvania R. R.

Lehigh avenue under Connecting Railway.

Gibson avenue over Baltimore & Philadelphia R. R.

Fifty-seventh street over West Chester & Philadelphia R. R.

Fifty-second street over West Chester & Philadelphia R. R.

Seventy-first street over Philadelphia, Wilmington & Baltimore R. R.

Oak Lane over North Pennsylvania R. R.

High street, Chew street and Washington Lane under the Chestnut Hill branch of the Philadelphia & Reading Railway, including the work of grading, paving and alteration of underground structures.

Dauphin street under the Connecting Railway.

Olney avenue under Tabor Branch of Philadelphia & Reading Railway.

Olney avenue under North Pennsylvania R. R.

All these bridges will have an important bearing upon the development of the territory on each side of the rail-

roads now connected by these new means of communication.

Of the bridges under contract, all have been completed during the year except the following:

Frankford avenue and Old Front street, 97 per cent. completed.
Lehigh avenue under Connecting Railway, 75 per cent. completed.
Dauphin street under Connecting Railway, 85 per cent. completed.

Fifty-second street over West Chester and Philadelphia R. R., 96 per cent. completed.

Contract was entered into for the construction of one abutment and four piers on the west approach of the bridge at Passyunk avenue over the Schuylkill river. The work of construction has not yet begun.

At the time when the existing lines of railroad were constructed, they were laid out far upon the outskirts of the built up portions of the City, when the only crossings were a few country roads and several main arteries of travel between the various towns and villages in Philadelphia County. Of late years the growth of the City has been so rapid that properties bordering upon the railroad for many miles in length are now built up closely. The demand for more frequent means of communication between these built up sections, and for the avoidance of grade crossings of streets and railroads necessitates the construction of numerous bridges.

The Chief Engineer in his report recommends the construction of a number of bridges. Especial attention is called to the following, all of which should be constructed as early as practicable:

Thirty-third street, over Philadelphia & Reading Railway and Connecting Railway (to complete).

Hunting Park avenue, over Richmond Branch, Philadelphia & Reading Railway.

Seventeenth street, over Philadelphia, Germantown and Norristown Railroad.

- Large street, under Frankford Branch of Philadelphia & Reading Railway.
- Erie avenue over Richmond branch of Philadelphia & Reading Railway.
- Allegheny avenue, under Connecting Railway.
- Walnut lane, over Wissahickon creek.
- Gravers lane, over Chestnut Hill Branch of Philadelphia & Reading Railway.
- Fifty-second street, over West Chester & Philadelphia Railroad.
(To complete to the full width of the street.)
- Sedgley avenue, over Richmond Branch of Philadelphia & Reading Railway.
- Glenwood avenue, over Richmond Branch of Philadelphia & Reading Railway.
- Wyoming avenue, over Frankford creek.
- Armat street, under Chestnut Hill Branch and Germantown Branch of Philadelphia & Reading Railway.
- Montgomery avenue, over Connecting Railway.
- Fifty-eighth street, over West Chester & Philadelphia R. R.
- Front street, over Connecting Railway.
- Sixty-fifth street, over Baltimore & Philadelphia R. R.
- "D" street, over Connecting Railway.
- Sixtieth street, over Philadelphia, Wilmington & Baltimore Railroad.
- Twelfth street, under Connecting Railway.
- Upper deck of Falls Bridge.
- School lane, over Philadelphia, Germantown & Norristown Railroad.
- Willow Grove avenue, under Germantown & Chestnut Hill Railroad.
- Belfield avenue, under Philadelphia & Reading Railway.
- Wyoming avenue, over Newtown Railroad.
- Frankford avenue, over Poquessing creek.

The aggregate cost of constructing these bridges is approximately \$1,605,000.

Harbor Work and Dredging Delaware and Schuylkill Rivers.

The Ordinance of July 27, 1901, carried an appropriation of \$250,000 for the purpose of deepening the channels of the Delaware and Schuylkill rivers. The contract was awarded to the American Dredging Company on September 27, 1901.

The work accomplished under this contract and which was completed during the past year, consisted of removing the shoals along the Tinicum Island Range, above Chester, in the Delaware river, and dredging in the Schuylkill river from the lower back channel, at League Island, northward. A total of 538,937 cubic yards of material was taken from the Delaware river and 365,341 cubic yards of material from the Schuylkill river. The material removed from both these rivers was placed behind impounding banks beyond high water, within the limits of League Island Park, east of Broad street, and resulted in raising the area of about eighty-seven acres an average of six feet.

On June 27, 1902, an additional appropriation of \$400,000 was made from the loan authorized by ordinance of June 11, 1902, for the improvement of the channels of the Delaware and Schuylkill rivers. This appropriation is subject to future legislation by Councils, and it is proposed to expend the entire amount in improving the channel of the Schuylkill river; it is expected that with this additional appropriation, the channel of the Schuylkill river will be widened and deepened and the material excavated will result in raising about one hundred acres of League Island Park six or seven feet above the present level.

Pennsylvania Avenue Subway and Tunnel.

This work has been completed and the subway and tunnel in service for a number of years, but it has occupied to a small extent the attention of the Department owing to cases to recover damages from the City.

The following is a statement of expenditures and balance to date:

Total amount paid for contracts.....	\$4,072,151 15
Paid by mandamus for land and damages.....	1,063,855 93
Expert fees in damage cases.....	29,735 05
Road Jury fees in damage cases.....	3,826 00
Labor: Water, Electrical and Gas Bureaus.....	41,102 00
Engineering, inspection and incidentals.....	227,815 01
Balance on hand December 31, 1902.....	1,514 86
	<hr/>
	\$5,440,000 00

Widening Delaware Avenue, Etc.

The work of widening this avenue, with the exception of the permanent regrading and repaving of the entire avenue, was completed during the year 1901.

The pavement which was placed on Delaware avenue consists of granite block on a gravel base. It was thought unwise to place a permanent base of concrete under these blocks until the style of rail and number of tracks to be placed on Delaware avenue, should be determined. By agreement of the various railroad interests and the Board of Directors of City Trusts, it was arranged that three tracks shall be laid in the avenue. On account of the heavy traffic on this thoroughfare, the steam railroads will lay a grooved rail of the girder type, so as to provide as smooth a roadway as possible.

Owing to the settlement of a suit for damages which has been pending and by which the City acquired title to an additional water front north of Race street, amounting to 138 feet, the right to construct an additional pier was obtained.

The proposed widening of the avenue north of Vine street has advanced to the point where the amount of land damages has been practically adjusted and reported to Councils. The continuation of the improvement of Delaware avenue north from Vine street to Green street awaits only necessary appropriation by City Councils.

The total expenditures on account of Delaware avenue widening are as follows:

For the bulkhead, sewer system, laying conduits and lighting Delaware avenue	\$1,040,173 28
For land damages, including acquiring additional water frontage	999,856 70
For engineering, inspection and incidentals.....	69,062 48
	<hr/>
	\$2,109,092 46
There still remains unexpended on the appropria- tion for this work	\$43,613 53

Testing Laboratory.

With the introduction of new machinery and instruments in the Testing Laboratory, its capacity has been largely increased. The number of tests made during the past year shows that the capacity is more than four times what it was in 1899, more than double that of 1900, and has increased over 70 per cent. since 1901. A more careful study of the methods employed has resulted in a greater degree of accuracy than has heretofore been attained, and the cost of testing to the City has also been considerably reduced.

The demands for the testing of various materials entering into public works, under contract with the various bureaus of the City, has placed upon this laboratory additional responsibilities. The rapid increase in the use of concrete in place of stone masonry and also in the adoption of concrete-steel for bridges has necessitated more frequent tests of the quality of cement and careful examination of the action of concrete and steel in combination. Over two hundred concrete cubes made from material taken from the mixers at the filtration plants have been tested for their resistance to compression, which tests give information of the strength of the concrete placed in these works. The testing of forty-three samples of paving brick used upon various streets has resulted in securing a uniform quality of material. Experiments are being made

upon original lines in order to keep pace with the other laboratories of like character in different cities of this country.

Rainfall, Discharge and Tidal Observations.

The placing of additional pluviometers in different parts of the City and stream gauges in sewers to determine the rates of flow, closely observing the results obtained, and combining them with the results of former years, has enabled the Department to determine with a fair degree of accuracy the effect produced upon sewers by rainfalls of varying duration and intensity. This is necessary owing to the rapidity with which a district is built up and paved with impermeable pavement. These observations, together with experiments to determine the velocity in sewers at varying depths and the state of the tide as automatically registered during heavy rainfalls, are important in the study of the efficiency of the sewers. The result of the observations is shown comprehensively in lithographs accompanying the report of the Chief Engineer. All of these observations are taken with the expectation of ultimately securing sufficient data to determine with more accuracy in advance, the duties which will be required of sewers when the improvements in any section shall have reached their most complete development.

Grade Crossings.

The growth of our centre of population and the consequent increase in the volume and speed of railroad traffic, is making the question of abolishing grade crossings on railroads more important each year. In any abolishment of grade crossings there are two parties to be considered whose interests will be directly affected: First, the railroad company, owning or operating the railroad for the transportation of persons and property; second, the public, using the highways for a similar purpose.

On June 17, 1898, Councils appropriated \$900,000 for the purpose of co-operating with the Philadelphia and Trenton Railroad, to remove thirty grade crossings on Trenton avenue, between Norris and Butler streets, work upon which was begun during the year 1900, but was interrupted by legal complications.

One of the most urgent improvements is the abolishment of grade crossings on the line of the Philadelphia, Germantown and Norristown Railroad on Ninth street, from Spring Garden to Broad streets.

Human life is imperilled every minute of the day by the surface tracks on Ninth street, and the sacrifice of life at these dangerous crossings is of frequent occurrence. The delay of traffic on the streets crossed by these tracks and barred off for trains every few minutes is a great nuisance and annoyance to the public, and the railroad company is handicapped by the necessity of running trains slowly for a considerable distance. An elevated road will benefit the railroad company greatly and relieve the City of an obstruction which bisects it and injures its business; but more important than all, the human lives and limbs now sacrificed to this surface juggernaut would be averted. This matter has been referred to frequently in previous reports, and the energy of the Department has been directed to its accomplishment.

The Philadelphia & Reading Railway Company has agreed to an elevated grade for this road and is now engaged in preparing plans for the work, and there should be no delay in beginning the construction as soon as necessary funds become available. The estimated cost is \$5,600,000.

The same company has also agreed to certain changes in the grade of its Richmond branch in order to abolish grade crossings at Frankford and Kensington avenues and

to provide for the opening of the streets now cut off. The estimated cost of the work on this line is \$2,700,000.

Miscellaneous.

The demands made upon the railroad interests in and about Philadelphia have been such as to require large alterations, extensions and improvements in their termini, which have more or less affected City streets and structures. These matters have engaged the attention of the Department and the plans of construction and their effect upon the City's interests have been carefully examined prior to the approval of plans.

Recent legislation authorizing the construction of a subway in Market street, between the Delaware and Schuylkill rivers, and an elevated structure west of the Schuylkill river, together with authority to occupy other streets for purposes of subway construction and the erection of an additional bridge, over the Schuylkill river, also legislation authorizing the placing on the City plan of boulevards and parkways have presented numerous problems to the Department for solution. These matters are all receiving the most careful consideration in order that the interests of the City may be properly protected.

District Surveyors.

Mr. Clement B. Webster, on February 1, 1902, was appointed Surveyor and Regulator of the new Fourteenth District, created by ordinance of Councils, approved December 30, 1901.

The Board of Surveyors, composed of the Surveyors and Regulators in charge of the work in the various districts of the City, held twenty-three stated meetings and eight special meetings. Four of the stated meetings were set apart as road days, on which occasions property owners interested in proposed revisions were given an opportunity

to appear before the Board and express their opinions. One hundred and twenty plans were placed before the Board for a hearing; ninety-six were finally confirmed and two rejected.

Numerous plans submitted by the passenger railway companies, providing for extensions, improvements, etc., of their systems, were considered and sixty-nine approved. Ordinances and petitions for the construction of sewers, placing of new streets upon the City plan, establishment of street lines and grades, revisions, etc., numbering four hundred and ninety-nine, were all acted upon and reported back to the Survey Committee of Councils.

The cash receipts and credit for work performed for various Departments and Bureaus of the City during the year, amounted to \$235,533.16, an increase of \$5,282.51 over the previous year and exceeding the expenditures of the fourteen districts by \$58,522.53.

The passage of new laws and the new constructions placed upon old laws by the Supreme Court, have added to the responsibilities of the officials of the several districts.

In addition to the preparation of all bills and estimates for work completed by the Bureaus of Surveys, Water, Highways and City Property, the duty of formally assessing the cost of municipal improvements now rests upon the District Surveyors.

The following is a summary of the receipts and expenditures of the District Surveyors for the year 1902, and the totals for the year 1899, 1900 and 1901:

Summary of Receipts and Expenses of District Surveyors.

	Surveyors.	Cash Receipts.	Credit for Work done for the City.	Total Credit.	EXPENSES.				Balance Profit to the City.	Profit to the City in 1901.	Increase.	Decrease.
					Salaries.	Pay of Assistants.	Miscellaneous.	Total.				
1	John M. Nobre.....	\$7,934 31	\$6,888 41	\$14,822 72	\$3,000 00	\$6,420 00	\$2,135 25	\$11,555 25	\$3,267 47	\$2,541 03	\$726 44	.....
2	Charles W. Close.....	4,382 96	6,520 83	10,903 79	3,000 00	5,591 55	1,499 10	10,090 65	813 14	751 78	61 36	.....
3	Wm. C. Cranmer.....	5,406 34	8,289 03	13,695 37	3,000 00	6,225 29	1,588 83	10,814 12	2,881 25	2,960 58	.....	\$79 33
4	Frits Bloch.....	3,212 69	7,124 45	10,337 14	3,000 00	4,819 00	1,541 10	9,430 10	907 04	2,013 58	.....	1,096 54
5	Walter Brinton.....	8,808 82	9,290 24	18,099 06	3,000 00	8,515 25	2,822 83	14,333 08	3,767 98	11,223 58	.....	7,462 60
6	Joseph Mercer.....	14,906 96	14,843 80	29,750 76	3,000 00	9,087 97	2,842 58	14,930 55	14,820 21	11,460 86	3,359 35	.....
7	Wm. K. Carlile.....	3,838 67	5,806 44	9,645 11	3,000 00	4,519 96	1,403 36	8,923 32	721 79	1,261 64	.....	539 86
8	C. A. Sundstrom.....	3,367 82	12,934 78	\$16,302 60	3,000 00	9,932 68	2,732 65	15,665 33	637 27	418 14	219 13	.....
9	Jos. C. Wagner.....	9,605 51	9,116 42	18,721 93	3,000 00	10,214 76	2,116 42	15,361 18	3,367 75	2,006 19	1,354 56	.....
10	Jno. H. Webster, Jr....	3,377 23	11,398 88	14,776 11	3,000 00	6,687 58	1,761 12	11,448 70	3,327 41	9,912 02	†.....	6,584 61
11	Joseph Johnson.....	12,940 75	12,201 10	25,141 85	3,000 00	9,727 67	2,357 63	15,085 30	10,056 55	10,601 61	.....	545 06
12	J. H. Gillingham.....	7,346 36	14,449 04	21,795 40	3,000 00	7,481 64	2,278 03	12,759 67	9,035 73	5,797 80	3,237 93	.....
13	H. M. Fuller.....	6,658 42	10,995 11	17,653 53	3,000 00	9,743 66	2,297 08	15,040 74	2,612 79	1,287 03	1,325 76	.....
14	C. B. Webster.....	2,766 35	11,121 44	13,887 79	2,750 00	5,376 79	3,440 85	11,567 64	2,320 15	.....	† 2,320 15	.....
	Total 1902.....	\$94,553 19	\$140,979 97	\$235,533 16	\$41,750 00	\$104,443 80	\$30,816 83	\$177,010 63	\$53,522 53	\$62,225 84	\$12,604 68	\$16,317 99
	Total 1901.....	\$105,280 53	\$124,970 12	\$231,250 65	\$38,283 33	\$101,705 71	\$28,035 77	\$168,024 81	\$62,225 84	\$48,135 41	\$21,428 99	\$7,338 56
	Total 1900.....	\$106,207 91	\$100,284 33	\$206,492 24	\$39,000 00	\$95,225 41	\$24,131 42	\$158,356 83	\$48,135 41	\$35,251 62	\$4,843 04	\$41,861 93
	Total 1899.....	\$106,973 51	\$138,305 68	\$245,279 19	\$39,000 00	\$95,960 67	\$25,164 22	\$160,124 89	\$35,251 62	\$51,143 22	\$42,890 59	\$3,704 40

† District divided and Surveyor appointed in 14th District, February 1, 1902.

Registry Division.

The following is a comparative summary of the operations of the Registry Division of the Bureau of Surveys during the years 1899, 1900, 1901 and 1902:

	1899.	1900.	1901.	1902.
Number of certificates of registered owners issued.	4,194	3,264	3,765	3,809
Number issued for use of Law Department.	1,010	1,235	1,031	765
Receipts from certificates of registered owners.	\$1,058 50	\$816 00	\$903 25	\$932 50
Receipts from miscellaneous sources. ...	\$115 68	\$119 85	\$133 85	\$152 06
Number of original lots plotted.	12,030	8,409	8,842	9,360
Number of transfers registered.	29,176	30,055	29,714	33,059
Number of plans made for use of City Departments, Bureaus, etc.	294	415	481	563
Number of examination of registry plan books made by the public.	39,981	48,996	50,308	51,109
Number of descriptions of property filed for registry.	41,206	38,464	38,556	42,419
Number of titles perfected.	2,345	2,407	2,361	2,476
Number of certificates of legal opening of streets issued to bureaus, etc.	2,534	1,308	1,876	2,006
Number of certificates of registered owners in municipal lien cases for Law Department.	1,713	1,849	1,230	916

The work of this division has been materially benefited and much time and annoyance saved to the public by the refitting of rooms in the Survey Bureau and assigning additional space upon the fifth floor, providing modern appliances for the shelving of the plan books and furnishing additional counter space. Plan books and City plans are being constantly renewed, although the small amount appropriated annually for this purpose is not sufficient to keep pace with the deterioration of these records. Attention is called to the recommendation in former reports that legislation be enacted to fix a reasonable charge for each

examination of these plan books, to aid in paying for the maintenance and repairs of the same.

The following tables give a comparative summary of the operations of the Bureau of Surveys in the actual construction of work and the receipts and expenditures during the years 1899, 1900, 1901 and 1902:

Summary of Main, Branch and Private Sewers and Bridges Built during the years 1899, 1900, 1901 and 1902.

	1899.		1900.		1901.		1902.	
	No.	Linear feet.	No.	Linear feet.	No.	Linear feet.	No.	Linear feet.
Bridges.....	1	.....	4	.....	21	.....	14	
Subway bridges.....	7							
Intercepting sewer connections.....	3	4,372.20	5	2,847.00	2	4,377.00	2	1,675.00
Main sewers.....	12	10,085.67	31	23,779.52	28	17,552.37	35	23,627.40
Branch sewers.....	209	176,013.31	191	186,237.68	187	121,373.24	180	110,629.96
Private sewers.....	69	29,665.00	48	20,324.00	46	17,480.00	55	22,036.00
Subway sewers.....	3	2,368.00						
Delaware avenue sewers.....	6	888.80						
Total.....	310	*233,392.91	279	†233,188.20	284	†160,782.61	286	¶157,968.36

* Equal to 42.21 miles.

† Equal to 44.16 miles.

‡ Equal to 30.45 miles.

¶ Equal to 29.92 miles.

*Statement of Work upon Bridges during the years 1899,
1900, 1901 and 1902.*

	1899.	1900.	1901.	1902.
Finished.....	1	2	4	11
Begun.....	1	1	17	3
Authorized.....		14	1	
Planned.....	23	24	15	10

Statement of Receipts.

Years	Receipts of Bureau.	Receipts of District Surveyors.	Total.	Increase.	Decrease.
1899.....	\$41,839 72	\$106,973 51	\$148,813 23		
1900.....	71,809 20	106,207 91	178,017 11	\$29,203 88	
1901.....	29,721 43	105,280 53	145,001 96		\$33,015 15
1902.....	31,542 72	94,553 19	126,095 91		18,906 05

Statement of Expenditures.

	1899.	1900.	1901.	1902.
Current expenses.....	\$246,506 41	\$245,122 78	\$256,432 45	\$265,694 24
For extensions.....	2,070,742 01	1,891,634 32	1,394,309 39	1,697,673 63
Totals.....	\$2,317,248 42	\$2,136,757 10	\$1,650,741 84	\$1,963,372 87

Bureau of Water.

During the past four years, the extensions and improvements made to this Bureau for increasing the water supply of the City are best shown by stating that on January 1, 1899, the pumping capacity at all stations was 399,040,000 gallons per day of twenty-four hours. On December 31, 1902, this capacity had been increased to 467,540,000 gallons, a gain of seventeen per cent.

The total length of water mains laid throughout the City previous to 1899, was 1,278 miles.

There was laid since that date 141 miles, an increase in mileage of eleven per cent. during the past four years.

Many of the mains laid were of the larger sizes, thus increasing the pressure in various sections of the City and giving to our citizens a greater supply of water than was possible during previous years. The benefit to be derived from the improvement of the water supply will not be fully realized or enjoyed until the entire work now in course of construction is completed.

The financial statement of the Bureau of Water for the past year shows an expenditure of \$4,843,733.07 for extensions and improvements, and \$1,668,001.76 for maintenance. The receipts were \$3,459,090.72, an increase of \$127,653.27 over the previous year.

While the work of the Improvement, Extension and Filtration of the Water Supply is conducted under the direct supervision of the Bureau of Filtration, the work is also identified with the Bureau of Water by reason of the fact that the appropriations for the improvement are made to the latter Bureau. Considerable work which it was not necessary to place under contract has been performed by the employes of the Bureau of Water, payment for same being made from the appropriation for the improvement of the water supply. By reason of the cost of all this work being charged against the Bureau of Water, it has largely increased the item of expenditure of said Bureau. The totals of work performed in constructing the filter plants, the laying of distributing mains, the erection of pumping stations and installation of engines in connection with the Improvement, Extension and Filtration of the Water Supply are referred to under their proper heading in this report and in detail in the report of the Chief Engineer of the Bureau of Filtration.

The largest item of expense which enters into the operation of the Bureau of Water, is the purchase of coal; it is delivered in daily allotments at the several pumping stations and the consumption averages about 500 tons per day.

Any interruption in the deliveries of coal, such as has occurred from snow blockades or by reason of strikes on railroads or of miners, is a serious menace to the operation of the works. The Department should have coal sheds of sufficient capacity to store enough coal to provide for any ordinary emergency which may arise to prevent its prompt delivery; the importance of this matter was fully demonstrated during the recent prolonged strike of the anthracite coal miners.

This strike began on May 10, 1902, and ten days thereafter, the shipments of hard coal ceased and it became necessary to go into the open market at once and make the best arrangements possible for the purchase and delivery of bituminous coal. In order to obtain a sufficient supply to operate the works, arrangements were made with several companies handling bituminous coal and monthly contracts entered into for its delivery at whatever prices it could be procured for.

During the continuance of the strike, we purchased 77,067 tons of bituminous coal at a cost of \$325,750.17. The additional expense due to the purchase of this coal compared with the same number of tons of anthracite coal at the old contract prices, was \$107,159.91. There were many other expenses incident to the use of soft coal, such as an increased force in the boiler rooms, wharfage, unloading from boats and cars, repeated handling at several of the stations which amounted in the aggregate to \$41,678.15, a total increase of expense to the Bureau of \$148,838.06 due to the use of soft coal.

The total quantity of water pumped during the year 1902 was 116,798,424,500 gallons. The average quantity

of water pumped daily at all stations was 319,995,683 gallons. The total consumption of water throughout the City was 114,607,314,362 gallons, an average of 313,992,642 gallons per day, an increase over the preceding year of 12,416,273,669 gallons or 34,017,189 gallons per day. The average consumption per capita per day was 232.6 gallons, an increase over the year 1901 of 20.7 gallons.

The great increase in the consumption of water as compared with that of the previous year is principally due to the laying of large distributing mains in various sections of the City, thereby increasing the pressure on the service mains and giving to the consumer a much better supply of water than heretofore. This is very desirable and necessary, particularly in those localities where, owing to the low pressure, it was difficult to obtain a sufficient force of water on the upper floors; but unfortunately, the increased pressure also increases the waste wherever leaky fixtures exist.

Distribution.

The number of permits issued during the year was.....	54,738
Number of premises supplied with water is.....	244,506
Number of premises without water is.....	11,738
Total length of pipe laid is.....	1419.60 miles
Of which there was laid during the present year..	40.57 miles

Included in the work of the past year, was the completion of the 48-inch water main in Broad street, from York to Arch street; the 30-inch main in Sixth street, from York street to Susquehanna avenue, and in Susquehanna avenue, from Sixth to Fourth street; and the 20-inch main in Twelfth street, from Girard avenue to Spring Garden street.

These mains were all put into service and have materially benefited the districts supplied by them in increased pressure and a larger supply of water.

There has also been laid during the year, other large supply mains for distributing water from the Roxborough and Belmont filter plants.

High Pressure Fire Service.

This service consists of eight miles of specially constructed mains, varying from eight to sixteen inches in size and laid in all the principal streets in the business center of the City, covering effectually an area of about 425 acres.

There are one hundred and forty-two fire hydrants of a special construction installed in connection with these mains. Each of these fire hydrants have two outlets, from which can be discharged by the use of a Siamese connection, six powerful streams of water under a maximum pressure of 300 pounds to the square inch.

There has been constructed in connection with these independent fire mains, a system of fire boxes connected by underground wires with the Central Station at City Hall, by means of which quick and direct communication by telephone is insured between the fire boat stations on the Delaware river front and the immediate vicinity of any fire that may occur within the boundaries covered by the fire pipe system.

The work of laying the mains of the high pressure fire service, which was commenced in 1901, was completed as far as the money available for the purpose would permit and the mains thoroughly tested as to their efficiency. Upon the completion of the work of laying the mains between the Delaware river and Eighth street, a preliminary test was made at Sixth and Race streets on April 10, 1902. This test demonstrated the efficiency of the system and also developed some minor defects which were remedied. A second test was made on May 2, at Eighth and Market streets; with the three fire boats pumping into the mains,

twelve powerful (two-inch nozzle) streams from two fire hydrants were simultaneously discharged to a height considerably above the highest buildings on Market street. On September 15, a third test was made at Broad and Sansom streets, distant about one and one-half miles from the principal fire boat on the Delaware river. This test, which was made under the direction and supervision of a committee representing the Board of Fire Underwriters' Association, was eminently satisfactory and proved beyond a doubt the effectiveness of this system for controlling and extinguishing fires.

The pumping station, engines and pumps, and forcing main for this system, are all under contract and in course of construction. It is expected to have the plant completed and ready for service during the latter part of the year 1903. In the meantime, the fireboats will be utilized to force water through these mains.

When the independent fire system is in service, it is proposed to pump directly into the mains under a pressure as high as may be desired up to 300 pounds to the square inch, taking the hose streams direct from the fire hydrants. In the tests made the fire boats were unable to give the desired maximum pressure of 300 pounds to the square inch, and this feature of the system will have to remain in abeyance until the completion of the pumping station at Delaware avenue and Race street, which will be equipped with engines and pumps of ample power and capacity to be operated under the desired conditions.

The pumping station now in course of construction is designed to contain nine pumps of not less than 1,200 gallons capacity each per minute and two of 350 gallons each per minute, and will be operated by Westinghouse four cycle gas driven engines of 300 and of 90 horse-power, respectively, against a pressure of 300 pounds to the square

inch, and can be operated either singly or all at one and the same time.

At present, the two small engines and seven of the large size are being constructed. These will give a total capacity of 9,100 gallons per minute when pumping against a head of 300 pounds to the square inch. A twenty inch pumping main 1,400 feet long will connect the pumps with the fire main system at Water and Market streets.

Pumping Stations.

At the Fairmount Station, where the pumpage is done by water power, all the machinery was submerged during the freshet of March 7-10. Considerable damage was done to the buildings and part of the bulkhead at the end of the mound was washed away. Repairs were promptly made, and with the exception of turbine wheels Nos. 6 and 9, the machinery at this station is in good condition.

At the Spring Garden Station there has been an increase in the average daily pumpage of over 15,000,000 gallons. This necessitated keeping all the engines working to their fullest capacity, and precluded the making of any repairs other than those absolutely necessary to keep them in operation.

The Belmont Station is in a very creditable condition. The three new Holly pumps erected at this station during the year 1901 have been in continuous operation throughout the past year with very satisfactory results. The coal shed at this station was destroyed by fire early on the morning of March 22. The trestle work supporting the tracks was not seriously impaired, and after reflooring the train platform, it was ready for use. Plans have been prepared for a new house over the tracks and the only drawback to proceeding with the work at once is the lack of funds for the purpose.

At the Queen Lane Station the chief trouble, as in pre-

vious years, has been the breaking of pump chambers on all the engines. Chambers of new design have been introduced, and although the results obtained are not entirely satisfactory, yet the conditions are far better than they were before the adoption of the new chamber.

The pumpage at the Roxborough Station increased 31 per cent as compared with that of the previous year. To meet the increased demand, we were obliged to put the two old Worthington pumps into service most of the time, and as these are great coal consumers when compared with the new high duty engines, there was a considerable increase in the quantity of coal consumed at this station.

To meet the increasing demands upon this station, it will be necessary at a very early date to instal two new 5,000,000 gallon pumping engines, with the necessary boilers, boiler house and stack.

The breaking of the Flat Rock Dam on February 23 and the failure on the part of the owners to promptly repair it, created a serious state of affairs at the Roxborough Station. By herculean efforts and by resorting to numerous devices, the Department, with considerable difficulty, kept the pumps working most of the time until the dam was repaired. By the erection of three centrifugal pumps on the river front by means of which water pumped from the river was discharged into a tank and from thence conveyed by a 30-inch pipe laid underground to the pump wells, we were enabled to keep the two old Worthington pumps in operation.

The chief feature of the year's operation at the Frankford Pumping Station was the great increase in the quantity of water pumped. This increase amounted to 38.7 per cent.

Engines No. 1 and 3 received an overhauling, but unfortunately the increased demand for water at this station was so urgent that we could not shut down for even slight

repairs. The severe strain to which these engines were subjected and by reason of our inability to make repairs in their incipency, has resulted in the damage spreading to such an extent that at this writing Engine No. 1 is entirely out of service awaiting a new pump chamber, and one side of No. 4 engine has broken and is now uncoupled, thus reducing the capacity of the engine one-half until repairs are made.

The demand upon the Belmont High Service Station for water, increased during the past year 54 per cent. The 5,000,000 gallon high duty Worthington pump at this station is operated to its fullest capacity in order to meet the demand for water from the high levels of West Philadelphia. To provide for the increasing demands an additional 5,000,000 gallon pump should be purchased and installed at this station as early as possible.

The high service stations at Roxborough and Frankford are in excellent condition.

Fairmount Dam.

The dam at Fairmount is greatly in need of repairs. A recent examination of this structure shows that the quantity of water leaking through it is fully equal to the daily average pumpage from the Fairmount pool. The cribbing, which extends below and about one half way across the dam, should be entirely renewed. The greater part of the filling between the old and the new dams is washed away and the top coating of concrete is badly cracked, allowing great quantities of water to pass through between the dams and thence out through the cribbing of the lower dam. The apron on the front of the dam is also in bad condition and will require renewal its entire length.

To make the necessary and much needed repairs required upon this dam will cost approximately \$20,000,

and this sum should be provided without delay in order that this structure may be put in good and safe condition.

The importance of keeping the Fairmount Dam in first class condition can best be realized when it is considered that upon the safety of this dam depends about eighty per cent. of the present water supply of the City and should this structure collapse, the pumping stations at Fairmount, Spring Garden, Belmont and Queen Lane would be practically thrown out of service.

Waste.

The noticeable increase in the consumption of water during the past year is a matter for serious consideration, and it is evident that measures should be taken to restrict the unlawful and unwarranted waste of water. The only remedy aside from careful management and inspection to secure a reduction of consumption is the use of water meters; and if Councils, by proper legislation, will place the Department in a position to introduce the meter system, the beneficial results derived from its introduction will very soon become apparent.

It is claimed that the introduction of the meter system will involve a large expenditure for cost, maintenance and inspection. This is true—but when water has to be pumped, the expenses for the purchase, placing and repairing of meters will be far less than those of increased pumping facilities and cost of pumping.

The following tables give the numbers and types of engines, locations and capacities of reservoirs and a comparative summary of the operations of the Bureau of Water; also, the receipts and expenditures for the years 1899, 1900, 1901 and 1902:

Statement of the Number and Type of Engines and their Several Aggregate Capacities, at the Various Stations.

Pumping Station.	Designated Number of Engine or Turbine.	Type of Engine.	Designed Capacity in Million Gallons per Day.	Total.
Spring Garden.	Old Station.....	Compound Rotary.....	20,000,000	170,000,000
	Old Station.....	Simpson's Compound Rotary.....	10,000,000	
	Old Station.....	Marine Compound Rotary.....	20,000,000	
	Old Station.....	Worthington Duplex.....	10,000,000	
	Old Station.....	Gaskill.....	20,000,000	
	New Station.....	Worthington Duplex.....	15,000,000	
	New Station.....	Worthington Duplex.....	15,000,000	
	New Station.....	Holly.....	30,000,000	
	New Station.....	Holly.....	30,000,000	
Queen Lane.....	1	Southwark.....	20,000,000	80,000,000
Queen Lane.....	2	Southwark.....	20,000,000	
Queen Lane.....	3	Southwark.....	20,000,000	
Queen Lane.....	4	Southwark.....	20,000,000	
Belmont.....	1	Worthington Duplex.....	5,000,000	68,000,000
Belmont.....	2	Worthington Duplex.....	5,000,000	
Belmont.....	3	Worthington Duplex.....	8,000,000	
Belmont.....	4	Worthington Duplex.....	20,000,000	
Belmont.....	5	Holly Horizontal Compound.....	10,000,000	
Belmont.....	6	Holly Horizontal Compound.....	10,000,000	
Belmont.....	7	Holly Horizontal Compound.....	10,000,000	
Belmont High Service....	1	Worthington.....	2,000,000	7,000,000
Belmont High Service....	1	Worthington.....	5,000,000	
Roxborough Old House..	2	Worthington Duplex.....	5,000,000	31,500,000
Roxborough Old House..	3	Worthington Duplex.....	5,500,000	
Roxborough New House..	4	Worthington Horizontal Compound.....	5,000,000	
Roxborough New House..	5	Worthington Horizontal Compound.....	5,000,000	
Roxborough New House..	6	Worthington Horizontal Compound.....	5,000,000	
Roxborough New House..	6	Worthington Horizontal Compound.....	5,000,000	
Roxborough New House..	7	Worthington Horizontal Compound.....	5,000,000	
Roxborough High Service	1	Worthington.....	5,000,000	10,000,000
Roxborough High Service	2	Worthington.....	5,000,000	
Mt. Airy.....	1	Davidson.....	1,000,000	3,000,000
Mt. Airy.....	2	Davidson.....	1,000,000	
Mt. Airy.....	3	Knowles.....	1,000,000	
Chestnut Hill.....	1	Knowles.....	250,000	750,000
Chestnut Hill.....	2	Worthington Duplex.....	500,000	
Frankford.....	1	Marine Compound Rotary.....	10,000,000	57,000,000
Frankford.....	2	Corliss Compound Rotary.....	10,000,000	
Frankford.....	3	Southwark Rotary.....	22,000,000	
Frankford.....	4	Southwark Fdy Quarter Crank Flywh'l	15,000,000	
Frankford High Service..	1	Holly Horizontal Compound.....	3,000,900	7,000,000
Frankford High Service..	2	D'Auria Compound Duplex.....	4,000,000	
Fairmount.	New House.....	Turbine Wheels.....	2,000,000	33,200,000
	New House.....	Turbine Wheels.....	5,330,000	
	New House.....	Turbine Wheels.....	5,330,000	
	New House.....	Turbine Wheels.....	5,330,000	
	Old House.....	Turbine Wheels.....	5,100,000	
	Old House.....	Turbine Wheels.....	5,100,000	
Total.....				467,540,000

Statement of the Location, Date of Completion, Elevation and Capacity of the City's Reservoirs.

Name of Reservoir.	Location.	Date of Completion.	Height above City Datum.	Capacity in Gallons.
Fairmount.. { Reservoir No. 1	East Fairmount Park.....	{ 1815	94 feet...	26,850,000
Reservoir No. 2		1821		
Reservoir No. 3		1827		
Reservoir No. 4, Section 1		1835		
Reservoir No. 4, Section 2		1836		
Reservoir No. 4, Section 3		1836		
Lehigh..... { Section 1	Sixth and Lehigh avenue.....	{ 1852	114 " ...	28,910,000
Section 2		and		
Section 3		1871		
Spring Garden.....	Twenty-sixth and Master streets.....	1844	120 " ...	12,950,000
Corinthian.....	Corinthian avenue and Poplar street.....	1852	120 " ...	37,341,000
East Park... { Section 1	East Fairmount Park.....	{ 1887	133 " ...	306,400,000
Section 2		1888		
Section 3		1889		
Queen Lane. { North Basin.....		Thirty-third street and Queen Lane.....			1894	238 " ...	205,620,000
South Basin.....	177,480,000			
Frankford.....	Oxford turnpike and Comly street.....	1877	167 " ...	36,046,000
Belmont.....	West Fairmount Park.....	1870	212 " ...	39,758,000
Mount Airy.....	Allen's lane and Mower street, Germantown.....	1851	363 " ...	4,546,000
Roxborough.....	Ridge and Shawmont avenues.....	1866	366 " ...	12,838,000
New Roxborough. { North Basin.....	Port Royal avenue and Ann street.....	1893	414 " ...	71,594,000
South Basin.....					75,438,000
Chestnut Hill Tank.....	Hartwell avenue and Chestnut Hill R. R., Chestnut Hill.....	1840	431 " ...	52,000
Belmont Stand Pipe.....	West Fairmount Park.....	1895	364 " ...	106,000
Roxborough Stand Pipe.....	Port Royal avenue and Ann street.....	1895	491 " ...	106,000
Frankford Stand Pipe.....	Oxford turnpike and Comly street.....	1900	300 " ...	106,000
Total.....				1,417,859,000

*Statement of Pumpage for the years 1899, 1900, 1901
and 1902.*

	1899. Gallons.	1900. Gallons.	1901. Gallons.	1902. Gallons.
Pumped to reservoirs.....	107,991,371.604	106,822,576.055	103,805,457,234	116,798,424,500
Equal to gallons pound 100 ft. high	231,813,666,728	218,119,532,621	210,456,847,513	239,698,545,013

NOTE.—The “pumped to reservoirs,” etc., includes 2,338,260,121 gallons of re-pumpage to higher levels at Belmont, Roxborough, Mt. Airy, Chestnut Hill and Frankford High Service Stations, which, deducted from the total pumped, gives a total pumpage from rivers, of 114,460,164,379 gallons.

The quantity stored in reservoirs on December 31, 1902, was 147,149,983 gallons less than that stored on December 31, 1901. This quantity added to the total pumpage from rivers, makes the total consumption for 1901, 114,607,314,362 gallons. The cost of pumpage is based on the total pumpage. The consumption per capita is computed from the average consumption during 1902, of 313,992,642 gallons per day.

	1899. Gallons.	1900. Gallons.	1901. Gallons.	1902. Gallons.
Pumped by water power.....	8,618,634,347	5,726,488,277	7,138,554,754	7,622,482,219
Pumped by steam power.....	99,372,737,257	101,096,087,778	96,666,902,470	109,175,942,381
Largest quantity pumped in 24 hrs.	342,368,144	353,295,438	343,790,688	366,119,389
Smallest quantity pumped in 24 hrs.	213,254,250	106,565,758	67,951,778	125,342,306

Year.	Average Daily Consumption.	Average consumption in gallons per capita per day, es- timating the popu- lation at*	Cost of 1,000,000 gallons pumped 100 feet high.
	Gallons.	Gallons.	
1899.....	290,073,290	199.6	\$2.90
1900.....	287,187,630	221.9	3.71
1901.....	279,975,453	211.9	4.14
1902.....	313,992,642	232.6	4.80

*1899, 1,452,340 estimated.

*1900, 1,293,697 U. S. Census.

*1901, 1,321,304 estimated.

*1902, 1,349,500 estimated.

The cost of pumping one million gallons one hundred feet high, during 1902, was \$4.80, or 66 cents in excess of that during the previous year. The increased cost of pumpage is due to the additional force employed at the several pumping stations incident to the use of bituminous coal, higher rates for coal, large items for repairs to boilers and machinery and increased amounts for small stores and of all other materials pertaining to the operation and maintenance of the pumping stations.

About six and one-half per cent. of the total pumpage was by water power, the turbine wheels using 228,674,466,570 gallons to pump 7,622,482,219 gallons.

Statement of the Total Pipe Laid and of the Other Work Done during the Years 1899, 1900, 1901, and 1902.

Year.	PIPE LAID.			*PIPE RELAID. Feet.	FIRE HYDRANTS PLACED IN POSITION.			SUBSTITUTED FOR DEFECTIVE HYDRANTS.			Fire Hydrants in Use.	New Water At- tachments.
	Feet.	EQUAL TO.			New Style.	Old Style.	Total.	New Style.	Old Style.	Total.		
		Miles.	Feet.									
1899.....	128,793	24	2,073	†86,727	711	.....	711	188	3	191	12,170	5,952
1900.....	196,178	37	818	‡32,282	450	.....	450	288	.....	288	12,620	5,148
1901.....	213,075	40	1,875	§20,794	380	.....	380	271	.....	271	13,000	5,144
1902.....	214,194	40	5,171	||6,042	394	.....	394	208	2	210	13,335	4,898

Total pipe laid, 1,419.60 miles.

* Adds nothing to feet in ground.

† 1899 Pipe taken up exceeds the quantity relaid, 3,951 feet.

‡ 1900 Pipe taken up exceeds the quantity relaid, 2,045 feet.

§ 1901 Pipe taken up is less than quantity relaid, 1,289 feet.

|| 1902 Pipe taken up exceeds the quantity relaid, 2,177 feet.

*Statement of Receipts and Expenditures for the years 1899,
1900, 1901 and 1902.*

	Receipts, 1899.	Receipts, 1900.	Receipts, 1901.	Receipts, 1902.
Receipts from water rents.	\$2,856,451 78	\$2,967,497 39	\$3,035,420 25	\$3,146,339 25
Receipts from fractional rent.....	54,075 44	55,954 52	76,481 65	4,698 22
Receipts from water pipes.	80,644 23	98,465 15	91,618 07	100,710 50
Receipts from City Solicitor's office.....	50,627 83	45,488 06	40,849 76	33,692 92
Receipts from penalties...	40,229 09	38,234 59	35,102 42	32,127 18
Receipts from delinquent rent.....	31,787 30	32,426 60	38,643 00	39,304 20
Receipts from Chief Engineer's office.....	4,590 42	6,300 21	5,326 34	10,479 99
Receipts from searches.....	942 75	173 75	2,322 75	2,914 00
Receipts from delinquent penalties.....	4,605 36	4,654 97	5,673 21	5,824 46
Total.....	\$3,123,954 20	\$3,249,195 24	\$3,331,437 45	\$3,459,090 72
	Expendi- tures, 1899.	Expendi- tures, 1900.	Expendi- tures, 1901.	Expendi- tures, 1902.
Current expenses.....	\$1,461,583 36	\$1,574,704 95	\$1,524,201 00	\$1,668,001 76
For extensions.....	222,973 90	855,353 25	1,945,159 21	4,843,733 07
Total.....	\$1,684,557 26	\$2,430,058 20	\$3,469,360 21	\$6,511,734 83

Bureau of Filtration.

From January 1 to August 1, 1902, the work on the Improvement, Extension and Filtration of the Water Supply was conducted as an adjunct to the Bureau of Water and Bureau of Surveys. From the latter date to the end of the year, the work has been conducted under the auspices of an independent Bureau, known as the Bureau of Filtration, created by ordinance of Councils approved July 18, 1902. Mr. John W. Hill, formerly Consulting Engineer, was appointed Chief Engineer of this Bureau; no other change was made in the organization of the staff.

All official correspondence, which previous to the creation of the new Bureau passed through the Bureaus of Water or Surveys, has, since August 1, been transmitted direct, thereby relieving the Bureaus of Surveys and Water of considerable labor and inconvenience in the formal transmission of important and urgent communications.

Amount appropriated for the Improvement, Extension and Filtration of Water Supply from the several loans created, was.....	\$17,000,000 00
Amount expended to date upon contracts, purchase of land, supplies, wages, and salaries of engineering corps	\$7,024,638 12
Unexpended, but under contract.....	7,367,747 17
	\$14,392,385 29
Balance available for future use.....	\$2,607,614 71

The improvement of the water supply of Philadelphia embraces three distinct propositions:

First. The filtration of the entire water supply assured in the near future at 300,000,000 gallons per day of twenty-four hours.

Second. A transfer of the source of supply from the districts now supplied from the Fairmount, Corinthian, East Park and Queen Lane reservoirs, from the Schuylkill river to the Delaware river.

Third. An adjustment of the water services of all that portion of the City lying east of the Schuylkill river to adapt them to the economical operation of the Upper and Lower Roxborough and Torresdale filters.

Nearly all of the more important details of the work have been completed and placed under contract.

Considering the natural difficulties attendant upon preparations for so large an undertaking as filtering and improving the entire water supply of our City, and which involves many features novel to American contractors, a generally satisfactory rate of progress has been made on all

work embraced under the several contracts. As a rule, the contractors have been diligent in forwarding the work and in some respects the machinery and appliances brought on the work to secure satisfactory and rapid results, have not been surpassed on any work of like character conducted in this or any other country.

During the past year, work has been completed and final payment made upon six contracts as follows:

- Contract No. 10:** Lower Roxborough Filters.
- Contract No. 13:** Rotary stop valves, patterns and core boxes.
- Contract No. 17:** Extension of distributing pipe system.
- Contract No. 21:** Low service pumping station for Upper Roxborough Filters.
- Contract No. 22:** Hand traveling crane for low service pumping station, Upper Roxborough Filters.
- Contract No. 26:** Torresdale Testing Station.

Upon the completion of the Lower Roxborough filters, they were placed in operation and filtered water is now supplied to the lower levels of Manayunk and Germantown.

Within ninety days after placing these filters in operation, we had effluents which showed a turbidity of zero by the silica standard and rarely has been in excess of three and the bacterial content has been very frequently below twenty-five colonies per cubic centimeter. This is due to the extreme care exercised in the selection and placing of the filtering gravel, sand and underdrains. The operations of these filters indicate that their yield between scrapings is much greater than that experienced abroad and that with the preparation of the water by preliminary filtration, it is expected that the average yield of the filters will be double that of those in Europe. This increased yield will reduce the cost of production below the estimate of the Board of Experts, yet at the same time, from a hygienic standpoint, the water will be above criticism and superior to the effluent of the plain sand filters in Europe which are

operated without treating the water by long sedimentation or preliminary filters.

The experiments made at our testing station with a view of increasing the rate of filtration, have demonstrated the fact that the filters can be run at a 6,000,000 gallon rate. Running at this rate their capacity will be as follows :

Stations.	Number of Filters.	Net Capacity 6,000,000 Gallon Rate with Preliminary Filters.
Lower Roxborough	5	12,000,000
Upper Roxborough	8	27,000,000
Belmont	18	66,000,000
Torresdale	55	200,000,000
Totals	86	305,000,000

During the past year, contracts have been awarded for the following work :

- Contract No. 20: Triplex pumps and gasoline driven engines for Upper Roxborough Filters.
- Contract No. 23-A: Administration Building and Pumping Station for Upper Roxborough Filters.
- Contract No. 37: Lower Roxborough Preliminary Filters.

Plans and specifications have also been prepared for the following work, which will be advertised for during the early part of the year 1903 :

- Contract No. 28: Lardner's Point pipe distribution system.
- Contract No. 37-A: Foundations and superstructure for the accommodation of the preliminary filters contracted for under Contract No. 37.
- Contract No. 49: Sand, gravel and collectors, Belmont Filters.

A large amount of office work has been accomplished, making a total since the inception of the work as follows :

Approved contract drawings	907
Studies and sketches	over 2,000
Field sheets and studies made at the various field offices...	1,515
Approved and miscellaneous prints, details and sketches filed for record and reference	1,345

Contract No. 11: High Service Pumping Machinery

for Lardner's Point. The work of constructing the engines under this contract embraces the furnishing and erecting of three self contained vertical triple expansion crank and fly wheel pumping engines, each capable of pumping 20,000,000 gallons of water per day of twenty-four hours, and three batteries of marine type fire box boilers, each battery consisting of four boilers of 200 horse power each and one 30-ton electric traveling crane.

The work of constructing the engines is now well under way. The first and second batteries of the boilers are completed and the third battery about one-half completed.

Contract No. 12: Upper Roxborough Filters. The work of constructing the Upper Roxborough filter plant is practically completed and filtering materials are now being placed in the beds. It is confidently expected that early in the spring of 1903, these filters will be placed in operation; they will supply filtered water to the sections of Germantown and Manayunk not supplied from the Lower Roxborough filter beds; also Chestnut Hill, Mt. Airy, Roxborough, Rising Sun and the upper part of Nicetown.

Contract No. 14: Torresdale Conduit. The work on this conduit has been somewhat retarded by the difficulties encountered in sinking the shafts through water bearing drift. These have all been sunk to their full depth, and from the bottom of these shafts the tunnel headings are driven in both directions, the work being pushed both day and night. Nine thousand one hundred and ninety-six (9,196) linear feet of heading have been driven and two thousand one hundred and thirty (2,130) linear feet trimmed ready for the masonry lining.

Contract No. 16: Belmont Filters. The work on these filters and their reservoirs has progressed very satisfactorily. Eleven filters have been practically completed and the floors, piers and side walls of five others have been finished. The work on these filters is in such an advanced

state that it is confidently expected the plant will be in operation during the year 1903.

Contracts Nos. 17 and 19: Distribution Pipe Systems. Work under Contract No. 17 has been completed and work under Contract No. 19 is so far advanced that it will be completed early in the month of January, 1903.

Contract No. 18: Low Service Pumping Machinery for Upper Roxborough Filters. This machinery is now being erected in the addition to the Roxborough Auxiliary Pumping Station and it is fully expected will be completed and in operation by February 1, 1903; it consists of three vertical compound, condensing, receiver, crank and fly-wheel engines, and three horizontal, rotary, centrifugal or impeller pumps, of a capacity of 7,000,000 to 10,000,000 gallons of water in twenty-four hours against a static head of twenty-five feet.

Contract No. 20: Triplex Pumps and Gasoline Driving Engines for Upper Roxborough Filters. The work embraced under this contract consists of the furnishing and erecting of two vertical, triplex pumps of 200,000 gallons each every twenty-four hours and two gasoline driven engines each 67.4 horse power, including pipe, valves, and all appurtenances.

The pumps and engines have been completed but have not yet been placed on their foundations in the pump room. They are to be erected in the new pumping station at the Upper Roxborough Filter Station, and will supply water to the sand washers and sand ejectors which convey sand from the filters to the sand washers in the court.

Contract No. 23.—A: Administration Building at Upper Roxborough Filters. This building is under roof, the engine and pump foundations completed and the interior finish well under way.

Contract No. 24: Collector, Pipes and Filtering Materials for Upper and Lower Roxborough Filters and Sand

Washers for Lower Roxborough Filters. The work under this contract on the Lower Roxborough Station was completed on November 6, 1902. The work of placing filtering material in the Upper Roxborough Filters is progressing.

Contract No. 25: Torresdale Filters. Very good progress has been made in the construction of the Torresdale Filter Station. The sewerage system has been completed; thirty-three per cent. of the work on the filters and twenty-one per cent. of the work on the filtered water basin has been accomplished to date.

Contract No. 27: Oak Lane Reservoir. The work accomplished on this reservoir during the past year amounts to 82 per cent. of the total embankment and 69 per cent. of the total excavation.

Contract No. 29: Lardner's Point Pumping Station No. 2. Work under this contract was commenced in the latter part of the past year. The contractor has driven the piles for the foundations of one of the chimneys and practically completed the excavation for the engine house. This is about five per cent. of the work embraced under this contract.

The work on the Improvement, Extension and Filtration of the Water Supply has been steadily pushed during the past year, and its magnitude can best be realized by reference to the following statistics, which give the general quantities of the most important items under construction during the year 1902 and the totals of work accomplished to date:

	Excava- tion, Cu. Yds.	Embank- ment, Cu. Yds.	Clay Puddle, Cu. Yds.	Concrete Masonry, Cu. Yds.	Water Pipe Laid, Tons.	Granolithic pavement, Sq. Yds.	Granite Curbing, Lin. Ft.
Lower Roxborough Filters.....	352	10,387	721	360	.....	4,512	2,110
Upper Roxborough Filters.....	2,447	58,564	12,828	22,765	621.0	6,509	3,346
Torresdale Conduit.....	46,281						
Belmont Filters.....	291,643	100,653	38,600	38,832	2,963.8		
Distribution Pipe Systems.....	121,327	.....	.....	.....	14,660.5		
Torresdale Filters.....	486,320	161,290	23,860	15,571	1,302.0		
Oak Lane Reservoir.....	187,390	33,290					
Lardner's Point Pumping Station.....	11,000						
Total 1902.....	1,146,760	384,184	76,009	77,528	19,247.3	11,021	5,456
Total 1901.....	495,561	159,607	12,929	14,822	9,509.17		
Total.....	1,642,321	523,791	88,938	92,350	28,756.47	11,021	5,456

Filters.

The type of filters adopted for the purification of the water supply is practically the same as that recommended by the Commission of Experts in their report dated September 15, 1898. They are all covered, and excepting the Lower Roxborough Station, have an area of approximately .75 of an acre. The filters at Lower Roxborough Station are approximately .50 of an acre in area.

The floors, side walls, piers and floorings are constructed of Portland cement concrete. Under the floors and back of the side walls to one foot above the water levels of the filter, are placed layers of clay puddle twelve and fourteen inches thick, respectively. The filters are provided with terra cotta pipe drains and a main collector, which delivers the filtered water to chambers located at the end of each filter. In these chambers are placed all the apparatus for controlling the operations of the filters. The piping, valves, etc., are so constructed that any one filter can be taken out of service for scraping, etc., without affecting the operation of the plant as a whole.

The filtering materials consist of a layer of clean river, beach or bank sand of thicknesses varying from twenty-eight to forty-four inches. Great care is exercised in the selection of the filtering materials and all the specification requirements, especially those affecting the sizes and uniformity, are strictly exacted, as the experience at the Lower Roxborough Station indicates that the early ripening of these filters was largely or perhaps entirely due to the careful selection of the filtering materials.

Gravel underdrains are used to support the sand and to allow a free flow of water from the sand into the drains and collectors. The thickness of the gravel drains is sixteen inches, and the sizes are graded and placed in separate layers of varying thicknesses.

The filtered water basins are designed and constructed

to contain approximately one-half day's supply for its respective district and are intended to compensate for the variation in the daily consumption of water. They are all covered, and the principal details, omitting the filtering materials and underdrains are constructed similar to the filters. Provision is made in the piping and conduit to admit of taking the filtered water basins out of service when necessary and supplying the district direct from the filters.

Testing Station.

In addition to carrying to completion the experiments started during the previous years in taking and analyzing bacteria of samples from the applied and effluent waters from the Lower Roxborough Station and comparative tests of efficiency of filters run at high rates, valuable information has been obtained showing no difficulty whatever will be encountered in dealing with the waters of the Delaware and Schuylkill rivers, so as to improve their quality, that complaint from a hygienic standpoint will certainly disappear when the entire water supply of the City is filtered.

A more elaborate and detailed description of the filters and the work performed to date will be found in the report of the Chief Engineer of the Bureau.

The following is a list of contracts for the Improvement, Extension and Filtration of the Water Supply:

List of Contracts for the Improvement, Extension and Filtration of the Water Supply.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
1 1 Sup.	A Testing Station.....	Thomas Parker.....	Feb. 27, 1900..	Mar. 6, 1900..	\$9,000 00	} \$11,653 54	July 13, 1900.
	Extension to Testing Station.....	Thomas Parker.....	.....	May 7, 1900..	5,000 00		
2	Ice Refrigerating Machine.....	Newburg Ice Machine & Eng. Co.....	July 20, 1900..	Aug. 20, 1900..	800 00	800 00	November 19, 1900.
3	Filtering Sand and Gravel for Testing Station.....	Norcross & Edmunds.	July 20, 1900..	Sept. 4, 1900..	2,500 00	1,016 54	November 2, 1900.
4	Platinum Ware for Testing Station.....	Chas. Lentz & Sons..	July 20, 1900..	July 27, 1900..	674 50	649 50	October 31, 1900.
5	Test Borings.....	Flaghouse & Beeson.	Aug. 7, 1900..	Sept. 6, 1900..	9,750 00	8,883 30	March 9, 1901.
6	Platinum Ware for Testing Station.....	Arthur H. Thomas Co.	Dec. 12, 1900..	.....	444 95	444 95	February 6, 1901.
7	Lower Roxborough Filters.....	.....	Dec. 12, 1900..	No award made. Readvertised as Contract No. 10.			
8	Sand Ejector.....	Patrick Gormly.....	Apr. 17, 1901..	May 6, 1901..	1,800 00	1,712 03	August 7, 1901.

List of Contracts for the Improvement, Extension and Filtration of the Water Supply—Continued.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
9	Cast Iron Water Pipe, Special Castings, Stop Valves, Pipe-laying, etc.....	Bids rejected on Pipe Lines "A" to "J" inclusive. See Contracts "9 A," "9 B" and "9 C" for rest of contract.					
9A	Cast Iron Stop Boxes	J. Alfred Clark.....	Feb. 11, 1901..	May 14, 1901..	\$2,100 00	\$1,563 80	December 21, 1901.
9B	Stop Valves.....	Eddy Valve Co.....	Feb. 11, 1901..	May 3, 1901..	17,000 00	14,403 00	December 21, 1901.
9C	Cast Iron Water Pipe and Special Castings for Lower Roxborough Filters.....	Daniel J. McNichol..	Feb. 11, 1901..	May 8, 1901..	7,500 00	7,488 14	December 20, 1901.
10	Lower Roxborough Filters.....	Daniel J. McNichol..	Feb. 11, 1901..	Mar. 20, 1901..	250,000 00	230,880 20	March 1, 1902.
11	Pumping Engines and Boilers and Electric Traveling Crane for Lardner's Point Pumping Station.....	Holly Mfg. Co.....	May 1, 1901..	June 6, 1901..	360,000 00	38,871 63	Not completed.
12	Upper Roxborough Filters.	Daniel J. McNichol..	Apr. 17, 1901..	May 8, 1901..	540,000 00	511,372 15	Not completed.
13	Rotary Stop Valves, Patterns and Core Boxes.....	Eddy Valve Co.....	Apr. 17, 1901..	June 1, 1901..	13,000 00	12,825 00	November 22, 1902.

List of Contracts for the Improvement, Extension and Filtration of the Water Supply—Continued.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
14	Torresdale Conduit	Daniel J. McNichol..	May 28, 1901..	Oct. 4, 1901...	\$1,350,000 00	\$398,832 56	Not completed.
15	A Test Pit at Lardner's Point.....	Contract abandoned. Work done by Water Bureau.					
16	Belmont Sedimentation Reservoir, Filters and Clear Water Basin.....	Ryan & Kelley	May 28, 1901..	Aug. 7, 1901.	2,000,000 00	1,096,484 67	Not completed.
17	Extension of Distribution Pipe System.	Daniel J. McNichol..	April 17, 1901.	June 4, 1901.	750,000 00	749,455 01	Oct. 24, 1902.
18	Low Service Pumping Machinery for Upper Roxborough Filters.....	Henry R. Worthington, Inc.....	July 29, 1901..	Aug. 22, 1901.	23,500 00	.....	No payment made.
19	Belmont Rising Mains, Upper Roxborough Connection Pipes and Extension of Distribution Pipe System.....	Daniel J. McNichol..	Dec. 18, 1901..	Jan. 30, 1902..	500,000 00	425,089 50	Not completed.
20	Triplex Pumps and Gasoline Driving Engines for Upper Roxborough Filters	Fairbanks, Morse & Co.....	Dec. 18, 1901..	Mar. 1, 1902..	10,800 00	.....	No payment made.
21	Low Service Pumping Station for Upper Roxborough Filters.....	Henderson & Co., Ltd	Sept. 25, 1901..	Oct. 21, 1901..	21,000 00	19,036 42	May 20, 1902.

List of Contracts for the Improvement, Extension and Filtration of the Water Supply—Continued.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
22	Hand Traveling Crane for Low Service Pumping Station, Upper Roxborough Filters.....	Alfred Box & Co.....	July 29, 1901..	Dec. 19, 1901..	\$2,900 00	\$2,800 00	Aug. 14, 1902.
23A	Administration Building and Pumping Station, Upper Roxborough Filters....	Daniel J. McNichol..	June 25, 1902..	Aug. 6, 1902..	43,000 00	17,943 24	Not completed.
24	Filtering Materials and Collectors for Upper and Lower Roxborough Filters and Sand Washers for Lower Roxborough Filters.....	Daniel J. McNichol..	Dec. 18, 1901..	Jan. 30, 1902..	290,000 00	112,525 75	Not completed.
25	Torresdale Filters and Clear Water Basin.....	Daniel J. McNichol..	Dec. 18, 1901	Jan. 18, 1902..	5,000,000 00	1,210,270 08	Not completed.
26	Torresdale Testing Station.....	Patrick Gormly.....	July 29, 1901..	Aug. 20, 1901..	9,000 00	8,643 00	December 19, 1901.
27	Oak Lane Reservoir.....	R. A. Malone & Co...	Dec. 18, 1901..	Mar. 14, 1902..	550,000 00	112,108 00	Not completed.
28	Lardner's Point Distribution.....						

List of Contracts for the Improvement, Extension and Filtration of the Water Supply—Continued.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
29	Lardner's Point Pumping Station, No. 2.	Geo. C. Deitrich.....	Sept. 17, 1902.	Oct. 4, 1902...	\$565,000 00	\$14,515 62	Not completed.
30	Lardner's Point Pumping Station, No. 2.	.....	Feb. 26, 1902..	Readvertised as Contract, No. 29.			
32	Addition to Testing Station at Spring Garden Pumping Station.....	.....	Sept. 25, 1901.	No Award Made.			
37	Lower Roxborough Preliminary Filters.	Maignen Filtration Co	Sept. 23, 1902.	Oct. 27, 1902..	49,800 00	.....	No payment made.
62	Baffles for the Lower Roxborough Reservoir.....	.....	June 25, 1902..	No Award Made.			

Bureau of Highways.

The report of the Chief of this Bureau shows in detail the extent and variety of work done on the highways and upon the bridges of the City during the past year.

The extent of streets repaved or newly paved with improved pavement is 37.67 miles; the grading of streets and sidewalks required the handling of 740,785 cubic yards of earth; 114,436 square yards of new sidewalks were laid; 120,344 linear feet of new curb stones and 13,638 linear feet of curved curb were set. All this shows the rapid growth of our City and the consequent opening of new streets. The figures relating to the general repairs and maintenance of our highways give gratifying evidence of active work, resulting in needed improvements of the streets.

The total expenditures of the year amounted to \$2,109,472.88, which is \$513,740.32 less than the previous year. The receipts on account of licenses, permits, etc., amounted to \$173,617.19, an increase over the preceding year of \$27,143.06.

The business of the Bureau was covered by the following contracts: 142 for new paving, 129 for repaving, 154 for grading, 94 for macadamizing and 25 of a miscellaneous character; a total of 544.

All the new paving laid during the year was upon a six inch concrete foundation and under a five year guarantee for maintenance. 59,948 linear feet of new pavement was laid, covering a distance of 11.35 miles.

Under the ordinance authorizing the repaving of streets with improved pavements, the cobble and rubble pavements were removed from 147 streets and their surface repaved with the following material

Sheet asphalt	115 streets
Granite block	26 streets
Vitrified brick or block	6 streets

This work amounted to 82,573 linear feet, equal to 15.64 miles.

Contracts for grading were entered into to the full extent of the appropriation available for this character of work. Sixteen miles of streets were graded to the established City grade by the City and parties conducting building operations, the latter doing the work without cost to the City.

In the suburban sections, 9.67 miles of macadam roadway were constructed during the year. All the unpaved and macadamized public highways which the City maintains received unremitting attention and were kept in excellent condition throughout the year.

The sprinkling of macadam highways began on April 15 and continued uninterruptedly until November 15. The good results derived from this work and the satisfaction and comfort of those using the roads or residing on their lines is of far greater value than the money expended for this purpose.

The repairing of streets paved with cobble, rubble, granite block, slag block, asphalt block and vitrified block or brick, was done under the system adopted in previous years, to wit, for a lump sum for the entire City. The cost for the year was \$156,900; work was begun by the contractors early in the season and prosecuted diligently throughout the year. Repairs to streets paved with asphalt and granolithic were made at a price per square yard.

During the past year the Keystone Telephone Company opened 135.5 miles of street surface for the laying of conduits; for the same purpose the Bell Telephone Company opened 21.5 miles, and the United Gas Improvement Company, for the laying of mains, opened 41 miles, a total of 198 miles of street surface broken by these three companies. In addition the United Gas Improvement Company made 44,000 openings for the purpose of making house

connections, repairing leaks, etc. The pavements disturbed by these companies in most instances, were promptly reinstated, but there were times when the weather conditions prevented the work being done as expeditiously as desired.

To this continued disturbance of the street surface by private corporations is mainly due the unsatisfactory condition of the paving on many of the streets.

One hundred and sixty thousand (160,000) dollars was appropriated for resurfacing streets paved with sheet asphalt, and was expended on streets paved years ago, the surface of which had worn to such an extent as to make repairs impracticable. 68,037 square yards were resurfaced during the year under a guarantee of ten years for maintenance.

The following statement shows a classification of the street pavements laid during the year and their mileage, also the total mileage of the various street pavements to December 31, 1902:

Kinds of Pavements.	LAID DURING 1902.		MAKING TOTAL IN CITY, DEC. 31, 1902.	
	Sq. Yards.	Miles.	Sq. Yards.	Miles.
Sheet asphalt.....	253,089	19.67	4,909,422	321.64
Asphalt block.....			180,702	19.30
Granite block.....	119,745	4.52	6,107,187	364.78
Cobble or rubble.....			1,263,201	44.99
Vitrified brick.....	62,272	3.81	2,200,931	138.62
Granolithic.....			72,726	12.77
Slag block.....			71,280	9.82
Macadam.....	105,301	9.67	2,453,779	235.79
Total.....	540,407	37.67	17,259,228	1,147.71

In addition to the paved and macadam streets, there are 412.29 miles of unpaved streets or dirt roads.

As set forth in the above statement, there still remains 44.99 miles of streets paved with cobble and rubble stones, but if Councils will continue to make appropriations for repaving with improved pavements, these ancient and unsightly pavements will in the near future become a thing of the past. As it is, Philadelphia can justly claim the distinction of being the best paved City and of having more miles of improved pavements than any municipality in the Union.

Great progress has been made in our City during the past four years in the matter of street paving. In 1898 there were 1,030.22 miles of paved streets, of which 89.28 miles were cobble, 69.43 miles rubble, 185.36 miles macadam and 686.15 miles improved pavements.

In 1902 there were 866.93 miles of improved street pavements, 235.79 miles of macadam, 30.96 miles of streets paved with cobble and 14.03 with rubble, a total of 1,147.71 miles of paved streets.

The total work accomplished in the paving and repaving of streets during the past four years is as follows:

New paving	55.21 miles
Repaving with improved pavements	126.68 miles
New macadam	50.44 miles
	<hr/>
	232.33 miles

All necessary repairs to sewers, inlets, etc., were promptly and thoroughly made by the contractor. A systematic inspection was made of a large number of sewers and where breaks were discovered they were promptly repaired. No serious break occurred in any of the sewers during the past year.

There are 318 City bridges under the care of the Bureau of Highways, of an estimated value of \$20,000,000. For the maintenance of these bridges Councils appropriated at various times during the past year sums aggregating \$90,000, which is less than one-half of one per cent. of their val-

uation. The Department cannot keep in proper repair and maintain the bridges of the City with the money provided, and it is poor economy to permit these important structures to depreciate for lack of money to keep them in proper condition. The deterioration of our bridges is becoming a serious matter, and if they do not receive attention soon, a number will become dangerously impaired, making it compulsory upon the Department to close them to travel.

Bridges, without regard to the material of which they are composed, have their natural span of life, and it may be taken for granted that the majority of those who are interested in the preservation of them, will take every precaution that this life is not shortened by accident or neglect, for financial if for no other reason. It is a well-known fact that railroad corporations frequently inspect and carefully preserve the stability of their bridges; as parts become weakened through any cause, they are removed and replaced by sound ones.

The least cared for bridges are those owned by municipalities, not by reason of carelessness or neglect of the officials having direct supervision of them, but through the omission of the legislative bodies to provide sufficient funds to properly paint and repair them, failing to recognize the fact that it is cheaper to inspect and care for an existing bridge than to build a new one.

A thorough inspection has been made of the condition of all bridges and a conservative estimate made of painting and putting them in good condition, fixes the cost at \$202,700.

The following tables give a comparative statement in detail of the work done during the years 1899, 1900, 1901 and 1902, and of the receipts and expenditures of the Bureau of Highways for the same period:

Comparative Statement of Work Done.

	1899.	1900.	1901.	1902.	
New paving.....	306,144	282,620	212,689	142,521	linear feet
Macadamizing (new).....	43,442	75,782	96,053	51,081	linear feet.
Grading.....	1,451,379	1,006,173	1,029,731	740,785	cubic yards:
New footway paving.....	111,861	122,885	117,746	114,436	square yards
Repairs to paved streets.....	1,901,984	1,008,152	556,787	504,611	square yards
Footways repaved.....	30,749	34,280	38,104	31,585	square yards
Ditches repaved.....	83,992	76,670	64,802	61,808	square yards
Gutter stone laid.....	65,042	42,119	24,148	9,292	linear feet.
Crossing stone laid.....	19,158	38,115	13,998	11,519	linear feet.
Curb stone reset.....	286,164	350,329	242,239	157,768	linear feet:
Wooden trunks.....	6,647	4,987	7,312	8,767	linear feet.
Brick and stone drains.....	2,950	992	566	467	linear feet.
Hand railings.....	3,666	2,675	7,267	3,512	linear feet.
Curved curb corners.....	37,066	30,434	16,031	13,638	linear feet.
New curb stone set.....		150,983	134,581	120,344	linear feet.
Vitrified brick and stone gutters.....		27,567	19,227	17,206	linear feet.
Resurfacing sheet asphalt.....		127,885	133,281	68,037	square yards
Footway, curb and railroad notices served.....	57,964	70,911	55,524	30,537	

Summary of Work Done in Improved Pavements—New Streets.

	1899.		1900.		1901.		1902.	
	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.
Granite blocks.....	7,715	3,052	21,901	5,000	8,666	2,740	45,373	7,154
Sheet Asphalt.....	37,240	11,035	171,157	49,022	197,676	60,332	97,778	34,180
Vitrified bricks.....	142,107	47,375	59,150	21,005	69,324	31,314	59,885	18,634
Asphalt blocks.....	2,702	685						
Macadamizing.....	75,408	43,442	155,004	75,782	171,292	96,053	105,301	51,081
Total.....	265,192	*105,550	407,212	†150,809	446,958	†190,439	305,357	§111,029

Replacing Cobblestone with Improved Pavements—Old Streets.

	1899.		1900.		1901.		1902.	
	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.	Sq. Yds.	Linear Feet.
Granite blocks.....	7,106	2,428	115,341	28,503	29,255	6,575	59,517	11,430
Sheet asphalt.....	551,121	221,695	290,186	133,683	272,374	106,249	155,311	69,692
Vitrified bricks.....	17,735	6,384	59,707	22,925	13,513	5,479	2,387	1,451
Slag block.....	22,995	13,490	30,413	22,482				
Total.....	602,947	*24,997	495,647	†207,593	315,142	†118,303	217,215	§39,573

* 1899.—Total amount of new paving 349,586 linear feet, equal to 66 miles, 1,106 linear feet.

† 1900.—Total amount of new paving 358,692 linear feet, equal to 67 miles, 4,642 linear feet.

‡ 1901.—Total amount of new paving 308,742 linear feet, equal to 58 miles, 2,502 linear feet.

§ 1902.—Total amount of new paving 193,698 linear feet, equal to 36 miles, 2,522 linear feet.

In addition to the work done by the City in the paving and repaving of streets with improved pavement, the following statement shows in detail the amount of work done by the passenger railway companies during the year 1902:

	Linear feet
Resurfacing—Sheet Asphalt	43,514
Granite Block Repaving	5,238
Granite Block Repaving between tracks	13,958
Vitrified Bricks Repaving between tracks	468
Total	63,178

Equal to 11 miles, 5,098 linear feet, at an estimated cost of \$300,000.

Comparative Statement of Receipts.

Year.	Receipts.	Increase.	Decrease.
1899	\$142,164 20		
1900	136,055 73		\$6,108 47
1901	146,474 13	\$10,418 40	
1902	173,617 19	27,143 06	

Comparative Statement of Expenditures.

	1899.	1900.	1901.	1902.
Current expenses.....	\$922,893 14	\$1,055,865 38	\$627,837 34	\$768,397 04
For extensions.....	1,584,729 33	1,991,807 31	1,995,375 86	1,341,075 84
Total.....	\$2,507,622 52	\$3,047,672 69	\$2,623,213 20	\$2,109,472 88

Board of Highway Supervisors.

The increased receipts of the Board and the number of permits issued show the continued disturbance of our highways, and the outlook for an early cessation of this work is not very promising.

The receipts for the year were \$35,398.18, and the expenditures \$11,776.36, showing a net profit to the City of \$23,621.82.

The earnings during the past year have far exceeded those of any previous year in the history of the Board of Highway Supervisors.

The following is a statement of the number of permits authorized to be issued during the year, to the several companies maintaining underground structures:

Edison Electric Light Company	88
Union Traction Company	13
Bell Telephone Company	269
The United Gas Improvement Company	683
Keystone Telephone Company	2,709
Southern Electric Light and Power Company	4
Pennsylvania Heat, Light and Power Company	1
Total	3,773

One hundred and twenty-eight plans of sub-structures, covering a distance of 27 miles, have been added to the records of the Board during the year, making a total of 290 miles of finished plans now on file. The large amount of work performed by the draughtsmen of the Board in the collection and preparing of data is more valuable than the moneys paid by the individuals and companies for whose accommodation the work has been done.

The plans of the Board are being used constantly by the different City departments in obtaining information of underground construction, and proves of great value in locating the many conduits and underground structures which have been laid.

The records of the Draughting Division during the year show that the Keystone Telephone Company laid 147 miles of conduit and 1,020 miles of duct. The Bell Telephone Company laid 20 miles of conduit and 130 miles of duct. The United Gas Improvement Company during the same period laid 37 miles of ten inch pipe and under, and four miles of larger pipe.

The following is a comparative summary of the trans-

actions of the Board of Highway Supervisors and of the work of the Draughting Department; also the receipts and expenditures for the years 1899, 1900, 1901 and 1902:

Transactions of the Board of Highway Supervisors.

Permits Authorized to be Issued.	1899	1900	1901	1902
For vaults.....	16	12	10	13
For railroad tracks, curves and turnouts.....	74	67	39	72
For underground pipes.....	9	15	450	690
For electrical conduits.....	578	560	1,023	3,065
For erecting bridges.....	4	1	4	3
For awnings.....	279	*63	.....	.....
For tunnels.....	.....	2	.....	4
For platform scales.....	.....	1	1	1
For drinking fountain.....	.....	1	1	.....
For travelling crane.....	.....	.....	.....	1

* Awnings transferred to Bureau of Highways by Ordinance of Councils, March 22, 1900.

Work done by the Draughtsmen of the Board of Highway Supervisors.

	1899	1900	1901	1902
Plans of iron awnings furnished.....	295	*63	.....	.....
New street record plans prepared.....	172	182	97	128
Blue print plans placed on file.....	246	159	147	233

* Awnings transferred to Bureau of Highways by Ordinance of Councils, March 22, 1900.

Receipts and Expenditures.

	1899.	1900.	1901.	1902.
Receipts.....	\$21,844 36	\$15,864 71	\$27,722 06	\$35,398 18
Expenditures.....	8,797 01	9,858 13	11,169 61	11,776 36
Excess of receipts.....	\$13,047 35	\$6,006 58	\$16,552 45	\$23,621 82

Recapitulation.

	1899.	1900.	1901.	1902.
Amount of earnings.....	\$25,117 39	\$14,235 03	\$32,230 54	\$46,309 14
Amount outstanding from previous years.....	2,256 18	5,529 21	3,764 24	8,462 01
	\$27,373 57	\$19,764 24	\$35,994 78	54,771 15
Amount received and deposited with City Treasurer.....	21,844 36	15,864 71	27,722 06	35,398 18
Amount outstanding.....	\$5,529 21	\$3,899 53	\$8,272 72	\$19,372 97

Bureau of Street Cleaning.

The work of this Bureau during the year 1902 has been performed in an eminently satisfactory manner, as is evidenced by the small number of complaints received and generally clean condition of our streets.

During the year there were expended for the cleaning of streets, inlets and alleys, removal of ashes, etc., \$712,042, and for the removal and disposal of garbage, \$488,830, making a total of \$1,200,872.

There were cleaned during the year 118,942.2 miles of streets and 195,090 private alleys; also 1,090,731 sewer inlets, from which there were removed 189,735 cart loads of dirt. From the buildings there were removed 617,847 cart loads of ashes and 29,963 cart loads of dry waste.

The decrease in the mileage of streets cleaned in comparison with the former year was owing to the unfavorable condition of the weather caused by incessant snows and rains at certain periods of the year, which, for days at a time, interfered with the cleaning of streets.

The decrease in the number of loads of ashes removed in comparison with the previous year, was by reason of the scarcity of coal due to the strike in the coal region.

There were removed and disposed of in a sanitary manner, 279,333 cart loads of kitchen garbage and 17,032 dead

animals. From the footways of bridges spanning the Schuylkill river and from the streets in the business center of the City, there were removed 7,136 single cart loads and 2,421 double cart loads of snow at a cost of \$11,351.08.

These figures will give an idea of the amount of work done under the supervision of this Bureau, and yet there were received only 2,703 complaints of all kinds. This attests the efficiency of the Bureau and the satisfactory manner in which the work was performed.

The Department has been very exacting during the year and imposed penalties for neglect by contractors amounting to \$9,918.

Contracts have been awarded to the lowest responsible bidders for cleaning streets, inlets and alleys, removing ashes, etc., for the year 1903, for the sum of \$693,850, which is \$27,040 less than the contract price for the year 1902. This is not owing to any decrease in the amount of work to be done, but to active competition among bidders.

The large amount of repaving of streets with improved pavements, the laying of water mains, the building of sewers, the opening of street pavements by the United Gas Improvement Company for the laying of pipe and improvements to their service, the construction of conduits by the Keystone and Bell Telephone Companies for the extensions to their systems, together with the erection of 4,674 new buildings, has rendered the work of keeping the streets clean, more difficult than usual.

The following is a statement in detail of the operations of the Bureau of Street Cleaning during the year 1902; also the totals for the years 1899, 1900 and 1901:

Total Work during the Year 1902.

DISTRICTS.	CLEANED.						REMOVED.				Number of complaints of all kinds.	
	Squares.	Alleys.	Inlets.	Crossings.	Market Houses.	Snow from Fire Plugs.	Number of Dead Animals.	NUMBER OF LOADS.				
								Dirt.	Ashes.	Dry Waste.		Garbage.
First	349,752	51,272	194,336	92,712	622	3,053	3,131	42,409	110,523	5,181	43,473	425
Second.....	336,016	52,409	198,930	98,078	1,240	3,230	3,271	46,090	107,118	5,853	46,297	899
Third.....	272,842	18,611	98,388	59,924	280	2,899	3,402	14,072	56,934	3,380	61,333	396
Fourth	509,420	41,085	427,908	63,613	.....	1,711	3,854	51,560	175,764	5,570	67,799	488
Fifth	407,671	31,713	151,497	51,968	.....	913	3,374	23,869	167,508	9,979	60,381	478
Sixth	23,712	.....	29,672	6,960	.....	2,722	.....	11,735	.....	.....	.....	17
Total 1902	1,899,422	195,090	1,090,731	373,255	2,142	14,528	17,032	189,735	617,847	29,963	279,333	2,703
Total 1901	2,046,139	173,387	1,034,329	127,481	2,123	4,295	14,753	178,495	639,883	30,472	252,238	10,668
Total 1900	2,154,611	*	1,128,423	261,790	2,174	17,548	10,532	192,125	568,636	15,253	224,256	2,248
Total 1899	2,048,454	*	1,411,787	501,070	2,156	22,817	8,702	202,799	625,459	.....	199,357	2,222

* Prior to the year 1901 the cleaning of alleys was not under the jurisdiction of the Department of Public Works.

Bureau of Gas.

Prior to December 1, 1897, the gas works were managed directly by the municipality under the supervision of the Bureau of Gas. When the lease of the works to The United Gas Improvement Company became operative, it modified decidedly the City's position with respect to the gas supply.

The duties of the Bureau of Gas, which was reorganized June 1, 1899, under authority of ordinance of Councils, approved March 29, 1899, are directed exclusively towards the enforcement of the terms of the lease. This covers the examination of all meters in dispute, but more especially the maintenance of the quality of gas supplied, which, at all times must be equal in illuminating power to 22 standard sperm candles.

The inspection of the gas at the testing station shows that the standard of illumination has been fully maintained. The average candle power of the tests was as follows:

	Candle power.
January	22.79
February	23.10
March	23.00
April	22.98
May	23.22
June	23.01
July	22.98
August	22.95
September	23.01
October	23.10
November	22.92
December	22.84
	<hr/>
Maximum monthly average	23.22
Minimum monthly average	22.79

The results of the above tests indicate the uniformity which characterizes the illuminating quality of the gas supplied.

The Chief Inspector of Meters reports that the gas, when subjected to chemical analysis, exhibits the following average compositions :

Carbon Di-oxide	2.89 per cent.
Illuminants	11.61 per cent.
Oxygen	0.60 per cent.
Hydrogen	32.70 per cent.
Carbon Mon-oxide	21.20 per cent.
Methane	26.30 per cent.
Nitrogen	4.70 per cent.
	<hr style="width: 10%; margin-left: auto; margin-right: 0;"/> 100.00 per cent.

Twenty-three requests were received during the year for the inspection of meters. In each case an examination was made and eighteen were found to be registering fast and five slow.

In view of the increased consumption of gas, the number of requests received for the examination of meters was astonishingly small.

It would be difficult to determine exactly how far gas has been substituted for coal by reason of the strike in the coal regions, but it has undoubtedly been relied upon by a great many consumers, and has contributed immeasurably to the relief of many, who, without the aid of sufficient gas for heating and cooking purposes, would have been in dire distress. For this reason the increased consumption of gas during the past year has been extraordinary. The demand of the public has been promptly and successfully met by the company, which not only furnished a sufficient supply of gas to meet the emergency, but also of a quality never below the standard prescribed by the lease.

The expense of operating this Bureau is provided for in the lease of The United Gas Improvement Company, which requires said company to deposit annually in the City Treasury, \$10,000, which, in turn, is appropriated by Councils to the Bureau of Gas, so that the inspection of the

gas supply does not involve the City in any expense. The appropriation of \$10,000 was all expended during the past year.

Bureau of Lighting.

The lighting of the City with gas and gasoline is under the supervision of this Bureau. The electric lighting, for technical purposes, is under the direction of the Chief of Electrical Bureau.

The total number of lamps lighted and under the supervision of the Bureau of Lighting on December 31, 1902, was 33,409, divided as follows:

Gas lamps maintained by The United Gas Improvement Company	20,677
Gasoline lamps furnished by the Pennsylvania Globe Gas Light Company	12,534
Gas lamps maintained by the Northern Liberties Gas Company	75
Gas lamps maintained by Department of Charities and Correction	123

In addition to the number enumerated in the above statement, there are 9,376 electric arc lights under the care of the Department of Public Safety (Electrical Bureau), and fifty are lights maintained by the Board of Directors of City Trusts and located on Delaware avenue, and Front street, between Vine and South streets.

The total number of lighted lamps of all descriptions on December 31, 1901, was 44,011; on December 31, 1902, 42,835; a decrease of 1,176.

This decrease is due to the introduction of the Welsbach incandescent gasoline lamp, authorized by ordinance of Councils approved December 20, 1901, which provided for the erection of this improved lamp, conditioned that the cost of lighting should not exceed the amount appropriated for the year.

To comply with the conditions of the ordinance, it was necessary to discontinue a large number of the plate burner gasoline lamps and substitute in their place a less number of the improved Welsbach gasoline lamps.

On January 1, 1902, there were 14,355 plate burner gasoline lamps; of this number 7,298 were discontinued during the year and 5,477 Welsbach incandescent gasoline lamps substituted for them, causing a decrease in the number of gasoline lamps of 1821. From this should be deducted 302 new gas lamps and 343 electric lights erected during the year, which explains the decrease hereinbefore referred to.

The Welsbach incandescent lamps are of 60 candle power and were placed on roads and streets which are now better and more satisfactorily lighted than they were with the greater number of the old style plate burner lamps.

The increase in the number of new gas lamps erected annually is comparatively small, and is due to the fact that The United Gas Improvement Company, under the terms of its lease with the City is required to erect only three hundred new gas lamps each year. This number is entirely too small to meet the demands for public lights required by the erection of new buildings and the extension of streets; and were it not for the fact that the Department has arranged with The United Gas Improvement Company to discontinue the lighting of all gas lamps in close proximity to electric lights and to re-erect them on streets where there are no gas lamps, many of our streets would be in darkness. Under this mutual arrangement, six hundred and sixty-eight discontinued gas lamps were relocated in other places during the year.

The gasoline lamps under the care of the Pennsylvania Globe Gas Light Company and the gas lamps under the care of The United Gas Improvement Company, have

been lighted, extinguished and maintained in a thoroughly satisfactory manner.

The following comparative statement shows the number of gas and gasoline lamps, also the expenditures of the Bureau of Lighting during the years 1899, 1900, 1901 and 1902:

	1899.		1900.		1901.		1902.	
	Number of Lamps.	Cost during the year.	Number of Lamps.	Cost during the year.	Number of Lamps.	Cost during the year.	Number of Lamps.	Cost during the year.
Gas lamps maintained by The United Gas Improvement Company.....	*19,922	.....	*20,137	.....	*20,495	.....	*20,798	.....
Gasoline lamps.....	13,314	\$279,559 61	13,966	\$286,268 59	14,355	\$298,388 14	12,534	\$304,724 93
Gas lamps supplied by the Northern Liberties Gas Company.....	92	1,858 44	80	1,693 13	77	1,587 97	75	1,528 48
Gas lamps maintained by the Bureau of Correction.....	*236	.....	*231	.....	*231	.....	*231	.....
Salaries and office expenses.....	.....	5,758 44	.....	6,572 20	.....	6,393 46	.....	10,489 54
Total.....	33,564	\$287,176 49	34,414	\$294,533 92	35,168	\$306,364 57	33,638	\$316,742 95

* Not lighted because of proximity to electric lights.

	1899	1900	1901	1902
Under care of The United Gas Improvement Company.....	180	166	122	121
Under care of Bureau of Correction.....	108	103	108	108

City Ice Boats.

The season of 1901-02 was a very trying one to the City Ice Boats. They were in continuous active service thirty-eight days and nights, to keep the channel of the Delaware river open for navigation.

During the early part of February, the ice in the river became so heavy and thick and packed to such an extent, as to make the river impassable to vessels unassisted by the City Ice Boats; by their constant trips and efficient service, the channel of the river was kept open so that the shipping interests suffered but little interruption from this source.

The severe duty to which the boats were subjected necessitated extensive repairs to the wheels and decks; also repairs to the boilers on Boat No. 3 and to the engines on Boats Nos. 2 and 3, and other repairs of a general character, all of which were made during the past summer and the boats are now in condition for work when needed.

There were expended for repairs and general maintenance, \$27,223.64; and \$477.80 received from the sale of old material and towage, was paid into the City Treasury.

The general condition of all three boats is such that if they are to be continued in service, extensive repairs must be made at an early date. The decks of all the boats need renewing. Boats Nos. 2 and 3 require new stacks; the boilers on Boat No. 2, which are thirty-four years old, must be replaced by new ones.

For the year 1903, Councils have appropriated \$25,000 for repairs to Boat No. 2. This amount will be applied to building new boilers, but before they can be installed, the old boilers must be taken out, which will necessitate the complete dismantling and tearing apart of the boat and will mean a complete rebuilding, as the old material will not be fit to replace. To place the new boilers and complete the rebuilding of the boat will require an additional sum of about \$35,000, and it is to be hoped that Councils will

provide this additional appropriation, in order that the rebuilding of this boat may be completed before its services are required next season.

The following tables give a comparative summary of the receipts and expenditures of the City Ice Boats for the years 1899, 1900, 1901 and 1902:

	1899.	1900.	1901.	1902.
Amount received for towage and assistance rendered.....		\$1,250 00	\$500 00	\$444 79
Amount received for sale of old material.....	\$72 45	65 39	58 60	33 01
Total paid to City Treasurer.	\$72 45	\$1,315 39	\$558 60	\$477 80

	1899.	1900.	1901.	1902.
Total amount of warrants drawn..	\$20,834 70	\$29,949 05	\$37,621 80	\$27,223 64
Deduct cash paid City Treasurer...	72 45	1,315 39	558 60	477 80
Total.....	\$20,762 25	\$28,633 66	\$37,063 20	\$26,745 84

Director's Office.

The work of the Director's office grows with the increase in the operations of the several Bureaus. During the past four years, the correspondence and papers filed in this office relating to the business in the Bureaus of the Department have increased more than one hundred per cent. All contracts in the several Bureaus, as well as pay rolls and bills for work done or material and supplies furnished, are audited in this office. The execution of the works performed by this Department require a great amount of detail to be followed continuously, in order to secure the best

results to the City and to prevent delay in the progress and completion of the work.

The work accomplished during the past four years which is without parallel in importance and extent, as compared with that of any previous four years, justifies me in saying that the liberal appropriations made by Councils which enabled so many improvements to be made, were judicious. The works completed have been of direct benefit to the public, and those under construction will assist in the future advancement and prosperity of the City.

The appropriations, receipts and expenditures of the Department of Public Works for the year 1902, are set forth in the following table in detail by Bureaus, and in totals for the years 1899, 1900 and 1901:

The following is a comparative summary of the expenditures of the Director's office for the years 1899, 1900, 1901 and 1902:

Item.	1899.	1900.	1901.	1902.
1 Salaries.....	\$30,420 00	\$20,560 00	\$20,447 50	\$20,860 00
2 Keep of horses.....	1,400 00	1,390 00	1,190 00	1,400 00
3 Printing, stationery, etc.....	2,438 42	2,353 97	2,367 05	2,356 39
4 Appraisalment of Philadelphia Gas Works.....	2,750 00			
7 To pay bills for gas pipe, etc..	455 79			
6 To pay Pennsylvania Railroad Company for expenses incurred in removing debris washed upon tracks at Powelton avenue, and for expenses in repairing round house and tracks at Thirty-first and Powelton avenue..	437 70			
4 To reimburse John J. Cassidy for gas pipe paid for by him.....		175 50		
5 To pay a verdict obtained against Thos. L. Hicks and Patrick McGinn.....		436 03		
Total.....	\$27,901 91	\$24,915 50	\$24,004 55	24,616 39

*Statement of the Appropriations, Expenditures, etc., of
the Department of Public Works for the years 1899,
1900, 1901 and 1902.*

APPROPRIATIONS, TRANSFERS, ETC.

1899	\$12,595,122 89
1900	13,329,310 94
1901	15,528,237 93
1902	11,189,035 22
Total	\$52,641,706 98
Deduct amount transferred from	861,441 77
	\$51,780,265 21

EXPENDITURES.

SALARIES, WAGES, MATERIAL, SUPPLIES, MAINTENANCE, ETC.

1899	\$3,873,264 27
1900	4,180,794 20
1901	3,840,726 00
1902	4,318,791 98
	\$16,213,576 45

EXTENSIONS OR PERMANENT IMPROVEMENTS.

1899	\$3,878,445 29
1900	4,738,794 88
1901	5,334,844 46
1902	7,882,487 54
	\$21,834,572 17

Total expenditures **\$38,048,148 62**

AMOUNT UNEXPENDED AT CLOSE OF YEAR AND MERGED.

1899	\$96,761 73
1900	46,519 89
1901	38,186 69
1902	34,446 73
	215,915 04
Amount unexpended December 31, 1902, and carried forward	13,516,201 55
	\$51,780,265 21

RECEIPTS.

1899	\$3,436,848 44
1900	3,580,451 18
1901	3,651,200 20
1902	3,779,304 62
	\$14,447,804 44

The following is an abstract from the ordinance making an appropriation to this Department for the year 1903, with a statement of the balances available from previous years for work ordered and for which contracts have been executed:

Bureaus.	Annual Appropriation for the year 1903.	Balance Available from Previous Years.	Total.
Director's Office.....	\$26,620 00	.....	\$26,620 00
City Ice Boats.....	51,680 00	.....	51,680 00
Gas.....	10,000 00	.....	10,000 00
Highways.....	1,201,603 07	\$917,107 13	2,118,710 20
Lighting.....	330,216 00	.....	330,216 00
Street Cleaning.....	1,242,470 00	.....	1,242,470 00
Surveys.....	885,160 00	2,378,911 58	3,264,071 58
Water.....	1,712,713 00	10,220,182 84	11,932,895 84
Total.....	\$5,460,462 07	\$13,516,201 55	\$18,976,663 62

I cannot close this report without referring to the efficient services of the employees of this Department. To my Assistant, Chiefs of Bureaus and others, I tender my acknowledgments for the able support they have given me in my efforts to secure satisfactory and honest service for the City. I do not believe any establishment, either public or private, can claim a more earnest and faithful set of officers and employees.

Having completed the last report which it shall be my duty and privilege as Director of the Department of Public Works to make to you as Mayor of the City of Philadelphia, I have to again express to you the gratification it has been to me that during the four years of office, your earnest support has always been accorded me and to thank you for the confidence reposed in me.

In anticipation of your retirement from the office of Mayor to private life, I wish you many years of continued health and happiness.

Respectfully submitted,

WM. C. HADDOCK,

Director.

ANNUAL REPORT

OF THE

BUREAU OF WATER

For the Year 1902

OFFICERS
OF THE
BUREAU OF WATER

Chief,

FRANK L. HAND.

General Superintendent,

ALLEN J. FULLER.

Chief Clerk,

J. T. HICKMAN.

Assistants to Chief,

WILLIAM WHITBY,

H. J. JOHNSON.

Correspondence Clerk, P. DE HAVEN.

Chief Draughtsman,

JOHN E. CODMAN.

Draughtsmen,

Martin Murphy,

James H. Hand, Jr.,

John R. Gorman,

Charles B. F. Waller,

Henry L. Lentz.

Joseph D. Austin.

Assistants to Chief Clerk,

Thomas Spence,

A. H. Raven.

*Time Clerk—*Wm. J. Innes.

*Clerk—*George G. Whitby.

*Assistant Clerk—*Kennedy McNeal.

*Search Clerk—*John S. Todd.

*Assistant Search Clerk—*John J. Maxwell.

*Assistant Clerk—*John J. Barney.

*Pipe Inspector—*Theodore S. S. Baker.

*Pipe Clerk—*Charles H. Pyrah.

*Messenger—*Haines Lewis.

*Janitor—*David Richards.

*Watchman—*James Robinson.

*Watchman—*George Harper.

Telephone Operators,

Jennie M. Hannings,

Calvin Cramer.

Permit Clerk—Thomas Orr.*Assistant Permit Clerk*—Chas. H. Russell.*Chief Inspector*—Edward Harshaw.*Inspectors,*

Wm. A. Agnew,
 Lewis Obermiller,
 Theo. Yeager,
 Jas. Buchanan,
 George Crook,
 Henry Homiller,
 Wm. J. Reed,
 John Van Dusen, Sr.,
 George Hoffman,
 John McGrory,
 Harry J. Stone,

John A. Brown,
 George W. Eckert,
 Frank Sloan,
 George Spence,
 Hillary Connor,
 Harrison D. Bates,
 Owen Jones,
 Thos. G. Morris,
 John T. Gault,
 Robert M. Snyder,
 Chas. W. Wells.

Works--General.*Assistant to General Superintendent*—Wm. Laumaster.*Clerk and Paymaster*—Frank Hohlfeld.*Assistant Clerk*—John B. Wright.*Foreman Machinist*—Robert Bromiley.*Foreman Bricklayer*—Lewis Myers.*Foreman Carpenter*—Henry Guest.*Foreman Plumber*—Chas. H. Green.*Foreman Stonemason*—Michael Farrell.*Foreman Painter*—Joseph Work.*Foreman Rigger*—Lewis Pederson.*Foreman Laborer*—Wm. Calhoun.*Foremen of Repairs,*

Edwin Hamm,

D. H. Rose,

E. N. Sampson.

General Storekeeper—John A. Acker.*Storekeepers,*

Daniel D. Todd,

Wm. F. Glenn.

Electrician—Henry F. Morgan.*Lineman*—D. McDougall.

CONSTRUCTION AND REPAIR SHOP, Twelfth and Reed Sts.*Superintendent of Shop*—James H. Dean.*Clerk*—Morris P. Getz.*Watchman*—John W. Watkins.**Purveyors' Districts.***First District Office*, 1120 Wharton street.*Purveyor*—Charles T. Erichson.*Clerk*—Wm. J. Mackey.*Assistant Clerk*—James McCracken.*General Foreman*—Thos. Preston.*Foreman of Repairs*—W. W. Wellington.*Hydrant Inspector*—James Preston.*Watchman*—John H. Peterson.*Second District Office*, 918 Cherry street.*Purveyor*—David A. Craig.*Clerk*—William J. McKee.*Assistant Clerk*—Fred. J. Gheen.*General Foreman*—Michael Young, to April 1, 1901.*Foreman of Repairs*—Edw. Homan.*Hydrant Inspector*—Robert S. Hughes.*Watchman*—J. D. Kirkpatrick.*Third District Office*, Beach street and Susquehanna avenue.*Purveyor*—Charles J. Lowry.*Clerk*—J. A. Spanagle.*Assistant Clerk*—Milton Fredericks.*General Foreman*—Elias Abrams.*General Foreman*—James Hutchinson.*Foreman of Repairs*—Wm. P. Yetter.*Hydrant Inspector*—Thos. P. Cowden.*Hydrant Inspector*—Henry Flake.*Hydrant Inspector*—Wm. Gerstner.*Hydrant Inspector*—Jno. R. Horn.*Watchman*—Jas. H. Jebbs.

Fourth District Office, Twenty-sixth and Master streets.*Purveyor*—John Montgomery.*Clerk*—Philip S. Thomas.*Assistant Clerk*—Jay T. Wilson.*Assistant Clerk*—Wm. W. Davis.*General Foreman*—George W. Showaker.*Foreman of Repairs*—John Richards.*Yardman*—Thos. F. Kelley.*Hydrant Inspector*—Wilson Lancaster.*Hydrant Inspector*—John C. Smith.*Watchman*—James S. Fleet.**Fifth District Office, 4377 Manayunk avenue.***Purveyor*—Charles T. Preston.*Clerk*—F. J. Cornman.*General Foreman*—Wm. H. Dawson.*Foreman of Repairs*—George Rittenhouse.*Hydrant Inspector*—Jos. R. Gardy.**Sixth District Office, Town Hall, Germantown.***Purveyor*—George W. Bardens.*Clerk*—Robert Howat.*Assistant Clerk*—R. M. J. Livezey.*General Foreman*—Jos. B. Fowler.*Foreman of Repairs*—John L. Cameron.*Hydrant Inspector*—Geo. W. Clemens.**Seventh District Office, Thirtieth and South streets.***Purveyor*—Michael Young.*Clerk*—John F. Mahaun.*Assistant Clerk*—Jas. S. Ashworth.*General Foreman*—Jas. H. Tawney.*Watchman*—John C. Bishop.*Watchman*—Jacob H. Boon.

ANNUAL REPORT
OF THE
BUREAU OF WATER
FOR THE YEAR 1902

SIXTEENTH ANNUAL REPORT
OF THE
BUREAU OF WATER

ONE HUNDRED AND FIRST ANNUAL REPORT
OF
OPERATIONS CONNECTED WITH THE CITY
WATER SUPPLY

Philadelphia, January 19, 1903.

WILLIAM C. HADDOCK, Esq.,
Director, Department of Public Works.

DEAR SIR:—I have the honor to submit the following report of operations connected with the Bureau of Water for the year 1902:

The past year has witnessed many unusual and important events affecting the interests of this Bureau.

In January last, part of the pumping machinery at four of our stations was submerged during a freshet in the

Schuylkill river, and considerable damage was done thereby to the buildings and grounds.

On February 23, the Schuylkill was again swollen by heavy rains, and a section of the Flat Rock dam was washed away.

This was followed a few days later by a third flood, which increased the crevasse in the dam to about eighty feet in length and approximately from four to eight feet in depth, thereby endangering the operation of the Shawmont Pumping Station, upon which Manayunk, Roxborough and Germantown depend for their water supply.

Early in May, a strike of the anthracite coal miners took place, in consequence of which, owing to our inability to obtain a supply of hard coal, we were obliged to substitute—and to adapt all our stations to the use of—bituminous coal. This change increased the cost of fuel, during the period of the strike, 45 per cent.

On August 12, the first filtered water from the Lower Roxborough filter plant was turned into the Manayunk district above Green lane, between Silverwood and Main streets.

Additional sections were, from time to time, added thereto, until August 27, when the full supply intended to be drawn from these filters, for the lower levels of Manayunk, was turned on, and that section of the City has since had an abundance of pure and wholesome water.

On September 27, the first filtered water (from the same source) was turned into the lower end of the Germantown district, and within a short time thereafter all of the territory between Wissahickon avenue and Chew street, and between Nicetown lane and Cheltenham avenue, was similarly supplied.

The extension of the filtered water supply to other districts is dependent upon the construction of additional filter basins and the necessary appurtenances. This is a matter

that comes under the jurisdiction of the Bureau of Filtration (created by ordinance of Councils on July 18, 1902), and will receive the attention of Mr. John W. Hill, Chief Engineer of that Bureau, who will make further reference to it in his report of the operations in connection therewith.

The work of laying the independent fire mains was completed, and, on September 15, the mains were subjected to a final test, under the supervision of a committee representing the Board of Fire Underwriters' Association. Later they were practically tested by actual service, which effectually demonstrated the high efficiency of this system for fighting fires.

A very important matter, and one for serious consideration, is the great increase in the consumption of water during the past year, our experience in this connection proving conclusively that the pumping capacity of all our works, with the exception of that at the Belmont Station, is inadequate to supply the demands for water during periods of extremely hot or cold weather. Provision must, therefore, be made to meet this deficiency, either by an increase in the pumpage capacity, or by a limitation in the quantity of water supplied to the consumers.

In default of any probability of action being taken to adopt the last-named course, I earnestly recommend that immediate provision be made for the following urgent requirements:

Shawmont Station:	
Two 5-million gallon pumping engines	\$75,000
Eight steam boilers	48,000
Boiler house and stack	35,000
	<u>\$158,000</u>
Belmont High Service Station:	
One 5-million gallon pumping engine	\$26,000
Frankford Station:	
Three steam boilers	\$18,500
Addition to boiler house	7,500
	<u>\$26,000</u>
Total	\$210,000

I also here beg to repeat the recommendation made in my reports for the years 1900 and 1901, relative to the needed repairs to the wheel house at Fairmount Station; the construction of a tower around the standpipe at George's Hill; the erection of a storehouse at 918 Cherry street, and the necessary buildings for office, stable and shop at the new Seventh District yard, Parkside avenue above Belmont avenue:

"For a long time the roof of the old wheel-house at the Fairmount station has been in a leaky condition, and although many attempts have been made to stop this leakage, even to the extent of putting an entire new outer covering on it several times, it was found to be impossible, owing either to the expansion and contraction of the iron beams, or to the vibration caused by the running of the turbine wheels, to prevent the percolation of water through the roof during, and for some time following, rainy weather. As a result, the engine room and pumps are now in a most deplorable condition.

"Another important construction which should receive immediate attention is the building of a tower to protect, as well as to conceal from view, the conspicuous and unsightly standpipe located on the summit of George's Hill.

"When permission to construct this standpipe was obtained from the Commissioners of Fairmount Park, it was granted only after a full understanding with the Commissioners that the pipe would eventually be enclosed in a substantial masonry structure of architectural merit, and subject to the approval of these gentlemen.

"Some years ago plans were prepared for this work and bids advertised for, but the amount named by the lowest bidder was considered too high, and the contract therefor was not awarded. I am therefore having new plans prepared, with a view, if possible, of bringing the cost within reasonable limit. Upon completion of these plans they

will be submitted to you for such action as you may deem proper in the premises.

“I would also call your attention to the necessity for a general storehouse, to which all small stores, material, etc., could be shipped, examined and entered of record, and from which they could be disbursed with greater promptness and accuracy than is possible under the present conditions, which are as follows:

“Part of these goods are sent to our storehouse at the Spring Garden Pumping Station, but a very large portion of them are delivered, by the contractors, at the various pumping stations and at the several Purveyors’ District yards, and this arrangement renders it impossible, with our limited clerical force, to keep a proper check and account of the disposition of the goods received.

“A storehouse of ample proportions should be erected in a central location, and for such purpose I would recommend the purchase of property adjoining the Second District office and yard, No. 918 Cherry street, on which (and including the premises now occupied by the Second District office, etc.), a warehouse and stable could be built, suitable for the purposes and requirements of the Bureau.

“The construction of a warehouse as above proposed would permit the use of the present storehouse at the Spring Garden station for a meter shop. Such a shop is absolutely necessary for the proper conduct of the meter business, every detail of which should receive prompt and careful attention. The necessary checking of this work cannot be accomplished with accuracy and despatch when it is performed under several heads and with the materials scattered in various parts of the City, as is now the case. It is also found that, even with the limited extent to which the use of water meters is permitted in this City, a shop conveniently located, for the repairing and storing of meters and the distribution of the work throughout the

City, is absolutely necessary for the perfect and satisfactory management of this branch of the service." See pages 64 and 65, Annual Report for 1900.)

"Provision was made by ordinance of Councils for the creation of an additional Purveyor's District, to be known as the Seventh District * * * *

"The Seventh District covers the Twenty-fourth, Twenty-seventh, Thirty-fourth and Fortieth Wards, formerly part of the Second District, and the latter has been increased by the addition of the Eleventh, Twelfth, Thirteenth, Fourteenth, Sixteenth and Seventeenth Wards, taken from the Third and Fourth Districts.

"A new district yard, located on the south side of Parkside avenue, west of Belmont avenue, has been provided for the storage of materials, etc. Plans for the erection therein of an office, stable, wagon shed and repair shop have been prepared, and I earnestly recommend their immediate construction so as to provide for the necessary housing and proper means to transact the business of this district." (See pages 90 and 91, Annual Report for 1901.)

In addition to the above, a new shed over the coal bins at the Belmont Pumping Station is needed, the old one having been destroyed by fire. The estimated cost of this work is \$4,500.

Revenue Collected.

The total collections during the year 1902, and the increased amount as compared with that for 1901, were as follows:

Water rents	\$3,032,411 57
Meter rents	226,684 10
Frontage	100,710 50
Amount collected by City Solicitor	36,692 92
Penalties	37,951 64
New connections	11,246 00

Searches	\$2,914 00
Miscellaneous	10,479 99
<hr/>	
Total collections for 1902	\$3,459,090 72
Total collections for 1901	3,331,437 45
<hr/>	
Net increase	\$127,653 27

The total collections for the four years ending December 31, 1902, as compared with the previous corresponding period ending December 31, 1898, are as follows:

1895	\$2,829,857 17
1896	2,879,133 26
1897	2,971,357 52
1898	3,065,665 86
<hr/>	
Total	\$11,746,013 81
1899	\$3,123,954 20
1900	3,249,195 24
1901	3,331,437 45
1902	3,459,090 72
<hr/>	
Total	\$13,163,677 61
	11,746,013 81
<hr/>	

Showing an increase in the amount collected during the latter period of\$1,417,663 80

Expenditures.

The expenditures for maintenance, service mains, etc., were	\$1,668,201 76
The expenditures for improvements and extensions were	4,843,733 07
<hr/>	
Total expenditures during 1902	\$6,511,934 83
The total expenditures for maintenance and extensions during 1899, 1900, 1901 and 1902, were.....	\$12,427,708 74
Total expenditures 1895, 1896, 1897 and 1898.....	6,883,986 14
<hr/>	
Total increase of expenditures for period 1899 to 1902, inclusive	\$5,543,722 60

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The increase of expenditures during the four years ending December 31, 1902, amounting to \$5,543,722.50 over and above the amount expended in the preceding four years, was due principally to the large items required for the construction of filter basins and the laying of distributing mains therefor. Also, for the laying of independent fire mains; for additions to the engine and boiler houses, pumping machinery, boilers, and other important structures that were necessary to meet the increasing demands for water.

Net Earnings of the Water Bureau.

The total revenue from water rents, etc., from the installation of the water works up to December 31, 1902, was	\$80,203,896 29
The total expenditures for maintenance and construction, including the amounts paid from 1899 to 1902, inclusive, for the Improvement, Extension and Filtration of the Water Supply, were..	\$56,498,869 59
Net profit earned by the Water Bureau from the installation of the water works up to December 31, 1902, was	\$23,705,026 70

Increased Consumption.

The total consumption of water throughout the City during 1902 was 114,607,314,362 gallons, or at an average rate of 313,992,642 gallons per day—an *increase*, as compared with that of last year, of 12,416,273,669 gallons, or of 34,017,188 gallons per day.

The average per capita consumption was 232.7 gallons—an increase, as compared with that of 1901, of 20.8 gallons.

This great increase was distributed throughout the City, from our several systems, as follows:

Distribution System.	Average daily consumption in million gallons.	Average increase in million gallons per day.	Percentage of increase in each system.
Belmont	31,459,208	.553	1.80
Queen Lane	71,167,145	4.129	6.16
East Park	161,355,205	16.215	11.17
Roxborough	19,856,203	4.700	31.03
Frankford	30,154,861	8.420	38.71

From the above it appears that the increase in the Belmont system has been inconsiderable, or less than two per cent., notwithstanding the fact that extensive building operations were carried on in that section during the past year, and that, in addition, large quantities of water were consumed in the construction of, and for testing, the Belmont filter basins.

The per capita consumption was about 203 gallons per day.

Of the 4.1 million gallons per day increase in the Queen lane system, it may be said that this additional quantity is more apparent than real, for during the past year the pumps at this station have been in better condition than heretofore, and they were consequently in operation a greater number of hours.

Under these circumstances they were able to supply the Queen lane system with considerable less assistance than usual from the Spring Garden works, and the increase of 4.1 million gallons per day in the pumpage does not, therefore, represent strictly additional consumption in the Queen lane district, but only pumpage which was formerly done at the Spring Garden Station.

The daily per capita consumption in the Queen lane section was approximately 232.7 gallons.

In the division comprising the East Park and Frankford systems, the consumption was materially increased

by putting into service a number of new supply mains, thus adding to the pressures on the distributing pipes, and correspondingly to the quantity of water consumed (and wasted) in that section.

The rate of consumption therein was 243 gallons per capita—an increase of about 16 per cent. during the past year.

The only useful function performed by this additional quantity of water was to give greater pressures on the service mains, thereby enabling consumers to draw water in less time on the upper floors of their premises. This is a desirable and necessary feature, especially in localities where, owing to the low head, it was difficult to obtain a sufficient supply of water on the upper floors; but it is to be regretted that this could not be accomplished by restriction of waste through leaky water fixtures and by the turning off of those allowed to remain open for no useful purpose, as was done in many instances during the house-to-house inspection in 1900 and 1901, when the consumption was materially decreased.

The average consumption in the Roxborough system, comprising the Twenty-first, Twenty-second, Forty-second, and parts of the Thirty-third and Thirty-eighth Wards, was 197 gallons per capita, but during the last half of the year, when the new supply mains were put into service, this was increased to 205 gallons per capita, and the last two months—owing to the extension of the filtered water system in Germantown and the putting into service of a new 20-inch supply main—to 243 gallons per capita. The latter high figure was, however, largely due to increased waste during the cold weather.

The distribution of water throughout the several water systems has been satisfactory, and there have been no serious complaints of a deficiency in the supply due to lack of pressure on the mains, except, during a very short

period, in the sections south of Vine street, between the Delaware and Schuylkill rivers, and north of Vine street east of Broad. This was remedied, however, by turning on the supply from the new 48-inch main in Broad street, between Arch and York streets, and from the new 30-inch main in Twelfth street and Girard avenue. We have since had no complaints of shortage of water in these sections.

Coal.

This is the largest and most important item of expense for materials which enters into the economic management of the Bureau.

It is delivered in daily allotments, by rail, except the supply for the Frankford pumping station (which is received in boatloads of about 100 tons each), and the total consumption averages about 500 tons per day.

Under favorable conditions for traffic, the quantities of coal stored at the several stations vary from one-half to the full capacity of the sheds, the latter being as follows:

	Tons.	No. of Days' Supply.
Spring Garden.....	800	4
Belmont.....	2,500	20
Queen Lane.....	400	3
Roxborough.....	900	8
Frankford.....	1,400	21
Belmont High Service.....	125	28
Roxborough High Service.....	300	45
Mt. Airy High Service.....	150	45
Chestnut Hill High Service.....	125	125
Wentz Farm High Service.....	250	150

Any interruption in the deliveries of coal, such as has occurred from snow blockades and from ice in the river, or by reason of a strike on the railroads, is a serious menace to the operation of the works, particularly to that of our two largest pumping stations, Spring Garden and

Queen Lane, where the facilities for storage are so inadequate as to require a constant watch of the coal pile in order to guard against a shortage, even under favorable conditions for its delivery.

I most earnestly recommend that the coal shed at the Spring Garden Pumping Station be enlarged, and that ample sheds, with the necessary sidings, be constructed to provide storage room at the Queen Lane Pumping Station.

Also, that a new shed be erected at the Roxborough Station, where we are now storing coal, to a limited extent, in an old ice house.

The importance of this matter was fully demonstrated during the recent prolonged strike of the anthracite miners, when the shipments of hard coal ceased entirely and it became necessary to go into the open market at once and make the best arrangements possible for the purchase of bituminous coal.

This proved to be a difficult matter, and in order to obtain a sufficient supply to operate the works, the arrangements made were *chiefly limited to getting coal*, and entering into monthly contracts for its delivery, at whatever prices might be demanded by the dealers.

The strike began May 10, but limited quantities of hard coal continued to be shipped and received for about 10 days thereafter.

The first soft coal arrived at the Spring Garden Pumping Station on May 31, at which time the bins at that station, as well as at Queen Lane Station, were practically empty.

Efforts were made to obtain immediate shipments of soft coal to all the other pumping stations, in order that the old supply on hand might be held in reserve for any contingency that might arise, and had the soft-coal miners struck, and held out as effectually as the anthracite miners

did, it is difficult to conceive a condition, due to any human agency, that would have been more disastrous in its results.

The total quantity of bituminous coal purchased during the strike was 77,067 tons, costing \$325,750.17.

The additional expense due to the purchase of bituminous coal, as compared with that for the same number of tons of anthracite coal at the old contract prices, was \$107,159.91.

There were many other expenses incidental to the use of soft coal, such as increased force in the boiler rooms (coal passers and coal trimmers), and a very large item for wharfage and unloading from the cars and boats.

All the coal for the supply of the Queen Lane Pumping Station had to be hauled from the boats or from the railroad siding, both of which are about a quarter of a mile distant from the pumping station.

The coal bins at the Spring Garden Pumping Station are not suitably constructed for soft coal, and it was found necessary to employ men at night to move it from the back to the front of the bins in order to get it through the shutes.

At Belmont and Roxborough Stations a large part of the coal was handled from two to three times. This was also the case, in addition to hauling, at the Frankford Station.

The expense due to these items was \$41,678.15, which, with the increased cost per ton mentioned above, gives a total increase to the Bureau of \$148,838.06, resulting from the six months' use of bituminous coal.

The following chart (Fig. 1) shows the pumpage from the rivers by steam power, and the number of tons of coal consumed in 1902, as compared with that during 1901:

Independent Fire Mains.

The construction of an independent fire main system for the better protection of the business section of the City was begun last year, and work thereon has since been completed as far as the money available for this purpose would permit.

The portion finished is shown on Fig. 2; also, that which remains to be done, including the installation of a pumping station, with engines and pumps, and a forcing main, all of which are in course of construction and under contract to be completed about the middle of the current year.

The fire main system as now constructed, and covering effectually about 425 acres in area, consists of the following-named mains:

Walnut street, from Delaware river, 12-inch.....	6,519 ft.
Market street, from Delaware avenue, 12-inch.....	221 ft.
Market street, from Water street, 16-inch.....	5,979 ft.
Arch street, from Delaware river, 12-inch.....	6,210 ft.
Race street, from Delaware river, 12-inch.....	5,121 ft.
Juniper street, from Filbert to Arch streets, 12-inch.....	540 ft.
Broad street, from Walnut street to S. Penn Square, 12-inch.....	871 ft.
Around City Hall, 12-inch.....	2,248 ft.
Delaware avenue, from Market to Race streets, 8-inch.....	1,446 ft.
Second street, from Walnut to Race streets, 8-inch.....	2,642 ft.
Fifth street, from Walnut to Race streets, 8-inch.....	2,642 ft.
Eighth street, from Walnut to Race streets, 8-inch.....	2,642 ft.
Eleventh street, from Walnut to Race streets, 8-inch.....	2,642 ft.
Fire hydrant connections, 8-inch.....	2,471 ft.
Total pipe laid.....	<u>42,194 ft</u>

The sizes given above are nominal. The external diameters conform to the standards used by the Water Bureau, and the internal diameters are reduced in proportion to the increased thickness of barrel necessary to give the required strength.

The straight and the curved pipes are of cast iron and are flanged at both ends, but owing to the former being cast vertically, the flanges on the cope ends of these pipes are reinforced with brackets.

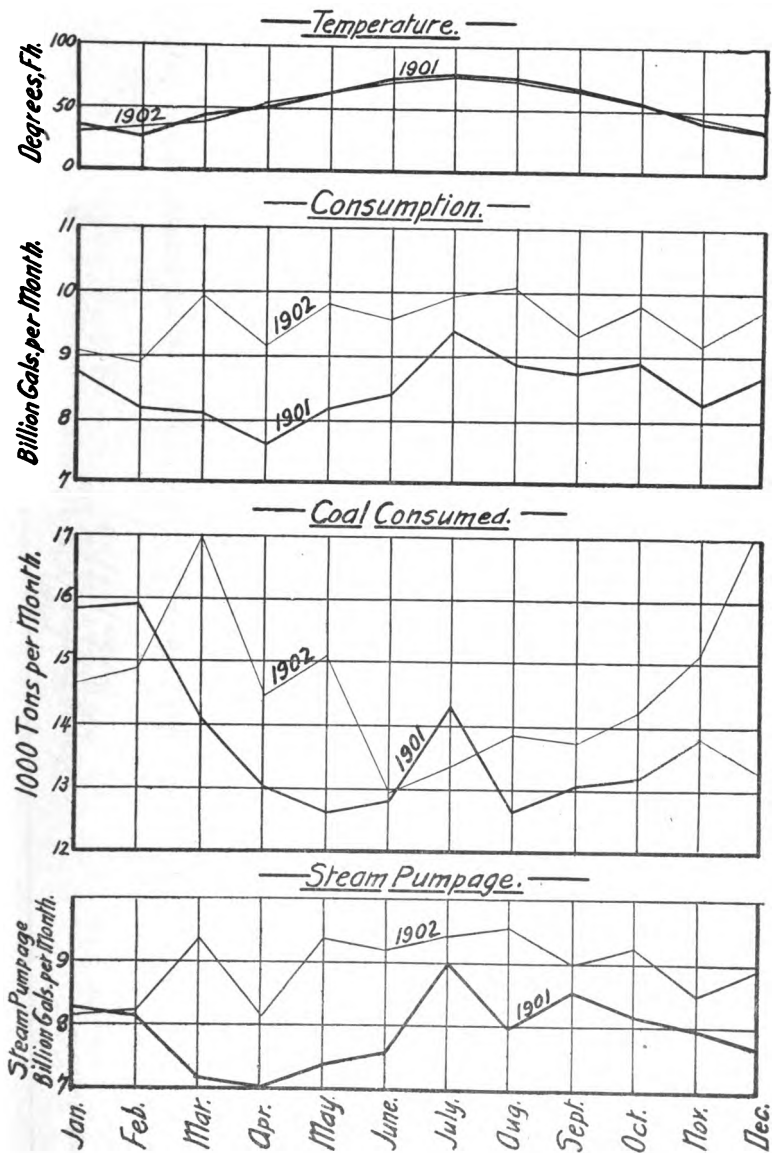


FIG. 1.

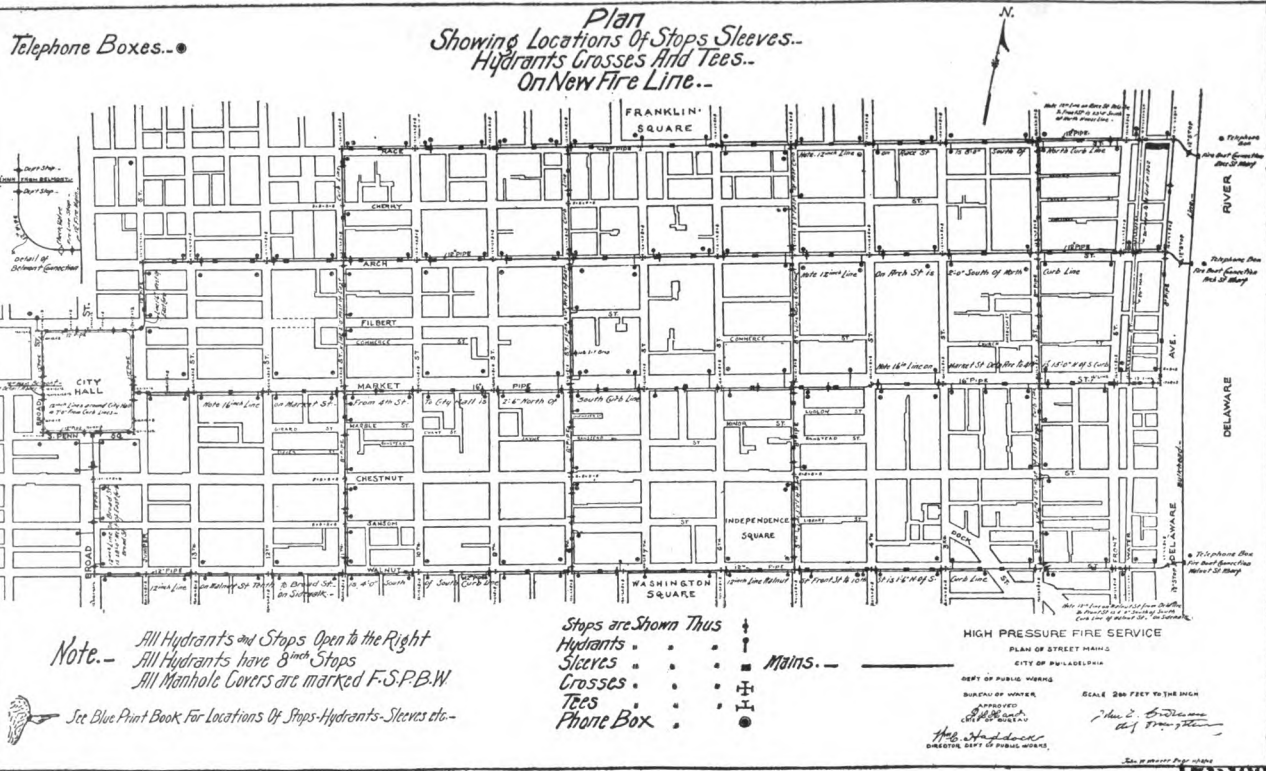
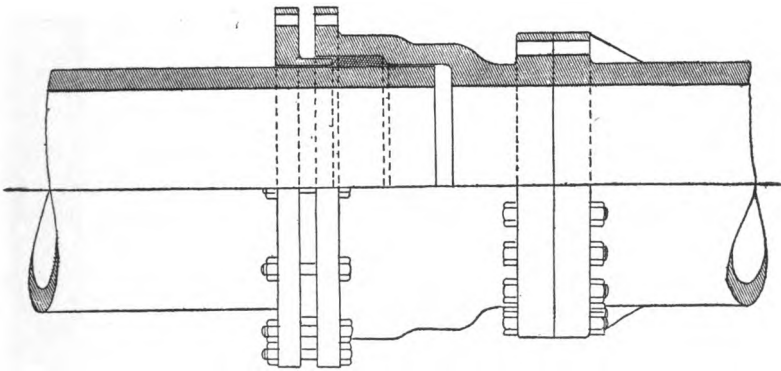
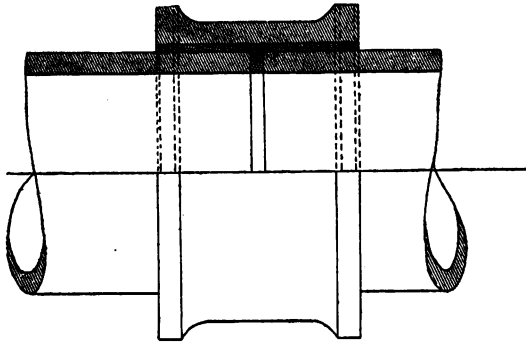


Fig. 2.



High Pressure Fire Main
Expansion Sleeves

Fig 3

All flanges are straight-faced and spot-faced around the bolt holes. The joints are packed with canvas, thoroughly coated with North Carolina tar, and cover the full width of the face of the flange.

The straight pipes are 12 feet in length; the curved pipes, for changing directions and passing obstructions encountered in the line of work, are from 8 to 16 feet radii, and the hydrant connections 19 inches radii, all of which vary in length from 1 to 8 feet, according to requirements.

The dimensions of the pipes and bolts are as follows:

Size. Inches.	PIPE.		FLANGES.			BOLTS.		
	Internal Diam. Inches.	External Diam. Inches.	Diam. Inches.	Thick- ness. Inches.	Bolt Circle Diam. Inches.	Number.	Diam. Inches.	Length Inches.
8	7 $\frac{1}{4}$	9	13 $\frac{1}{4}$	1 $\frac{1}{4}$	11 $\frac{5}{8}$	8	1	4 $\frac{1}{4}$
12	10 $\frac{1}{2}$	13 $\frac{3}{8}$	17 $\frac{1}{4}$	2 $\frac{1}{4}$	15 $\frac{1}{4}$	12	1 $\frac{1}{8}$	5 $\frac{1}{2}$
16	14 $\frac{5}{8}$	17 $\frac{3}{8}$	22 $\frac{1}{4}$	2 $\frac{3}{8}$	20	16	1 $\frac{1}{8}$	7 $\frac{1}{2}$

The crosses and tees for connecting laterals or intersecting pipes are made of cast steel, and in all respects are of the same diameters as those given above for cast iron pipes, except that the interior diameters are greater and the thickness of the flanges is reduced as follows:

8-inch interior diameter, 7 $\frac{1}{2}$ in. ; thickness of flange, 1 in.

12-inch interior diameter, 11 $\frac{1}{2}$ in. ; thickness of flange, 1 in.

16-inch interior diameter, 15 $\frac{3}{8}$ in. ; thickness of flange, 1 $\frac{1}{2}$ in.

The gate valves are of the double disc pattern, with inside screws; the bodies are of semi-steel; the gates, valve seats and screws, of bronze; the 16-inch size being provided with by-passes, bolted to the body of the stop with flanged connections.

The hydrants are of the post pattern and were especially

designed for this work by the A. P. Smith Manufacturing Company, of Newark, N. J.

Each hydrant is provided with two 4-inch nozzles, controlled by independent valves, and the main valve of the hydrant is a solid 8-inch single-faced gate, all of the working parts being of bronze and so constructed that they can be taken out for repairs by removing the top of the hydrant. The body and goose-neck are of semi-steel.

Two styles of expansion joints were used on the mains, one consisting of a solid sleeve with lead joints, such as is ordinarily adopted in water works practice for joining the bead, or cut ends, of cast iron water pipes, and the other (and by far the greater number used) of the stuffing box and gland pattern (Fig. 3), in which square flax packing was used for making the joints water-tight.

Brass air cocks, of the ordinary plug type, but made extra strong, are placed on all summits in the mains.

Brick chambers, with iron man-hole covers, are constructed over all stops and expansion joints, so that repairs can be easily made and without unnecessary delay.

At the foot of Walnut, Arch and Race streets, the 12-inch pipes terminate in an enlarged bottle-shaped chamber (called a fire-boat connection), 36 inches in diameter, the outer (or river) end of which is flanged, and to which is bolted a heavy plate, the latter being provided with eight 4-inch nozzles. Each of these nozzles is controlled by a check valve within, and so arranged that no water can flow out of the chamber.

On top of the fire-boat connection there is a 15-inch flanged opening surmounted by an air chamber 24 inches in diameter and 6 feet high.

The fire-boat connection is made of cast steel, the nozzle and check valves of bronze and the air chamber of $\frac{1}{2}$ -inch steel plate.

All pipe and materials forming part of the fire-main

system were subjected to a hydrostatic pressure of 800 pounds to the square inch at the manufacturers, and to another test of 400 pounds to the square inch after being laid in the ground, in order to insure the integrity of the completed work.

The total quantity of the various materials, the cost thereof and of the labor in connection with the work, are given in the following table (Fig. 4).

The fire main system, as above described, is maintained under a constant pressure of about 70 pounds to the square inch, by means of a 12-inch connection to the main which supplies the City Hall with water by gravity from the George's Hill reservoir.

The 12-inch connection is also provided with a check valve, which permits the water to pass into the fire mains, but not in the reverse direction.

The principal feature of the gravity supply is to keep the fire mains primed and ready for instant service at all times; but in addition to this it is useful for the extinguishment of incipient fires not exceeding 100 feet in elevation above the street level.

A complete system of fire boxes, connected by underground wires with the central station at the City Hall, has been constructed, by means of which quick and direct communication by telephone is insured between the fire boats stationed on the river front and the immediate vicinity of any fire which may occur within the boundaries covered by the independent fire mains.

This telephone system was constructed by the Electrical Bureau, and the cost of its installation is not included in the amounts given in Fig. 4.

When the independent fire system is in service it is proposed to pump directly into the mains, under a pressure, as high as may be desired, up to 300 pounds to the square

inch, and to take the hose streams direct from the fire hydrants (see Fig. 5).

Until the completion of the pumping station and its appurtenances, as referred to above, the fire boats "Edwin S. Stuart," "Samuel H. Ashbridge," and the "Visitor," will be utilized to force water into these mains, and one of them (the "Edwin S. Stuart") having a pumping capacity of 9,000 gallons per minute, will be stationed at the Race street wharf, with eight 4-inch lines of hose attached to the fire main system, ready for instant service, as shown in Fig. 6.

Upon completion of the fire mains between the Delaware river and Eighth street, a preliminary trial, for the purpose of testing the pumps, mains, hose and hose connections, was made on April 10, 1902, at Sixth and Race streets.

This test demonstrated the high efficiency of the system as a whole, and developed some minor defects, which were remedied.

A further test was made on May 2, 1902, at Eighth and Market streets, when, at different times, two, four and six fire-streams were discharged from one fire hydrant off the gravity supply; also, two, four, six and twelve fire-streams, from two hydrants, with the three fire boats pumping into the mains.

With the three fire-boat pumps working at full capacity, twelve powerful (2-inch nozzle) fire streams were simultaneously discharged at a height considerably above the highest buildings on Market street; but no actual measurements of these streams were taken, as the object of the test was, as in the former case, entirely for practice and to insure the integrity of the system while in operation.

On September 15, a third test of the independent fire main system was made, at Broad and Sansom streets (Fig. 7), distant about $1\frac{1}{2}$ miles from the principal fire boat

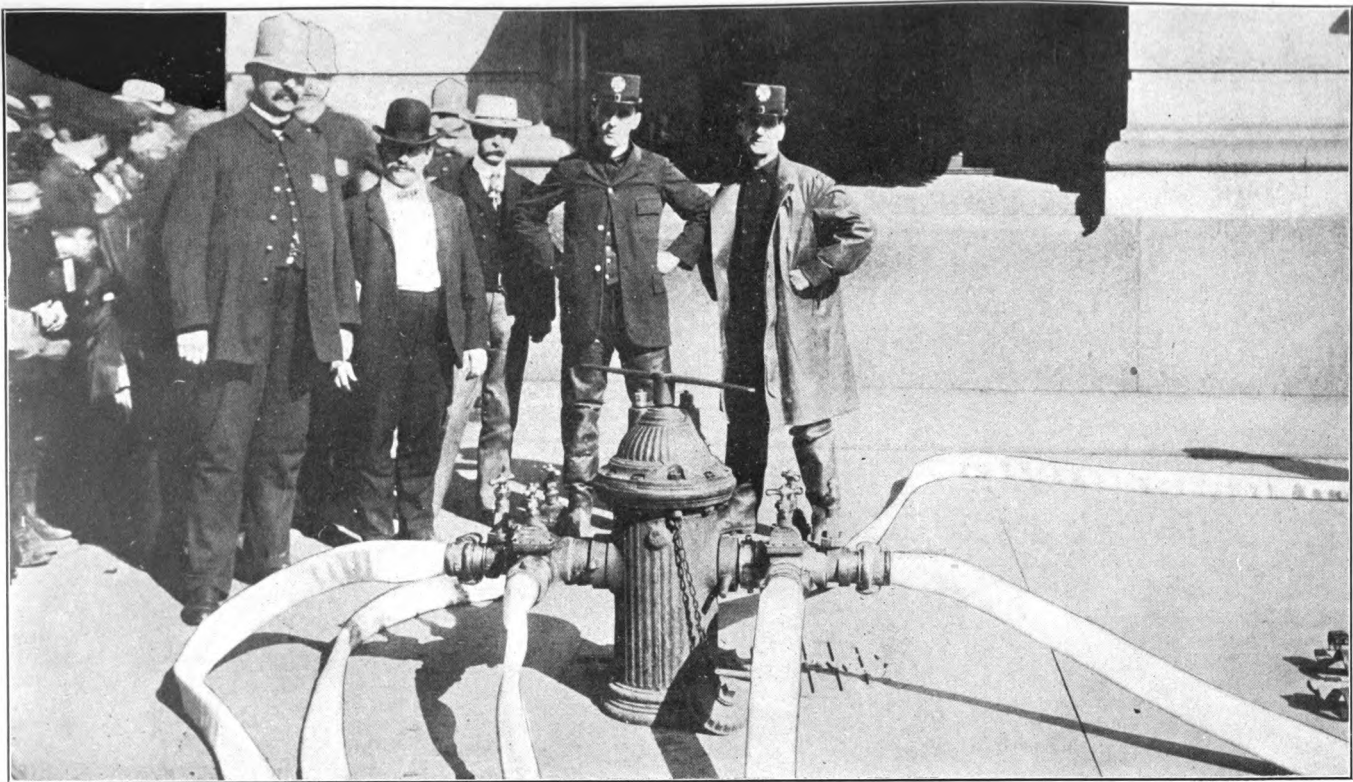
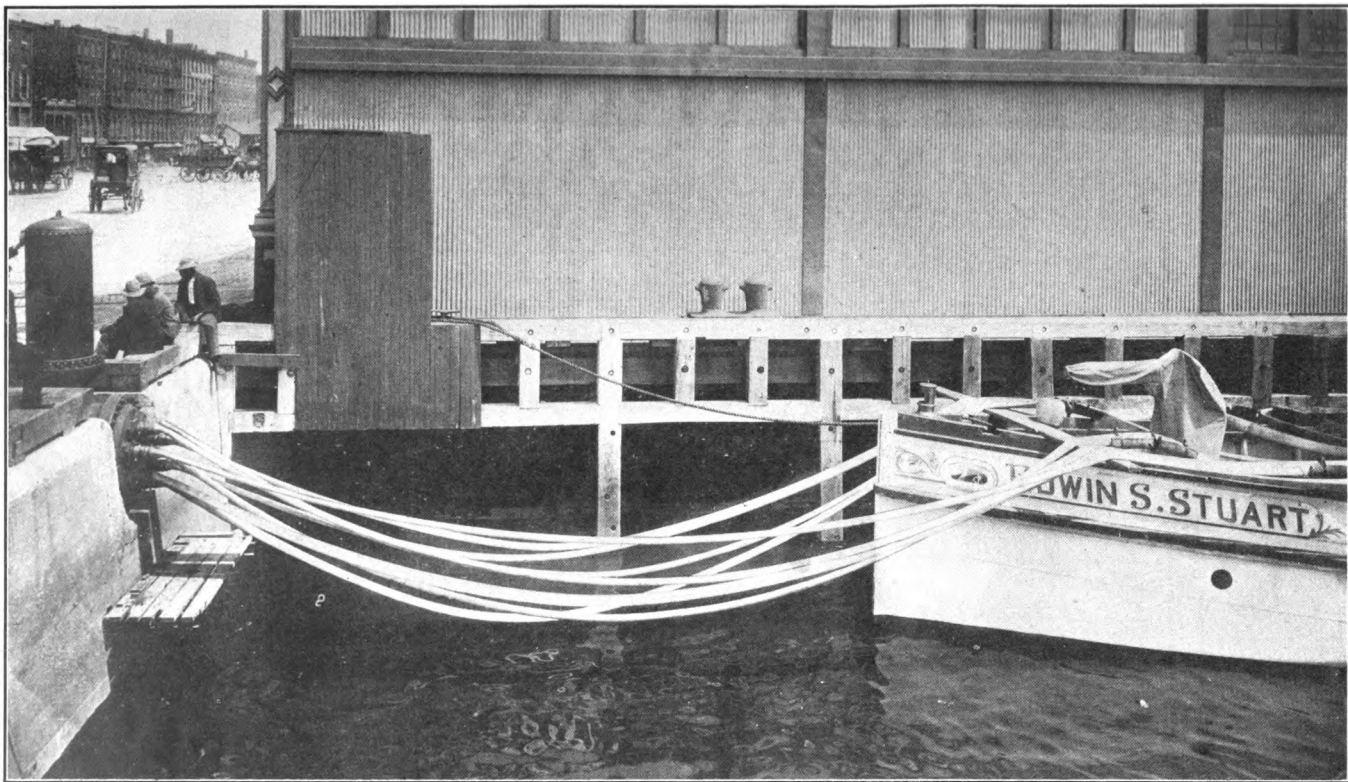


FIG. 5.—FIRE MAIN HYDRANT, WITH SIAMESE HOSE ATTACHMENTS.



· FIG. 6.—FIRE BOAT “EDWIN S. STUART, WITH EIGHT 4-INCH LINES OF HOSE ATTACHED TO FIRE MAIN SYSTEM.

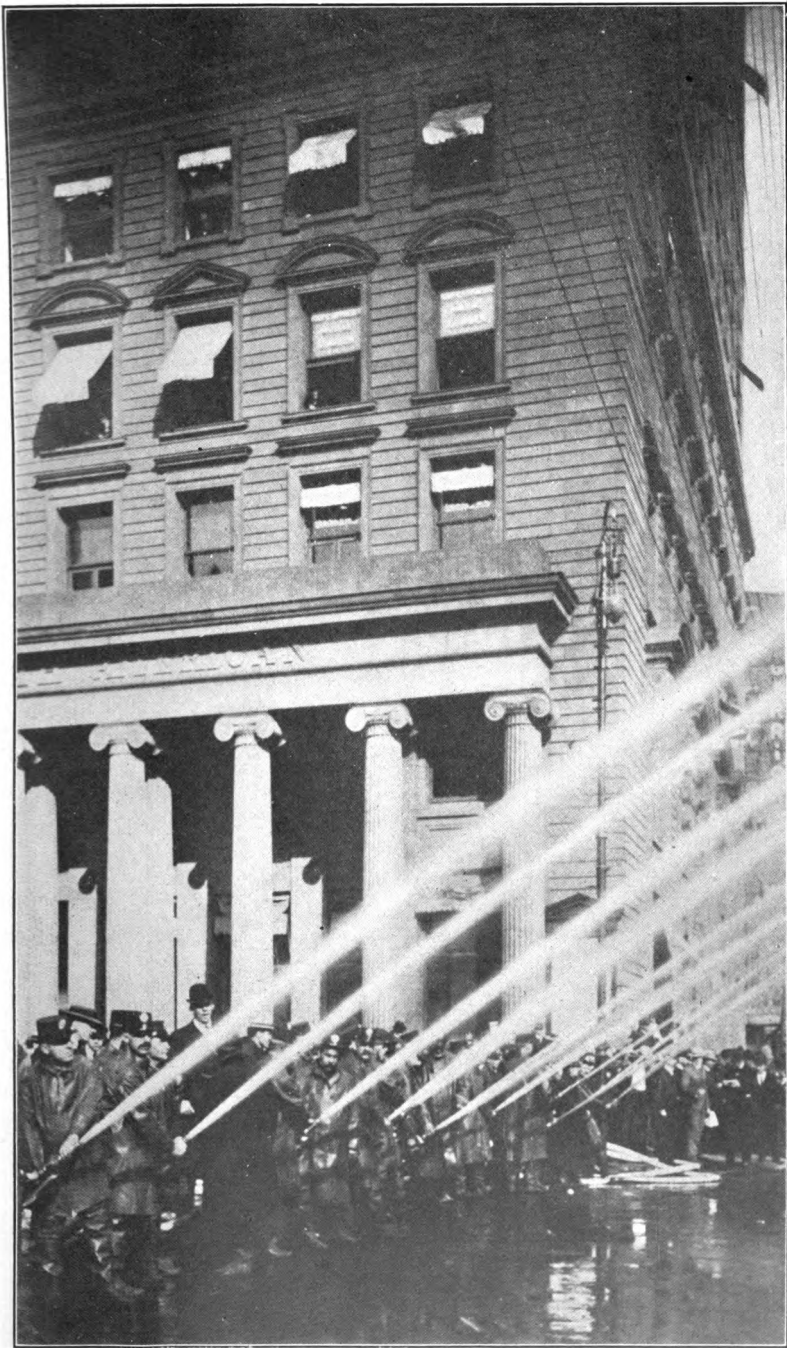


FIG. 7.—TWELVE 2-INCH FIRE STREAMS, DURING TEST MADE BY THE BOARD OF FIRE UNDERWRITERS.

on the Delaware river. This test was made under the direction and supervision of a committee representing the Board of Fire Underwriters' Association, as follows:

Mr. Chas. A. Hexamer, Chairman; Mr. Chas. Platt, Jr., Mr. Herbert Wilmerding, Secretary.

The following table, published by the committee in their report, shows the results obtained from the several tests made under their supervision, but in these, as in the previous trials, the fire-boat pumps were unable to give the desired maximum pressure of 300 pounds to the square inch, and this desirable feature of the system will have to remain in abeyance until the completion of the fire station at Delaware avenue and Race street, which will be equipped with engines and pumps of ample power to be operated under the desired conditions.

The tests, however, have shown that, as now constructed and with three fire boats forcing water into the mains, streams discharging in the aggregate from 8,000 to 10,000 gallons per minute, through 200 to 250 feet lengths of hose, can be concentrated at any point in the district covered by the system, and that in conjunction with the fire engine system, supplied from the old water mains, there is no question as to there now being "ample facilities for controlling fire."

Some Results Shown in Exhibition of High Pressure Pipe Line, Philadelphia, under Gravity and Fire Boat Pressures, September 15, 1902.

No. of Streams, 300 feet of Hose.	Size of Hose, Inches.	Size of Nozzle, Inches.	FIRE BOAT "STUART."		FIRE BOAT "ASHBRIDGE."		FIRE BOAT "VISITOR."		Hyd. 6th & Race Sts. Pressure. Pounds.	Hyd. Broad & Sansom Sts. Pressure. Pounds.	Hyd. in use Broad & Sansom Sts. Pressure. Pounds.	Base of Play-Pipe. Pounds.	Distance thrown horizontally. Feet.	
			Steam Pressure. Pounds.	Water Pressure. Pounds.	Steam Pressure. Pounds.	Water Pressure. Pounds.	Steam Pressure. Pounds.	Water Pressure. Pounds.						
1	2½	1¼	.....	.....	.....	.....	.....	.....	75	65	50	.....	65
6	2½	1¼	.....	.....	.....	.....	.....	.....	?	?	18	.....	30
6	2½	1¼	100	220	.....	.....	.....	.....	185	165	150	Probably incor- rect, owing to gauge being out of order. Size given as recorded.	175
12	2½	1¼	80	175	.....	.....	.....	.....	120	100	90		130
12	2½	1¼	80	190	125	220	.....	.....	175	155	140		175
12	2½	1¼	60	150	108	220	75	170	130	109	95		150	
1	3½	2	.....	.....	.....	.....	.....	.....	60	55	.....		75
1	3½	2	95	190	118	270	75	235	200	170		50	262
1 } 50' of hose }	3½	2	115	230	315
2	3½	2	53	47	50
2	3½	2	120	225	200	178		44	230
2	3½	2	90	215	130	260	75	245	190	175		45	225
3	3½	2	100	190	.....	.....	.....	.....	170	150	.....	35	175
3	3½	2	90	220	130	260	75	225	188	164	.....	40	200
4	3½	2	100	195	.....	.....	.....	.....	153	120	.....	30	150
4	3½	2	90	220	135	270	75	220	175	160	.....	38	190

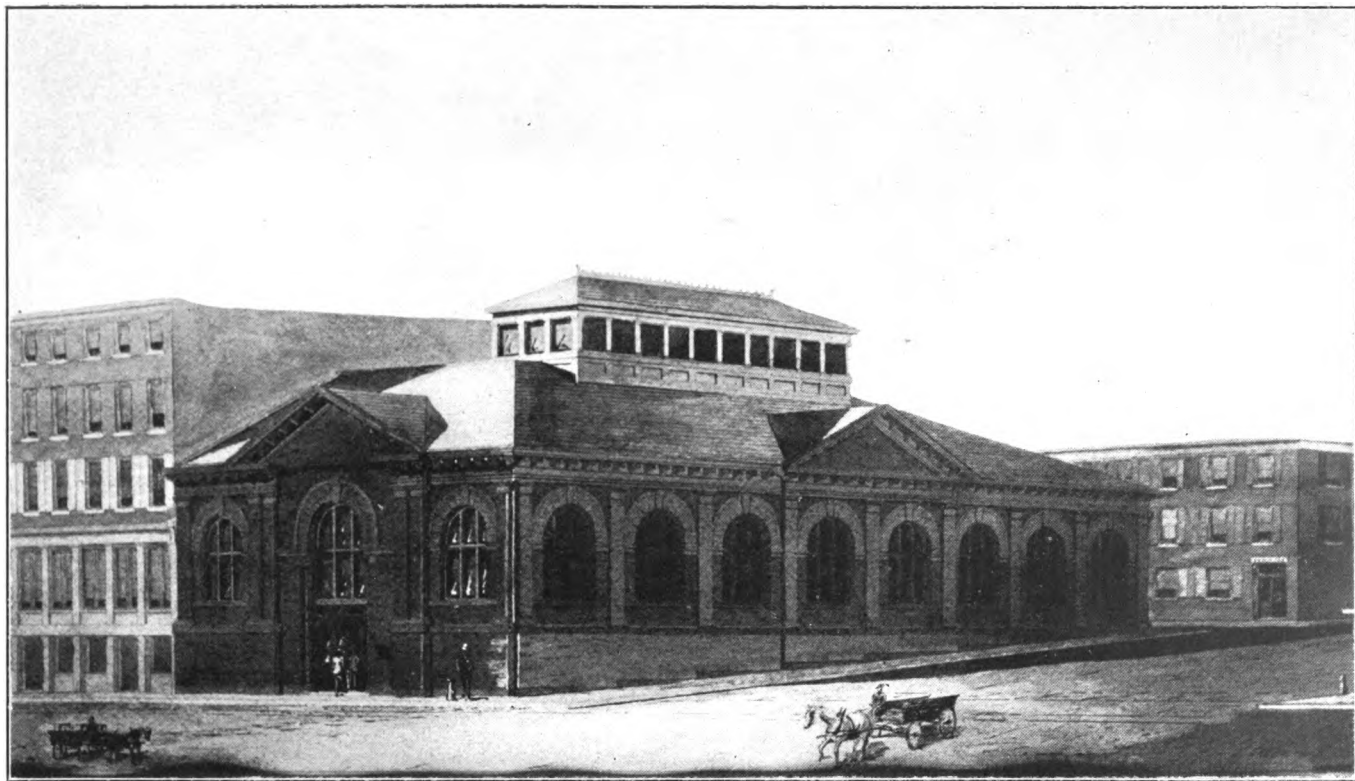


FIG 8.—HIGH PRESSURE FIRE SERVICE PUMPING STATION, CITY OF PHILADELPHIA.

The new pumping station now in course of construction at Delaware avenue and Race street (see Fig. 8) will be 71 feet by 138 feet in plan, proportioned to contain nine pumps, of not less than 1,200 gallons capacity per minute, and two of 350 gallons capacity per minute, and which are to be driven by Westinghouse four cycle gas-driven engines of 300 and of 90 horse power, respectively, against a pressure of 300 pounds to the square inch.

These engines are designed to be operated either singly or all at one and the same time, under a load of from 275 to 300 brake horse power for each of the large engines, and 90 horse power for the smaller ones, at a speed not in excess of 200 revolutions per minute.

The pumps are of the double acting triplex design, with externally packed plungers, and are geared to the engines in the proportion of about 1 to 5.

At present the two small engines and only seven of the large size are being constructed, and these will give a total capacity, when pumping against a head of 300 pounds to the square inch, of 9,100 gallons per minute, or about 13 million gallons per day. It is expected, however, to increase this quantity to 15 million gallons per day by a slight reduction in the head pumped against, and by a corresponding increase in the speed of the pumps.

A 20-inch pumping main, 1,400 feet long, will connect the pumps with the fire main system at Water and Market streets.

All of this work is now in course of completion, and will be ready for service early in the fall of the current year.

Fairmount and Flat Rock Dams.

In my report for last year I earnestly recommended that "sufficient means be provided * * * * for the important repairs needed to Fairmount dam, upon the

safety of which 90 per cent. of this City's water supply depends."

From a recent examination of this structure it is evident that the quantity of water leaking through it is fully equal to the daily average pumpage from the Fairmount pool.

The City is under contract with the Schuylkill Navigation Company to keep this dam in repair, but aside from any such obligation no effort should be spared to put it immediately in good condition, in order to insure the safety of this branch of the service, upon which so large a section of the City is dependent for its water supply.

The breaking of the Flat Rock dam, early in the evening of February 23, illustrated the grave importance of this matter. Previous to the time named there had been several rainy days, causing the water in the river to rise to a height of 69 inches above the crest of the dam, and though this was not unusually great for periods of freshet, it showed that the dam, in failing to support it, was exceedingly weak.

The break occurred at a point adjoining the western end of a section which collapsed in 1893, and, fortunately, where a ledge of rocks and old cribbing formed a barrier, which prevented the drainage of the pool to the bottom of the dam (see Fig. 9).

By February 25, the water receded to 14 inches on the dam, and from observations then made it was decided that the pool would be drained to a level at least from four to five feet below the crest, under which condition it would be necessary for the four new high duty Worthington engines at the Roxborough station to lift the water about 26 feet, and the suction pipes of the two old pumps would be out of water.

There was no assurance that the high duty Worthington pumps would work under these conditions; but, owing to frequent rains, the greatest fall in the river proved to be

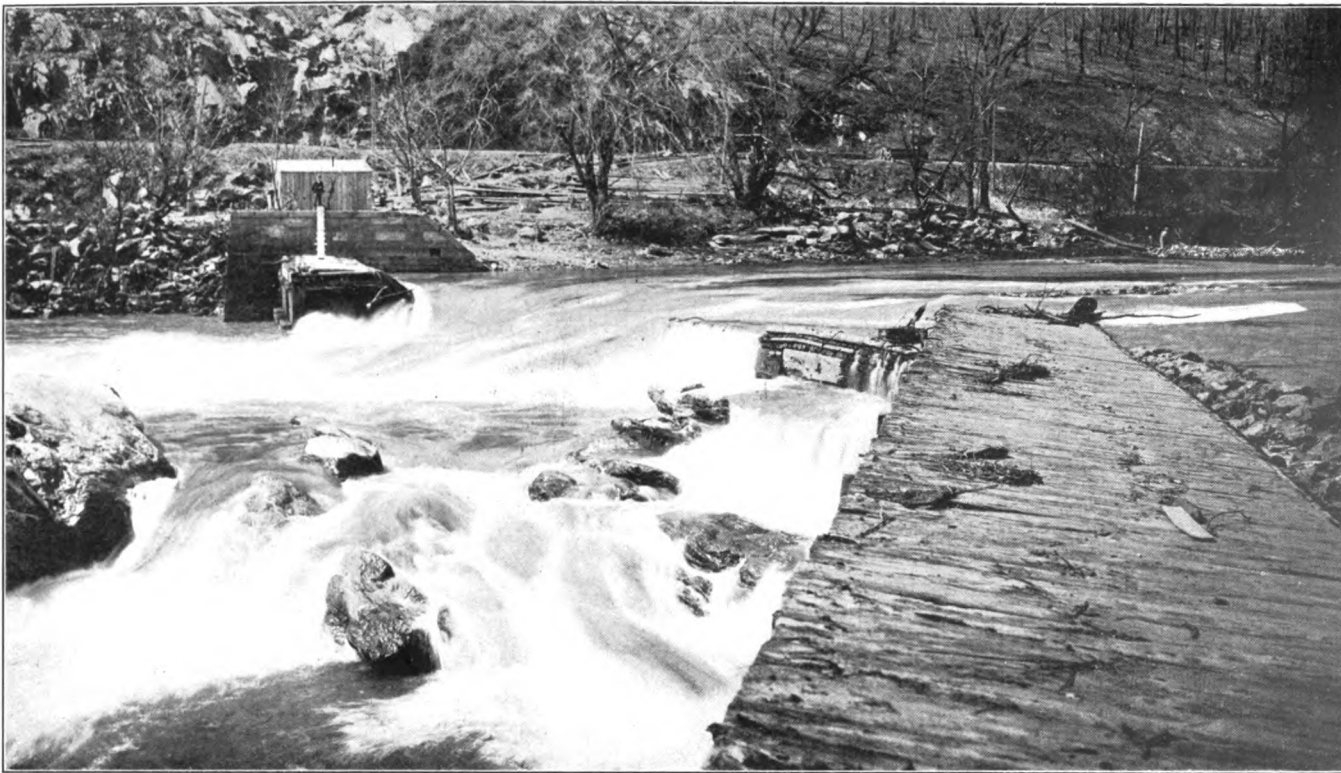


FIG. 9.—BREAK IN FLAT ROCK DAM, FEBRUARY 23, 1902.



FLAT ROCK DAM, SHOWING PARTLY FINISHED TEMPORARY CRIBBING TO SHUT OFF THE WATER WHILE REPAIRING THE BREAK IN THE DAM.

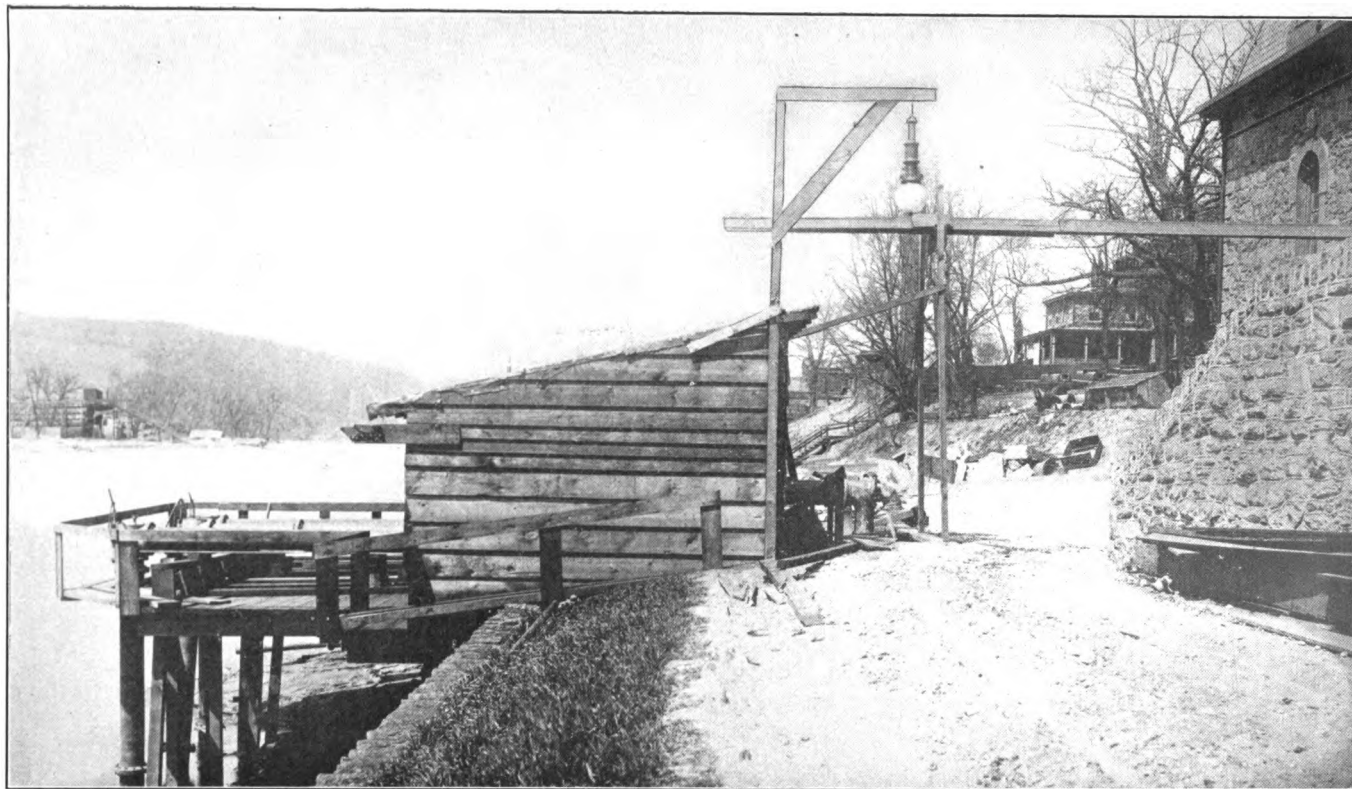


FIG. 10.—ROXBOROUGH WORKS. TEMPORARY CENTRIFUGAL PUMPING STATION, ERECTED TO SUPPLY NOS. 2 AND 3 PUMP WELLS DURING PERIOD OF LOW WATER IN THE RIVER.

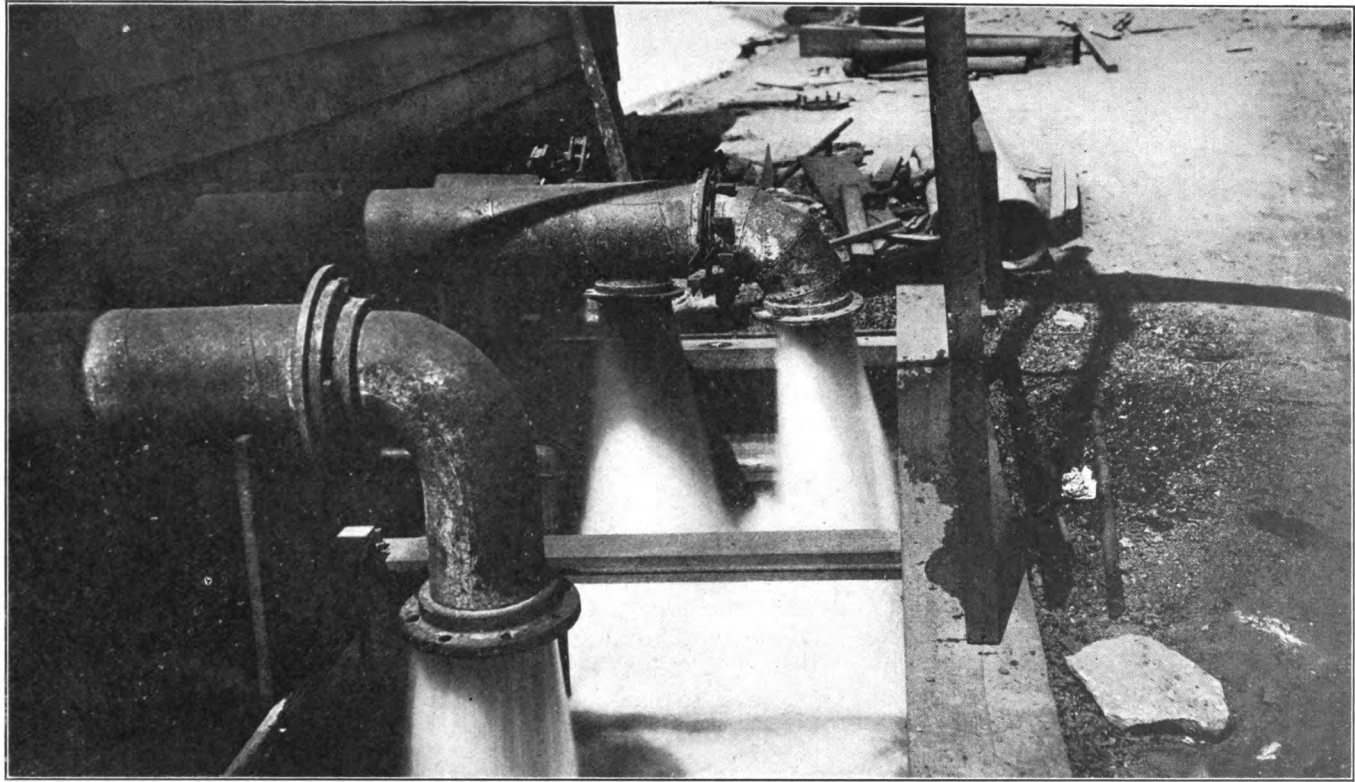


FIG. 11.—ROXBOROUGH WORKS. DISCHARGE FROM THREE CENTRIFUGAL PUMPS SUPPLYING NOS 2 AND 3 PUMP WELLS.

4.33 feet below the crest of the dam, making the maximum suction lift 25.08 feet, under which trying circumstances, and with considerable difficulty, the pumps were kept working most of the time.

On March 10, the water in the river had risen again to 39 inches on the dam, but on the 16th it was down to — 14 inches, + 7 inches on the 17th, and (with very few + intervals) from 10 to 54 inches below, until the latter part of May, when the repairs to the dam had progressed sufficiently to prevent most of the leakage through the crevasse.

To keep the two old Worthington pumps working, three centrifugal pumps were erected on the river front, immediately back of the Roxborough pumping station, by means of which water pumped from the river was discharged into a wooden tank and thence conveyed, through a 30-inch pipe laid underground, to the pump wells (see Figs. 10 and 11).

In this manner these engines were enabled to pump from 11 to 12 million gallons daily until the completion of the repairs to the dam.

In the meantime, however, the water in the reservoir supplied from these works had decreased from 93 to 53 million gallons, which would have been entirely drawn off for consumption except for the construction of the centrifugal pumping plant, through the aid of which the two old Worthington pumps were kept in operation, thereby furnishing a supply to Germantown, Chestnut Hill and Manayunk, which otherwise would have been almost entirely without water.

The possibility of so serious a state of affairs occurring through any breakage in the Fairmount dam should be averted by making the repairs necessary to place this most important structure in a safe condition.

Fairmount Station.

All the pumpage at this station is done by water power and the water pumped is discharged into the East Park system, the latter being otherwise supplied by steam power from the Spring Garden works.

The total pumpage at Fairmount was 7,622,482,219 gallons, or 483,927,465 gallons in excess of the quantity pumped during the preceding year, and at a cost, for all operating expenses, of \$1.93 per million gallons.

The expense of pumping one million gallons at the Spring Garden station was \$4.46, showing a saving of \$2.53 per million gallons in favor of water power as compared with steam pumpage; or, in other words, the total quantity of water pumped at Fairmount cost \$24,106.09 less than if it had been pumped by steam power at the Spring Garden works, where it would have amounted to \$5,666.57 in excess of the total cost of operating the Fairmount works.

During the freshet of March 7-10, when the water on the dam rose to the unusual height of 10 feet 9 inches, all the machinery at this station was submerged. Considerable damage was done to the buildings, and part of the bulkhead at the end of the mound dam was washed away (see Fig. 12). All of this work has since been repaired.

The turbine wheels at this station are in good condition with the exception of Nos. 6 and 9—the former requiring a new set of wooden cogs, and the latter a new glass step.

The buildings were considerably discolored by the flood and have since needed repainting both inside and out, but as yet the force has been inadequate to accomplish much in this direction, and before any such work is done in the old mill house, the roof covering it should be rebuilt and made water-tight, if for no purpose other than to protect the machinery.



FIG. 12.—FLOOD. SCHUYLKILL RIVER, FEBRUARY 25-27, 1902.

Spring Garden Pumping Station.

Owing to the laying of several additional distributing mains for the improvement of the water supply south of Vine street, between the Delaware and the Schuylkill rivers and between Vine street and Girard avenue east of Broad street (thereby increasing the consumption), there has been an increase of over 15 million gallons per day in the average daily pumpage at this station.

This additional pumpage compelled us to keep all the engines working to the fullest extent possible, and precluded the making of any repairs thereto other than those absolutely necessary to keep them in operation.

At present there are several cracked valve decks in Nos. 2 and 3 pump chambers, and a broken pump chamber on No. 3 engine. Nos. 5, 6, 8, 9 and 10 engines need a thorough overhauling; No. 7 will have to be partly dismantled to repack joints between the pump barrel and suction chamber, and No. 11 needs a new connecting rod and many other repairs. All of this work must be accomplished during the winter months and at the same time supply the daily demands for water, which is especially difficult to do with the engines and pumps in their crippled condition.

Belmont Pumping Station.

This station is in a most creditable condition and has attracted the attention of many water works' engineers from all parts of this country, as well as from abroad, who, without exception, have commented favorably on its general arrangement, finish and cleanly appearance.

The three new Holly pumps erected during 1901 have continued in operation throughout the past year with very satisfactory results, and with their aid we have a pumping capacity at this station sufficient to throw any engine out of service, whenever it may be found necessary to do so,

to make repairs. Their introduction has also enabled us (a very important feature) to put all the pumps at these works in good condition, with the exception of No. 4, on which such work is under way and will be completed during the present winter.

The coal shed, which stood immediately back of this station, was destroyed by fire early on the morning of March 22. The trestle work supporting the tracks was not seriously damaged, and after reflooring the train platform it was ready for use.

Since then a shed, for weather protection, has been constructed in front and back of the trackway, but the house over the tracks should be rebuilt as soon as possible, and with this object in view, plans therefor have been prepared and are now awaiting the necessary appropriation in order to have the work done.

Queen Lane Station.

As was the case during 1901, the chief trouble at these works has been the breaking of pump chambers on all the engines.

In my report for last year I stated that:

“It is difficult to determine the cause of these accidents, as the castings are made extremely heavy for the work to be performed. It is possible, however, that a change recently made in the design of the castings will remove at least one cause of their failure. Another change consists in the construction of suitable drains to keep the water from between the base of the pump chamber and the masonry foundations. The latter have been wearing away through the action of the water drawn between the pump chamber and the foundations with each revolution of the pump.”

The chambers of the new design have withstood the strain, and none has broken; but there is still great diffi-

culty experienced in keeping the joint between the suction and discharge chambers tight. Several of them have been repacked, but without as yet entirely successful results, although they are in far better condition in this respect than they were before the adoption of the new chambers.

The construction of new drains around Nos. 1 and 2 engines has been completed and we now have no trouble with the foundations of those pumps. A portion of the new drains for engines Nos. 3 and 4 has been completed, but we have so far been unable to shut down these pumps long enough to finish the work.

On April 9 the low-pressure piston of No. 1 pump broke to pieces and both piston rods were bent. These were replaced with new piston rods on November 19.

This pump is of the triple expansion type, and during the interval required for the manufacture of the piston and rods, the engine was operated as a compound engine, using the high and intermediate cylinders, the latter exhausting into the low-pressure cylinder, with the exhaust valves blocked open. Under these conditions the engine was operated at nearly its full capacity and without difficulty except in starting, when the high pressure crank was on its center, in which case the electric crane with which this station is provided was used to turn the engine to a convenient starting point.

Another accident which occurred at these works was the breaking of a 48-inch check valve on the discharge main of No. 4 pump. This was caused by the settling of the pipe outside the building, thereby throwing too great a strain upon the flange of the check valve and breaking it where it joins the body of the check valve, except for about one-quarter of the circumference on the bottom.

To avoid the delay of having a new casting made, a circular angle flange, made in two pieces, was placed in position and riveted to the body of the check valve, the leg

of the angle being bolted to the flange with the same bolts used for coupling the adjoining pipe.

The edges of the circular pieces were caulked to make them water-tight, the ends being caulked with copper.

Twelve $1\frac{1}{8}$ inch rods were used to tie the check to the next adjoining flange on the main.

This whole arrangement was accomplished in ten days. It has since proved to be effective and enabled us to avoid shutting down this engine from six to eight weeks, the time required to procure a new casting for replacing the broken one.

Roxborough Station.

The work at this station during the past year has been subjected to various trying conditions, the most important of which was due to the breaking of the Flat Rock dam on February 23 (already referred to in this report), and the failure on the part of the owners to repair it for some months thereafter.

During this interval the water in the river fell several feet and the suction lift of the pumps was correspondingly increased, necessitating constant watchfulness and care in the operation of the four high-duty pumps, which are of the direct acting type of engine and exceedingly liable to "knock" with any slight variation in the working conditions.

The operation of pumps Nos. 5 and 7 was also seriously affected by the cracking of the valve decks in four of the chambers, necessitating the blanking off of several of the pump valves.

The attention of the engine builders was called to the condition of the pumps, and they have since furnished three new chambers free of cost to the Bureau, to be substituted for those which broke. To complete the repairs, however, a fourth one will also be required.

There has been a considerable increase in the pumpage at these works, amounting to 31 per cent., as compared with that of the preceding year, or an average increase of 4,700,123 gallons per day, a large part of which was consumed in testing and "ripening the beds" at the Upper and Lower Roxborough filter plants, and the balance in meeting the increased demands upon the distribution system supplied from this station.

To pump the additional quantity of water necessary to meet the daily requirements, we were obliged to put the two old Worthington pumps into service most of the time, and as these are great coal consumers, in comparison with the new high duty engines, there was an increase in the use of coal at these works, while these old pumps were in operation, of about 1/3 of a ton for each million of gallons of water pumped.

From this it would appear to be a wise economy to remove the old pumps and substitute well-constructed high-duty engines in their places.

Advantage was taken during the period of low water, to construct a retaining wall of stone, about 400 feet in length, along the river front, for the better appearance of the grounds and to protect them during periods of high water.

Frankford Station.

The chief feature of the operation of these works during the past year was the very great increase of 38.7 per cent. in the quantity of water pumped.

Part of this was diverted into the East Park system, and a small portion of it, owing to the better facilities for distribution, was consumed; but by far the greater quantity was allowed to run to waste through leaky fixtures or through others which were turned on for no useful purpose.

There was also an increase in the consumption of coal

at this station, amounting to 5,241 tons in excess of the quantity used in 1901, as well as in many other incidental expenses pertaining to the pumpage of water, which add materially to its cost and must therefore be taken into consideration in determining the per capita expense of pumping water.

Nos. 1 and 3 engines received a thorough overhauling, but, unfortunately, the increased demand for water at this station necessitated the operation of all the pumps, with the inevitable result of failure to shut down for slight repairs and thus avoid, in nearly every instance, the necessity for making greater ones that are otherwise sure to follow, as proved to be the case at this station, resulting in the breaking of the bottom high pressure pump chamber on No. 3 engine.

This was replaced with a new one, but within a short period thereafter the upper one broke, and we have now been waiting several months for a new casting with which to replace it.

The high pressure piston of No. 4 engine broke on August 5, cracking the steam cylinder quite badly and knocking a hole in it. A wrought iron patch, with a rust joint between it and the damaged cylinder, was fastened on with studs and the broken piston was replaced with a new one, but in less than one month the latter broke, and a third one, of a different design, is now being made.

In the meantime, the damaged side of the engine has been uncoupled, and the other half of the pump is doing effective service.

High Service Stations.

The demand on the Belmont High Service Station for water has increased 54 per cent. during the past year.

There are two pumps at this station, one of which, No. 1, is a Worthington single-cylinder direct-acting pump, of

two million gallons capacity, and is incapable of pumping sufficient water to supply the district. As a result, the only dependence to be relied upon to do this work is the No. 2, five-million gallon high-duty, Worthington pump, which at times of maximum consumption is operated to its fullest capacity.

This pump has been kept running almost continuously for the past year, and should any accident occur thereto the high levels of West Philadelphia would be dependent entirely upon the limited supply that could be furnished by the No. 1 pump, and I therefore repeat my earnest recommendation that a new five-million gallon engine be purchased and installed at this station, at the earliest moment possible.

The pumps, boilers and station from which the Roxborough High Service district obtains its supply are in excellent condition and reflect creditably the care and attention they receive.

This may also be said of the Wentz Farm High Service Station.

The Chestnut Hill and Mt. Airy High Service Stations are at present practically out of service, and are simply held in reserve in case of accident to the mains which supply the high levels of Germantown and Chestnut Hill from the Roxborough High Service Stations.

Distribution.

The total quantity of new pipe laid for the distribution of water was 96,739 feet, in addition to which 16,279 feet of 8-inch, 12-inch and 16-inch pipes were laid by contract for the new fire main system, making a total of 113,018 feet of pipe laid by the Bureau during 1902.

There was also laid by contract, under the supervision of Mr. John W. Hill, Chief Engineer Bureau of Filtration, 103,353 feet of pipe, principally large supply mains,

for distributing water from the Roxborough and Belmont filter plants, all of which are in service except that pertaining to the Belmont section, on which there yet remains one or two sections to complete the work.

Meters.

The increase in the number of meters in service amounts to 67, making the total in use at the end of the year 1,502.

There are many applications for meters from consumers, but, as stated in my last report:

“Owing to lack of sufficient appropriation for the purchase of meters, many applicants for these could not be accommodated. The inability of the Bureau to furnish meters proves very frequently a hardship, especially to manufacturers, for the latter are sometimes obliged to have, in reserve, on their premises, extra boilers, engines and other appliances, and are compelled to pay thereon full schedule rates, whether water is used through these fixtures or not.

“I would, therefore, urge an increase of appropriation sufficient to enable us to meet these demands.”

In conclusion, I beg to thank you, and, through you, his Honor, the Mayor, for the unfailing co-operation extended in matters pertaining to the welfare of this Bureau, for the encouragement and support given during the many trying situations with which it has been confronted, and for advice and aid in solving problems with which it has had to deal.

Very respectfully yours,

F. L. HAND,
Chief of Bureau.

Comparison of Pumpage for the Delaware and Schuylkill Rivers for 1901 and 1902.

	GALLONS.		GALLONS.	
	1901.	1902.	Increase.	Decrease
Annual pumpage:				
From rivers.....	101,886,624,094	114,460,164,379	12,573,540,285	
High service.....	1,968,883,130	2,338,260,121	369,426,991	
Total.....	103,855,457,224	116,798,424,500	12,992,967,276	
Maximum daily pumpage:				
From rivers.....	388,248,683	360,040,744	21,792,106	
High service.....	5,542,050	6,078,645	536,595	
Total.....	348,790,688	366,119,389	22,328,701	
Average daily pumpage:				
From rivers.....	279,004,450	313,589,491	34,585,041	
High service.....	5,394,063	6,406,192	1,012,129	
Total.....	284,398,513	319,995,683	35,597,170	
Average daily pumpage:				
From rivers, per capita.	211	232	21	

*Volume and Cost of Pumpage for the Years 1892 to 1902,
Inclusive.*

Year.	Number of gallons pumped.†	Number of gallons pumped 100 feet high.†	Cost per million gallons pumped 100 feet high.	Gallons pumped per capita per day.	Population Estimated.
1892	59,787,584,178	102,443,373,631	2.68	143	†1,142,650
1893	65,352,786,978	110,590,708,479	3.22	150	1,190,493
1894	72,073,724,238	121,199,588,887	3.48	159	1,238,112
1895	78,775,849,104	132,040,954,195	3.69	162	1,329,957
1896	87,693,642,529	161,776,711,718	3.43	172	1,367,815
1897	95,667,466,871	187,371,927,277	3.16	185	1,335,734
1898	102,241,835,372	210,828,629,625	2.97	196	1,400,000
1899	107,991,371,604	231,313,686,728	2.90	199	1,425,848
1900	106,822,576,055	218,119,532,621	3.71	221	*1,298,697
1901	103,805,457,224	210,456,847,513	4.14	211	1,321,304
1902	116,798,424,500	239,698,545,013	4.80	232	1,349,500

* United States Census.

† City Census.

‡ Including repumpage or high service.

*Cost of raising 1,000,000 Gallons 100 feet during 1901
and 1902.*

Pumping Stations-	1901	1902	Increase.	Decrease.
Fairmount.....	\$1 90	\$1 93	.03	
Spring Garden.....	3 95	4 46	.51	
Belmont.....	5 60	5 70	.10	
Queen Lane.....	3 10	3 64	.54	
Roxborough.....	5 18	6 29	1.11	
Frankford.....	4 73	6 50	1.77	
Average.....	\$3 99	\$4 64	.65	
High Service Stations:				
Belmont.....	\$22 36	\$16 71	.....	\$5.65
Roxborough.....	7 86	8 09	.83	
Mt. Airy.....	54 28	111 75	57.47	
Chestnut Hill.....	309 02	433 64	174.62	
Frankford.....	84 13	187 46	103.33	
Average.....	\$17 86	\$18 02	.16	
Total average.....	\$4 14	\$4 80	.66	

Comparison of the Nominal, Maximum, Minimum and Average Daily Pumpage for 1901 and 1902.

PUMPING STATIONS.	NOMINAL-		MAXIMUM-		MINIMUM-		AVERAGE-	
	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.
Fairmount	33,290,000	33,200,000	37,332,037	38,099,645	2,094,300	555,776	19,557,684	20,883,513
Spring Garden	170,000,000	170,000,000	158,975,620	160,922,400	14,952,980	35,401,620	125,070,244	140,373,758
Belmont	68,000,000	68,000,000	42,310,500	47,312,964	16,140,320	4,968,930	30,923,128	31,423,979
Queen Lane	80,000,000	80,000,000	89,025,750	8,713,300	9,189,650	22,545,100	66,567,209	71,162,173
Roxborough	32,500,000	31,500,000	25,947,880	29,190,930	1,959,780	209,595	15,162,146	19,595,946
Totals from Schuylkill	383,790,000	382,790,000	353,591,787	357,239,739	44,337,530	63,681,071	257,285,411	283,429,369
Increase				3,647,952		19,343,541		26,143,958
Decrease		1,000,000						
Frankford	57,000,000	57,000,000	34,216,630	42,050,635	8,063,655	9,754,270	21,719,039	30,160,122
Totals from Delaware	57,000,000	57,000,000	34,216,630	42,050,635	8,063,655	19,754,270	21,719,039	30,160,122
In rease				7,834,005		11,670,615		8,441,083
Decrease								
Totals from Delaware and Schuylkill, ...	440,790,000	439,790,000	387,808,417	399,290,374	52,421,185	83,435,341	279,004,450	313,590,491
Increase				11,481,957		31,014,156		34,585,041
Decrease		1,000,000						

Comparison of the Nominal, Maximum, Minimum and Average Daily Pumpage, etc.—Continued.

HIGH SERVICE STATIONS.	NOMINAL.		MAXIMUM.		MINIMUM.		AVERAGE.	
	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.
Belmont.....	7,000,000	7,000,000	7,762,858	3,520,600	564,705	720,900	1,182,696	1,750,756
Roxborough.....	10,000,000	10,000,000	4,982,100	5,411,940	1,169,880	2,799,495	3,766,452	4,348,044
Mt. Airy.....	3,000,000	3,000,000	2,231,250	1,700,000	90,000	48,650	324,323	192,766
Chestnut Hill.....	750,000	750,000	735,480	600,248	73,600	73,800	28,302	19,184
Frankford.....	7,000,000	7,000,000	2,034,408	337,176	56,880	57,616	142,290	95,492
Total High Service..	27,750,000	27,750,000	17,696,096	11,569,364	1,955,015	3,700,461	5,394,063	6,406,192
Total Daily.....	468,540,000	467,540,000	405,504,518	410,859,738	54,376,200	87,135,802	284,398,513	319,995,683
Increase.....				5,355,225		32,759,602		35,597,170
Decrease.....		1,000,000						

The following appendices accompany this report:

- A. Report of Chief Clerk.
- B. Report of General Superintendent.
- C. Report of Assistant in charge of Distribution.
- D. Report of Superintendent of Construction and Repair Shop.
- E. Report of Chief Draughtsman.
- F. Report of Consulting Engineer in charge of the Improvement, Filtration and Extension of the Philadelphia Water Supply.

APPENDIX A

REPORT OF CHIEF CLERK

Philadelphia, January 17, 1903.

MR. F. L. HAND,
Chief of Bureau.

DEAR SIR:—I have the honor to transmit herewith a detailed statement of the expenditures of the Bureau, an itemized list of miscellaneous receipts, and a table of the revenues derived from the operations of the Bureau during the year 1902.

Yours respectfully,

J. T. HICKMAN,
Chief Clerk.

Detailed Expenditures of the Bureau for 1902.

General Appropriation.	Amount Appropri'd	Amount expended.	Amount merging.	Amount not merg'g.
An Ordinance to make an appropriation to the Bureau of Water, approved Dec. 30, 1901, \$803,843 00				
Balance from books of 1901.....	12,263,915 91			
Additional appropriations and transfer...	3,704,417 98			
	<u>\$16,769,176 89</u>			
Diminished by transfer.....	13,619 86			
	<u>\$16,755,557 03</u>			
Net appropriation.....	16,755,557 03			
Item 1. Salaries.....	\$371,029 00			
Diminished by transfer	10,000 00			
	<u>\$361,029 00</u>			
Net appropriation to item.....	361,029 00			
For salary of Chief of Bureau.....	6,000 00	\$6,000 00		
Chief clerk.....	2,000 00	2,000 00		
Assistant clerk.....	1,200 00	1,200 00		
Correspondence clerk.....	900 00	900 00		
Time clerk.....	1,000 00	1,000 00		
Messenger.....	720 00	720 00		
Draughtsmen.....	7,200 00	7,000 02		
General superintendent.....	3,500 00	3,500 00		
Assistant to general superintendent.....	900 00	900 00		
Clerk and paymaster.....	1,100 00	1,100 00		
Assistant clerk.....	900 00	900 00		
Assistants to chief.....	3,600 00	3,600 00		
Pipe inspector and clerk.....	2,200 00	2,078 19		
Search clerks.....	3,200 00	2,200 00		
Assistant clerks.....	3,650 00	3,650 00		
Chief inspector.....	1,200 00	1,200 00		
Inspectors.....	21,502 00	21,289 56		
Permit clerks.....	2,300 00	2,300 00		
Purveyors.....	10,680 00	10,668 07		
Clerks to purveyors.....	5,600 00	5,514 83		
Purveyors' assistant clerks.....	5,250 00	5,143 14		
Hydrants inspectors.....	7,050 00	7,013 86		
General foremen.....	7,573 00	7,365 18		
Foremen of repairs.....	7,020 00	6,765 24		
Superintendent of shop.....	1,500 00	1,500 00		
Clerk to Superintendent of shop.....	900 00	900 00		
Watchmen, office and yards.....	6,075 00	6,015 90		
Storekeepers.....	1,400 00	1,400 00		
Foreman machinist.....	1,500 00	1,500 00		
Foreman bricklayer.....	1,100 00	1,085 22		
Foreman carpenter.....	900 00	1,000 00		
Foreman stone mason.....	900 00	900 00		
Foreman painter.....	900 00	957 50		
Foreman rigger.....	900 00	900 00		
Foreman laborer.....	840 00	840 00		
Foreman plumber.....	834 00	798 40		
Janitor main office.....	720 00	720 00		
Lineman.....	1,000 00	1,000 00		
Telephone operator.....	1,220 00	1,220 00		
Electrician.....	1,200 00	1,200 00		
General storekeeper.....	1,000 00	1,000 00		
Yard keeper (4th district).....	915 00	895 94		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 1—Continue .				
SALARIES AT PUMPING STATIONS.				
Fairmount	\$12,950 00	\$12,476 2-		
Spring Garden.....	82,440 00	78,279 84		
Belmont	28,140 00	26,588 50		
Belmont High Service.....	7,110 00	6,917 72		
Queen Lane	89,720 00	87,054 12		
Roxborough.....	29,440 00	27,486 71		
Roxborough High Service.....	8,120 00	8,167 12		
Mt. Airy	4,510 00	4,386 72		
Chestnut Hill.....	2,350 00	2,211 79		
Frankford	19,820 00	17,029 59		
Frankford High Service.....	7,400 00	7,274 4		
Total.....		\$355,544 55	\$5,484 47	
Item 2. For the purchase and hauling of coal \$300,000 00				
Increased by additional appropriations 2 5,000 00				
	\$565,000 00			
Net appropriation to item.....	\$565,000 00			
Deficiency of 1901:				
116.13 tons buck, Mount Airy, at \$2.60.....	\$308 29			
64 tons egg, Fairmount, at \$5.21.....	333 44			
11,707 tons pea, Frankford H. S., at \$3.50.....	431 73			
1,780.08 tons pea, Belmont, at \$3.04.....	5,260 42			
5,800.03 tons buck, Frkd., at \$2.36.....	13,900 75			
5,239.11 tons pea, Roxborough, at \$3.03.....	15,980 68			
5,844.06 tons pea, Queen Lane, at \$3.30.....	19,686 19			
11,739.08 tons buck, Sp'g Garden, at \$2.30.....	27,000 05			
		\$2,496 50		
COAL FOR OFFICES AND SHOP.				
1 ton nut.....	\$5 75			
2 tons bituminous, at \$3.50	7 00			
2 tons bituminous, at \$4.40	8 80			
3 tons bituminous, at \$3.36	10 08			
2 tons stove, at \$6.....	12 00			
4 tons bituminous, at \$3.67	14 68			
4 tons bituminous, at \$4.20	16 80			
3 tons nut, at \$5.60.....	16 80			
4 tons stove, at \$5.65.....	22 60			
10 tons stove, at \$5.50.....	55 50			
73.15 tons pea, at \$3.17.....	233 24			
240.07 tons bit., at \$3.47.....	834 04			
		1,267 29		
COAL FOR STATIONS.				
51.13 tons pea, Frankford H. S., at \$3.50.....	\$181 65			
96.03 tons bituminous, Mt. Airy, at \$2.87.....	256 63			

Detailed Expenditures of the Bureau for 1902—Continued

General Appropriation.	Amount appropriated.	Amount expended.	Amount merged.	Amount not merged.
Item 2—Continued.				
85.19 tons pea, Mt. Airy, at \$3.67.....	\$310 46			
187.10 tons buckwheat, Mt. Airy, at \$2.67.....	313 72			
957.10 tons pea, Frankford, at \$3.09.....	2,958 67			
2,282.17 tons buckwheat, Belmont, at \$2.31.....	5,273 39			
7,800.06 tons buckwheat, Frankford, at \$2.36.....	18,479 51			
8,708.19 tons pea, Belmont, at \$3.05.....	26,562 30			
13,149.06 tons pea, Roxborough, at \$3.06.....	40,236 85			
15,140.08 tons pea, Queen Lane, at \$3.31.....	50,114 73			
26,526.08 tons buckwheat, Spring Garden, at \$2.23.....	61,806 51			
		\$206,494 42		
Hauling coal, Roxborough to High Service, 567 tons, at 79c.....		447 94		
BITUMINOUS COAL FOR STATIONS.				
22.187 tons, Mt Airy, at \$4.50.....			99 84	
161.08 tons Frankford, at \$1.55.....	\$250 15			
685 tons, Frankford, at \$2.90.....	1,986 50			
1,358 tons, Frankford, at \$3.50.....	4,753 00			
633 tons, Frankford, at \$3.70.....	2,527 10			
1,109 tons, Frankford, at \$3.95.....	4,380 55			
449 tons, Frankford, at \$4.60.....	2,065 40			
2,377 tons, Frankford, at \$4.95.....	11,766 15			
2,309 tons, Frankford, at \$5.75.....	13,276 75			
		41,005 60		
681 tons, Belmont, at \$1.55.....	\$1,055 87			
115.987 tons, Belmont, at \$1.65.....	191 29			
659.18 tons, Belmont, at \$2.05.....	1,352 82			
563.2080 tons, Belmont, at \$2.25.....	1,268 84			
625.2 tons, Belmont, at \$3.....	1,875 67			
1,686.11 tons, Belmont, at \$3.15.....	5,312 62			
127.544 tons, Belmont at \$3.45.....	440 08			
748.225 tons, Belmont, at \$3.50.....	2,618 43			
1,624.3 tons, Belmont, at \$4.50.....	7,308 66			
655.12 tons, Belmont, at \$4.60.....	3,013 81			
1,408.1 tons, Belmont, at \$4.70.....	6,595 73			
		81,033 77		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 2—Continued.				
844.04 tons, Roxborough, at \$1.60.....	\$1,350 72			
840 tons, Roxborough, at \$1.65.....	1,386 00			
497.15 tons, Roxborough, at \$2.10.....	1,045 22			
1,228.391 tons, Roxborough, at \$2.25.....	2,988 87			
1,079.12 tons, Roxborough, at \$3.....	3,238 80			
154.076 tons, Roxborough, at \$3.10.....	478 49			
1,522.3 tons, Roxborough, at \$3.40.....	5,175 29			
1,022.591 tons, Roxborough, at \$3.50.....	3,579 07			
1,199 tons, Roxborough, at \$4.50.....	5,395 57			
1,198.12 tons, Roxborough, at \$4.70.....	5,633 70			
		\$90,271 78		
489.4 tons, Queen Lane, at \$1.65.....	\$807 18			
1,468.17 tons, Queen Lane, at \$2.25.....	3,345 48			
1,274.02 tons, Queen Lane, at \$3.....	3,822 72			
2,109 tons, Queen Lane, at \$3.08.....	6,495 72			
1,395 tons, Queen Lane, at \$3 10.....	4,298 48			
2,237.321 tons, Queen Lane, at \$3.50.....	7,880 62			
2,170 tons, Queen Lane, at \$3.60.....	7,985 60			
222.820 tons, Queen Lane, at \$4.60.....	1,022 89			
1,248.5 tons, Queen Lane, at \$4.70.....	5,866 82			
1,727 tons, Queen Lane, at \$4.88.....	8,427 76			
2,098 tons, Queen Lane, at \$5.93.....	17,778 14			
		67,676 41		
4,997 tons, Spring Garden, at \$1.65.....	\$7,419 85			
1,205.3 tons, Spring Garden, at \$2.05.....	2,470 53			
4,566.3 tons, Spring Garden, at \$2.25.....	10,273 85			
2,531.7 tons, Spring Garden, at \$3.....	7,594 96			
2,539.4 tons, Spring Garden, at \$3.45.....	10,209 22			
1,866.251 tons, Spring Garden, at \$3.50.....	6,601 88			
751.006 tons, Spring Garden, at \$4.50.....	3,382 23			
222.10 tons, Spring Garden, at \$4.60.....	1,023 50			
3,862.3 tons, Spring Garden, at \$4.70.....	18,152 05			
		67,128 07		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd.	Amount expended.	Amount merging.	Amount not merg'g
Item 2—Continued.				
FREIGHT UPON COAL-				
21.187 tons, Mt. Airy, at \$1.55.....	\$34 89			
161.07 tons, Frankford, at \$1.45.....	234 00			
612.19 tons, Queen Lane, at \$1 45.....	888 84			
3,375.18 tons, Roxborough, at \$1.40.....	4,726 06			
4,916.1 tons, Belmont, at \$1.45.....	7,128 27			
6,156.3 tons, Sp'ng Garden, at \$1.45.....	8,926 45			
			\$21,988 01	
UNLOADING COAL-				
2,723 tons, Frankford, at 14 cents.....	\$381 22			
4,149 tons, Belmont, at 12 cents.....	502 98			
3,904.98 tons, Belmont, at 18 cents.....	702.88			
6,281 tons, Queen Lane, at 14 cents.....	879 34			
5,486 tons, Frankford, at 28 cents.....	1,344 28			
20,780 tons, Sp'ng Garden, at 18 cents.....	3,740 40			
Extra work at Belmont.	8 75			
			7,559 85	
HAULING COAL-				
7,804.18 tons, Queen Lane, at 40 cts			3,121 93	
WHARFAGE.				
10,069 tons, Queen Lane, t 8 cents.....	\$805 52			
Services of engineer.....	4 50			
			810 02	
Total.....			\$561,351 41	\$3,648 59
Item 3. For the purchase of oil, lubricants, paints, brushes, wood, coke and for the hauling of coal..... \$10,000 00 increased by additional appropriation..... 1,000 00 \$11,000 00				
Net appropriation to item.....	\$11,000 00			
Coke.....		\$292 00		
Gas for fuel.....		10 65		
Grease, lubricating, 9,898 lbs., at 10 cents.....		980 80		
Hauling coal, Roxborough to High Service, 1,243 tons, at 79 cents.....		981 97		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 8—Continued.				
OIL.				
Neatsfoot		\$3 95		
Gasoline, 218½ gals., at 11 cents	\$23 50			
Lard, 58 gals., at 80 cents	31 80			
Headlight, 4,008½ gals., at 10½ cents	420 85			
Cylinder, 1,527 gals., at 55 cents	839 83			
Cylinder, 5,854 gals., at 45 cents	2,634 82			
Engine, 5,946 gals., at 35 cents	2,081 18			
Paints		6,081 43		
Tallow		2,543 44		
Wood		58 05		
		54 00		
Total		\$10,965 29	\$34 71	
Item 4. For wages of mechanics, helpers, laborers and other workmen at the City Construction and Repair Shop.....	\$22,000 00			
Increased by additional appropriation.....	10,300 00			
	\$32,300 00			
Net appropriation to item.....	\$32,300 00	\$32,223 38	\$71 62	
Item 5. To pay wages of the Hydrographic Corps and expenses incidental thereto.....		1,600 00	1,596 00	4 00
Item 6. For the purchase of hardware, bolts and nuts....	\$6,000 00			
Increased by additional appropriation.....	4,000 00			
	\$10,000 00			
Net appropriation to item.....	10,000 00	9,570 27	429 73	
Item 7. For repairs to boilers.....	\$20,000 00			
Increased by additional appropriation.....	5,500 00			
	\$25,500 00			
Net appropriation to item.....	25,500 00			
Third District.....	\$3 00			
Fourth District.....	9 00			
City Shop.....	59 09			
Belmont High Service...	76 80			
Frankford.....	1,596 55			
Queen Lane.....	4,093 34			
Belmont.....	4,463 61			
Roxborough.....	6,001 52			
Spring Garden.....	9,196 92			
		25,499 84	16	

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd.	Amount expended.	Amount merging.	Amount not merg'g
Item 8. For the purchase of chandlery.....	\$4,000 00			
Increased by additional appropriation.....	2,000 00			
	<u>\$6,000 00</u>			
Net appropriation to item.....	\$6,000 00			
Chandlery.....	\$3,633 90			
Cotton waste.....	2,048 08			
	<u>.....</u>	\$5,681 98	\$318 02	
Item 9. For purchase of wrought iron pipe and fittings...	\$3,000 00			
Increased by additional appropriation.....	2,000 00			
	<u>\$5,000 00</u>			
Net appropriation to item.....	5,000 00	4,513 70	486 30	
Item 10. For the purchase of fire bricks and clay.....	1,500 00	211 40	1,288 60	
Item 11. For covering steam pipes and boilers.....	1,000 00	965 88	34 12	
Item 12. For the purchase of forage.....	\$4,000 00			
Increased by additional appropriation.....	5,000 00			
	<u>\$9,000 00</u>			
Net appropriation to item.....	9,000 00	8,968 38	31 62	
Item 13. For hauling water pipe and machinery.....	\$5,000 00			
Increased by additional appropriation.....	1,000 00			
	<u>\$6,000 00</u>			
Net appropriation to item.....	6,000 00	5,991 74	8 26	
Item 14. For the purchase of cement.....	3,000 00	2,767 19	232 81	
Item 15. For the purchase of iron and steel.....	\$1,500 00			
Increased by additional appropriation.....	1,000 00			
	<u>\$2,500 00</u>			
Net appropriation to item.....	2,500 00	1,477 85	1,022 15	
Item 16. For the purchase of bricks, blocks, lime, sand and stone.....	\$5,000 00			
Increased by additional appropriation.....	2,000 00			
	<u>\$7,000 00</u>			
Net appropriation to item.....	7,000 00	6,987 35	12 65	
Item 17. For the purchase of electric supplies.....	\$2,000 00			
Increased by additional appropriation.....	1,000 00			
	<u>.....</u>	3,000 00	2,989 30	70

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd.	Amount expended.	Amount merging.	Amount not merg'g.
Item 18. For repairs to roofs.				
\$1,500 00				
Increased by additional appropriation.....	\$1,000 00			
\$2,500 00				
Net appropriation to item.....	\$2,500 00			
Frank'd High Service	\$9 75			
Belmont High Service	6 50			
Second District.....	9 75			
Fairmount.....	13 00			
Seventh District.....	19 50			
Testing Station.....	22 75			
Queen Lane.....	26 00			
First District.....	32 50			
Third District.....	65 00			
Belmont.....	107 25			
Roxborough.....	100 75			
Frankford.....	292 50			
Spring Garden.....	1,794 00			
		\$2,469 25	\$0 75	
Item 19. For the purchase of granite, curbing and coping stone.....	\$1,000 00			
Diminished by transfer..	500 00			
\$500 00				
Net appropriation to item.....	500 00	496 38	3 62	
Item 20. For the purchase of brass castings, expansion metal and lead coating.....	\$5,000 00			
Increased by additional appropriation.....	1,000 00			
\$6,000 00				
Net appropriation to item.....	6,000 00			
Lead coating, 7,138 lbs. at 4 ¹ / ₂ c.....	\$330 12			
Yellow brass, 8,900 lbs., at 12.95c.....	1,152 53			
Ajax metal, 8,194 ¹ / ₂ lbs., at 23 ¹ / ₂ c.....	1,935 95			
Red brass, 17,262 lbs., at 14.95c.....	2,580 65			
		5,999 25	75	
Item 21. For the purchase of sta- tionery, blank books, engineer supplies and printing..	\$5,000 00			
Increased by additional appropriation.....	2,000 00			
\$7,000 00				
Net appropriation to item.....	7,000 00	6,893 65	106 35	
Item 22. For clerk hire in writing up duplicates.....	\$2,500 00			
Diminished by transfer..	146 53			
\$2,353 47				
Net appropriation to item.....	2,353 47	2,353 47		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 23. For keep of horse for Chief of Bureau, General Super- intendent and assistant.....	\$1,200 00	\$1,200 00		
Item 24. For the purchase of horse and horse shoeing \$1,000 00 Increased by additional appropriation..... 500 00	\$1,500 00			
Net appropriation to item.....	1,500 00			
Horse..... \$225 00				
Horse shoeing..... 1,275 00		1,500 00		
Item 25. For the purchase of tap- ping machines and fit- tings..... \$3,000 00 Increased by additional appropriation..... 1,000 00	\$4,000 00			
Net appropriation to item.....	4,000 00			
One tapping machine.... \$75 00				
Three tapping machines, at \$100..... 300 00				
One tapping machine.... 450 00				
Fittings..... 3,144 20		3,969 20	\$30 80	
Item 26. For the purchase of and repairs to wagons and carts..... \$2,000 00 Diminished by transfer, 1,000 00	\$1,000 00			
Net appropriation to item.....	1,000 00	982 05	17 95	
Item 27. For the purchase of and repairs to harness and stable supplies..... 1,000 00				
Harness..... \$141 74				
Repairs to harness..... 899 85				
Stable supplies..... 429 27		970 86	29 64	
Item 28. For the purchase of donkey pumps, machine tools and condensers..... 2,000 00				
Three lever jacks..... \$59 98				
16-in-h lathe..... 400 00				
20-inch lathe and fittings. 544 78				
Pipe cutting machine..... 995 00		1,999 71	29	
Item 29. For asphalt paving and repairs thereto..... 1,000 00		1,000 00		
Item 30. For advertising, office supplies, text books and incidentals..... \$2,500 00 Increased by additional appropriation..... 1,000 00	\$3,500 00			

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropriated	Amount expended.	Amount merging.	Amount not merg'g
Item 30—Continued.				
Net appropriation to item.....	\$3,500 00			
Advertising.....		\$374 00		
Barges for inspectors.....		68 25		
Care of clocks.....		15 00		
Electric current.....		317 22		
Freight.....		184 34		
Furnishing meals.....		146 93		
Ground rent, No. 918 Cherry st.....		26 66		
Hire of carriage and wagon.....		19 00		
Incidentals.....		76 56		
Incidentals, Hydrographic corps.....		149 33		
Maps.....		65 00		
Office supplies.....		379 75		
Photo supplies.....		110 97		
Plants.....		76 50		
Postage stamps and cards.....		267 00		
Professional services, V. S.....		119 00		
Rent of disinfectors.....	\$72 00			
Rent of fire extinguisher.....	22 50			
Rent of office and shop, 5th district.....	145 50			
Rent of stable.....	72 00			
		312 00		
Repairs to meters.....	15 15			
Repairs to pipe.....	38 91			
		54 06		
Serving morning papers.....		21 20		
Subscription.....		47 10		
Testing material.....		11 50		
Text books.....		7 50		
Transportation.....		374 00		
Traveling expenses.....		121 55		
Tube cleaner.....		10 50		
Washing towels.....		120 00		
Water proofing canvass.....		24 44		
		\$3,499 36	\$0 64	
Item 31. For the purchase of special articles, small stores, repairs to tools, pipes, pavements, wagons, harnesses, etc.....				
Increased by additional appropriation.....	\$2,500 00 2,000 00			
	\$4,500 00			
Net appropriation to item.....	4,500 00			
Arnica.....		30 00		
Babbiti metal.....		26 00		
Boiler compound.....		564 40		
Cleaning well.....		36 00		
Dynamite.....		194 90		
Electric current.....		109 40		
Fire insurance.....		302 49		
Flash light.....		8 00		
Ice.....		1,091 74		
Lint.....		11 88		
Plumbing.....		29 46		
Postage stamps and cards.....		45 00		
Rent of disinfectors.....		72 00		
Rent of fire extinguishers.....		52 50		
Rent of office and shop.....		48 50		
Rent of stable.....		24 00		

Detailed Expenditures of the Bureau for 1902--Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 31--Continued.				
Repairs to bicycle.....	\$11 00			
Repairs to chair.....	1 25			
Repairs to crane.....	2 77			
Repairs to condenser.....	5 76			
Repairs to engines.....	81 46			
Repairs to gauge.....	7 55			
Repairs to meters.....	14 64			
Repairs to pavement....	51 50			
Services of diver.....		\$175 93		
Stove pipe.....		75 00		
Special articles.....		4 35		
Washers.....		1,477 58		
		6 00		
		\$4,385 13	\$114 87	
Item 32. For the purchase of lead pipe, block tin and sheet lead,				
\$5,000 00				
Increased by additional appropriation.....	2,000 00			
	\$7,000 00			
Net appropriation to Item.....	\$7,000 00			
1,020 lbs. block tin, at 28½c.....		290 70		
125,71¼ lbs. lead pipe, at 5¼c.....		6,600 00		
		\$6,890 70	109 80	
Item 33. Emergencies...	\$4,000 00			
Increased by additional appropriation.....	3,000 00			
	\$7,000 00			
Net appropriation to Item.....	7,000 00			
Repairs to engines.....		4,138 78		
Repairs to sidings and tracks.....		1,197 35		
		\$5,301 13	1,698 87	
Item 34. For hauling ashes from Queen Lane, Spring Garden and Belmont Stations.	\$3,350 00			
Increased by additional appropriation.....	11,775 00			
	\$15,125 00			
Diminished by transfer..	1,973 33			
	\$13,151 67			
Net appropriation to Item.....	13,151 67			
Queen Lane.....		3,285 00		
Belmont.....		3,500 00		
Spring Garden.....		6,366 67		
		\$18,151 67		
Item 35. For improvement at Roxborough Station. Balance				
Jan. 1.....	7,500 00			
Final payment for pumping engines.....		7,500 00		
Item 36. For improvement in West Philadelphia. Balance				
Jan. 1.....	77,827 46			
Belmont Filters and Reservoir.....		76,981 76		\$845 70

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 37. For the improvement, extension, and filtration of the water supply. Balance Jan. 1, \$587,672 86				
Increased by additional appropriation..... 1,200,000 00				
	\$1,787,672 86			
Net appropriation to Item.....	\$1,787,672 86			
Advertising.....		\$56 20		
Chandlery.....		20 52		
Coal.....		68 66		
Crane.....		2,800 00		
Electric current.....		4 50		
Electric supplies.....		34 05		
Engineer supplies.....		1,220 87		
Fibre.....		41 60		
Filter.....		15 00		
Gas for fuel.....		10 50		
Gum goods.....		95 95		
Hardware.....		44 59		
Hire of horse.....		67 50		
Incidentals.....		155 55		
Inspecting material.....		307 94		
Iron casting.....		33 80		
Iron pipe and fittings.....		5 46		
Office supplies.....		24 42		
Oil.....		21 45		
Supporting tracks.....		197 60		
Services of architect.....		1,782 00		
Stationery and printing.....		140 80		
Subscription.....		3 00		
Text books.....		4 50		
Transportation.....		49 00		
Valves.....		12,825 00		
Lower Roxborough filters.....		77,759 92		
Upper Roxborough filters.....		389,687 87		
Salaries, Bureau of Filtration.....		33,699 17		
Wages, Bureau of Filtration.....		3,665 74		
Wages, Fourth District.....		1,584 42		
		\$526,426 66		\$1,261,246 20
Item 38. For Filtration, balance Jan. 1.....	11,454,888 91			
Advertising.....		\$483 75		
Bricks and sand.....		111 25		
Brass fittings.....		206 41		
Chandlery.....		174 45		
Cement.....		26 72		
Copper pipe.....		121 00		
Coal.....		99 11		
Conduits.....		355 30		
Electric current.....		59 52		
Electric supplies.....		182 63		
Engineer supplies.....		3,423 97		
Extra work on valves.....		78 10		
Filters.....		1,515 00		
Fire insurance.....		256 13		
Gas for fuel.....		195 50		
Gum goods.....		936 06		
Hardware.....		651 65		
Hauling.....		1,904 97		
Hire of horse.....		500 00		
Incidentals.....		1,603 46		
Inspecting material.....		8,921 66		
Iron fittings.....		375 28		
Jurors.....		834 00		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 38—Continued.				
Laboratory supplies.....		\$1,778 08		
Lumber.....		1,288 60		
Meters and fittings.....		165 60		
Moulds.....		72 00		
Office supplies.....		781 06		
Oil.....		230 95		
Paints.....		250 07		
Printing.....		1,797 64		
Repairs to engine.....		16 17		
Repairs to still.....		8 00		
Services of architect.....		1,000 00		
Services of draughtsman.....		15 00		
Services of experts.....		12,985 00		
Services of referee.....		228 70		
Services of stenographer.....		925 20		
Sand and gravel.....		177 85		
Shafting.....		15 70		
Shelving.....		84 50		
Stakes.....		482 01		
Stationery.....		487 59		
Stoves.....		87 65		
Subscription.....		16 60		
Tanks.....		20 00		
Telephone rentals.....		64 85		
Text books.....		123 05		
Testing apparatus.....		240 00		
Towel service.....		221 87		
Transportation.....		1,015 10		
Traveling expenses (inspectors).....		181 50		
Wire screens.....		701 10		
Valves.....		225 00		
Vertical engine.....		125 00		
Testing Station, Torredale.....		1,873 02		
Pumping Station, Frankford.....		14,515 62		
Pumping Station, Upper Roxbor- ough.....		16,416 08		
Administration Building, Upper Roxborough.....		17,943 24		
Engines, Frankford.....		88,871 68		
Oak Lane Reservoir.....		112,108 00		
Filtering material.....		112,525 75		
Torredale conduit.....		98,832 56		
Land damages.....		502,352 27		
Belmont filters.....		675,346 85		
Furnishing and laying mains.....		86,391 43		
Torredale filters.....		1,210,270 08		
Paving over mains.....		79,527 26		
Salaries, Bureau of Filtration.....		116,725 03		
Wages, Bureau of Filtration.....		12,78 57		
Wages, Fourth District.....		1,250 74		
		\$4,041,688 98		\$7,418,260 98
Item 39. For High Pressure Fire Service. Balance Jan. 1.....	\$186,026 68			
Gasket.....		\$24 24		
Incidentals.....		82 70		
Iron water pipe.....		2 6 59		
Inspection.....		303 45		
Repairing over pipe.....		609 52		
Wages, Eng. Corps.....		3,147 60		
Fire hydrants.....		1,804 00		
Furnishing and laying mains.....		118,566 62		
		\$185,764 72		261 96

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 40. For the wages of mechanics, laborers and other workmen employed upon repairs to machinery, and the maintenance of and repairs to buildings, grounds and reservoirs, and the transportation of workmen incident thereto, \$80,000 00				
Increased by additional appropriation.....	107,000 00			
	\$187,000 00			
Net appropriation to item.....	\$187,000 00			
Bricklayers.....		\$12,132 90		
Carpenters.....		8,922 56		
Helpers.....		7,622 50		
Horses, carts and drivers.....		7,159 42		
Laborers.....		102,872 82		
Machinists.....		30,295 50		
Painters.....		4,921 34		
Stonemasons.....		5,849 67		
Transportation.....		5,962 64		
Item 41. For wages of mechanics, drillers, laborers and other workmen connected with repairs to and improvement of the distribution and the laying of Service Mains, the transportation of workmen engaged in repairs and the traveling expenses of pipe inspectors \$129,000 00		\$185,739 35	\$1,260 65	
Increased by additional appropriation.....	145,706 98			
	\$274,706 98			
Net appropriation to item.....	\$274,706 98			
Traveling expenses (inspectors).....		1,123 22		
Transportation.....		3,955 25		
Wages:				
Improvement.....		25,281 02		
First district.....		20,981 77		
Second ".....		25,885 32		
Third ".....		78,349 55		
Fourth ".....		28,286 24		
Fifth ".....		31,816 82		
Sixth ".....		26,879 45		
Seventh ".....		30,983 19		
Item 42. For the purchase of iron water pipe, special pipe castings and pig lead.....	40,000 00	\$273,541 83	1,165 15	
Expressage.....		52 02		
Iron Water Pipe:				
2,283 6-in., 840,235 lbs. at 1.18c.....		9,914 78		
761 8-in., 365,922 lbs. at 1.17c.....		4,281 29		
719 10-in., 486,145 lbs. at 1.11c.....		5,396 21		
103 16-in., 150,605 lbs. at 1.09c.....		1,506 05		
89 20-in., 164,720 lbs. at 1.09c.....		1,795 45		
12,142 lbs. B pipe at 5.9c.....		716 38		
324,283 lbs. specials at 2.25c.....		7,294 71		
1,475 hours machine work at 50c.....		737 50		
133,618 lbs. pig lead at 4.49c.....		5,999 44		
		\$37,693 83	\$2,306 17	

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd.	Amount expended.	Amount merging.	Amount not merg'g
Item 43. For the purchase of iron, steel, malleable cast- ings..... \$15,000 00				
Increased by additional appropriation..... 7,500 00				
	\$22,500 00			
Net appropriation to item.....	\$22,500 00			
Altering patterns.....		\$4 50		
Frames and covers, 29,912 lbs. at 1.49c.....		445 70		
Machine work and forgings.....		507 29		
Grate bars, 33,459 lbs. at 1.69c.....		565 46		
Machine and miscellaneous, 30,828 lbs. at 2.35c.....		724 45		
Fire hydrants, 83,089½ lbs. at 2.09c.....		1,736 56		
Machinery, 52,131 lbs. at 3.50c.....		1,824 62		
Stop box, 129,035 lbs. at 1.55c.....		2,000 00		
Stop, 158,663 lbs. at 2.14c.....		3,395 38		
Loam for machinery, 169,873 lbs. at 4.50c.....		7,644 29		
		\$18,848 16	\$3,651 84	
Item 44. For the purchase of gum goods and packing.... \$10,000 00				
Increased by additional appropriation..... 14,500 00				
	\$24,500 00			
Net appropriation to item.....	\$24,500 00			
Gum goods.....		4,113 76		
Valves.....		7,831 57		
Packing.....		12,521 79		
		\$24,467 12	\$32 98	
Item 45. For the purchase of brass fittings, cocks and valves for steam and water.. \$7,500 00				
Increased by additional appropriation..... 5,000 00				
	\$12,500 00			
Net appropriation to item.....	\$12,500 00			
Brass fittings.....		\$6,721 39		
Corporation cocks:				
9,000 ¼ inch, at 34.93 cents.....		3,143 72		
500 ½ inch, at 44 cents.....		220 00		
100 ¾ inch, at 63 cents.....		63 00		
94 1½ inch, at 2.04 cents.....		194 76		
262 2 inch, at 2.90 cents.....		759 80		
4,000 ⅝ inch, curb stops, at 35 cents.....		1,400 00		
		\$12,499 67	\$0 33	
Item 46. For the purchase of lumber..... \$7,500 00				
Increased by additional appropriation..... 7,300 00				
	\$14,800 00			
Net appropriation to item.....	\$14,800 00	14,800 00		

Detailed Expenditures of the Bureau for 1902—Continued.

General Appropriation.	Amount appropri'd	Amount expended.	Amount merging.	Amount not merg'g
Item 47. For high pressure fire services, June 30, 1902.....	\$300,000 00			
Borings.....		\$48 00		
Bronze tablets.....		98 00		
Engine house.....		2,800 00		
Furnishing and laying mains.....		52,500 00		
		\$55,441 00		\$244,559 00
Item 47. For pipe lines for filtered water, June 30, 1902.....	1,300,000 00			1,300,000 00

RECAPITULATION.

General Appropriation.			
Balance from books of 1901.....	\$12,263,915 91		
Special appropriations.....	3,704,417 98		
Annual appropriations.....	800,848 00		
	\$16,769,176 89		
Amount transferred.....	13,619 86		\$16,755,557 03
Expended for maintenance.....	\$1,668,001 76		
Expended for extensions.....	4,843,783 07	\$6,511,784 83	
Amount merging.....	\$23,639 36		
Amount not merging.....	10,220,182 84	10,248,822 20	16,755,557 03

List of Miscellaneous Receipts for the Year 1902.

Jan	10	Penna. R. R. Co.....	Laying 6-inch pipe.....	\$324 13
	15	David Cram.....	Drawing ferrules.....	1 50
	17	Union Traction Co.....	Repairing fire hydrants.....	11 25
	30	David McMahon.....	Making shut-off.....	1 19
	31	Edwin F. Merritt.....	For empty oil barrels.....	219 70
Feb.	5	Edison Electric Co.....	Six-inch main on Ninth st...	23 75
	5	Penna. R. R. Co.....	Shifting and cutting off pipe	1,490 39
	6	Wetherill Bros.....	Lead dross for year.....	188 21
	6	Wetherill Bros.....	Lead dross from 3d District.	33 32
	6	David McMahon.....	Recaulking joints.....	1 37
	6	David McMahon.....	Redriving ferrule.....	1 82
	6	David McMahon.....	Repairing break in 6-in. main	10 44
	6	David McMahon.....	Driving ferrule.....	2 13
	23	Union Traction Co.....	Moving fire hydrant.....	51 53
	20	Union Traction Co.....	Moving 6-inch stop.....	83 63
	20	Union Traction Co.....	Moving 6-inch stop.....	24 36
Mar.	14	Joseph Perna.....	Repairing 6-inch main.....	15 01
	14	Burnham, Williams & Co....	Recaulking joint.....	11 93
	17	John Hanifen.....	Stop box.....	3 99
	20	A. A. Jewett Co.....	Repairing 3-inch stop.....	13 55
	27	D. McMahon.....	Repairing break in main....	20 59
April	2	Reading Ry. Co ..:	Renewing fire hydrant.....	8 92
	3	J. R. Neison.....	Brass scrap and turnings....	1,063 69
	9	Wm Sellers & Co.....	Packing 6-inch stop box....	78
	21	Ryan & Kelly.....	Connecting service pipe....	15 03
	21	Ryan & Kelly.....	Repairing service pipes....	11 21
	21	Ryan & Kelly.....	Replacing 6-inch pipe.....	111 65
	21	David Peoples.....	Repairing 6-inch main.....	52 44
	21	Robert Cunliffe.....	Old gum and rope.....	17 20
	28	David McMahon.....	Repairing 6-inch pipe.....	14 35
	28	David McMahon.....	For making shut-off.....	1 37
	28	Burnham, Williams & Co....	New iron frame.....	2 22
	29	Merchant Warehousing Co..	Removing hydrant.....	34 33
	30	U. G. I. Co.....	Lowering fire hydrant.....	59 51
	30	U. G. I. Co.....	Lowering fire hydrant.....	21 30
May	1	U. G. I. Co.....	Lowering fire hydrant.....	47 10

List of Miscellaneous Receipts for the Year 1902.

May	9	U. G. I. Co.....	Lowering 6-inch pipe.....	\$26 39
	9	U. G. I. Co.....	Lowering 6-inch pipe.....	\$21 56
	14	Ryan & Kelly.....	Putting in ferrule.....	3 63
	14	Ryan & Kelly.....	Replacing fire hydrant.....	5 55
	14	Ryan & Kelly.....	Placing 6-inch pipe.....	29 96
	14	U. G. I. Co.....	Raising 6-inch pipe.....	42 81.
	(20	Union Traction Co.....	Shifting 6-inch pipe.....	36 09
	20	Union Traction Co.....	Shifting 6-inch pipe.....	26 81
	23	Keystone Watch Case Co....	Renewing two 4-inch stops..	56 77
	27	Robert Higgins.....	Repairing 6-inch main.....	15 21
31	Girard Iron and Metal Co...	Scrap iron during year.....	3,097 63	
June	2	J. H. Loucheim.....	Laying 6-inch pipe.....	16 50
	20	Union Traction Co.....	Lowering stop box.....	2 30
	20	Union Traction Co.....	Repairing fire hydrant.....	7 20
	20	Union Traction Co.....	Moving 6-inch stop.....	24 15
	20	Union Traction Co.....	Shifting 6-inch stop.....	26 81
	30	A. M. Collins Mfg. Co.....	Making connection.....	5 00
	30	J. H. Loucheim.....	Raising main.....	18 50
July	19	R. F. Simpson.....	Renewing stop box.....	5 13
	22	Union Traction Co.....	Changing stops.....	114 06
	24	The Ransome Construc'n Co.	Shifting 6-inch pipe.....	204 50
	24	The Ransome Construc'n Co.	Raising 6-inch pipe.....	49 48
	24	The Ransome Construc'n Co.	Repairing 6-inch pipe.....	36 11
	24	The Ransome Construc'n Co.	Raising and con. 6-inch pipe	101 37
	24	The Ransome Construc'n Co.	Replacing 6-inch pipe.....	32 50
	29	Imperial Woolen Co.....	Making connection.....	82 13
Aug.	5	P. J. McCormick.....	Repairing break in 6-in. main	10 60
	12	Pennsylvania R. R. Co.....	Repairing 20-inch main....	160 19
	12	Pennsylvania R. R. Co.....	Repairing 20-inch main....	17 60
	12	Pennsylvania R. R. Co.....	Relaying 30-inch main.....	1,437 21
	12	Pennsylvania R. R. Co.....	Cutting out 12-inch pipe....	20 41
	14	Ryan & Kelly.....	Replacing service main and hydrant.....	5 62
	19	Union Traction Co.....	Changing location of stop...	25 33
	19	Union Traction Co.....	Changing location of stop....	51 78
	28	The Prospect Brewing Co...	Testing 3-inch crown meter..	2 00

List of Miscellaneous Receipts for the Year 1902.

Sept.	5	Ryan & Kelly.....	Intersecting fire hydrant....	\$15 75
	5	Ryan & Kelly.....	Replacing 6-inch pipe.....	39 50
	5	United Gas Improvement Co.	Driving ferrule.....	1 91
	8	A. J. Reach & Co.....	Fire hydrant.....	14 97
	16	David McMahon.....	Replacing 6-inch pipe.....	59 32
	17	Kingan & Bronsion.....	Testing 4 gem meters.....	2 00
	26	Bureau of Water.....	Two dead horses.....	6 00
	27	United Gas Improvement Co.	Lowering 12-inch pipe.....	45 23
	30	Ryan & Kelly.....	Replacing 6-inch pipe.....	40 63
Oct.	1	United Gas Improvement Co.	Lowering 6-inch pipe.....	29 04
	3	Robert Higgins.....	Replacing 6-inch main.....	10 32
	17	Geo. C. Thomas.....	Placing fire hydrant.....	21 48
	21	Phila. Rapid Transit Co.....	Setting 6-inch stop.....	28 24
Nov.	7	Joseph Perna.....	Raising 6-inch main.....	44 50
	13	Boon & Sample.....	Moving of fire hydrant.....	25 24
	20	Pennsylvania Railroad Co..	Resetting fire hydrant.....	25 09
	26	Bureau of Water.....	Sale of horse.....	32 40
Dec.	2	Geo. A. Fuller Co.....	Setting 6-inch stop.....	31 96
	3	Eastern Penitentiary.....	Renewing 4-6 in. connections	80 20
	3	Eastern Penitentiary.....	Putting in 6-in. connections.	117 83
				\$10,479 99

REVENUE OF TAXES.

	Charges for Ferrules on New Connections.	Miscellaneous	Total .
January.....	\$112 00	\$557 77	\$44,825 44
February.....	78 00	1,904 95	288,126 88
March.....	769 00	65 07	246,851 12
April.....	1,421 00	1,414 00	375,925 78
May.....	1,427 00	8,409 51	1,871,585 85
June.....	1,188 00	100 46	75,148 05
July.....	899 00	625 28	64,700 68
August.....	605 00	1,780 74	160,523 48
September.....	1,249 00	225 81	91,021 57
October.....	1,209 00	89 08	97,014 86
November.....	1,681 00	127 88	85,108 66
December.....	658 00	229 99	68,818 45
Totals for 1902	\$11,246 00	\$10,479 99	\$8,459,090 72
Totals for 1901	7,549 00	5,826 84	8,831,487 45
Increase.....	\$3,697 00	\$5,153 65	\$184,785 85
Decrease.....			7,182 08
Net increase.....			\$127,653 27

APPENDIX B

REPORT

OF THE

GENERAL SUPERINTENDENT

SUBMITTING

TABLES OF EXPENSES, PUMPAGE AND CONSUMPTION OF WATER DURING 1902

Philadelphia, January 19, 1903.

F. L. HAND, Esq.,
Chief of Bureau.

DEAR SIR:—I have the honor to submit the following report of operations and expenses in connection with the work performed at the several pumping stations during 1902.

The tables herewith submitted show the average daily maximum and minimum, as well as the monthly and total, pumpage and consumption for the year.

Instead of a decrease in the pumpage, as was the case in 1901, there has been a material increase, averaging over 34,000,000 gallons per day.

There has also been a corresponding increase, amounting to 12,539 tons, in the consumption of coal, which, at contract prices, represents an additional expenditure of \$42,482.13 for fuel.

Very respectfully yours,

ALLEN J. FULLER,
General Superintendent.

Classification and Prices of Coal consumed during 1902.

Pumping Station.	Classification.	Tons.	Price per ton.	Cost.	Total Cost
Spring Garden.....	Buck.....	37,789	\$2 33	\$7,981 87	
	Bituminous..	26,231	4 23	110,957 13	
	Pea.....	23	3 06	70 38	
	Chestnut....	324	5 47½	1,773 90	
	Stove.....	25	5 47½	136 87	\$20,870 15
Belmont.....	Pea.....	9,424	3 05	28,743 20	
	Bituminous..	10,809	4 23	45,722 07	
Queen Lane.....	Buck.....	2,238	2 31	5,273 73	79,789 00
	Pea.....	20,732	3 31	68,622 92	
	Bituminous..	19,404	4 23	82,078 92	
Roxborough.....	Buck.....	2,611	2 58	6,736 38	157,483 22
	Pea.....	15,416	3 06	47,172 06	
	Bituminous..	10,362	4 23	43,811 26	
Frankford.....	Buck.....	1,884	2 33	4,389 72	95,393 94
	Buck.....	9,592	2 36	22,637 16	
	Bituminous..	8,309	4 23	37,262 07	
	Pea.....	957	3 09	2,957 13	62,856 36
Totals and averages..		176,925	\$3 87½		\$596,297 67
H. S. STATIONS.					
Belmont.....	Pea.....	975	\$3 71	\$3,617 25	
	Bituminous..	478	4 39	2,337 42	\$5,954 67
Roxborough.....	Pea.....	1,255	3 85	4,831 75	
	Bituminous..	384	5 02	1,927 68	6,759 43
Mt. Airy.....	Buck.....	195	2 67	520 65	
	Bituminous..	118	4 23	499 14	
Chestnut Hill.....	Pea.....	86	3 57	307 02	1,328 81
	Pea.....	44	3 35	147 40	
Frankford.....	Buck.....	51	2 60	132 60	280 00
	Pea.....	186	3 50	651 00	
	Bituminous..	22	5 23	115 06	
	Buck.....	49	2 75	134 75	900 81
Totals and averages..		3,843	\$3 93		\$15,221 72
Grand Total.....		180,468	\$3 88½		\$611,519 39
Increase for 1902...		12,539	\$0 61½		\$145,828 84

No. 1—Worthington Du
2,000,000 gallons per d

Capacity,
x. Capacity,
BELMONT HIGH SERVICE
STATION, 1902.

No. 2—Worthington High Service.
Capacity, 5,000,000 gallons per day.

Total Capacity, 7,000,000 gallons per day.

1902.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oils.		Mean Water Pressure per Square Inch, less Mean Pressure on Suction Pipe		Gallons Raised 100 feet.
	No. 1.	No. 2.	No. 1.	No. 2.			Tons.	Lbs.		Cylinder.	Engine.	No. 1.	No. 2.	
Months.					Gallons.	Gallons.				Qts.	Qts.			
January.....	456	31	21,899,605	3,594,100	25,493,705	822,378	107	365	.25	69	8	65	73	146.5
February.....	455	10	21,855,275	1,251,350	23,106,625	825,237	113	2,010	.25	47	7	65	73	124.9
March.....	397	28	23,909,850	3,481,450	27,391,300	883,590	127	965	.25	54	8	65	73	132.3
April.....	480	64	22,949,980	8,766,700	31,716,680	1,057,223	103	1,380	.25	65	8	65	73	188.4
May.....	474	124	22,576,060	16,139,900	38,715,960	1,248,902	129	1,570	.25	79	8	65	73	183.8
June.....	414	178	21,484,080	22,240,100	43,724,180	1,457,473	134	1,385	.25	84	8	65	73	200.0
July.....	464	182	22,291,805	22,655,850	44,947,655	1,449,918	139	580	.25	84	8	65	73	198.7
August.....	379	390	15,230,420	46,070,800	63,301,220	2,041,975	123	1,735	.25	102	7	65	73	314.8
September.....	.....	712	.....	73,018,695	73,018,695	2,433,956	113	20	.25	180	8	.....	73	398.2
October.....	.....	740	.....	92,728,200	92,728,200	2,991,232	113	1,720	.25	192	8	.....	75	501.8
November.....	.....	720	.....	92,343,000	92,343,000	3,078,100	112	1,410	.25	186	8	.....	73	504.7
December.....	.....	744	.....	82,539,090	82,539,090	2,662,548	134	1,255	.25	186	8	.....	73	377.6
Totals and averages..	3,549	3,923	172,196,875	466,829,145	639,026,020	1,750,756	1,453	985	.25	1,328	94	65	73	270.7

Classification and Prices of Coal consumed during 1902.

Pumping Station.	Classification.	Tons.	Price per ton.	Cost.	Total Cost
Spring Garden.....	Buck.....	87,789	\$2 33	\$37,981 87	
	Bituminous..	26,231	4 23	110,957 13	
	Pea.....	23	3 06	70 88	
	Chestnut....	324	5 47½	1,773 90	
	Stove.....	25	5 47½	186 87	\$203,870 15
Belmont.....	Pea.....	9,424	3 05	28,743 20	
	Bituminous..	10,809	4 23	45,722 07	
Queen Lane.....	Buck.....	2,238	2 31	5,273 78	79,789 00
	Pea.....	20,732	3 31	68,622 92	
Roxborough.....	Bituminous..	19,404	4 23	82,078 92	
	Buck.....	2,611	2 58	6,786 38	157,488 22
Frankford.....	Pea.....	15,416	3 06	47,172 96	
	Bituminous..	10,362	4 23	43,8 1 26	
Frankford.....	Buck.....	1,884	2 33	4,389 72	95,398 94
	Pea.....	9,592	2 36	22,637 16	
Frankford.....	Bituminous..	3,809	4 23	37,262 07	
	Pea.....	957	3 09	2,957 13	62,856 36
Totals and averages..	176,925	\$3 37½	\$596,297 67
H. S. STATIONS.					
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	Bituminous..	478	4 59	2,337 42	\$5,954 67
Roxborough.....	Pea.....	1,255	3 85	4,831 75	
	Bituminous..	384	5 02	1,927 68	6,759 43
Mt. Airy.....	Buck.....	195	2 67	520 65	
	Bituminous..	118	4 23	499 14	
Chestnut Hill.....	Pea.....	86	3 57	307 02	1,326 81
	Pea.....	44	3 35	147 40	
Frankford.....	Buck.....	51	2 60	132 60	280 00
	Pea.....	186	3 50	651 00	
Frankford.....	Bituminous..	22	5 23	115 06	
	Buck.....	49	2 75	134 75	900 81
Totals and averages..	.....	3,843	\$3 93	.....	\$15,221 72
Grand Total.....	.....	180,468	\$3 88½	.....	\$611,519 39
Increase for 1902...	.....	12,539	\$0 61½	.....	\$145,828 84

No. 1—Worthington Du x. capacity,
2,000,000 gallons per d

BELMONT HIGH SERVICE STATION, 1902.

No. 2—Worthington High Service.
Capacity, 5,000,000 gallons per day.

Total Capacity, 7,000,000 gallons per day.

1902.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oils.		Mean Water Pressure per Square Inch, less Mean Pressure on Suction Pipe		Gallons Raised 100 feet per Pound of Coal.
										Cylinder.	Engine.			
	Months.	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.		Lbs.	Qts.	Qts.	No. 1.		No. 2.
January.....	456	31	21,899,605	3,594,100	25,493,705	822,378	107	365	.25	69	8	65	73	146.5
February.....	455	10	21,855,275	1,251,350	23,106,625	825,237	113	2,010	.25	47	7	65	73	124.9
March.....	397	28	23,909,850	3,481,450	27,391,300	853,590	127	965	.25	54	8	65	73	132.3
April.....	480	64	22,949,980	8,766,700	31,716,680	1,057,223	103	1,380	.25	65	8	65	73	188.4
May.....	474	124	22,576,060	16,139,900	38,715,960	1,248,902	129	1,570	.25	79	8	65	73	183.8
June.....	444	178	21,484,080	22,240,100	43,724,180	1,457,473	134	1,385	.25	64	8	65	73	200.0
July.....	464	182	22,291,605	22,655,850	44,947,455	1,449,918	139	580	.25	84	8	65	73	198.7
August.....	379	390	15,230,420	48,070,800	63,301,220	2,041,975	123	1,735	.25	102	7	65	73	314.8
September.....		712	.....	73,018,695	73,018,695	2,433,956	113	20	.25	180	8	.....	73	398.2
October.....		740	.....	92,728,200	92,728,200	2,991,232	113	1,720	.25	192	8	.....	75	501.8
November.....		720	.....	92,343,000	92,343,000	3,078,100	112	1,410	.25	186	8	.....	73	504.7
December.....		744	.....	82,539,000	82,539,000	2,662,548	134	1,255	.25	186	8	.....	73	377.6
Totals and averages..	3,549	3,923	172,196,875	466,829,145	639,026,020	1,750,756	1,453	955	.25	1,328	94	65	73	270.7

No. 1—Worthington Duplex.
Capacity, 5,000,000 gallons per day.

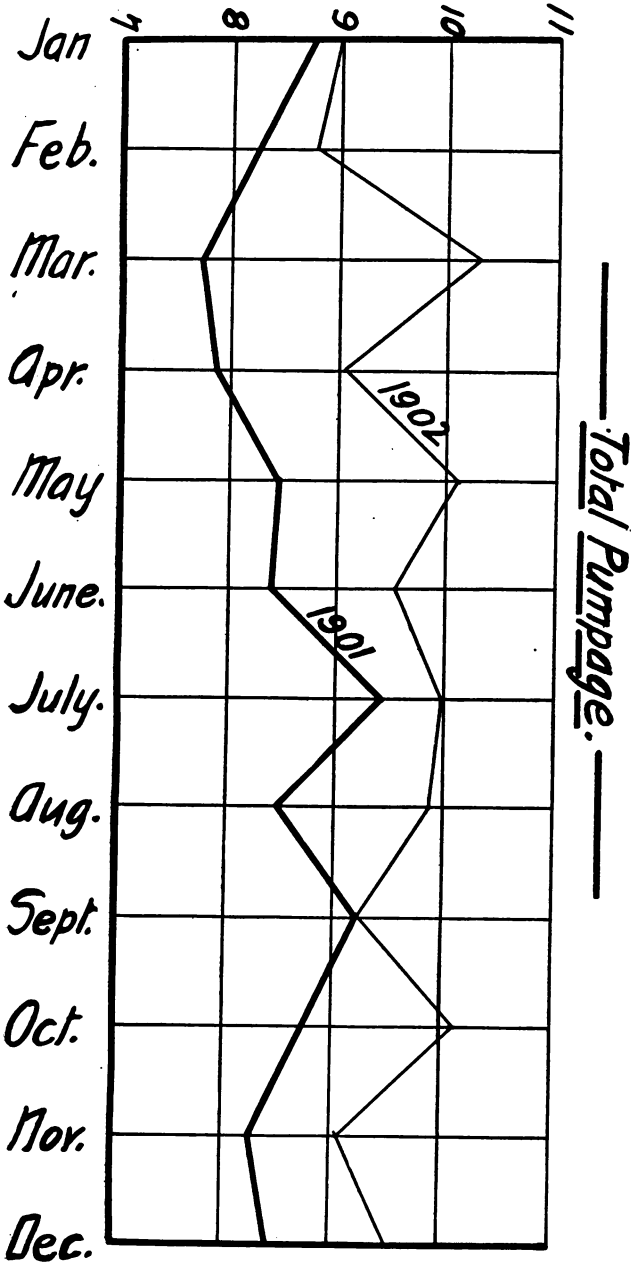
ROXBOROUGH HIGH SERVICE STATION, 1902.

Total Capacity, 10,000,000 gallons per day.

No. 2—Worthington High Duty
Duplex. Capacity, 5,000,000 gallons
per day.

1902. Months	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	Coal		Percentage of Ashes.	Oils.		Mean Water Pressure per square inch less Mean Pressure on Suction Pipe.		Gallons Raised 100 feet per Pound of Coal.
	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.	Lbs.		Cylinder.	Engine.	No. 1.	No. 2.	
January	65	676	13,745,160	117,057,675	130,802,835	4,219,446	136	1,720	.25	155	23	56	56	497.8
February	608	68	131,437,130	12,052,280	143,489,410	5,124,622	208	180	.25	140	7	56	56	367.8
March	69	676	14,080,680	116,352,510	130,442,190	4,207,813	1 9	890	.25	155	23	56	56	524.7
April	20	698	4,276,800	113,678,405	117,955,205	3,981,840	124	570	.25	150	12	25	56	494.1
May.....	12	732	2,625,480	129,654,200	132,279,680	4,267,0 6	124	220	.25	155	23	56	56	554.9
June	143	576	29,251,020	105,441,900	134,692,920	4,489,764	141	1,290	.25	150	23	55	55	495.2
July... ..	4	740	679,060	133,474,655	134,153,7 5	4,338,991	127	380	.25	155	23	56	56	49.9
August.....	14	727	3,362,040	131,801,885	135,163,925	4,360,126	134	910	.25	155	23	56	56	23.5
September.....	9	710	2,121,620	129,341,475	131,463,095	4,382,108	134	1,380	.25	150	22	56	56	508.3
October	21	710	4,365,900	126,901,775	131,267,675	4,234,441	131	1,750	.25	155	23	56	5 6	518.5
November.....		720		123,306,725	123,306,725	4,276,81	110	2,160	.25	150	23	.....	56	605.9
December	31	713	6,634,980	130,183,655	136,818,635	4,413,504	140	1, 20	.25	155	23	52	56	506.6
Totals and averages.	996	7,741	212,788,870	1, 74,247,140	1,587,036,010	4,348,044	1,638	1,570	.25	1,825	248	58	56	504.1

Billion Gals. per Month.



No. 1—Worthington Duplex.
Capacity, 5,000,000 gallons per day.

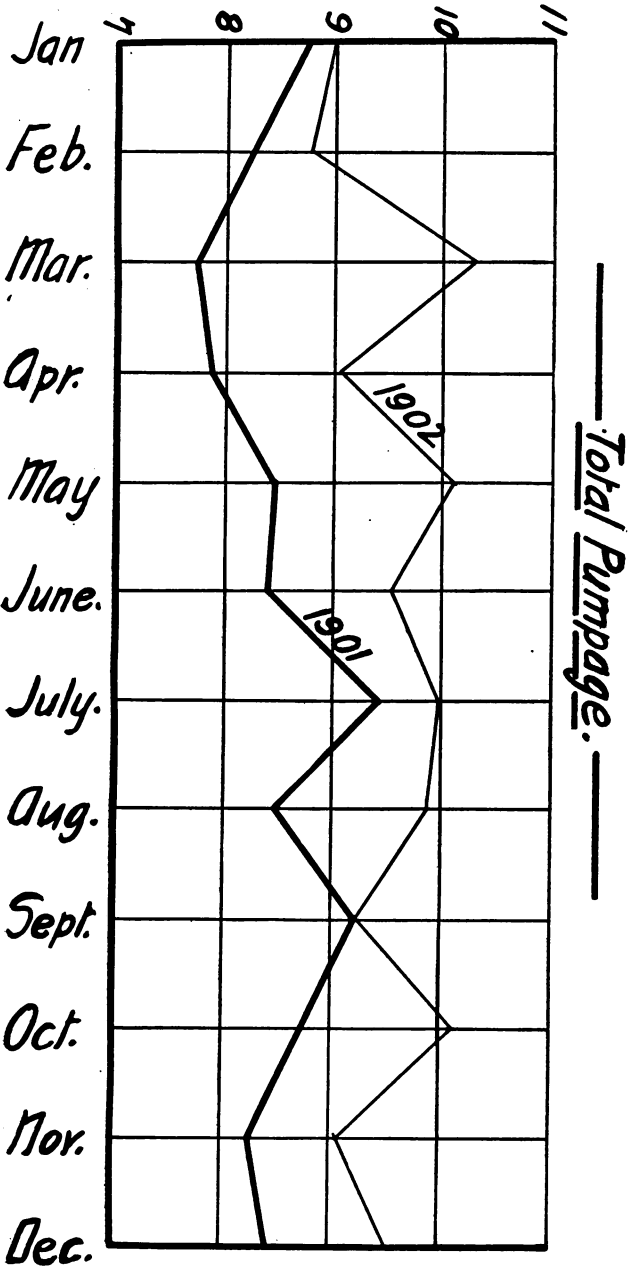
ROXBOROUGH HIGH SERVICE STATION, 1902.

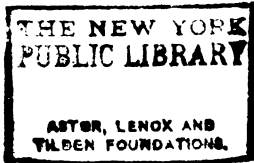
Total Capacity, 10,000,000 gallons per day.

No. 2—Worthington High Duty
Duplex. Capacity, 5,000,000 gallons
per day.

1902.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	Coal		Percentage of Ashes.	Oils.		Mean Water Pressure per square inch less Mean Pressure on Suction Pipe.		Gallons Raised 100 feet per Pound of Coal.
	Months	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.		Lbs.	Cylinder.	Engine.	No. 1.		No. 2.
January	65	676	13,745,160	117,057,675	130,802,835	4,219,446	136	1,720	.25	155	23	56	56	497.8
February	608	63	131,437,130	12,052,280	143,489,410	5,124,622	203	180	.25	140	7	56	56	367.8
March	69	676	14,080,680	116,352,510	130,442,190	4,207,813	1 9	890	.25	155	23	56	56	524.7
April	20	698	4,276,800	113,678,405	117,955,205	3,981,840	124	570	.25	150	12	25	56	494.1
May.....	12	782	2,625,480	129,654,200	132,279,680	4,267,0.6	124	220	.25	155	23	56	56	554.9
June	143	576	29,251,020	105,441,900	134,692,920	4,489,764	141	1,290	.25	150	23	55	55	495.2
July... ..	4	740	579,060	133,474,655	134,053,7.5	4,333,991	127	380	.25	155	23	56	56	49.9
August.....	14	727	3,362,040	131,801,885	135,163,925	4,360,126	134	910	.25	155	23	56	56	28.5
September.....	9	710	2,121,620	129,341,475	131,463,095	4,382,108	134	1,380	.25	150	22	56	56	508.3
October	21	710	4,365,900	126,901,775	131,267,675	4,234,441	131	1,750	.25	155	23	56	5	518.5
November.....		720		128,306,725	128,306,725	4,276,91	110	2,160	.25	150	23		56	605.9
December	31	713	6,634,980	130,183,655	136,818,635	4,413,504	140	1, 20	.25	155	23	52	56	506.6
Totals and averages.	996	7,741	212,788,870	1, 74,247,140	1,587,036,010	4,348,044	1,638	1,570	.25	1,325	248	53	56	504.1

Billion Gals. per Month.





athwark Vertical Compound Rotary. Capacity, 22,000,-
lons per day.

athwark Vertical Compound Rotary. Capacity, 15,000,-
lons per day.

Percentage of Ashes.	Oils.		Mean Water Pressure and Mean Suction Lift in Pounds per Square Inch.				Gallons Raised 100 Feet per Pound of Coal.
	Cylinder.	Engine.	No. 1.	No. 2.	No. 3.	No. 4.	
	Qts.	Qts.					
.25	490	1,000	70	70	.....	70	382.3
.25	394	1,000	70	70	.....	70	367.4
.25	448	1,160	70	70	.....	70	360.7
.25	400	1,240	70	70	68	70	379.3
.25	730	1,472	70	70	70	70	465.3
.25	696	1,540	.....	70	75	70	525.0
.25	736	1,640	70	70	70	70	552.1
.25	690	1,400	70	70	70	70	517.1
.25	8	1,370	70	70	67	70	564.4
.25	916	1,290	70	70	66	70	556.9
.25	39	1,160	70	70	65	70	471.0
.25	80	880	70	70	.....	70	445.2
.25	7,643	15,272	70	70	69	70	469.2

No. 1—Davidson Rotary, Capacity
1,000,000 Gallons per Day.
No. 2—Davidson Rotary, Capacity
1,000,000 Gallons per Day.

MOUNT AIRY PUMPING STATION. 1902.

Total Capacity, 3,000,000 Gallons per Day.

No. 3—Knowles Rotary, Capacity
1,000,000 Gallons per Day.

1902.	Running Time of each Engine in Hours.			Gallons Pumped by each Engine.			Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	OILS.		Mean Water Pressure per Square Inch less Mean Pressure on Suction Pipe.			Gallons Raised 100 feet per Pound of Coal.
												Cylinder	Engine.				
	Months.	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	Gallons.	Gallons	Tons.		Lbs.	Qts.	Qts.	No. 1.	No. 2.		No. 3.
January.....	5	5	.....	245,400	245,400	.....	490,800	15,882	21	1,960	.25	1	.....	50	50	.....	9.6
February.....	1	.....	.....	48,650	.....	.....	48,650	1,737	18	1,680	.25	1	.....	60	.....	.....	1.1
March.....	56	.....	.....	2,730,000	.....	.....	2,730,000	88,064	26	2,010	.25	1	1	60	.....	.....	43.5
April.....	342	.....	.....	16,587,500	.....	.....	16,587,500	552,917	56	60	.25	13	8	60	.....	.....	127.0
May.....	26	53	.....	1,218,750	2,542,500	.....	3,761,250	121,381	28	1,780	.25	5	3	60	60	.....	57.6
June.....	83	98	.....	4,648,750	4,477,500	.....	9,121,250	304,042	41	260	.25	12	6	50	50	.....	95.1
July.....	51	87	.....	2,686,250	4,631,250	.....	7,317,500	236,048	35	1,600	.25	7	4	50	50	.....	87.9
August.....	20	85	.....	975,000	2,997,500	.....	4,972,500	160,403	32	1,020	.25	6	3	50	50	.....	65.7
September.....	146	126	.....	6,902,500	6,158,750	.....	13,061,250	435,375	50	1,800	.25	15	7	50	50	.....	110.3
October.....	74	121	.....	3,591,250	5,898,750	.....	9,490,000	306,129	41	960	.25	11	6	50	50	.....	98.3
November.....	24	33	.....	1,170,000	1,608,750	.....	2,778,750	92,625	24	1,140	.25	2	1	50	50	.....	48.7
December.....	.....	.....	.....	.....	.....	.....	.....	.....	2	600	.25	.....	.....	.....	.....	.....	.....
Totals and averages.	828	603	.....	40,799,050	29,560,400	.....	70,359,450	192,766	398	1,430	.25	74	39	54	51	.....	75.7

No. 1—Knowles. Capacity, 250,000 gallons per day.

CHESTNUT HILL PUMPING STATION, 1902.

No. 2—Worthington Duplex. Capacity, 500,000 gallons per day.

Total Capacity, 750,000 gallons per day.

1902.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	COAL.		Percentage of Ashes.	OILS.		Mean Water Pressure per Square Inch, less Mean Pressure on Suction Pipe.	Gallons Raised 100 Feet per Pound of Coal.	
	MONTHS.	No. 1.	No. 2.	No. 1.	No. 2.	Gallons	Gallons	Tons.		Lbs.	Cylinder.			Engine.	No. 1.	No. 2.
January		4		167,280	167,280	5,896	8	950	.25	1			50	9.9
February							8	80	.25					
March		25		984,000	984,000	31,742	11	1,715	.25	2			50	42.1
April		123		4,319,768	4,319,768	143,992	16	716	.25	8			50	133.4
May							8	1,481	.25					
June							4	1,323	.25					
July														
August		4		167,280	167,280	5,896	4	725	.25	1			50	19.4
September		2		78,720	78,720	2,624	6	1,250	.25	1			50	6.0
October		15		507,620	507,620	16,875	6	1,605	.25	1			50	38.1
November		24		759,134	759,134	25,304	9	439	.22	5			50	41.8
December							10	255	.25					
Totals and averages		197		6,983,802	6,983,802	19,134	94	1,579	.25	19			50	37.2

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.



BARBADOES

Year	Population	Male	Female	White	Coloured	Indian	Chinese	Portuguese	Other
1800	1100	550	550	100	450	0	0	0	0
1801	1100	550	550	100	450	0	0	0	0
1802	1100	550	550	100	450	0	0	0	0
1803	1100	550	550	100	450	0	0	0	0
1804	1100	550	550	100	450	0	0	0	0
1805	1100	550	550	100	450	0	0	0	0
1806	1100	550	550	100	450	0	0	0	0
1807	1100	550	550	100	450	0	0	0	0
1808	1100	550	550	100	450	0	0	0	0
1809	1100	550	550	100	450	0	0	0	0
1810	1100	550	550	100	450	0	0	0	0
1811	1100	550	550	100	450	0	0	0	0
1812	1100	550	550	100	450	0	0	0	0
1813	1100	550	550	100	450	0	0	0	0
1814	1100	550	550	100	450	0	0	0	0
1815	1100	550	550	100	450	0	0	0	0
1816	1100	550	550	100	450	0	0	0	0
1817	1100	550	550	100	450	0	0	0	0
1818	1100	550	550	100	450	0	0	0	0
1819	1100	550	550	100	450	0	0	0	0
1820	1100	550	550	100	450	0	0	0	0
1821	1100	550	550	100	450	0	0	0	0
1822	1100	550	550	100	450	0	0	0	0
1823	1100	550	550	100	450	0	0	0	0
1824	1100	550	550	100	450	0	0	0	0
1825	1100	550	550	100	450	0	0	0	0
1826	1100	550	550	100	450	0	0	0	0
1827	1100	550	550	100	450	0	0	0	0
1828	1100	550	550	100	450	0	0	0	0
1829	1100	550	550	100	450	0	0	0	0
1830	1100	550	550	100	450	0	0	0	0

No. 1—Holly Rotary Duplex;
Capacity, 3,000,000 gallons per day.

FRANKFORD HIGH SERVICE STATION, 1902.
Total capacity, 7,000,000 gallons per day.

No. 2—D'Auria Horizontal Compound;
Capacity, 4,000,000 gallons per day.

1902.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per day.	Coal.		Percentage of Ashes.	Oils.		Mean Water Pressure per Square Inch, less Mean Pressure on Suction Pipe.		Gallons Raised 100 Feet per Pound of Coal.
	Months.	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.		Pounds	Cylinder.	Engine.	No. 1.		No. 2.
January.....	47	.....	2,644,920	.....	2,644,920	85,320	23	1,345	.25	18	12	71	.....	70.4
February.....	42	.....	2,388,960	.....	2,388,960	85,320	23	120	.25	16	12	71	.....	65.1
March.....	46	.....	2,644,920	.....	2,644,920	85,320	20	625	.25	16	14	71	.....	82.0
April.....	46	.....	2,616,480	.....	2,616,480	87,216	18	645	.25	13	17	71	.....	89.9
May.....	40	19	2,246,760	1,078,234	3,324,994	107,258	20	1,470	.25	21	16	71	71	101.2
June.....	31	20	1,870,025	1,728,222	3,598,247	119,941	20	2,005	.25	25	18	71	71	108.2
July.....	28	28	1,592,640	1,574,424	3,167,064	102,168	19	1,585	.25	22	17	71	71	101.1
August.....	28	28	1,803,250	1,618,327	3,421,577	108,760	20	1,410	.25	23	16	71	71	98.0
September.....	27	27	1,507,320	1,547,504	3,054,824	101,827	20	520	.25	20	15	71	71	94.9
October.....	24	24	1,615,780	1,332,297	2,948,077	95,132	21	1,220	.25	15	12	71	71	86.0
November.....	23	22	1,308,240	1,276,560	2,584,800	86,160	20	545	.25	16	11	71	71	80.3
December.....	23	24	1,380,680	1,333,296	2,663,976	85,934	28	370	.25	16	12	71	71	59.4
Totals and averages.....	405	201	23,369,975	11,484,864	34,854,839	95,492	257	610	.25	231	172	71	71	85.1

APPENDIX C

REPORT

OF THE

Assistant in Charge of Distribution

Philadelphia, January 19, 1903.

F. L. HAND, Esq.,
Chief, Bureau of Water.

DEAR SIR:—I have the honor to submit the following report on the distribution system for the year 1902:

Mains.

The following is a statement of the mains laid, re-laid, taken up, etc.:

New Work.

By Bureau of Water:

Service mains laid	87,943 feet.
Supply mains laid	1,034 feet.
Connections, etc.	7,762 feet.
Total	<u>96,739 feet.</u>

By Bureau of Filtration:

Supply mains	100,679 feet.
Connections, etc.	2,674 feet.
Total	<u>103,353 feet.</u>

High Pressure Fire Service:

Mains	14,508 feet.
Connections	1,771 feet.
Total	<u>16,279 feet.</u>

*Comparison of Conditions Relative to the Distribution,
1901-1902.*

	1901.	1902.	Increase.	Decrease.
Service mains, 4-in. to 12-in.....	108,692	87,943	.....	20,749
Supply mains, 10-in. to 48-in.....	8,701	1,034	.....	7,667
Pumping mains, 12-in. to 48-in.....	2,298	.....	.....	2,298
Connections and miscellaneous work,.....	9,664	7,762	.....	1,902
Totals in feet.....	129,355	96,739	.....	32,616
Re-laid, 6-in. to 36-in.....	20,794	16,042	.....	4,752
Miscellaneous repairs, 3-in. to 48-in.....	6,240	3,754	.....	2,486
Taken up, 3-in. to 48-in.....	14,218	13,335	.....	883
Lowered, raised and shifted. 6-in. to 48-in.	5,003	7,256	2,253	.....
Totals in feet.....	46,255	40,387	2,253	8,121
Pipe cut off and abandoned, 3-in. to 20-in.	5,287	4,884	.....	403

Meters.

	1901.	1902.	Increase.	Decrease.
Meters in use.....	1,435	1,502	67	.....

*Number of Dwellings and Principal Appliances for the
Use of City Water.*

	1901.	1902.	Increase.	Decrease.
Dwellings with water.....	240,168	244,506	4,338	.....
Dwellings without water.....	12,493	11,738	.....	755
Water closets.....	250,331	277,960	27,629	.....
Baths.....	279,128	284,478	5,350	.....
Wash paves.....	95,842	95,695	.....	157
Basins and sinks.....	103,714	103,338	4,624	.....
Urinals.....	5,539	5,813	274	.....

<i>Repairs.</i>		Feet.	Feet,
Mains relaid		16,042	
Repairs and connections		3,754	
		<hr/>	19,796
Old pipe taken up		13,335	
Pipe lowered, raised and shifted		7,256	
		<hr/>	20,591
Total			<hr/> 40,387

<i>Abandoned.</i>		Feet.
Two-inch		200
Three-inch		232
Four-inch		1,955
Six-inch		1,687
Ten-inch		278
Twelve-inch		482
Thirty-inch		50
		<hr/>
Total		4,884

The total quantity of pipe handled, for all purposes, throughout the year, was 137,126 feet, weighing 5,037,028 pounds.

The total quantity of new pipe laid was 96,739 feet, or 18.32 miles, making, in addition to that previously laid, 1,381.09 miles now in use.

Fire Hydrants.

New style fire hydrants in new locations (Bureau of Water)	394
New style fire hydrants in new locations (Bureau of Fil- tration; Contract)	40
New style fire hydrants in new locations (High Pressure Fire Service; Contract)	142
Old style fire hydrants in new locations	
New style fire hydrants in place of old style	208
Old style fire hydrants in place of others of the old style....	2
	<hr/>
Total	786
New style fire hydrants taken out	37
Old style fire hydrants taken out	22
	<hr/>
Total	59

The total number of new style fire hydrants added to the distribution system was 517, and the total number in use December 31, 1902, was 13,517, of which 544 are of the old style and 12,973, or 95.99 per cent. are of the new pattern.

Drills for Attachments.

One-half inch ...	4,187 area of openings..	811 square inches.
Five-eighth inch.	270 area of openings..	83 square inches.
Three-quarter in.	141 area of openings..	62 square inches.
One-inch	116 area of openings..	91 square inches.
One and one-quarter inches ..	21 area of openings..	26 square inches.
One and one-half inches	35 area of openings..	62 square inches.
Two inches	106 area of openings..	333 square inches.
Three inches	7 area of openings..	49 square inches.
Four inches	8 area of openings..	101 square inches.
Six inches	7 area of openings..	198 square inches.
Total	4,898 area of openings..	1,816 square inches.

For attachments, including ferrules, service pipes and curb stops, which were put in from the street mains to the curb, by employees of this Bureau, in order to provide for possible future service, without breaking of street pavements, see Table "A."

Tabulations of work performed and of expenditures made are also submitted herewith, together with various other tables, compiled as in previous years.

The report of the Chief Pipe Inspector, relative to the inspection of pipes and other castings during the year, in tabulated form, also accompanies this report.

Respectfully submitted,

W. WHITBY,

Assistant in Charge of Distribution.

SERVICE AND SUPPLY MAINS LAID DURING 1902.

FIRST DISTRICT.

Comprising the 1st, 2d, 3d, 4th, 26th, 30th, 36th and 39th Wards.

Purposes for which used.		SIZE IN INCHES.					Total in feet and pounds.
		4	6	10	12	16	
New pipe or feet added.	Service Main.....		10,841	1,081	450		11,872
	Fire hydrant connections.....		464				464
	Supply connections (private).....	70					70
	Total.....	70	10,805	1,081	450		12,406
	{ Feet.....						
	{ Pounds.....	1,400	856,565	59,455	88,750		451,170
Pipe used but adding nothing to feet in ground.	Pipe relaid.....		894				894
	Repairs general.....		218	82		9	259
	Pipe taken up.....	866	70				436
	Pipe raised.....		72			41	113
	Total.....	866	754	82		50	1,202
	{ Feet.....						
	{ Pounds.....	7,320	24,882	1,760		5,750	89,712
Total handled.....		486	11,559	1,118	450	50	13,808
	{ Feet.....						
	{ Pounds.....	8,720	881,447	61,215	88,750	5,750	490,882
Pipe cut off and abandoned.....				4			4

SERVICE AND SUPPLY MAINS LAID DURING 1902.

FIRST DISTRICT.

Comprising the 1st, 2d, 3d, 4th, 26th, 30th, 36th and 39th Wards.

Purposes for which used.		SIZE IN INCHES.					Total in feet and pounds.	
		4	6	10	12	18		
New pipe or feet added.	Service Main		10,841	1,081	450		11,872	
	Fire hydrant connections.....		464				464	
	Supply connections (private).....	70					70	
	Total.....	{ Feet.....	70	10,805	1,081	450		12,406
	{ Pounds.....	1,400	866,565	59,455	88,750		451,170	
Pipe used but adding nothing to feet in ground.	Pipe relaid.....		894				894	
	Repairs general.....		218	82		9	259	
	Pipe taken up.....	866	70				496	
	Pipe raised.....		72			41	113	
	Total.....	{ Feet.....	866	754	82		50	1,202
	{ Pounds.....	7,820	24,882	1,760		5,750	39,712	
Total handled.....		{ Feet.....	486	11,559	1,118	450	50	18,808
	{ Pounds.....	8,720	381,447	61,215	88,750	5,750		490,882
Pipe cut off and abandoned.....				4				4

SECOND DISTRICT.

Comprising the 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 16th and 17th Wards.

Purposes for which used.		SIZE IN INCHES.						Total in feet and pounds.
		8	4	6	8	10	12	
New pipe or feet added.	Service mains.....			1,089				1,089
	Supply mains.....					1,016		1,016
	Supply main connections.....						28	28
	Fire main connections.....						80	80
	Bye-pass connections.....					88	8	96
	Fire hydrant connections.....			123				123
	Fire connections (private).....	8	18	321				342
	Supply connections (private).....	82	113					195
	Motor connections (private).....		21					21
	Total..... { Feet.....		90	147	1,583		1,104	66	2,940
{ Pounds.....		1,350	2,940	50,589		60,720	4,950	120,540
Pipe used, but adding nothing to feet in ground.	Pipe relaid.....			2,763	675			3,438
	Repairs, general.....			573		88		611
	Pipe taken up.....	423	1,991	691				3,105
	Pipe shifted.....			964				964
	Total..... { Feet.....		423	1,991	4,991	675	88		8,118
{ Pounds.....		6,345	39,820	164,703	23,350	2,060		241,306
Total handled..... { Feet.....		513	2,188	6,524	675	1,142	66	11,058
{ Pounds.....		7,695	42,760	215,292	23,350	62,810	4,950	361,357
Pipe cut off and abandoned.....		223	158	52				433

THIRD DISTRICT.

Comprising the 18th, 19th, 23d, 25th, 35th, 41st, and part of 33d and 42d Wards.

	Purposes for which used.	SIZE IN INCHES.								Total in feet and pounds.		
		3	4	6	8	10	12	30	36		48	
New pipe or feet added.	Service mains.....			20,002	2,288	1,572	400		18		24,262	
	Supply mains.....					12	14				18	
	Supply main connections.....			1,463							1,463	
	Fire hydrant connections.....		10	40							50	
	Fire connections (private).....	26	23	24							73	
	Supply connections (private).....			71		92					163	
	Drains.....											
	Total.....	{ Feet.....	26	33	21,600	2,300	1,678	400	18			26,055
	{ Pounds.....	390	660	712,800	96,600	92,290	30,000	5,940			938,680	
Pipe used but adding nothing to feet in ground.	Pipe relaid.....		10	5,280		501	459			22	6,274	
	Repairs, general.....		3	566	17	5	22	7			620	
	Pipe taken up.....		2,209	1,253		181	90		22		3,755	
	Pipe lowered.....			47	176				64		287	
	Pipe raised.....			160		35					195	
	Pipe shifted.....			113							113	
	Total.....	{ Feet.....		2,222	7,419	193	724	571	71	22	22	11,244
		{ Pounds.....		44,440	244,827	8,106	39,820	42,825	23,430	9,240	14,300	426,988
Total handled.....	{ Feet.....	26	2,255	29,019	2,493	2,402	971	89	22	22	37,299	
	{ Pounds.....	390	45,100	957,627	104,706	132,110	72,825	29,370	9,240	14,300	1,365,668	
Pipe cut off and abandoned.....			852	939		278	369				2,438	

FOURTH DISTRICT.

Comprising the 15th, 20th, 28th, 29th, 32d, and part of 37th and 38th Wards.

Purposes for which used.	SIZE IN INCHES.							Total in feet and pounds.
	3	4	6	8	10	12	48	
New pipe or feet added.	Service mains.....			4,858		53	126	5,087
	Supply main connections.....			19				19
	Fire hydrant connections.....			360				360
	Fire connections (private).....		14	69				83
	Supply connections (private).....	20	36					65
	Drains.....			29				29
	Total { Feet.....	20	50	5,335		53	126	5,598
{ Pounds.....	435	1,000	176,055		2,915	9,450	189,855	
Pipe used but adding nothing to feet in ground.	Pipe relaid.....		2,403					2,403
	Repairs general.....		8	373	8	8	68	472
	Pipe taken up.....	260	2,081					2,341
	Pipe lowered.....						182	182
	Pipe shifted.....			56				56
	Total { Feet.....	260	2,089	2,882	8	8	200	5,404
{ Pounds.....	3,900	41,780	98,456	336	440	15,000	159,462	
Total handled	{ Feet.....	289	2,139	8,167	8	61	326	10,997
	{ Pounds.....	4,335	42,780	269,511	336	3,355	24,450	349,317
Pipe cut off and abandoned.....		49	42					91

FIFTH DISTRICT.
Comprising the Twenty-first and part of the Thirty-eighth Wards.

Purposes for which used.	SIZE IN INCHES.												Total in feet and pounds	
	3	4	6	8	10	12	16	20	24	30	36	48		
New pipe or feet added.	Service mains.....		28	4,621		70								4,719
	Filter refill mains.....							27						27
	Supply main connections.....			18				15				30		68
	Pumping main connections.....							39		62				101
	Fire hydrant connections.....			267										267
	Fire connections (private).....	24	4	12	19	25								84
	Supply connect'ns (private).....		18	453										471
	Drains.....		27	229										256
Total..... { Feet.....	24	77	5,600	19	95		81		62		30		5,988	
{ Pounds..	360	1,540	184,800	798	5,225		9,315		13,020		12,600		227,658	
Pipe used, but adding nothing to feet in ground	Pipe relaid.....			417		20							437	
	Repairs general.....		31	129		19	12	10	6		37	9	18	271
	Pipe taken up.....		22	770		25	297							1,114
	Pipe lowered.....						378							378
	Total..... { Feet.....		53	1,316		64	687	10	6		37	9	18	2,200
{ Pounds..		1,060	43,428		3,520	51,525	1,150	930		12,210	3,780	11,700	129,303	
Total handled..... { Feet.....	24	130	6,916	19	159	687	91	6	62	37	39	18	8,188	
{ Pounds..	360	2,600	228,228	798	8,745	51,525	10,465	930	13,020	12,210	16,380	11,700	356,961	
Pipe cut off and abandoned.....		434	34										468	

SIXTH DISTRICT.

Comprising the Twenty-second, and part of the Thirty-third, Thirty-seventh, Thirty-eighth and Forty-second Wards.

Purposes for which used.		SIZE IN INCHES.								Total in Feet and Pounds.	
		2	3	4	6	8	10	12	20		30
New pipe or feet added.	Service mains.....				15,458		8	745			16,211
	Bye pass connections.....					5	30	62			97
	Fire hydrant connections.....				1,128						1,128
	Fire connections (private).....				15						15
	Supply connections (private).....		26								26
	Drains.....				5						5
Total..... { Feet.....			26		16,604	5	38	807			17,480
{ Pounds.....			390		547,982	210	2,000	60,525			611,147
Pipe used but adding nothing to feet in ground.	Pipe relaid.....				284		7	814			1,105
	Repairs, general.....			4	697	15	18	47	18	28	827
	Pipe taken up.....			15	1,239						1,254
	Pipe lowered.....				2,522			1,404			3,926
	Pipe shifted.....				527						527
	Total..... { Feet.....				19	5,269	15	25	2,265	18	28	7,689
{ Pound.....				380	173,877	630	1,375	169,875	2,790	9,240	358,167
Total handled..... { Feet.....			26	19	21,873	20	63	3,072	18	28	25,119
{ Pounds.....			390	380	721,809	840	3,465	230,400	2,790	9,240	969,314
Pipe cut off and abandoned.....		200		124	109						433

FIFTH DISTRICT.
Comprising the Twenty-first and part of the Thirty-eighth Wards.

Purposes for which used.	SIZE IN INCHES.												Total in feet and pounds
	3	4	6	8	10	12	16	20	24	30	36	48	
New pipe or feet added.	Service mains.....		28	4,621		70							4,719
	Filter refill mains.....						27						27
	Supply main connections.....			18			15				30		63
	Pumping main connections.....						39		62				101
	Fire hydrant connections.....			267									267
	Fire connections (private).....	24	4	12	19	25							84
	Supply connect'ns (private).....		18	453									471
	Drains.....		27	229									256
Total..... { Feet.....	24	77	5,800	19	95		81		62		30		5,988
{ Pounds..	360	1,540	184,800	798	5,225		9,315		13,020		12,400		227,658
Pipe used, but adding nothing to feet in ground	Pipe relaid.....			417		20							437
	Repairs general.....		31	129		19	12	10	6		37	9	271
	Pipe taken up.....		22	770		25	297						1,114
	Pipe lowered.....						378						378
	Total..... { Feet.....		53	1,316		64	687	10	6		37	9	18	2,200
{ Pounds.....		1,060	43,428		3,520	51,525	1,150	930		12,210	3,780	11,700	129,303
Total handled..... { Feet.....	24	130	6,916	19	159	687	91	6	62	37	39	18	8,188
{ Pounds.....	360	2,600	228,228	798	8,745	51,525	10,465	930	13,020	12,210	16,300	11,700	356,961
Pipe cut off and abandoned.....		434	34										468

SIXTH DISTRICT.

Comprising the Twenty-second, and part of the Thirty-third, Thirty-seventh, Thirty-eighth and Forty-second Wards.

Purposes for which used.		SIZE IN INCHES.								Total in Feet and Pounds.	
		2	3	4	6	8	10	12	20		30
New pipe or feet added.	Service mains.....				15,458		8	745			16,211
	Bye pass connections.....					5	80	62			87
	Fire hydrant connections.....				1,128						1,128
	Fire connections (private).....				15						15
	Supply connections (private).....		26								26
	Drains.....				5						5
Total.....			26		16,604	5	88	807			17,480
			390		547,982	210	2,000	60,525			611,147
Pipe used but adding not bringing to feet in ground.	Pipe relaid.....				284		7	814			1,105
	Repairs, general.....			4	697	15	18	47	18	28	827
	Pipe taken up.....			15	1,280						1,254
	Pipe lowered.....				2,522			1,404			3,926
	Pipe shifted.....				527						527
	Total.....				19	5,269	15	25	2,265	18	28	7,689
				380	173,877	690	1,375	169,875	2,790	9,240	858,167
Total handled.....			26	19	21,873	20	68	3,072	18	28	25,119
			390	380	721,809	840	8,465	230,400	2,790	9,240	969,314
Pipe cut off and abandoned.....		200		124	109						438

SEVENTH DISTRICT.

Comprising the 24th, 27th, 34th and 40th Wards.

Purposes for which used.	SIZE IN INCHES.									Total in feet and pounds.	
	3	4	6	8	10	12	20	30	36		
New pipe or feet added.	Service mains.....			24,128	40	585					24,758
	Supply main connections.....							6			6
	Fire hydrant connections.....			1,283	12						1,295
	Supply connections (private).....	74	2	90							166
	Motor connections (private).....	24	23								47
	Drains.....			10							10
	Total { Feet..... Pounds.....	98 1,470	25 500	25,511 841,663	52 2,181	585 82,175			6 1,980		26,277 880,172
Pipe used but adding nothing to feet in ground.	Pipe relaid.....			1,243				143		1,991	
	Repairs, general.....	16	4	432	113	50	29		50	694	
	Pipe taken up.....		1,205					125		1,330	
	Pipe lowered.....			100						100	
	Pipe raised.....			189						189	
	Pipe shifted.....			128		25		75	48	276	
	Total { Feet..... Pounds.....	16 240	1,209 24,180	2,692 88,836	113 4,746	75 4,125	29 2,175	75 11,625	321 105,930	50 21,000	4,580 262,857
Total handled { Feet..... Pounds.....	114 1,710	1,234 24,680	28,203 930,699	165 6,980	660 36,300	29 2,175	75 11,625	327 107,910	50 21,000	80,857 1,143,029	
Pipe cut off and abandoned.....	9	338	507			118		50		1,017	

Pipe Laid by Contract by the Bureau of Filtration during 1902.

Purposes for which used.	SIZE IN INCHES.										Total.
	6	8	10	12	16	20	24	30	36	48	
SECOND DISTRICT.											
Supply mains.....						1,625		2,400			4,025
Supply main connections.....	140		88		28	27					283
Total.....	140		88		28	1,652		2,400			4,308
THIRD DISTRICT.											
Supply mains.....								2,171		912	3,083
Total.....								2,171		912	3,083
FOURTH DISTRICT.											
Supply mains.....								3,148		18	3,166
Supply main connections.....	80		148		17	3					248
Total.....	80		148		17	3		3,148		18	3,414
FIFTH DISTRICT.											
Supply mains.....					220	2,115		11,012			13,347
Supply main connections.....	169	30	150	68	18						435
Drains.....	4										4
Total.....	173	30	150	68	238	2,115		11,012			13,786

Pipe Laid by Contract by the Bureau of Filtration during 1902—Continued.

Purposes for which used.	SIZE IN INCHES.										Total.
	6	8	10	12	16	20	24	30	36	48	
SIXTH DISTRICT.											
Supply mains.....					8,408	12,910	2,300	8,655	2,611	3,179	38,063
Supply main connections.....	544	79	276	71							470
Drains.....	4										4
Total.....	548	79	276	71	8,408	12,910	2,300	8,655	2,611	3,179	39,037
SEVENTH DISTRICT.											
Supply mains.....					3,865	14,550			15,180	5,400	38,995
Supply main connections.....	228		472	20	10						730
Total.....	228		472	20	3,875	14,550			15,180	5,400	39,725
Grand Total.....	1,109	109	1,134	159	12,566	31,230	2,300	27,386	17,791	9,509	103,353

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High Pressure Fire Service Laid with Flange Pipe and Special Castings.

Purposes for which used.	SIZE IN INCHES.			Total.
	8	12	16	
Mains.....	3,564	9,945	999	14,508
Hydrant connections.....	1,771			1,771
Total.....	5,335	9,945	999	16,279

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TABLE

		PURPOSES FOR WHICH USED	48	Total feet and pounds.
	01			
	180,1	New pipe or feet added.		87,948
	101,1			1,064
	878,1			27
	82			142
	58			101
	82			198
	828			80
				5,098
				574
	182,1			1,066
	078,12			68
				468
	82				96,789
	82	Total.....	{ Feet..	
	187		{ Pounds.....	8,419,281
	8			
	18	Pipe used but adding nothing to feet in ground.		16,042
	52			8,754
	57			18,865
				4,828
				497
	800			1,966
	021,82			
	008,5		47	40,887
	000,804	Total.....	{ Feet.....	
			{ Pounds.....	80,550
				1,617,797
	872	Total handled.....	{ Feet.....	47
			{ Pounds.....	80,550
				187,128
				5,087,028
		Pipe cut off and abandoned.....		4,884

Total Feet of Pipe in Use December 31, 1902.

Size in Inches.	Total in use Dec. 31, 1901.	Extension during 1901 Omitted from Report.	EXTENSION AND RELAYS DURING 1902.			DEDUCTIONS DURING 1902.			Total in Use Dec. 31, 1902.
			Laid.	Relaid.	Total.	Taken up.	Abandoned.	Total.	
1	175								175
1½	3,566								3,566
2	3,855						100	200	3,855
3	82,255		298		298	688	282	915	81,638
4	199,242		402	10	412	7,869	1,955	9,444	189,810
6	4,954,290	57	88,157	13,384	101,541	4,023	1,687	5,710	5,050,178
8	243,972	9,129	7,820	675	8,495				26,596
10	418,599	151	5,768	580	6,298	206	278	484	424,864
12	485,744	11,785	11,958	1,273	13,226	887	482	869	459,886
16	122,304	8,794	18,646		18,646				144,744
18	16,085								16,085
20	228,717	6,010	81,280		81,280				285,957
22	606								606
23	27								27
24	2,896		2,362		2,362				5,058
30	283,309	33,666	27,410	148	27,558	125	50	175	294,358
36	83,431	118	17,821		17,821	22		22	101,348
48	168,897	14,060	9,509	22	9,531				192,488
Total	7,197,570	88,720	216,371	16,042	232,413	18,385	4,884	18,219	7,495,484

BROKEN MAINS.

Breaks for which no Special Reasons could be assigned, occurred in the following named Mains.

Districts.	SIZE IN INCHES.						Total.
	4	6	8	10	12	30	
First.....							
Second.....		3	.....	1	.....	.....	4
Third.....		8	2	.....	1	.....	11
Fourth.....		4	.....	1	.....	.....	5
Fifth.....							
Sixth.....		11	.....	1	1	1	14
Seventh.....	1	2	2	.....	1	.....	6
Total.....	1	28	4	3	3	1	40

The following breaks were caused by sewer contractors and street cleaners in their rough usage of fire hydrants and by water freezing in the pipes and various other causes.

Districts.	SIZE IN INCHES.							Total.
	4	6	8	12	20	36	48	
First.....								
Second.....		2	.....	.....	.....	.....	.....	2
Third.....								
Fourth.....		5	.....	1	.....	.....	.....	6
Fifth.....	2	4	.....	.....	.....	1	1	8
Sixth.....		5	.....	.....	1	.....	.....	6
Seventh.....		6	1	1	.....	.....	.....	8
Total.....	2	22	1	2	1	1	1	30

Recapitulation of Fire Hydrants Set, Renewed and Removed.

Districts.		STYLE.				Total.
		O. S.	No. 1.	No. 2.	No. 3.	
Set.	First.....		46			46
	Second.....		12	3		15
	Third.....		107	17		124
	Fourth.....		13	22		35
	Fifth.....		19			19
	Sixth.....		79			79
	Seventh.....		53	23		76
	Total.....		329	65		394
Renewed.	First.....					
	Second.....	1	23	31		55
	Third.....		6	1		7
	Fourth.....					
	Fifth.....		33			33
	Sixth.....		51			51
	Seventh.....	1	40	23		64
	Total.....	2	153	55		210
Total new fire hydrants.....		2	482	120		604
Removed.	First.....			1		1
	Second.....	3	5	1		9
	Third.....	4	9	2	4	19
	Fourth.....	5				5
	Fifth.....	1	3	1		5
	Sixth.....		10	1		11
	Seventh.....	9				9
	Total.....	22	27	6	4	59
Total added during 1902.....						335

Fire Hydrants by Wards.

Wards.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
First.....	3	200	67	8			278
Second.....	3	121	91	15			230
Third.....	3	76	42	6			127
Fourth.....	1	64	32	14			111
Fifth.....	18	100	60	7			185
Sixth.....	8	76	49	8			141
Seventh.....	6	141	85	7		1	240
Eighth.....	11	114	98	6		1	230
Ninth.....		121	79	4		1	205
Tenth.....		108	70			4	182
Eleventh.....	4	75	26	1			106
Twelfth.....	7	60	29	5			101
Thirteenth.....	23	62	70	9			164
Fourteenth.....		85	90				175
Fifteenth.....		234	210	6	1	2	453
Sixteenth.....	2	83	40	2	1		128
Seventeenth.....	12	79	34				125
Eighteenth.....	12	196	61	4			273
Nineteenth.....	31	331	124				486
Twentieth.....	19	132	139				290
Twenty-first.....	70	304	54	3			431
Twenty-second.....	70	1,077	154	17			1,318
Twenty-third.....	38	310	77	1			426
Twenty-fourth.....	50	289	153	14			506
Twenty-fifth.....	4	503	134				641
Twenty-sixth.....	1	225	123	14			363
Twenty-seventh.....	27	311	102	4		1	445
Twenty-eighth.....	1	148	135	20			304
Twenty-ninth.....	19	197	199	11		1	427
Thirtieth.....	5	119	110	6			240
Thirty-first.....		235	69	5			309
Thirty-second.....	9	126	94	10		1	240

Fire Hydrants by Wards—Continued.

Wards.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
Thirty-third.....	23	646	177	12	1	.....	859
Thirty-fourth.....	28	482	92	10	.....	1	613
Thirty-fifth.....	.....	96	10	.....	.....	.....	106
Thirty-sixth.....	7	296	100	29	.....	.....	433
Thirty-seventh.....	5	92	80	6	.....	.....	183
Thirty-eighth.....	17	376	96	7	.....	.....	496
Thirty-ninth.....	.....	207	90	7	.....	.....	304
Fortieth.....	7	203	46	2	.....	.....	258
Forty-first.....	.....	54	8	.....	.....	.....	62
Forty-second.....	.....	134	7	1	.....	.....	142
Total.....	544	8,888	3,606	281	3	13	13,335

Fire Hydrants by Purveyors' Districts.

DISTRICTS.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
First.....	20	1,318	686	102	.....	.....	2,126
Second.....	85	1,112	728	52	1	7	1,985
Third.....	111	2,257	682	17	1	.....	3,018
Fourth.....	60	995	887	44	1	4	1,991
Fifth.....	72	895	55	4	.....	.....	526
Sixth.....	84	1,526	225	82	.....	.....	1,867
Seventh.....	112	1,285	398	30	.....	2	1,822
Total.....	544	8,888	3,606	281	3	13	13,385

STATEMENT OF THE NUMBER OF F

	FIRST DISTRICT.								SECOND								
	Wards.								Total.	Wards.							
	1	2	3	4	26	30	36	39		5	6	7	8	9	10	11	
Prior to 1902.....									2,081								
During 1902.....		2	1	1	8	4	26	4	46	1		2	4		1		
Total									2,127								
Taken out, 1902.....			1						1	1		1	1	1	1		
Total in City									2,126								

Number of attachmen:

Made during 1902.....

Total

HYDRANTS BY DISTRICTS AND WARDS DURING 1902 AND

FIRST DISTRICT					THIRD DISTRICT										FOURTH DISTRICT								
				Total.	Wards.										Total	Wards.							
13	14	16	17		18	19	23	25	31	33	35	41	42	15		20	28	29	32	37	38		
				1,979										2,913									
4	2	1		15	86	13	7	19	15	21	7	1	5	124	4	8	7	10	4	2			
				1,994										3,037									
4				9	9	3		2	3	2				19		1		3	1				
				1,985										3,018									

ts for fire purposes previously reported.....

- { First District.....
- { Second District.....
- { Third District.....
- { Fourth District.....
- { Fifth District.....
- { Sixth District.....
- { Seventh District.....

Attachments, etc., made by the Purveyors, in Accordance with Permits Issued by the Bureau of Water, Arranged by Districts.

DISTRICT.	NEW ATTACHMENTS.										SHUT OFF BY PERMIT.					WORK DONE WITHOUT PERMIT.						
	SIZE.										Reamed for Larger Attachments.	Re-driven.	Discontinued.	Transfer.	REPAIRS.		Total.	DRAWN.				
	½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.	Not Drawn.					Drawn and Re-driven.	Discontinued and Abandoned.		Delinquen't.	Leak.	Total.	Drawn and Re-driven.	
First.....	461	55	14	6	1	4	5	2	2	.....	580	122	25	.....	.....	45	192	82	1	122	155	.....
Second.....	131	29	35	36	5	10	24	.....	.....	.....	270	40	188	1	.....	102	408	48	.....	81	129	155
Third.....	829	12	11	26	3	12	31	2	3	4	933	2	40	8	93	29	167	127	36	166	929	158
Fourth.....	423	10	9	14	5	4	13	.....	3	3	489	82	3	.....	53	30	195	15	.....	149	164	186
Fifth.....	238	.....	1	5	.....	.....	5	.....	.....	.....	249	1	4	7	26	26	65	2	.....	.....	2	13
Sixth.....	600	71	20	18	1	1	6	.....	.....	.....	777	67	37	9	18	16	164	.....	.....	58	53	.....
Seventh.....	1,440	113	51	11	6	4	23	8	.....	.....	1,650	37	26	1	.....	47	127	12	.....	61	73	101
Total.....	4,187	270	141	116	21	35	106	7	8	7	4,988	351	318	21	190	285	1,918	236	87	632	905	613

Permits Issued during the Year 1902.

Aquaria.....	7	Lawn sprinklers.....	7
Bakeries.....	45	Laundries.....	41
Barber shops.....	104	Laboratories.....	1
Bars.....	38	Machines for scouring, rinsing, etc.....	65
Basins and sinks in dwellings	4,020	Milk houses.....	54
Basins and sinks in offices and stores.....	782	Motors, beer.....	38
Baths in dwellings.....	5,442	Motors, organ.....	29
Baths in hotels, etc.....	6	Photograph galleries.....	3
Baths, shower.....	21	Pantry sink.....	574
Bidets.....	2	Pools, swimming.....	3
Boats, etc., supply of.....	150	Pools in churches.....	4
Bottling establishments.....	22	Restaurants and eating saloons.....	66
Building purposes.....	336	Slaughter houses.....	2
Carriages and wagons.....	154	Stables.....	110
Cellar drainers.....	11	Stalls in stables.....	1,241
Dwellings.....	5,338	Stalls, cow.....	6
Dwellings, half.....	182	Steam boilers, number.....	97
Drug stores.....	29	Steam boilers, H. P.....	2,468
Dye houses.....	2	Steam engines, number.....	70
Factories.....	15	Steam engines, H. P.....	299
Ferrules, number.....	4,932	Street sprinklers.....	95
Filters.....	3	Tubs, vats and tanks.....	11
Fire hydrants, use of.....	200	Urinals in dwellings.....	30
Fish troughs and stands.....	10	Urinals in stores, offices, etc.....	200
Forges.....	12	Urinals, trough.....	60
Fountains, counter.....	29	Wash paves and screw nozzles.....	2,003
Fountains, garden.....	3	Wash paves for watering horses.....	29
Green houses.....	21	Wash tubs, stationary.....	3,213
Heating boilers.....	30	Water closets in dwellings..	17,252
Hydrants in new buildings..	4,338	Water closets in stores, etc..	415
Hydraulic elevators.....	7		
Ice cream saloons.....	6		

Premises Supplied and Appliances in Use January 1, 1903.

Aquaria.....	18	Factories, foundries and mills.....	2,000
Arsenals.....	2	Filters.....	22
Asylums.....	7	Fire stations.....	50
Bakeries.....	1,327	Fountains, garden.....	45
Barber shops.....	1,788	Fountains, counter.....	528
Bars.....	1,768	Forges.....	1,154
Basins and sinks in dwellings.....	78,689	Furnaces.....	28
Basins and sinks in offices and stores.....	29,649	Gas works holders.....	10
Baths in dwellings.....	282,796	Glass works.....	15
Baths, public.....	1,807	Green houses.....	1,081
Baths, shower.....	275	Grind stones.....	125
Baths, foot.....	100	Halls and club houses.....	220
Beam houses and tanneries.....	26	Hatters, planks, per set.....	16
Bidets.....	442	Hydrants.....	255,741
Bottling establishments.....	661	Hospitals.....	49
Brick yards.....	15	Hotels.....	57
Brick yards, gangs of men.....	75	Hydraulic elevators.....	251
Breweries.....	98	Ice cream saloons.....	316
Barrels brewed.....	2,550,420	Institutions, charitable.....	92
Cars, steam and electric.....	1,500	Ice machines.....	156
Carriages and wagons.....	9,244	Laundries.....	791
Cellar drainers.....	47	Lawn sprinklers.....	274
Cemeteries.....	23	Laboratories.....	86
Churches.....	510	Machines for washing, scouring, etc.....	86
Coal yards.....	240	Marble yards.....	76
Coloring rooms.....	115	Malt houses.....	16
Condensers.....	20	Market houses.....	77
Depot and railway stations.....	108	Milk houses.....	402
Dwellings with water.....	244,506	Mints.....	1
Dwellings without water.....	2,000	Motors, beer.....	1,881
Dwellings half without water.....	9,738	Motors, organs.....	164
Dyers.....	750	Photograph galleries.....	134
Drug stores.....	393	Photograph galleries, operators.....	174
Dye houses.....	675	Polishing wheels.....	23
Engines on railroads.....	340		

Premises Supplied and Appliances in Use—Continued.

Police stations and patrols	50	Steam engines, number.....	2,144
Pools, swimming.....	28	Steam engines, horse power	34,445
Pools in churches.....	88	Steam saws.....	61
Printing establishments.....	176	Steam presses and hammers	66
Prisons.....	4	Shops and stores, with water	5,926
Rectifying establishments..	8	Shops, without water.....	928
Restaurants and oyster saloons.....	1,140	School houses.....	346
Shot towers.....	1	Theatres.....	21
Slaughter houses.....	457	Tubs, vats and tanks.....	2,223
Soap boiling establishments.	18	Turbine wheels.....	38
Standpipes for watering engines.....	36	Urinals in dwellings.....	256
Stalls.....	7,758	Urinals in stores, offices, etc.	4,825
Stalls in stables.....	52,445	Urinal troughs.....	782
Stalls, cow.....	174	Vinegar establishments ...	10
Stalls, fish and trough.....	98	Wash paves and screw nozzles.....	95,685
Steam boilers, number.....	3,670	Wash paves for watering horses.....	654
Steam boilers, horse power..	124,164	Washtubs, stationary.....	36,200
Steam boilers, heating.....	922	Water closets in dwellings..	250,712
Steam boilers, heating, horse power.....	5,720	Water closets in stores, etc.	27,248
		Wool washers.....	104

TABLE "A."

Service Attachments Laid to the Curb (on Streets to be Paved or Repaved) by the Bureau of Water.

DISTRICTS.	NUMBER OF CONNECTIONS.		Total.	LENGTH IN FEET.		Total in feet.
	½-inch.	¾-inch.		½-inch.	¾-inch.	
First.....	777	.....	777	10,650	.....	10,650
Second.....	20	.....	20	220	.....	220
Third.....	836	.....	836	12,096	.....	12,096
Fourth.....	146	.....	146	1,655	.....	1,655
Fifth.....	100	.....	100	1,263	.....	1,263
Sixth.....	314	.....	314	4,712	.....	4,712
Seventh.....	627	1	628	10,545	24	10,569
Total.....	2,820	1	2,821	41,141	24	41,165

Account of Iron Stop Boxes, New Stops and Check Valves for 1902.

DISTRICTS.	Iron Stop Boxes.	STOPS.						Check Valve.	Total.
		BUREAU OF WATER.		Eddy.	Ludlow.	Smith's Patent.	Eddy.		
		2-way.	Butterfly.						
First.....	89	73	.....	.....	.....	1	.....	74
Second.....	105	81	.....	.....	.....	28	.....	110
Third.....	82	184	.....	.....	2	3	.....	189
Fourth.....	145	77	.....	.....	1	4	.....	82
Fifth.....	7	36	1	.....	.....	.....	3	40
Sixth.....	4	97	1	1	.....	.....	.....	99
Seventh.....	75	113	.....	.....	5	1	.....	119
Total.....	507	661	2	1	8	37	3	1	713

Repairs to Mains, Stops and Fire Hydrants, also Stops and Fire Hydrants Removed during 1904.

DISTRICTS.	Repairs to Mains.	STOPS.			FIRE HYDRANTS.		
		Repaired.	Renewed.	Removed.	Repaired.	Renewed.	Removed.
First.....	37	195	4	1	163	.....	1
Second.....	167	235	8	17	222	55	9
Third.....	156	123	41	5	191	7	19
Fourth.....	242	510	2	8	415	.....	5
Fifth.....	7	17	4	4	42	33	5
Sixth.....	98	9	4	14	24	51	11
Seventh.....	118	291	21	4	113	64	9
Total.....	825	1,380	84	53	1,170	210	59

Check Valves Put In.

Street.	Location.	Ward.	Size.
Broad.....	54 feet south of north house line of Market street, and 15 feet west of east curb line of Broad street.....	9	12

Total Number of Stops and Valves Arranged by Districts.

Pattern.	Size.	Outlets.	DISTRICTS.							Total.
			1st.	2d.	3d.	4th.	5th.	6th.	7th.	
Single Gate. Bureau of Water.	3	2-way.	1	184	4	16	2	13	12	232
	4	2-way.	97	250	45	156	47	95	70	760
	6	2-way.	3,702	2,566	4,160	3,098	676	2,399	2,939	19,540
	8	2-way.	143	118	129	96	8	71	281	846
	10	2-way.	222	343	217	226	29	162	179	1,378
	12	2-way.	104	186	296	146	51	206	206	1,195
	16	2-way.	38	43	45	20	5	39	19	209
	18	2-way.	.....	.....	5	.....	.....	1	.....	6
	20	2-way.	24	35	19	37	14	16	24	169
	30	2-way.	8	9	29	37	13	3	4	103
	36	2-way.	3	1	9	12	11	.....	6	42
	48	2-way.	.....	.....	3	9	.....	.....	.....	12
Totals...			4,342	3,735	4,961	3,853	856	3,005	3,740	24,492
Butterfly. Bureau of Water.	20	2-way.	.....	1	5	8	3	3	5	25
	30	2-way.	2	2	6	7	9	1	5	32
	36	2-way.	.....	.....	4	17	2	.....	.....	23
	43	2-way.	.....	1	7	27	21	.....	.....	56
Totals....			2	4	22	59	35	4	10	136
Butterfly. Eddy.	30	2-way.	.....	.....	.....	.....	.....	1	.....	1
Barton.	6	4-way.	3	3	.....	12	.....	.....	14	32
	8	4-way.	.....	.....	.....	5	.....	.....	.....	5
	6	5-way.	12	24	.....	.....	.....	.....	.....	36
	6	6-way.	.....	6	.....	.....	.....	.....	.....	6
	Totals ...			15	33	17	14	79

Total Number of Stops, Valves, etc.—Continued.

Pattern.	Size.	Outlets.	DISTRICTS.							Total.
			1st.	2d.	3d.	4th.	5th.	6th.	7th.	
Viney.	6	2-way.	5	.....	4	3	.....	.....	.....	12
	6	3-way.	50	56	30	232	5	10	20	403
	8	3-way.	.....	.....	.....	.....	.....	.....	5	5
	10	3-way.	.....	.....	.....	3	.....	.....	.....	3
	12	3-way.	.....	1	.....	3	.....	.....	1	5
	6	4-way.	24	28	22	104	4	10	23	215
	8	4-way.	1	.....	2	.....	.....	.....	5	8
	10	4-way.	.....	.....	.....	14	.....	.....	4	18
	12	4-way.	.....	.....	.....	.....	.....	2	.....	2
	6	5-way.	25	5	2	26	.....	.....	3	61
	Total...			105	90	60	385	9	22	61	732
Smith's Patent.	3	2-way.	1	28	.....	1	.....	.....	6	36
	4	2-way.	4	25	2	1	.....	.....	5	37
	6	2-way.	1	42	20	16	8	6	15	108
	8	2-way.	1	.....	9	.....	.....	.....	.....	10
	10	2-way.	.....	1	8	.....	1	1	1	12
	12	2-way.	1	4	8	.....	.....	.....	.....	13
	16	2-way.	4	.....	2	.....	.....	.....	.....	6
	20	2-way.	.....	1	1	.....	.....	.....	2	4
Total....			12	101	50	18	9	7	29	226
Ludlow.	3	2-way.	.....	.....	2	.....	.....	.....	6	8
	4	2-way.	.....	.....	.....	1	.....	.....	.....	1
	30	2-way.	.....	.....	.....	.....	.....	.....	3	3
Total....			.....	.....	2	1	.....	.....	9	12
Eddy.	24	2-way.	.....	.....	.....	.....	3	.....	.....	3
Total number of stops....			4,476	3,963	5,095	4,323	912	3,039	3,863	25,681

Total Number of Stops, Valves, etc.—Continued.

Pattern.	Size.	Outlets.	DISTRICTS.							Total.
			1st.	2d.	3d.	4th.	5th.	6th.	7th.	
	12	.....	.....	1	.....	.....	.....	.....	.....	1
	20	.....	.....	.....	.....	.....	.....	.....	1	1
Check Valves.	30	.....	.....	.....	1	.....	4	.....	3	8
	36	.....	.....	.....	1	.....	4	.....	1	6
Bureau of Water.	48	.....	.....	.....	4	4	6	.....	.....	14
	Total....	.....	.....	1	6	4	14	.....	5	3

Number of Valves Raised in the Several Districts during the Year 1902.

Districts.	BARTON.			VINEY.			SINGLE GATE.					Total.
	4-way.	5-way.	6-way.	3-way.	4-way.	5-way.	8-inch.	6-inch.	10-inch.	12-inch.	30-inch.	
First.....						1		19				20
Second.....	3	1	1	2	3	1	1	15	2			29
Fourth.....					2			4		1	1	8
Seventh.....								1				1
Totals.....	3	1	1	2	5	2	1	39	2	1	1	58

Number of Complaints and Examinations during 1901 and 1902.

MONTHS.	HYDRANTS.		SERVICE PIPES.		WASH PAVES.		SPIGOTS.		WATER CLOSETS.		HORSE TROUGHS.		NO. LEAKS.		TOTALS.	
	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.
January.....	186	156	148	173	1	16	12	8	76	49	2	1	9	22	434	425
February.....	288	188	179	167	21	7	3	13	89	40	1	.....	13	27	604	442
March.....	170	153	130	181	5	7	8	9	66	69	.....	.....	9	6	388	425
April.....	116	162	97	154	10	4	8	14	66	60	.....	1	14	4	311	399
May.....	187	122	90	148	2	9	15	3	56	68	2	.....	12	9	364	359
June.....	244	148	137	133	6	1	7	6	66	37	.....	.....	13	6	473	331
July.....	116	117	71	132	1	3	1	12	33	22	3	3	.....	11	225	300
August.....	100	141	61	110	2	4	2	14	30	34	2	.....	5	8	202	311
September.....	169	122	121	124	3	5	6	10	31	32	.....	.....	13	7	343	300
October.....	163	166	175	157	5	4	22	23	52	54	2	.....	19	18	438	422
November.....	181	122	108	115	14	4	7	7	38	24	1	1	10	2	359	275
December.....	148	134	222	106	9	1	15	23	49	39	1	3	15	8	459	314
Total.....	2,068	1,731	1,539	1,700	79	65	116	142	652	528	14	9	132	128	4,600	4,303

NEW METERS SET.

Ward.	Occupant.	Location.	Business.	Date When Set.	Name of Meter.	Size.								Cubic Feet Consumed.	Remarks.	
						½-inch.	⅝-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.			6-inch.	Total.
1	J. Weaver.....	1400-42 South Front street.....	Distillery.....	Mar. 4..	Crown..				1					1	210,100	
1	N. & G. Taylor.....	N. S. Tasker street Meadow and Swanson	Tin Plate.....	June 18..	Crown..			1						1	2,100	
1	V. Ebert.....	601-13 Moore Street.....	Furniture Factory...	Dec. 11..	Trident..				1					1	7,000	
5	Brown Bros. & Co....	330 Chestnut street, S. E. cor. Fourth.....	Banking House.....	Mar. 23..	Union..						1			1	721,800	
5	Manor Real Estate and Trust Co.....	108-20 South Delaware avenue.....	Warehouse.....	April 24..	Gem....							1		1	423,000	
6	Real Estate Trust Co.	212-16 Race street.....	Paints and Oils.....	Jan. 7...	Crown..				2					2	73,900	
6	Wm. P. Datz & Bro..	237-41 North Sixth street.....	Paper Box Factory..	Feb. 15..	Crown..					1				1	112,000	
6	Commonwealth Title Ins. and Trust Co..	126 Market street.....	Miscellaneous.....	June 30..	Union..	1								1	500	
7	Clinton Hotel Co....	N. E. cor. Tenth and Clinton streets.....	Hotel.....	April 1..	Union..						1			1	372,300	
7	D. W. Van Tine.....	300 South 11th street, S. W. cor. Spruce...	Apartment House...	June 12..	Union..				1					1	100,100	
7	C. S. Warfield.....	333 South Twentieth street.....	Plumbing Shop.....	Dec. 5....	Keyst'e..	1								1	400	
8	John Stafford.....	S. E. cor. Thirteenth and Walnut streets..	Apartment House...	June 13..	Gem....							1		1	788,100	
8	B. F. Keith.....	1118 Chestnut street.....	Theatre.....	Aug. 12..	Gem....						1	1		2	62,400	
9	Master Builders Exc.	18-24 South Seventh street.....	Exhibition Building.	Feb. 8....	Union..					1				1	119,100	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date When Set.	Name of Meter.	Size.										Cubic Feet Consumed.	Remarks.
						½-inch.	⅝-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.		
9	U. S. Post Office.....	S. W. cor. Ninth and Market to Chestnut.	Post Office.....	April 18..	Stand'd.										1	9,900	
9	Peter S. Dooner.....	23-29 South Tenth street.....	Hotel.....	April 28..	Union.						2				2	1,036,300	
10	Robt. H. Foerderer..	231-35 North Sixteenth street.....	Office Building.....	Mar. 19...	Gem.....								1		1	173,300	
10	Stephen Greene.....	N. E. cor. Sixteenth and Arch streets.....	Printing Office.....	April 15..	Gem.....								1		1	271,800	
10	B. Seybert.....	230 North Twelfth street.....	Laundry and Print- ing Office.....	June 20...	Union..				1						1	90,100	
13	J. G. Donoghue.....	N. E. cor. Eighth and Vine streets.....	Restaurant.....	Jan. 3....	Crown..						1				1	708,700	
13	J. K. Wright & Son..	531-33 North Ninth street.....	Printing Ink Works..	Oct. 29...	Crown..					1					1	4,600	
15	Mary Douglas.....	810 North Twenty-fifth street.....	Dwelling.....	Feb. 4....	Trident.		1								1	2,500	
15	R. M. Green & Sons.	1413-21 Vine street.....	Mineral Waters.....	Aug. 8....	Crown..						1				1	139,100	
16	J. J. Wolf.....	927-31 N. Fifth st. and rear 924 Orkney st..	Brewery.....	June 17...	Union..				1	1					2	595,900	
16	Jacob Behrend.....	118-24 West Allen street.....	Furniture Factory....	June 30...	Union..					1					1	10,500	
17	J. M. Crouthamel....	1524 Frankford avenue.....	Blacksmith Shop.....	Jan. 17....	Crown..						1				1	9,100	
17	J. M. Crouthamel....	1528-30 Frankford avenue.....	Flour and Feed.....	Jan. 17....	Crown..						1				1	16,700	
18	H. A. Pedrick & Co..	226 East Girard avenue.....	Machine Shop.....	May 23....	Crown..						1				1	57,600	
19	Stewart Ralph Manu- facturing Co.....	S. W. cor. Mascher st. and Columbia ave..	Snuff Factory.....	Mar. 17....	Crown..					1					1	13,200	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE										Cubic feet Consumed.	Remarks.
						1/2-inch.	3/8-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.		
19	Standard Hosiery Co.	S. W. cor. Hancock and Berks streets.....	Furniture Factory .	Mar. 29...	Crown ..				1						1	26,100	
19	Wm. Ritter & Bro....	2519-37 Germantown avenue.....	Furniture Factory...	May 6....	Gem....					1					1	76,900	
19	James E. Buckley....	S. W. cor. Waterloo and York streets.....	Wheel Factory.	June 10....	Crown..			1							1	7,000	
19	Collins Mfg. Co.....	N. W. cor. Oxford and American streets .	Paper Factory.....	June 23.	Crown ..				1						1	14,400	
20	Est. of Mahlon Fulton	1615 North Ninth street.	Miscellaneous	Oct. 10 ...	Empire.					1					1	96,700	
20	Samuel S. Fretz.....	N. side Diamond, 100 ft. West of Tenth st.	Umbrellas	Nov. 12...	Union ..						1				1		No water used.
21	Geo. W. Metzler.....	114 Levering street.....	Saloon.....	April 28...	Crown ..			1							1	35,400	
21	Geo. Loughrey & Son	W. side Cresson st , N. W. of Jamestown..	Coal Yard	Aug. 27....	Trident.			1							1	51	
21	G. J. Littlewood & Sons.....	Main street, South of Walnut lane	Dye House.....	Sept. 12...	Empire.				1						1	4,800	
21	Carl Eichman.....	4311 Main street.....	Saloon.....	Sept. 17...	Crown ..				1						1	20,600	
21	David Farrar.....	117 Levering street.....	Saloon.....	Dec. 8....	Crown ..	1									1	5,100	
22	Thos. A. Gummev..	6118 Germantown avenue.....	Dwelling.....	Jan. 17...	Crown.....			1	1						2	11,800	
22	H. E. Currier.....	200 East Sharpnack street.....	Dwelling.....	Feb. 28...	Crown.....			1							1	1,800	
22	Orlando Crease....	Wayne street, 1st mill S. Berkley.....	Woolen mill.....	July 3...	Empire ..					1					1	56,700	
22	G. Woodward, M D.	400 W. Willowgrove avenue.....	Dwelling.....	Nov. 10...	Crown.....				1						1	4,500	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	Size.								Total.	Cubic Feet Consumed	Remarks
						½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
22	Morris Rufe.....	Rear N. W. cor. Wister st. & Read. Ry...	Coal yard.....	Nov. 24..	Empire	1								1	31,400	
22	Marg't S. Thurman.	N. S. Ashmead 25 ft. E. of Rubicam av.	Cotton mill.....	Dec. 16..	Union..	1								1	1,800	
22	Marg't S. Thurman.	N. S. Ashmead 320 ft. E. of Rubicam av.	Cotton mill.....	Dec. 16..	Union..	1								1	7,600	
22	Chas. W. Henry.....	N. S. Cherokee st. 150 ft S. Springfield av.	Dwelling.....	Dec. 24..	Gem....					1				1	700	
23	Kinkarter and Shep- pard.....	4669 Frankford avenue.....	Hardware.....	Feb. 7..	Pittsb'h		1							1	12,100	
23	James Bromley.....	S. W. cor. Adams & Leiper st eet.....	Carpet mill.....	May 21..	Union..				1					1	100,700	
23	Robert Megowan...	1250 Adams street.....	Hosiery mill.....	Sept. 1..	Union..				1					1	73,700	
23	Thomas Davies.....	Orthodox street N. E. cor. Large.....	Cotton mill.....	Nov. 17..	Union..				1					1	10,300	
24	Avil Printing Co.....	3941-43 Market street, and rear.....	Printing office.....	June 6..	Empire			1						1	118,800	
25	Joseph C. Campbell	2029 Willard street.....	Machine shop.....	Jan. 21..	Crown..		1							1	1,400	
25	Albert Herbst,.....	S. E. cor. Emerald st. and Allegheny av.	Hosiery factory....	May 19..	Crown..		1							1	33,200	
25	P. & R. R. W. Co.....	S. S. Allegheny av. 1,345 ft. E. Richmond.	Freight yard.....	June 20..	Trident						1			1	1,027,800	
25	Horace Linton & Bro.	3069-71 Ruth street.....	Ribbon factory.....	Nov. 10..	Union..		1							1		{ No water used.
26	N. Z. Graves & Co...	N. W. Broad and Geary streets.....	Paints and oils.....	Oct. 22..	Gem....						1			1	228,800	
27	Louis N. Kenton.....	226 S. Thirty-ninth street.....	Dwelling.....	Jan. 6..	Crown..		1							1	5,500	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.									Cubic Feet Consumed	Remarks.
						½-inch.	¾-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.			Total.
27	Quaker City Apartment House.....	N. E. cor 36th and Chestnut street	Apartment house....	June 6..	Crown..							1	1	526,930		
27	P. W. & B. R. R. Co..	S. W. S. Gray's Ferry road, 214 feet S. E. of Paschal st.....	Freight yard.....	June 26..	Hersey..							1	1	1,009,300		
28	Union Traction Co..	N. E. cor. 15th and Cumberland sts.....	Depot.....	Feb. 7..	Crown..				1				1	241,200		
29	Bergner & Engel B'g Co.....	S. side Thompson st., east of 82d st.....	Grain drying.....	May 26..	Crown..					1			1	1,100		
29	Henry Hess Brewing Co.....	S. E. c. Montgomery ave. and Carlisle st.	Bottling works.....	June 25..	Crown..				1				1	19,400		
29	Arnholt & Schaeffer	N. side Thompson st., east of 31st st.....	Brewery.....	Aug. 7..	Gem....							1	1	1,584,700		
32	William Chaplin....	2307 N. 30th st.....	Produce.....	June 11..	Empire				1				1	477,900		
32	Carbon Dioxide and Magnesia Co.....	N. W. cor. 29th st. and Montgomery ave.	Magnesia works....	Aug. 28..	Union..					1			1		No water used.	
33	Alex. Turkington....	E. s. Palsethorpe, 3d prop. N. Lehigh ave.	Cotton mill.....	April 7..	Trident				1				1	127,100		
33	John J. McCloskey..	2700 N. 2d st., N. W. cor. Lehigh ave.....	Saloon.....	June 9..	Crown..			1					1	39,700		
33	C. J. Kulp.....	1813 Jerome st.....	Dwelling.....	July 8..	Union..	1							1	1,800		
33	Florentine Wieland.	Rear 4020 Kensington ave.....	Leather works.....	July 31..	Empire				1				1	36,500		
34	P. J. McGarvey.....	1284-86 Belmont ave.....	Ice manufactory....	Feb. 11..	Gem....							1	1	8,471,700		

New Meters Set—Continued.

17

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.								Total.	Cubic Feet Consumed	Remarks.
						½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
34	Providence Mills M'g Co.....	N. E. cor. 55th st. and Girard ave.....	Woolen mill.....	July 21..	Hersey.....						1		1	599,300		
34	H. C. Carroll & Sons.	E. side 59th st., 200 feet north Girard ave.	Brick yard.....	July 29..	Hersey.....					1			1	208,400		
34	John F. Hausmann.	914 North 50th st.....	Dwelling.....	Sept. 22..	Union.....	1							1	900		
36	Atlantic Refining Co.	Old W. Passyunk ave., N. E. c. River rd.	Oil works.....	May 19..	Crown.....					1			1	40,300		
36	Quaker City Cooperation Co.....	S. E. cor. 23d and Washington ave.....	Barrel factory.....	May 28..	Crown.....				1				1	64,000		
36	Harrison Bros.....	N. s. Gray's Ferry rd, from 35th to 36th sts	Chemical works....	Oct. 7..	Gem.....						1		1	81,100		
36	John Chambers Memorial Church....	N. E. cor. 28th and Morris sts.....	Church.....	Dec. 4..	Empire.....			1					1	300		
37	George L. Pallatt...	3255 North 12th st.....	Confect'rs' supplies.	June 30..	Union.....	1							1	1,500		
37	Bessie Becker.....	1117 Dauphin street.....	Dwelling.....	July 8..	Union.....	1							1	1,200		
37	Louis J. Kolb.....	3709-31 North Broad street.....	Bakery.....	July 9..	Crown.....				2				2	104,200		
38	John Hohenadel....	S. E. Queen Lane and Reading Ry.....	Brewery.....	M'ch 25..	Crown.....		1						2	213,000		
38	Connecting Ry. Co..	E. side 17th st., 405 feet N of Lehigh ave.	Stand pipe.....	April 17..	Crown.....						1		1	155,500		
38	Link Belt Eng. Co..	N.W. Hunting Park ave. and P. & R. Ry.	Machine shop.....	June 20..	Gem.....						1		1	1,080,000		
38	Philada. Pneumatic Tool Co.....	S. E. Twenty-first and Lippincott sts.....	Tool works.....	July 22..	Union.....				1				1	206,800		

DISTRIBUTION EXPENSES DURING THE YEAR 1902.
Including Expenses of Main Office, Purveyors' Districts and Meter Shop.

Material and Labor.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Seventh District.	Distribution.	Meter Shop.	Main Office.	Totals.
Lead.....	\$1,347 22				\$1,076 34	\$658 86	\$2,244 19				\$5,326 61
Gasket.....	48 65					29 95	60 62				139 22
Coke.....	69 35	\$50 05	\$189 65	\$64 20	45 40	118 50	75 00				621 15
Wood.....						36 00	18 00				54 00
Straight pipes.....								\$23,424 99			23,424 99
Small specials.....								6,676 29			6,676 29
Large specials, 20-inch.....								1,118 35			1,118 35
Frames and covers.....	89 22		89 04		74 01	118 88	74 50				445 60
Cast iron stop boxes.....	255 51	305 41	108 67	545 21	244 13	244 91	296 95				2,000 79
Hauling, transportation and hotel.....					40 00			8,298 28			8,338 28
Supplies, tools, small stores, etc.....	1,212 77	7,154 92	1,670 29	2,566 42	1,247 85	1,012 50	873 21	491 71	\$5,554 40	\$1 50	21,785 57
Plumbing and plumbing supplies.....						25 25					25 25
Meters, etc.....									29 79		29 79
Brick, stone, lime and cement.....	595 57	300 20	284 25	1,222 40	36 40	147 50	216 80	253 96	30 00		3,087 08
Lumber.....	4,274 90	317 00	1,127 01	302 54	356 24	457 86	305 91		690 43		7,821 89
Hay, feed, etc.....	1,170 81	682 82	1,280 83	1,378 71	179 46	349 35	653 18				5,639 62
Stable supplies.....	152 87	56 08	122 73	70 81	110 75	60 57	18 98				592 29

Distribution Expenses—Continued.

Material and Labor.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Seventh District.	Distribution.	Meter Shop.	Main Office.	Totals.
Stable repairs,.....	\$198 71	\$61 32	\$234 15	\$188 00	\$59 45	\$90 80	\$127 85	.....	.....	.....	\$909 78
Stable medicines.....	85 50	5 75	26 25	6 00	.....	9 00	21 50	.....	.....	.....	104 00
Stable shoeing.....	276 50	112 00	190 00	147 50	82 89	74 00	87 25	.....	.....	.....	920 14
Supplies, stationery.....	158 17	347 99	265 05	276 59	188 85	308 27	338 82	\$144 08	\$28 40	\$410 75	2,456 47
Wages { Per diem.....	20,981 77	20,508 00	68,687 78	23,356 78	17,107 29	26,180 22	25,888 15	.....	.....	.....	197,004 00
Wages { Salary.....	4,649 00	4,584 05	7,350 88	6,737 68	2,426 88	8,889 19	8,755 15	.....	.....	.....	83,292 83
Total cost of labor and material on account of distribution.....	85,516 52	84,489 59	76,626 08	86,807 35	23,219 94	88,706 06	85,006 01	40,402 66	6,323 02	412 25	822,450 48
Buildings, grounds and reservoirs..	.....	2,779 84	14,661 77	5,099 88	14,967 65	749 20	3,958 08	.....	.....	.....	42,206 87
Filtration.....	.....	.....	.....	2,844 16	.....	.....	.....	.....	.....	.....	2,844 16
Total labor and material.....	\$85,516 52	\$87,219 43	\$91,287 85	\$44,751 84	\$88,177 59	\$34,455 26	\$88,964 09	\$40,402 66	\$6,323 02	\$412 25	\$967,510 01

Schedule of Pipe and Special Castings accepted and rejected during the Year 1902.

	Manufacturer.	SIZE IN INCHES.		Ordered.	Inspected.	Rejected.	Cancelled.	ACCEPTED	
		Pipe.	Special Castings.					Quantity	Cost.
Bureau of Water.	Donaldson Iron Co.....	6	.....	2,412	2,816	404	.....	2,412	\$10,458 82
	United States Cast Iron Pipe and Fdy. Co.	8	.....	761	878	117	.....	761	4,281 29
		10	.....	719	895	176	.....	719	5,396 21
		16	.....	103	108	5	.....	103	1,506 05
		20	.....	89	99	10	.....	89	1,795 45
	R. D. Wood & Co.....	16	.....	6	7	1	.....	6	716 38
		.....	3 to 20	30	56	31	5	25	
	Donaldson Iron Co.....	.....	3 to 20	1,953	2,241	288	.....	1,953	6,555 21
		.....	Machine	.....	.....	.....	.....	.....	737 50
	Gregor Manufacturing Co.....	.....	Stop boxes	321	331	10	.....	321	2,000 00
Cresswell & Co.....	.....	Frames & covers	150	162	12	.....	150	445 70	
	Total.....	.....	.....	6,544	7,593	1,054	5	6,589	33,892 61
Filtration.	Reading Iron Co.....	6	.....	45	69	24	.....	45	
		10	.....	48	65	20	.....	45	
		12	.....	3	4	1	.....	3	

Schedule of Pipe and Special Castings, etc. — Continued.

Manufacturer.	SIZE IN INCHES.		Ordered.	Inspected.	Rejected.	Cancelled.	ACCEPTED.	
	Pipe	Special Castings.					Quantity.	Cost.
Reading Iron Co.	16	.....	315	435	120	.....	315	
	20	.....	1,094	1,807	713	.....	1,094	
	24	.....	185	246	61	.....	185	
	36	.....	1,195	1,650	464	.....	1,195	
R. D. Wood & Co.	48	.....	604	818	214	.....	604	
	36	.....	20	39	19	.....	20	
	48	.....	8	16	8	.....	8	
Reading Iron Co.		Breeches 20 to 48.	15	17	2	.....	15	
		Specials 3 to 20.	70	75	5	.....	70	
		24 to 48	139	148	9	.....	139	
Total.....			3,738	5,398	1,660	.....	3,738	*
R. D. Wood & Co.	20	.....	82	103	21	.....	82	*
Grand totals			10,864	18,094	2,735	5	10,359	

* The cost of material used in connection with Filtration and Fire Main is included in the contract price for laying the various lines of pipe, and, being the property of the contractor, this cost cannot be given in this table.

New Attachments Made and Delivered to Districts during the Year 1902.

Districts.	Number of Attachments Made and Delivered.	FEET OF LEAD PIPE.		Total.
		$\frac{5}{8}$ -inch.	$\frac{3}{4}$ -inch.	
First.....	1,100	16,725	.....	16,725
Second.....	20	220	.....	220
Third.....	368	5,895	.....	5,895
Fourth.....	487	5,474	.....	5,474
Fifth.....	50	550	.....	550
Sixth.....	383	6,352	.....	6,352
Seventh.....	728	11,840	25	11,865
Total.....	3,081	47,056	25	47,081

APPENDIX D



REPORT

OF THE

Operations at the Construction and Repair Shop,
Bureau of Water, During the Year 1902

Philadelphia, January 8, 1903.

MR. F. L. HAND,
Chief, Bureau of Water.

SIR:—I herewith submit the annual report of the operations at the Construction and Repair Shop, Twelfth and Reed streets, for the year ending December 31, 1902.

Respectfully,

JAS. H. DEAN,
Superintendent of Shop.

MERCHANDISE.	DR.
Inventory January 1, 1902	\$27,388 46
Bolts and nuts	\$721 59
Hardware	322 54
Steel	888 15
Wrought iron	714 90
Iron castings	8,946 20
Brass castings	5,669 13
Lead castings	330 12
Chandlery	228 44
Gum goods	191 87
Coal	1,407 74
Coke	17 60
Lumber	994 76
Paints, brushes, oil, etc.	98 08
Brass fittings	284 25
Oils and tallows	133 76
Wrought iron pipes and fittings	47 54
Lead	672 83
Plug valves	340 00
Forage, stable supplies, etc.	239 38
Miscellaneous	397 94
Wages	32,228 38
	54,870 20
	\$82,258 66

MERCHANDISE.	CR.
First District	\$4,769 82
Second District	2,609 52
Third District	5,486 63
Fourth District	5,474 16
Fifth District	2,536 89
Sixth District	5,990 13
Seventh District	4,035 60
	\$30,902 75
Fairmount machinery	\$112 75
Spring Garden machinery	4,240 30
Spring Garden boilers	1,486 63
Belmont machinery	3,969 22
Belmont boilers	453 34
Queen Lane machinery	3,294 76

Queen Lane boilers	\$310 24	
Roxborough machinery	1,627 59	
Roxborough boilers	667 51	
Frankford machinery	5,529 43	
Frankford boilers	271 79	
Mt. Airy machinery	98 64	
		<hr/> 22,062 20
Buildings, grounds and reservoirs	2,248 67	
Extension, Improvement and Filtration	1,252 78	
Meter department	190 29	
Main office	245 33	
Holmesburg Water Co.	59 15	
Hydrographic work	87 75	
Distribution	295 57	
Fixed patterns	493 99	
Fire main	2,878 20	
Shop machinery	312 52	
Construction and Repair Shop	1,572 47	
Old metals	1,179 24	
		<hr/> 10,815 96
		\$63,780 91
Total Cr.	\$63,780 91	
Inventory Jan. 1, 1903	24,553 38	
		<hr/> \$88,334 29
Total Dr.	82,258 66	
		<hr/> \$6,076 63

INVENTORY, JANUARY 1, 1903.

3 No. 1 fire hydrants, \$28.00.....	84 00
1 4-inch wedge stop valve, \$13.00	13 00
12 6-inch wedge stop valves, \$14.50	174 00
4 8-inch wedge stop valves, \$22.00	88 00
6 10-inch wedge stop valves, \$30.00	180 00
3 12-inch wedge stop valves, \$37.00	111 00
5 16-inch wedge stop valves, \$65.00	325 00
4 20-inch wedge stop valves, \$100.00	400 00
2 30-inch wedge stop valves, \$190.00	380 00
2 36-inch wedge stop valves, \$300.00	600 00
1 6-inch wedge stop, hst. flanged	18 00
1 10-inch wedge stop, with flange	33 00
1 20-inch wedge stop, with flange	105 00

2 6-inch plug stop valves, \$45.00.....	\$90 00	
6 6-inch globe valves, \$30.00	180 00	
1 8-inch globe valve, \$40.00	40 00	
2 10-inch globe valves, \$55.00	110 00	
		<hr/>
		\$2,931 00
1 36-inch foot valve	\$350 00	
1 30-inch check valve	325 00	
1 20-inch check valve	170 00	
4 large drilling machines, \$60.00	240 00	
4 small drilling machines, \$45.00	180 00	
1 air pump barrel	15 00	
4 bell cranks, \$15.00	60 00	
		<hr/>
		1,340 00
Finished parts of fire hydrants	2,143 01	
Finished parts of stop valves	1,987 25	
Finished parts of rotary valves	755 80	
		<hr/>
		4,886 06
1 48-inch rotary valve unfinished	536 00	
4 20-inch rotary quadrants, \$7.00	28 00	
2 30-inch rotary quadrants, \$7.00	14 00	
5 48-inch rotary quadrants, \$10.75	53 75	
		<hr/>
		631 75
56 old style stop screws	397 25	
30 Viney stop screws, \$1.75	51 50	
12 Viney stop screws, \$4.50	54.00	
26 Barton stop screws, \$4.00	104 00	
12 Barton stop screws and bonnet, \$8.00....	96.00	
		<hr/>
		702 75
421 new style stop screws, 4-inch to 48-inch	\$1,348 50	
82 socket screws, \$2.00	164 00	
51 spindles, \$2.25	126 75	
		<hr/>
		1,639 25
441 iron bands, 4-inch to 48-inch	1,224 75	
		<hr/>
		1,224 75
216 4-inch fire hydrant valves, .68	146 88	
134 6-inch fire hydrant valves \$1.70	227 80	
		<hr/>
		374 68
27 air pump rod straps, \$9.00	243 00	
70 air pump rod brasses, \$2.50	175 00	
73 sets gibs and keys, \$4.50	329 50	
18 pump rods, unfinished	338 00	
11 spindles for drilling machines, \$6.50.....	75 50	
205 hoe heads, \$1.75	363 75	
		<hr/>
		1,520 75

Articles and tools carried in stock, issued to Districts	\$1,980 40	
		<hr/>
		\$1,980 40
25,076 pounds wrought iron, 0 $\frac{1}{4}$	\$626 90	
354 pounds Norway iron, 3 $\frac{1}{2}$	12 39	
2,348 pounds iron forgings, 9	211 32	
18,631 pounds steel	1,088 93	
1,339 pounds expansion metal, 25	334 75	
5,968 pounds lead, 4.49	267 96	
192 pounds Babbitt metal, 14	26 88	
25 pounds bismuth, \$1.95	48 75	
		<hr/>
		2,617 88
7,591 pounds stop valve castings, 2.14	162 45	
16,172 pounds fire hydrant castings, 2.09 ...	338 00	
4,385 pounds machinery castings	178 48	
8,717 pounds Ajax castings, 23 $\frac{1}{8}$	2,059 40	
3,617 pounds brass castings	523 01	
272 pounds rolled brass, 18 $\frac{1}{2}$	50 32	
		<hr/>
		3,311 16
Hardware	115 78	
Bolts and nuts	558 56	
Oils and tallows	14 63	
Chandlery	37 25	
Paints, brushes, etc.	17 92	
Gum goods	134 37	
Lumber	493 94	
		<hr/>
		1,392 45
		<hr/>
Total		\$24,553 38

Principal articles delivered to Purveyor's Districts and Works.

Districts.	No. 1 Fire Hydrants.	No. 2 Fire Hydrants.	WEDGE STOP VALVES.									CHECK VALVES.		ROTARY VALVES.		PLUGS.		FISH TRAPS.			GLOBE VALVES.		Iron Bands.			
			4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.	48-inch.	20-inch.	30-inch.	36-inch.	48-inch.	Wood.	Brass.	1½-inch.	2-inch.	4-inch.	6-inch.	8-inch.		10-inch.		
First.....	19		4	83	2	6	2								50	595										
Second.....	5	1		72		8									84											36
Third.....	58			143	10	2	9								180	258										
Fourth.....	10		6	81			8	2			1			2		204										
Fifth.....	27		5	80						1		2			12	60										2
Sixth.....	100		4	107		5	9									438										12
Seventh.....	36		2	103	10										36	138										26
Works.....										3															4	
Meter Department.....																										
Extension, Improvement and Filtration.....	2			1					4	1																
Holmesburg Water Works.....	2																									
Totals.....	289	1	21	620	22	21	28	7	1	5	1			2	312	1,698	14	10	7					4	76	

PRINCIPAL ARTICLES MANUFACTURED DURING 1902

226 No. 1 fire hydrants, \$28.00	6,328 00
14 4-inch wedge stop valves, \$13.00.....	182 00
617 6-inch wedge stop valves, \$14.50	8,946 50
24 8-inch wedge stop valves, \$22.00	528 00
25 10-inch wedge stop valves, \$30.00.....	750 00
28 12-inch wedge stop valves, \$37.00	1,036 00
6 16-inch wedge stop valves, \$65.00	390 00
5 30-inch wedge stop valves, \$190.00	950 00
1 36-inch wedge stop valve, \$300.00	300 00
2 48-inch wedge stop valves, \$625.00	1,250 00
1 20-inch rotary valve	275 00
1 48-inch rotary valve	910 00
1 36-inch foot valve (Belmont)	425 00
2 rods and pistons (Frankford)	750 00
1,464 wood plugs	734 00
1,780 brass plugs	623 00
	\$24,377 00

APPENDIX E

REPORT

OF THE

Chief Draughtsman for the Year 1902

Philadelphia, January 10, 1903.

F. L. HAND, Esq.,

Chief, Bureau of Water.

DEAR SIR:—The following report of work under my charge in the draughting room for the year 1902 is respectfully submitted.

A large number of diagrams, tables of statistics, sketches, etc., were made which were not recorded as drawings, but which were placed on temporary file if of any value for future reference.

There are now about three thousand recorded drawings in sheets, to which reference is being made daily. In order to facilitate the finding of any drawing, considerable work has been done in cross-indexing the card index.

One hundred and thirty-one drawings, relating to the following-named subjects, were made and recorded during the year:

Plans and details of buildings	26
Details of engines	13
Details of boilers	2
Details of intakes and conduits	3
Special machinery	7

Special castings	9
Check valves and details	1
Stop valves and details	5
High Pressure Fire Service	31
Plans of Pumping Stations	5
Surveys	8
Diagrams, tables and reports	15
Perspectives (water color)	1
Total	131

All of these drawings required much time and labor for their perfection, and a simple statement of the number made conveys no idea of the amount of work and engineering skill required to complete them.

About two thousand blue prints, of various subjects, for the use of the machine shop and pumping stations, were made during the year.

The electric light and printing frame enabled the work to be done at any time of the day, or at night, and on rainy days, when the sun was obscured by clouds.

The photographer was employed, during the year, in making photographs of buildings, machinery and contract work for the Bureau of Water; also in making record of drawings for the Improvement, Extension and Filtration of the Water Supply, and of the progress of contract work for the Bureau of Filtration.

From the data prepared by the inspectors of the Bureau one hundred and eighty calculations for boiler horse power were made. From these calculations are determined the water rents to be paid by the owners of steam boilers using City water from the mains.

The daily pumpage and storage charts, showing the height of water in Fairmount Pool, temperature of the air and of the water, for the year 1902, and the daily stream flow of the Perkiomen, Neshaminy, Tohickon and Wissahickon creeks have been prepared, as in previous years.

Complete detail, with specifications, for the engine house for the High Pressure Fire Service, at Delaware avenue and Race street, were prepared and the work advertised, and contract awarded on the plans.

The dimensions of the lot, 138 feet from Water street to Delaware avenue, and 71 feet from Race street to the north wall of the property on the south side of the lot, being about 9 feet less in width than originally designed for, a new drawing and a re-arrangement of the engine room floor and engine foundations had to be made.

For the Bureau of Filtration, I inspected and approved, at the Lukens Steel and Iron Company's works, Coatesville, Pa., in April, one hundred and sixty tons of steel plates for the boilers to be erected at the Frankford Pumping Station.

The material was made to comply with the following specification, which also shows the position which the plates will occupy in the boilers. One coupon was taken from every shell and head plate and from each sheet to be cut into smaller pieces.

Frankford Pumping Station, Lardner's Point, Philadelphia.

List of plates for 12 9' 0" dia. x 20' 0" long Furnace Flue and Tubular Boilers.

Open hearth flange steel having a tensile strength of 55,000 to 60,000 pounds per square inch, and an elastic limit of 33,000 pounds. Elongation not less than 25 per cent. in 8 inches. Shall not contain more than 0.06 per cent. of phosphorus, not more than 0.05 per cent. of sulphur and not more than 0.60 per cent. of manganese. Test specimens for bending thickness shall be of the same thickness as the finished plates, but for material more than $\frac{3}{4}$ " thick,

the thickness may be $\frac{1}{2}$ " thick. The cold bending test shall be made on plates in the condition in which it is to be used, and for quenching test the material shall be heated to a cherry red as seen in the dark, and then quenched in water between 80 degrees and 90 degrees Fah. Test pieces to bend before and after the quench, cold 180 degrees flat on itself without fracture on the outside of the bent portion. The standard test specimens of 8" gauged length shall be cut and finished to the standard dimensions adopted by the Committee of the International Association for Testing Materials. Each plate shall be legibly stamped with the melt number, grade of steel and tensile strength:

No. of Plates	Width in inches.	Length in inches.	Thickness in inches.	
24	121 $\frac{1}{4}$	172	$\frac{1}{8}$	Large shell.
24	121 $\frac{1}{4}$	169	$\frac{1}{8}$	Small shell.
24	18	121 $\frac{1}{4}$	$\frac{5}{8}$	Outside buttstraps.
24	18	116	$\frac{5}{8}$	Outside buttstraps.
24	20	116	$\frac{5}{8}$	Inside buttstraps.
24	20	110	$\frac{5}{8}$	Inside buttstraps.
12	45	120	$\frac{1}{8}$	Dome shell.
12	30	34	1	Manhole reinf.
36	14	18	1 $\frac{1}{4}$	Manhole plates.
240	18	49 $\frac{1}{4}$	$\frac{3}{4}$	Crown bars.
24	21 $\frac{1}{2}$	36	$\frac{1}{2}$	Gusset Plates.
24	18 $\frac{1}{2}$	36	$\frac{1}{2}$	Gusset Plates.
12	24	52	$\frac{3}{8}$	Furnace doors.
24 to sketch			$\frac{1}{2}$	Furnace front
12	122 diameter		$\frac{7}{8}$	Front heads.
12	120 $\frac{1}{2}$ diameter		$\frac{7}{8}$	Back heads.
12	46 diameter		$\frac{1}{8}$	Dome heads.

Fire box steel having a tensile strength of 52,000 to 62,000 pounds per square inch, 32,000 pounds elastic limit and 26 per cent. elongation in 8 inches. Shall not contain more than 0.04 per cent of phosphorus, not more than 0.04 per cent of sulphur and not more than 0.05 per cent. of manganese. A sample taken from the broken tensile test specimens shall not show, when bent, any single seam or cavity more than $\frac{1}{4}$ " long in each of the three (3)

fractures obtained on the test for homogeneity. Bending tests and stamping of plates to be the same as for flange steel:

No. of Plates.	Width in inches.	Length in inches.	Thickness in inches.	
12	41½	111	¾	Comb. Chamd. top.
12	41½	175	¾	Comb. Chamd. sides.
12	59	104	¾	Comb. Chamd. back.
12	61	106	¾	Comb. Chamd. front.

I also inspected and approved, at the works of the Standard Steel Casting Co., Chester, Pa., thirty-six cast steel valve decks, and at the works of H. R. Worthington, Inc., Elizabethport, N. J., fifteen sub and engine base castings, eight discharge valve chambers, six pump cylinders, three first receiver shell castings, and at the works of the George F. Blake Co., East Cambridge, Mass., three discharge valve chambers. All of these castings were for the engines to be erected at the Frankford Pumping Station.

I also visited the works of the I. P. Morris Co., Port Richmond, Philadelphia, and noted the progress being made on the 12 boilers for the same station.

REPORT
ON THE
HYDROGRAPHIC WORK
FOR THE YEAR 1902

The following report on hydrographic work and on data collected during the year 1902 is respectfully submitted.

Rainfall observations at twenty stations, three of which are provided with automatic gauges, have been continued, completing twenty years of continuous records of data relating to rainfall.

Stream flow observations on the Perkiomen, Neshaminy and Tohickon creeks, and on the Schuylkill river, were continued during the year, making nineteen years of continuous records relative to stream flow.

Owing to a leak having been found in the new dam on the Wissahickon creek, above the automatic gauge, it was necessary to drain off the lower dam again, which prevented stream flow observations from being taken after May 22nd.

Observations on the Schuylkill river with the automatic gauge put in operation at Fairmount dam in 1897 were continued.

It has been found almost impossible to make stream flow measurements on the Schuylkill river, owing to the numerous dams and slack water pools.

Observations at Fairmount dam, on the amount of water flowing over the flash boards, together with the known

amount pumped from the river, and quantity used for power through the wheels, the leakage and lockage (both estimated), give an approximate estimate of the flow of the river at Fairmount.

A comparison of the inches of rainfall flowing off in the Perkiomen and Neshaminy creeks, the flow of which are probably correct, is shown in the following table:

Inches of ainfall flowing off January to December	Perkiomen.	Neshaminy.	Schuylkill.
1898	21.50	22.22	24.39
1899	24.66	21.06	22.29
1900	15.21	17.27	18.23
1901	17.55	22.80	17.80
1902	29.01	30.74	29.02

The average daily flow of the Schuylkill river, given in Table VIII, is computed from the total monthly flow, which is often, for days at a time during the months of low flow, much less than shown in the table.

The greatest monthly rainfall on the watershed of the Schuylkill during the year was 6.32 inches, being the average of 19 stations, for the month of June. There was a deficiency of rainfall on the same area during April and May, an excess in February, June, September and October, and a mean in the remaining months.

The automatic gauge at Philadelphia recorded 24 rain-falls, that at Spring Mount, on the Perkiomen, 23, and the one at the Forks of the Neshaminy 23 in which the rate exceeded more than .25 of an inch per hour for ten (10) minute or longer periods.

The snow and rain storms of the 21st, 22d, 26th and 28th of February, combined with a high temperature, produced many freshets in the rivers and streams in Pennsylvania. The flood recorded at Pittsburg, on the Allegheny river, was far higher than ever before. At Wilkes-Barre the Susquehanna river rose higher than ever before recorded.

The Schuylkill river at Fairmount was not as high on the dam as during the freshet of October, 1869, but the back water from the Delaware river, below the dam, was higher in the wheel house than ever before noted.

The Delaware river at Trenton, N. J., was also higher than ever before known.

On the 28th of February I had an opportunity to make a personal observation of the rise of the Neshaminy creek. Beginning with 5 feet of water on the gauge at noon, the creek rose steadily to 16 feet before 6 P. M., or about 20 feet above the normal height.

The flood flow due to the rains of the 22nd and 26th having all passed down the stream, and no snow remaining on the ground in the valley, it follows that the rainfall of the 28th was the immediate cause of the high water, as falling on frozen ground, nearly all the rainfall ran directly into the stream. The total precipitation at this time was 1.32 inches, 80 per cent. of which fell in 40 minutes.

The quantity of water that 1.32 inches of rainfall would produce on the area of the Neshaminy watershed (139.3 square miles), would be 427,181,000 cubic feet. The computation from the stream flow curve of this creek shows that the quantity of water flowing away, directly due to the storm, was 323,334,000 cubic feet, or nearly all the rainfall. This calculation is based upon observations of the height of water on the gauge at the time the stream began to rise, which was continued until it subsided to the same point, 22 hours afterward. The flow per second for this period of time was 408.25 cubic feet; the flow per second for the two hours of extreme height of the creek was 10,450 cubic feet. The flow per second per square mile of watershed at the extreme height was 75.2 cubic feet. The flow per second per square mile of watershed, for the whole period of flood flow, was 29.3 cubic feet.

The flow of the Perkiomen creek (area of watershed 152 square miles), from the time it began to rise until it subsided to the same point, a period of 28 hours of flood flow, was 35.7 cubic feet per second per square mile of watershed; and for two hours of extreme height, 105.4 cubic feet per square mile. This is not the total flow of the stream in either case, but only that resulting from the previous rainfall.

From measurements made at Fairmount Dam, on the Schuylkill river, the extreme height of the river was found to be 112 inches over the crest of the dam. The formula used for the flow over the dam gives 108,755 cubic feet per second.

The Neshaminy creek was found to give 72.5 cubic feet per second per square mile of area at the extreme height. Using this quantity for 1,915 square miles, the area of the Schuylkill watershed above Fairmount Dam, it was found to give 144,000 cubic feet per second, or 35,245 cubic feet per second less than the smaller streams. This is due to the much longer flood volume of the larger stream, which will continue at a flood flow for from 36 to 48 hours after the smaller streams have subsided, or about 2 or 3 times as long at the extreme height. The yearly computation of the flow of the Schuylkill, in inches of rainfall, as compared with the computation of the smaller streams, approximates nearly the same amount. These flood flow calculations are only approximate, but they show how large a proportion of rainfall will run off the surface of the ground when certain conditions produce flood flows in the natural water courses.

In February of 1896, when the ground was frozen, a similar storm occurred, during which more rain fell, but with much less rapidity. Almost all the water passed into the creeks, and the Perkiomen and Neshaminy rose to

nearly 21 feet on the gauges. When the ground is not frozen the run-off is rarely one-half the rainfall, unless the ground storage is full, which is the case when one heavy rain follows another.

The following-named tables, compiled as in previous years, accompany this report:

- I. Monthly precipitation on sundry watersheds.
- II. }
 III. } Rainstorms exceeding $\frac{1}{2}$ inch per hour { Philadelphia.
 IV. } { Forks of Neshaminy.
 { Frederick.
 { Perkiomen Valley.
- V. Inches of rainfall flowing in the... { Perkiomen.
 { Neshaminy.
 { Tohickon.
- VI. Average annual yield of streams.
- VII. Comparative stream flow..... { Perkiomen.
 { Neshaminy.
 { Tohickon.
 { Wissahickon.
 { Schuylkill.
- VIII. }
 IX. } Monthly and daily yield of..... { Perkiomen.
 { Neshaminy.
 { Tohickon.
 { Wissahickon.
 { Schuylkill.

The Bureau is indebted to the following-named persons who have kindly furnished rainfall records:

Mr. J. L. Heacock, Quakertown, Pa.

Mr. Thomas J. Beans, Moorestown, N. J.

During the years 1901 and 1902 all observations on rainfall were taken uniformly in accordance with the instructions given at the beginning of the year.

Yours respectfully,

JOHN E. CODMAN,
Chief Draughtsman.

Philadelphia.

	TICKON SERIES.			NESHAMINY SERIES.		
	Quakertown.	Smith's Corner.	Point Pleasant.	Lansdale.	Forks of Neshaminy.	Doylestown.
ELEVATIONS ABOVE SEA LEVEL	36	480	119	350	143	405
	in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.
January	3.26	2.98	2.85	3.19	2.53	4.00
February	5.05	4.28	6.32	6.92	5.32	7.43
March	4.90	3.50	4.28	3.74	3.45	6.16
April	4.31	3.46	3.50	3.53	3.39	3.28
May	4.55	1.77	1.72	1.52	2.02	1.83
June	5.15	5.03	5.07	3.50	6.89	6.13
July	3.99	5.57	4.46	2.68	4.70	4.03
August	3.32	2.87	3.21	2.15	4.61	5.14
September	7.90	6.68	7.17	4.08	5.74	6.33
October	5.68	6.41	5.88	5.29	6.95	7.77
November	7.70	1.72	1.66	1.63	1.75	1.59
December	3.06	6.57	7.63	6.45	6.59	7.94
Total	4.87	50.84	53.15	45.78	53.04	61.63
Percentage	111	102	107	92	107	124
20 years yearl	1.13	52.26	49.74	45.81	46.47	48.47
	112	131	123	114	116	118
Average defic	74	-1.42	3.41	0.63	6.57	13.16
Percentage d	14	-35	85	0.00	16	32

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TABLE II.

Rain Storms Exceeding in Rate 0.25 Inches per Hour as Recorded by the Automatic Rain Gauge at Philadelphia, for the Year 1902.

DATE OF OBSERVATION. 1902.	AUTOMATIC RAIN GAUGE.					REMARKS.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in Inches.	Duration—Hours, Minutes.	Amount in Inches.	Duration in Minutes.	Rate per Hour During Maximum Fall.	
February 28th, rain storm..	1.08	4—10	.51	.48	.64	Heavy freshet on the Schuylkill river. 10 feet $\frac{1}{2}$ inch on Fairmount dam.
March 17th, rain storm.....	.42	9—30	.22	.40	.33	
April 29th, rain storm.....	1.24	13—00	.40	.25	.96	
May 25th, shower.....	.25	1—30	.10	.15	.40	
June 16th, shower.....	.84	5—25	.64	.60	.64	
June 17th, shower.....	.45	—30	.45	.30	.90	
June 21st, shower.....	.75	4—30	.20	.20	.60	
June 29th, shower.....	1.82	8—10	1.02	.60	1.02	
July 3d, shower.....	1.18	3—15	.88	.25	2.11	
July 25th, rain storm.....	1.98	7—10	1.66	.60	1.66	
July 29th, shower.....	.51	5—40	.30	.15	1.20	
August 6th, shower.....	.70	1—30	.60	.45	.80	
August 7th, shower.....	.44	2—45	.30	.10	.60	
August 10th, rain storm.....	1.44	20—0	.40	.35	.70	
August 11th, shower.....	.36	2—0	.33	.20	.66	
September 9th, rain storm..	.77	14—50	.20	.25	.48	
September 25th, rain storm.....	.....	.....	.15	.25	.36
September 26th, rain storm.	2.61	30—25	.15	.20	.45	
October 5th, rain storm.....	1.2	36—55	.15	.20	.45	
October 6th, rain storm.....	1.03	.....	.15	.10	.45
October 11th, rain storm....	1.84	22—30	.20	.30	.40	
October 28th, rain storm....	1.30	12—30	.15	.25	.36	
December 21st, rain storm..	2.02	17—0	.35	.30	.70	
December 21st, rain storm..	2.02	17—00	.45	.10	.90	

TABLE III.

Rain Storms Exceeding in Rate 0.25 Inches per Hour as Recorded by the Automatic Rain Gauge at Forks of Neshaminy for the year 1902.

DATE OF OBSERVATION. 1902.	AUTOMATIC RAIN GAUGE.					REMARKS.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in Inches.	Duration—Hours, Minutes.	Amount in Inches.	Duration—In Minutes.	Rate per Hour during Maximum Fall.	
February 28th, rain storm..	1.36	5—30	.80	40	1.20	Very heavy freshets on the Neshaminy Creek rose 16 feet above normal flow.
April 8th, rain storm.....	2.18	17—10	.30	60	.30	
April 29th, rain storm.....	1.03	25—30	No	Record.		
May 25th, shower.....	.53	2—00	.20	15	.80	
June 16th, shower.....	.96	5—30	.30	10	1.80	
June 21st, shower.....	2.13	11—25	.73	15	2.92	
June 24th, shower.....	.27	—50	.25	30	.60	
June 29th, rain storm.....	1.53	11—5	.35	20	1.05	
July 8d, shower.....	.17	—30	.15	15	.60	
July 15th, shower.....	.61	4—35	.35	15	1.40		Hail with rain.
July 24th, shower.....	1.51	3—20	1.01	25	2.40	{ Hail, thunder & lightning.
July 25th, shower.....	1.13	3—30	.88	31	1.76	Thunder storm.
August 3d, shower.....	.59	2—10	.49	15	1.66	
August 6th, shower.....	.53	2—10	.40	30	.80	
August 10th, rain storm....	1.96	14—35	.96	60	.96	
August 11th, shower.....	.73	—50	.70	20	2.10	
August 27th, shower.....	.27	—45	.25	30	.50	
September 9th, rain storm..	1.10	14—35	.17	15	.63	
September 20th, rain storm.	.43	4—00	.10	10	.60	
September 25th, rain storm.	3.63	45—10	.40	40	.60	
September 29th, rain storm.	.28	—30	.18	20	.54	
October 12th, rain storm....	1.98	21—25	.15	12	.75	
October 28th, rain storm....	1.01	11—20	.20	20	.60	

TABLE IV.

Rain Storms exceeding in rate 0.25 inches per Hour, as recorded by the Automatic Rain Gauge at Spring Mount, for the Year 1902.

DATE OF OBSERVATION. 1902.	AUTOMATIC RAIN GAUGE.					REMARKS.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in Inches.	Duration—Hours. Minutes.	Amount in Inches.	Duration in Minutes.	Rate per Hour during Maximum Fall.	
January 21st, rain storm.....	1.91	30—00	.30	40	.45	Heavy freshet on the Perkiomen. Creek rose 20 feet above normal height.
February 28th, rain storm....	1.70	8—30	.58	40	.87	
February 28th, rain storm....	1.70	8—30	.20	20	.60	
March 17th, rain storm.....	.40	15—45	.25	30	.50	
April 8th, rain storm.....	1.50	16—50	.30	40	.45	
April 29th, rain storm.....	.90	13—00	.25	40	.38	
May 25th, rain storm.....	1.22	13—20	.97	48	1.21	
June 16th, shower.....	.48	4—35	.10	20	.30	
June 24th, shower.....	.22	45	.15	15	.60	
June 25th, shower.....	1.42	6—30	.45	00	.45	
June 29th, rain storm.....	1.53	13—45	.25	20	.75	
June 29th, rain storm.....	1.53	13—45	.30	30	.60	
July 5th, shower.....	.28	15	.25	15	1.00	
August 3d, shower.....	.20	15	.20	15	.80	
August 6th, shower.....	.15	15	.15	15	.60	
August 11th, rain storm.....	.77	23—35	.10	20	.30	
August 15th, shower.....	.20	20	.20	20	.60	
August 28th, shower.....	.28	2—40	.25	30	.50	
September 9th, rain storm....	1.42	14—20	.59	40	.89	
September 25th, rain storm....	.....	.....	.10	10	.60
September 26th, rain storm....	3.43	28—50	.15	20	.45	
October 5th, rain storm.....	1.33	17—50	.25	30	.50	
October 12th, rain storm.....	1.40	22—15	.40	30	.80	
October 27th, rain storm.....	1.37	13—30	.10	10	.60	
December 16th, rain storm....	2.36	17—40	.25	40	.38	
December 21st, rain storm....	1.27	16—00	.35	40	.50	

TABLE V.

Inches of Rainfall Flowing in the Perkiomen, Neshaminy and Tohickon Creeks.

Watersheds.	Area in Miles.	PERCENTAGE OF TOTAL AREA.				AVERAGE FOR 19 YEARS, 1883-1902.												
		Woodland.	Cultivated.	Flats.	Roads	January.	February.	March	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Perkiomen at Frederick, 19 years.....	152	25	71	2	2	2.84	3.66	3.77	2.12	1.43	0.82	1.25	0.95	0.96	0.92	1.58	2.32	
Neshaminy below Forks, 19 years.....	139.3	6	92	¼	1¼	3.20	4.12	3.55	2.05	1.89	0.75	1.03	0.99	0.84	0.81	1.42	2.46	
Tohickon, 19 years.....	102.2	24	72	2	2	3.74	4.64	4.74	2.48	1.96	0.77	1.16	.....	.....	0.94	1.92	2.75	
Perkiomen at Frederick .	}					Maximum, 19 years.....	5.40	9.73	5.58	3.48	6.66	2.65	4.89	2.48	3.63	2.77	6.67	6.45
						Minimum, 19 years.....	0.59	1.25	2.38	0.97	0.46	0.23	0.17	0.28	0.16	0.20	0.24	0.63
Neshaminy below Forks..	}					Maximum, 19 years.....	6.77	10.41	5.55	3.57	7.41	2.46	5.47	3.37	3.51	4.55	6.31	5.55
						Minimum, 19 years.....	1.60	0.90	1.84	1.03	0.25	0.08	0.04	0.14	0.03	0.06	0.11	0.41
Tohickon	}					Maximum, 19 years.....	7.34	10.41	7.10	4.76	8.56	3.43	6.41	3.75	5.49	4.24	7.07	7.58
						Minimum, 19 years.....	0.54	1.19	2.98	0.73	0.30	0.08	0.11	0.04	0.05	0.05	0.14	0.67

TABLE VI—Average Annual Yield of Sundry Watersheds to October 1, 1902.

Watersheds.	Period covered, years.	Area in miles.	Average rainfall in inches.	Average rainfall flowing off in inches.	Per cent. flowing off.	Average annual yield in gallons.	Average daily yield in gallons.	Average yield in cubic feet per second per sq. mile of drainage area.	Average yield in cubic feet per second per square mile of drainage area for each inch of rainfall.
Perkiomen at Frederick..	19	152.0	47.365	22.696	48.00	59,948,940,000	164,211,500	1.6716	0.0353
Neshaminy, below Forks.	19	139.3	47.721	2.484	47.118	54,427,535,000	149,093,300	1.6561	0.0347
Tohickon	19	102.2	48.685	27.344	56.200	48,592,436,000	133,023,000	2.0140	0.0413
Wissahickon		64.6	Norecord after April—See			Table VIII.			
Schuylkill.....	4	1,915	47.135	20.843	48.400	.....	1,900,801,000	1.5359	0.0325
Sudbury, Mass.....	27	72.5	46.39	22.702	48.90	.....	78,371,000	1.6750	0.0362
Croton, N. Y.....	19	338.0	45.97	22.780	49.50	135,400,000,000	371,600,000	1.680	0.0365

TABLE VII—Comparative Daily Stream Flow, 1901 and 1902.

Watersheds.	Area of watershed.	MAXIMUM GALLONS.		Date.	MINIMUM GALLONS.		Date.
		Per day.	Per sq. mile.		Per day.	Per sq. mile.	
Perkiomen.....	152	4,420,000,000	27,300,000	February 23..	11,631,000	76,400	August 25
Neshaminy.....	139.3	3,930,000,000	23,250,000	February 28..	8,080,000	57,800	July 21
Tohickon.....	102.2	3,851,000,000	27,700,000	March 1..	1,810,000	17,700	September 8
Wissahickon.....	64.6	1,288,200,000	20,000,000	February 23			
Schuylkill.....	1,915	53,098,600,000,000	27,700,000	March 1			

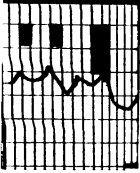
HICKON

PER CENT OF RAINFALL	Rainfall in Inches.
3	1.687
4	1.952
14	7.860
	3.080
7	5.215
9	4.075
10	3.592
10	1.632
5	5.242
20	4.687
73	2.692
17	7.527
8	49.141
78	5.887
19	1.672
54	7.280

Year	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	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	50.0	50.1	50.2	50.3	50.4	50.5	50.6	50.7	50.8	50.9	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9	54.0	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0	55.1	55.2	55.3	55.4	55.5	55.6	55.7	55.8	55.9	56.0	56.1	56.2	56.3	56.4	56.5	56.6	56.7	56.8	56.9	57.0	57.1	57.2	57.3	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.1	59.2	59.3	59.4	59.5	59.6	59.7	59.8	59.9	60.0	60.1	60.2	60.3	60.4	60.5	60.6	60.7	60.8	60.9	61.0	61.1	61.2	61.3	61.4	61.5	61.6	61.7	61.8	61.9	62.0	62.1	62.2	62.3	62.4	62.5	62.6	62.7	62.8	62.9	63.0	63.1	63.2	63.3	63.4	63.5	63.6	63.7	63.8	63.9	64.0	64.1	64.2	64.3	64.4	64.5	64.6	64.7	64.8	64.9	65.0	65.1	65.2	65.3	65.4	65.5	65.6	65.7	65.8	65.9	66.0	66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2	70.3	70.4	70.5	70.6	70.7	70.8	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.6	71.7	71.8	71.9	72.0	72.1	72.2	72.3	72.4	72.5	72.6	72.7	72.8	72.9	73.0	73.1	73.2	73.3	73.4	73.5	73.6	73.7	73.8	73.9	74.0	74.1	74.2	74.3	74.4	74.5	74.6	74.7	74.8	74.9	75.0	75.1	75.2	75.3	75.4	75.5	75.6	75.7	75.8	75.9	76.0	76.1	76.2	76.3	76.4	76.5	76.6	76.7	76.8	76.9	77.0	77.1	77.2	77.3	77.4	77.5	77.6	77.7	77.8	77.9	78.0	78.1	78.2	78.3	78.4	78.5	78.6	78.7	78.8	78.9	79.0	79.1	79.2	79.3	79.4	79.5	79.6	79.7	79.8	79.9	80.0	80.1	80.2	80.3	80.4	80.5	80.6	80.7	80.8	80.9	81.0	81.1	81.2	81.3	81.4	81.5	81.6	81.7	81.8	81.9	82.0	82.1	82.2	82.3	82.4	82.5	82.6	82.7	82.8	82.9	83.0	83.1	83.2	83.3	83.4	83.5	83.6	83.7	83.8	83.9	84.0	84.1	84.2	84.3	84.4	84.5	84.6	84.7	84.8	84.9	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.7	85.8	85.9	86.0	86.1	86.2	86.3	86.4	86.5	86.6	86.7	86.8	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	88.0	88.1	88.2	88.3	88.4	88.5	88.6	88.7	88.8	88.9	89.0	89.1	89.2	89.3	89.4	89.5	89.6	89.7	89.8	89.9	90.0	90.1	90.2	90.3	90.4	90.5	90.6	90.7	90.8	90.9	91.0	91.1	91.2	91.3	91.4	91.5	91.6	91.7	91.8	91.9	92.0	92.1	92.2	92.3	92.4	92.5	92.6	92.7	92.8	92.9	93.0	93.1	93.2	93.3	93.4	93.5	93.6	93.7	93.8	93.9	94.0	94.1	94.2	94.3	94.4	94.5	94.6	94.7	94.8	94.9	95.0	95.1	95.2	95.3	95.4	95.5	95.6	95.7	95.8	95.9	96.0	96.1	96.2	96.3	96.4	96.5	96.6	96.7	96.8	96.9	97.0	97.1	97.2	97.3	97.4	97.5	97.6	97.7	97.8	97.9	98.0	98.1	98.2	98.3	98.4	98.5	98.6	98.7	98.8	98.9	99.0	99.1	99.2	99.3	99.4	99.5	99.6	99.7	99.8	99.9	100.0	

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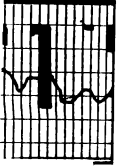


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APPENDIX F

ANNUAL REPORT

OF THE

Chief Engineer of the Bureau of Filtration

For the Year 1902

DEPARTMENT OF PUBLIC WORKS

BUREAU OF FILTRATION

(Improvement, Extension and Filtration of the Water Supply)

OFFICERS--1902

Chief Engineer,
JOHN W. HILL.

First Assistant Engineers,
RICHARD I. D. ASHBRIDGE,
HENRY C. HILL,
GEORGE T. PRINCE.

Assistant Engineers in Charge of Construction.

Frank R. Fisher, Upper and Lower Roxborough Filters and Auxiliaries.

La Monte Lloyd, Belmont Filters and Reservoir.

T. Nelson Spencer, Torresdale Conduit.

Fred. C. Dunlap, Torresdale Filters.

Fred. Schaffhauser, Distribution Pipe Lines.

D. Jones Lucas, Oak Lane Reservoir, and Lardner's Point Pumping Station, No. 2.

W. W. De Berard, Acting Assistant Engineer in charge of Testing Stations.

Clerical.

J. William Lee, Chief Clerk.

Howard L. Klotz, Stenographer.

John J. Klang, Messenger.

ANNUAL REPORT
OF THE
Chief Engineer of the Bureau of Filtration
FOR THE YEAR 1902

Philadelphia, December 31, 1902.

HON. WILLIAM C. HADDOCK,
Director, Department of Public Works.

DEAR SIR:—I have the honor to submit the following report for the year ending December 31, 1902, on the operations connected with the Improvement, Extension and Filtration of the Water Supply:

From January 1st to August 1st the work was conducted as an adjunct of the Bureau of Water, from the latter date to the end of the year the work has been conducted under the auspices of an independent Bureau, known as the Bureau of Filtration, created by Ordinance of Councils of July 18, 1902. No change has been made in the organization of the staff, but all official correspondence which, previous to the creation of the Bureau, passed through the Bureau of Water or Bureau of Surveys, has since August 1st been transmitted direct to and from your office, thereby saving valuable time and labor to this Bureau in the conduct of its work, and relieving the older Bureaus of considerable labor and inconvenience in the formal transmission of important and urgent communications to your office.

The duties of this Bureau are limited to the preparation of plans, specifications and contracts for the construction of the works required for the general improvement of the water supply; the management of contracts during construction, and the operation of the filters and other details of the work until such time as, by your direction, they are formally transferred to the custody and control of the Bureau of Water.

The improvement of the Water Supply of Philadelphia embraces three distinct propositions:

First. The filtration of the entire water supply, assumed in the near future at 300,000,000 gallons per day of 24 hours.

Second. A transfer of the source of water for the districts now supplied from the Fairmount, Corinthian, East Park and Queen Lane Reservoirs from the Schuylkill to the Delaware river.

Third. An adjustment of the water services of all but that portion of the City lying west of the Schuylkill river, comprising the Twenty-fourth, Twenty-seventh, Thirty-fourth and Fortieth Wards, to adapt them to an economical operation of the Upper and Lower Roxborough and Torresdale filters.

Nearly all the more important details of the work have been completed and placed under contract.

Considering all conditions affected, the purchase and supply of materials, the supply of labor and the natural difficulties attendant upon the preparations for large works involving many features novel to American contractors, a generally satisfactory rate of progress has been obtained with all the construction contracts. As a rule the contractors have been diligent in forwarding their work, and in some respects the machinery and appliances brought on the work to secure rapid and satisfactory construction re-

sults, probably have not been surpassed on any works of like character conducted in this country or abroad.

In the report of the Commission on the Extension and Improvement of the Water Supply, September 15, 1899, it was very wisely recommended that at no time should the consumption of water from the Schuylkill river exceed 150,000,000 gallons per day. In the light of this quantity of water it may be well to consider the ultimate capacity of the two Roxborough Filtration Stations and the Belmont Station combined, all of which must, for an indefinite period of time, draw their raw water from the Schuylkill river at the Shawmont and Belmont Pumping Stations.

Lower Roxborough, 5 filters	12,000,000 gallons.
Upper Roxborough, 15 filters	37,800,000 gallons.
Belmont, 26 filters	92,000,000 gallons.
Total	141,800,000 gallons.

As the growth of population and demands on the Belmont works will probably increase in a high yearly ratio for the next twenty years, the inadvisability of expending large sums of money for filters and other works to supply that part of the City lying between the two rivers, and south of the water purveying district to be supplied from the Roxborough works from the Schuylkill river, should be obvious. However, the revision of the plans of the Commission of Experts suggested the wisdom of proceeding at once to establish the main source of supply and works of filtration on the sites selected by them on the banks of the Delaware river at Harrison Mansion, and to make the works broadly and promptly available by the construction of the Torresdale Conduit (Contract No. 14), of the Lardners Point Pumping Station (Contract No. 29), and the Lardners Point Pipe Distribution System (Con-

tract No. 28), together with the auxiliary works necessary to make complete and operative the principal contracts.

Financial.

The total fund provided by law for the improvement of the water supply amounts to \$17,000,000, created as follows:

By Ordinances, June 17, July 12, 1898..	\$500,000 00
By Ordinance January 12, 1900	3,200,000 00
By Ordinance, March 23, 1900	12,000,000 00
By Ordinance, June 30, 1902	1,300,000 00
	\$17,000,000 00

Against the fund thus provided there has been charged off for

Completed Contracts	\$48,564 86
Limits of Uncompleted	
Contracts	\$12,328,000 00
Paid on account of Uncompleted Con-	
tracts	4,960,252 83
Amount still due on account of Uncom-	
pleted Contracts	7,367,747 17
Purchases of Land	517,325 16
Expenses and Supplies	89,417 94
Soundings and Borings	3,213 04
Inspections	7,293 82
Salaries and Wages of Engineering	
Staff	302,816 47
Expended by Bureau of Water for	
work not embraced in above items	1,095,754 00
	14,392,385 29
Leaving an available balance of	\$2,607,614 71

With one or two exceptions it is believed that the limits placed on each contract will embrace all additional and unforeseen work liable to arise under such contracts, and the difference between the actual cost and the limits of contracts will merge in the improvement fund and increase correspondingly the balance available for future contracts.

Contract No. 10.

LOWER ROXBOROUGH FILTERS.

For a description of this contract see Annual Report of the Bureau of Water for 1901.

This contract was completed June 1st, and the work done during the year to the time of completion consisted of placing puddle back of walls of the last four filters; constructing about one-half of the necessary embankments and building three regulator houses.

Total payments to contractor, \$229,880.20.

Contract No. 11.

HIGH SERVICE PUMPING MACHINERY FOR LARDNERS POINT STATION.

The work under this contract embraces the furnishing and erection in the new pumping station now being erected at Lardners Point, on the Delaware river, under Contract No. 29; three self-contained vertical triple expansion crank and fly wheel pumping engines, each of 20,000,000 gallons daily capacity against a static head of 210 feet above C. D., steam pressure of 150 pounds at the engine throttle, and three batteries of marine type fire box boilers. Each battery consists of four boilers of 200 commercial horse power each, with steam at 160 pounds pressure, and one 30-ton electric traveling crane.

The work of construction of these engines is now well under way. The pump end of the first engine is completed and the work of assembling the steam end begun. About 650 tons of material have been prepared for the second engine, of which about 40 per cent has been finished and about 20 per cent assembled in the construction shop. Of the third engine 530 tons have been made, of which 10

per cent. is finished. When completed the engines will weigh approximately 950 tons each. The boilers, forming part of this contract are being constructed at the works of the I. P. Morris Company, Philadelphia. The first and second batteries are completed at the shops, the third battery is about one-half completed.

Total payments to contractor, \$38,871.63.

Contract No. 12.

UPPER ROXBOROUGH FILTERS.

For a description of this contract see Annual Report of the Bureau of Water for 1901.

At the beginning of the current year the status of the work on this contract was as follows:

The excavation for the filtered water basin and pipe trenches and sewers completed, terra-cotta pipe laid and manholes built, about three-fourths of the cast iron water pipe laid. All of the puddle in the bottom of the filtered water basin was laid, and some of the lower courses placed on the filter floors; concrete floor of the filtered water basin completed and 72 piers built.

During the year this contract has been practically completed with the exception of the paving of the court, which is about 50 per cent. completed, and some minor details, such as placing the regulating valves and indicating apparatus, etc.

After completion and before the placing of the filtering materials the filter tanks were tested for water tightness by filling to the normal depth and recording the leakage. No filter tank is accepted that shows a leakage of more than 1,000 gallons per day, which corresponds to a fall in the water surface of 0.05 inch in 24 hours.

Total payments to contractor, \$511,372.15.

*Contract No. 13.*PATTERNS, CORE BOXES AND MANUFACTURE OF BELL END
GATE AND ROTARY STOP VALVES.

The work under this contract consisted of the manufacture and delivery of 17 rotary stop valves from 20 inches to 48 inches in size; also the manufacture and delivery of the patterns and core boxes for the above mentioned valves.

This contract was completed November 22, 1902.

Total payments to contractor, \$12,825.00.

Contract No. 14.

TORRESDALE CONDUIT.

For a description of this contract see Annual Report of the Bureau of Water for 1901.

During the year all the shafts have been sunk to their full depth, and 67½ per cent. of the headings and 61 per cent. of the benching completed.

Total payments to contractor, \$398,832.56.

Contract No. 16.

BELMONT FILTERS AND RESERVOIR.

For a description of this contract see Annual Report of the Bureau of Water for 1901.

The work performed on this contract prior to the year 1902 consisted mainly of excavating for the reservoir and filters, and the construction of the drainage system. Practically no puddle and no concrete, with the exception of the sub-structure for the reservoir gate house, was placed before May of this year. The progress made since then is shown by the following statement of quantities, and the percentages of them thus far completed for the most important items:

Item.	Quantities.	Per cent. Completed.
Excavation	550,000 cubic yards	100
Embankment	319,400 cubic yards	69
Concrete	67,600 cubic yards	55
Puddle	69,600 cubic yards	55
Pipe	3,800 tons	81
Valves	261	78

Seventy-one per cent. of all the work embraced in this contract is completed.

Total payments to contractors, \$1,096,484.67.

Contract No. 17.

EXTENSION OF PIPE DISTRIBUTION SYSTEM.

The work under this contract consists in furnishing, delivering and laying cast iron water pipe on Pipe Lines "A to J," inclusive, the routes of which are described under Contract No. 9 (Bureau of Water Report for 1901), and the pipe around the Lower Roxborough Reservoir, and at the crossings of Frankford Creek at Frankford avenue and at Old Front street.

This contract was completed October 24, 1902.

Total payments to contractor, \$749,455.01.

Contract No. 18.

LOW SERVICE PUMPING MACHINERY FOR THE UPPER ROXBOROUGH FILTERS.

This contract embraces three vertical, compound, condensing, crank and fly wheel engines, and three horizontal rotary centrifugal or impeller pumps, each of a maximum capacity of 10,000,000 gallons in 24 hours, against a static head of 25 feet, with a steam pressure of 100 pounds at engine throttle.

The engines are being erected in the addition to the Rox-

borough Auxiliary Pumping Station (Contract No. 21), and will lift the water from the Upper Roxborough Reservoir to the Upper Roxborough Filters. This work is well advanced, and it is expected that the machinery will be completed and started by February 1, 1903.

No payments have been made to the contractors.

Contract No. 19.

BELMONT RISING MAINS, UPPER ROXBOROUGH CONNECTION PIPE AND EXTENSION OF DISTRIBUTION PIPE SYSTEM.

The work under this contract embraces the furnishing, delivering and laying certain lines of distribution mains with their valves and other appurtenances. For the location of these lines see report of the Bureau of Water for 1901. Most of the lines are now completed, and it is expected that all of them will be completed during January, 1903.

Total payments to contractor, \$425,089.50.

Contract No. 20.

TRIPLEX PUMPS AND GASOLINE DRIVING ENGINES FOR UPPER ROXBOROUGH FILTERS.

The work embraced under this contract consists of the furnishing, delivery and erection of two vertical triplex pumps of 1,200,000 gallons capacity, each in 24 hours, and two gasoline driving engines each 67.4 horse power, including all appurtenances, to be installed in the new Administration Building and Pumping Station now being erected on the site of the upper Roxborough Filters under Contract No. 23-A. These pumps will take water from the clear water basin and supply it to the sand ejectors,

and also pump to the sand washers. The engines and pumps have been delivered but have not been erected.

No payments have been made to the contractors.

Contract No. 21.

LOW SERVICE PUMPING STATION FOR UPPER ROXBOROUGH FILTERS.

This contract consists in the construction of an addition to the present Roxborough Auxiliary Pumping Station, situated at the intersection of Shawmont avenue and Eva street, in the Twenty-first Ward, and is intended for the accommodation of the low service pumping machinery, constructed under Contract No. 18, for raising the subsided water from the Upper Roxborough Reservoirs to the level of the Upper Roxborough Filters on Port Royal avenue.

The contract is practically completed, except in a few minor details, pending the erection of the pumping machinery.

Total payments to contractors, \$18,636.42.

Contract No. 22.

HAND TRAVELING CRANE FOR ROXBOROUGH AUXILIARY PUMPING STATION.

This contract embraces the construction of a hand traveling crane for the low service pumping station of the Upper Roxborough Filters (Contract No. 21), capable of raising and safely sustaining a load of 6 tons.

The crane was tested July 11, 1902, and met all contract requirements.

Total payments to contractors, \$2,800.00.

*Contract No. 23-A.*ADMINISTRATION BUILDING AND PUMPING STATION AT
UPPER ROXBOROUGH FILTERS.

The work under this contract consists of the construction of a building located at the site of the Upper Roxborough Filters, containing an office for administration purposes, toilet and locker rooms, storeroom and engine room for the engine and pumps furnished under Contract No. 20.

The building is under roof, the engine and pump foundations completed and the interior finishings well under way.

Total payments to contractors, \$17,943.24.

*Contract No. 24.*COLLECTOR PIPES AND FILTERING MATERIALS FOR THE
UPPER AND LOWER ROXBOROUGH FILTERS, AND SAND
WASHERS FOR THE LOWER ROXBOROUGH FILTERS.

The work embraced under this contract consists in furnishing and laying the terra-cotta lateral collectors, delivering and placing the filter sand and gravel in the Upper and Lower Roxborough Filters, and the construction of two sand washers at the Lower Roxborough Station. The work under this contract, on the Lower Roxborough Station, was completed November 6, 1902.

The contractor is now at work placing filtering materials in the Upper Roxborough Filters. In Filter No. 7 all the lateral collectors and gravel have been placed, and about 50 per cent. of the sand. In Filters Nos. 3 and 5, the work of placing the collectors and gravel is in progress.

Total payments to contractor, \$112,525.75.

Contract No. 25.

TORRESDALE FILTERS.

For a description of this contract see Annual Report of the Bureau of Water for the year 1901.

Work was started on this contract January 23, 1902, but owing to the condition of the weather practically nothing was done until March 27, 1902, since which date the progress of the work has steadily increased, and a large force of men, also a very complete working plant is engaged.

The following are the principal quantities involved in the construction of the work, and the percentage of same completed:

	Total Quantities.	Percentage done.
Total work on filters ...		33
Total work on filtered water basin.....		21
Filters:		
Excavation	582,000 cubic yards	60
Puddle	83,700 cubic yards	30
Concrete	135,800 cubic yards	11
Cast iron pipe, laid	7,820 tons	19
Main sewers	4,385 linear feet	100
Concrete conduits.....	3,838 linear feet	17
Clear water basin:		
Excavation	353,000 cubic yards	40
Puddle	34,100 cubic yards	..
Concrete	32,800 cubic yards	..

Total payments to contractor, \$1,210,270.08.

Contract No. 27.

OAK LANE RESERVOIR.

The work under this contract embraces the construction of a compensating reservoir of 70,000,000 gallons capacity

for the Torresdale-Lardners Point Service, located near intersection of Second street and Green lane, in the Twenty-second Ward. For a description of this contract see Annual Report of the Bureau of Water for the year 1901.

The work was started April 14, 1902, and at the present time about 82 per cent. of the embankments have been built and 69½ per cent. of the excavation has been made.

Total payments to contractors, \$112,108.00.

Contract No. 28.

LARDNERS POINT PIPE DISTRIBUTION SYSTEM.

This system is designed to convey the water filtered at Torresdale and brought through the Torresdale Conduit to Lardners Point Pumping Station, to two definite points west and south of Frankford creek, viz., to Torresdale and Kensington avenues, and to Frankford avenue, south of Frankford creek. At the former point provision is made for the further extension of the system into the Queen Lane and East Park districts by six lines of 48 inch pipe, and from the latter point into the East Park, Fairmount and Corinthian districts by three lines of 48 inch pipe. The plan contemplates four lines of 60 inch pipe on Robbins street, from Delaware avenue to Tacony street, and three lines on Tacony street to Robbins street, to Torresdale avenue, and on Torresdale avenue to Kensington avenue. The extension of the fourth line of pipe laid on Robbins street will be through Robbins street to Torresdale avenue, thence on Torresdale avenue to Frankford avenue, where it will connect in valve chamber No. 6 with the system of valves and special castings provided under Contract No. 28 with the three lines of pipe first laid.

Valve chambers and valves are placed at convenient

locations between Lardners Point Pumping Station and the terminus on the line of 60 inch pipe at Kensington avenue to admit of cutting out of service a portion of either line of pipe for examination and repairs.

This pipe system, in conjunction with the present 48 inch and 30 inch rising mains from Engine House No. 1 at the Lardners Point Pumping Station, is intended to distribute 300,000,000 gallons of water per day of 24 hours, and the first three lines of 60 inch pipe and the present lines of 48 inch and 30 inch rising mains to the Wentz Farm Reservoir are expected to deliver 240,000,000 gallons of water per day.

In carrying out this pipe system, which is the largest system of 60 inch cast iron distributing water pipes ever placed under paved streets of a city, it will be necessary to relocate and re-construct nearly all the sewers now lying in the streets mentioned.

The plans and specifications have been prepared and the work will soon be advertised.

Contract No. 29.

LARDNERS POINT PUMPING STATION, No. 2.

This pumping station is located at Lardners Point, on the Delaware river. The work embraced in this contract consists of the construction of the foundation and superstructures of Engine and Boiler Houses, No. 2, to supplement the present pumping station at this point, together with the necessary dynamo, toilet and locker rooms, chimney, pump wells, water conduits, connections to Delaware river, gate chambers, sluice gates, sewers, pipes, engine and boiler foundations, and all the necessary detail of grading, walks, curbing, etc. The purpose of this station is to pump the filtered water from the Torresdale Filters to

the distribution districts of East Park, Queen Lane, Fairmount, Corinthian and Wentz Farm. (The filtered water is conducted from the Torresdale Filters through the conduit now being constructed under Contract No. 14.) In addition to the pumping machinery now being built under Contract No. 11, this Station is intended to accommodate pumping engines to be moved from the Spring Garden and Queen Lane Pumping Stations, and when completed will have a total pumping capacity of 300,000,000 gallons daily, making it the largest single pumping station in the world.

The engine house is 175 feet 4 inches long and 91 feet 7 inches wide, and is 51 feet 2 inches from the floor to the underside of the roof trusses. The house is provided with an electric traveling crane constructed under Contract No. 11. The boiler house is 163 feet long by 69 feet 7 inches wide, and will contain 24 marine fire box type boilers, arranged in six batteries of four each. The house is provided with two chimneys of the "Alphons Custodis construction," 7 feet internal diameter and 150 feet high. In the rear of the boiler house are the dynamo, toilet, locker and feed pump rooms.

Two steam pipe tunnels, built of concrete, connect the engine and boiler houses. A system of smoke tunnels and dampers connect the boilers with the chimneys, and a double line of tracks and switches will be laid longitudinally through the building to be used in connection with the coal conveyor for supplying the boilers with fuel.

The super-structures of the engine and boiler houses will have a base of pink granite, walls of Roman mottled brick with terra-cotta moulding, and a roof of red tile, with ventilator extending the entire length of building, covered with rolled copper. The inner face of the engine house will be of buff brick, and the boiler house will have an interior lining of Philadelphia red stretcher brick of standard dimensions.

During the present year the contractor has driven the piles for the foundations of one of the chimneys, and has practically completed the excavation for the engine house. About 5 per cent. of the work having been accomplished. Total payments to contractor, \$14,515.62.

Contract No. 37.

LOWER ROXBOROUGH PRELIMINARY FILTERS.

The work on the preliminary filters for Lower Roxborough, under contract with the Maignen Filtration Company, of Philadelphia, is now going forward, but no part of the material can be erected until the foundations and buildings have been constructed; the plans and specifications for these will be ready and offered for letting within a short time.

PRELIMINARY FILTERS.

In preparing the specification for Contract No. 37 it was so drawn that the bids might be received on several well-known types of roughing or preliminary filters. Experience at the Spring Garden and Torresdale Testing Stations having shown that the principles upon which preliminary filters might be constructed admitted of several methods of successfully doing this part of the work.

Referring to the broad question of preliminary filtration of the water at high rates before it is passed to the plain sand filters, the experience gathered from the operations of the testing stations at the Spring Garden Pumping Station, dealing with the Schuylkill river water, and at Harrison Mansion, Torresdale, dealing with the Delaware river water, demonstrates conclusively that to maintain a satisfactory condition of effluent, as regards turbidity and bacterial content, it is absolutely necessary that the pre-

liminary filters be regarded as an essential part of any successful system for filtration of the water supply. Their use also serves two other very important purposes. The first to make it an easy matter to maintain a rate of 6,000,000 gallons per acre per day with, at all times, a satisfactory condition of the effluent; and, second, to materially decrease the cost of filtration as a whole by prolonging the period of operation of the plain sand filters, and reducing the number of scrapings of the sand beds per thousand million gallons of water filtered.

Plans are now being prepared for the preliminary filters at Belmont, and it is hoped that these may be offered for letting at an early date.

Contract No. 49.

FILTERING MATERIALS AND UNDERDRAINS FOR BELMONT FILTERS.

This contract embraces the furnishing and placing of 32,398 linear feet of eight inch terra-cotta perforated lateral collectors, 23,170 cubic yards of underdrain gravel and 62,407 cubic yards, more or less, of filtering sand.

Plans and specifications are prepared for this contract, which will be offered for letting at an early date.

Scope of Office Work.

Since the inception of the work the following approved contract drawings, studies, photographs and other details have been prepared:

Approved contract drawings	907
Studies and sketches	2,000
Field sheets and studies	3,615
Photographs of work	1,050
Approved and miscellaneous blue prints	1,345

Operation of Lower Roxborough Filters.

Your attention is called to the rapidity with which the Lower Roxborough Filters have been adjusted to active satisfactory service.

From the experience abroad, and with the filters at the Spring Garden and Torresdale Testing Stations, it would not have been unreasonable to anticipate possibly six months or more service of each of these filters, before ripening of the sand beds and an effluent satisfactory in point of turbidity and bacterial content could have been attained, while, as the records show, we have had within 90 days of starting the filters, effluents which show a turbidity of zero by the silica standard, and rarely in excess of 3, and a bacterial content very frequently below 25 colonies per cubic centimeter. I can ascribe this only to the extreme care that has been displayed by the men in charge, in the selection and placing of the filter sand and underdrains. No material was allowed to go indiscriminately into these filters, and the same care that was exercised in carrying on the construction work was emphasized when it came to the inspection and placing of the filtering materials.

The first filtered water was supplied to Manayunk August 12, 1902. The district was gradually enlarged as the various beds were placed in service, the lower portion of Germantown being the next to receive filtered water on September 26, 1902, and by December 1st this station was supplying from 7,000,000 to 8,000,000 gallons of filtered water daily.

The average actual yield between scrapings of the filters has been 38.00 million gallons, or 71.70 million gallons per acre, with an average of 28.8 days service. The average scraping has been 95.2 cubic yards per acre, giving an average depth of 0.78 inches. The cost per million gallons filtered for labor of scraping, wheeling and washing, has

been \$2.22. With more experience on the part of the labor employed it is hoped that the work can be performed at even less expense.

Referring to the yield of filters between scrapings, the experience abroad indicates that a plain sand filter rarely exceeds 60,000,000 gallons per acre, even after the sand beds of such filters have become thoroughly ripened; while the Lower Roxborough Filters, during the period of operation, have averaged for all the filters, as above stated, a yield of 71.70 million gallons per acre between scrapings with an average run of 28.8 days. With preparation of the water by preliminary filters it is expected that the average yield of the large filters will not fall below 125,000,000 gallons per acre between scrapings, which corresponds to a 21 days' service.

Charging all labor for the operation of the filters, exclusive of the salary of the Assistant Engineer in charge, who, in due time will have charge of both the Upper and Lower Roxborough Filters, when his compensation can be divided pro rata between the two stations, the cost of all other labor you will notice is less than \$2.25 per million gallons of water filtered, which is a fair index of the probable cost of dealing with the entire water supply of the City by plain sand filtration, and which you will observe is considerably below the estimates made by the Commission of Experts in their report of September 15, 1899, and even less than we had anticipated in the early history of the work. It is probable that when to the work of maintaining the plain sand filters is added the cost of the preliminary filters, that the cost per million gallons will be about \$2.75, but this, as we know from our long experience with preliminary filters and plain sand filters at the testing stations, will carry with it at all times a quality of effluent which, from a hygienic point of view, will be above

criticism and superior to the effluents of the plain sand filters abroad which operate without adequate preparation of the water either by long sedimentation or preliminary filtration.

Testing Stations.

The work of the Spring Garden Testing Station has largely been in carrying to completion such experiments as had been started during previous years.

Since the starting of the Lower Roxborough Filters the experimental work at the Testing Station has been gradually decreased to make room for the increasing work at the filters, while the work of the Torresdale Station has remained practically the same since the beginning of operations there.

During the early part of the year the following experiments which were started in previous years were concluded:

Experiments on preliminary filtration with beds of broken stone and slag. Sedimentation for various periods. Experiments on asbestos films for artificial "schmutz-decke." Using mattresses of "antiseptic" fibre, and "peat moss" on preliminary filters.

Experiments have been conducted with the Warren mechanical filter since its installation to determine the relative turbidity and bacterial reductions at various rates of filtration, and various modes of washing and operating between washings. The cost per million gallons filtered have been figured for each method of operation.

Various filters at the testing station have been run from time to time at a 3,000,000 gallon rate to make comparisons of efficiencies with filters running at a 6,000,000 gallon rate. There appears to be little difference in the efficiencies of filters operating at these rates when filtering a water which has received a proper preliminary treatment.

Tank Filter No. 4, now being operated at a 10,000,000

gallon rate in order to determine the factor of safety in operating sand filters at high rates.

During the year there were 9,000 samples of water chemically examined and over 20,000 examinations made in the bacteriological laboratory.

It is not possible with the time at command to indulge in a careful review of the practical results obtained from the operations of the Spring Garden and Torresdale Testing Station, but considering the large force employed for the past two years, and the wide range which the investigations have taken, it can be well understood that a vast amount of valuable information touching the purification of water by sedimentation, preliminary filtration and filtration by plain sand filters has been obtained. Suffice it at this time to say that it has shown that no difficulty whatever will be found in dealing with the waters of the Schuylkill and Delaware rivers, nor of so improving their quality that complaint from a hygienic standpoint will certainly disappear when the entire water supply of the City is filtered.

From such investigations as have been made elsewhere and here it is reasonable to expect that the general introduction and use of filtered water will reduce the cases of zymotic diseases, due to the drinking of unfiltered water, by upwards of 80 per cent.

In closing this report I wish to thank each and every member of the engineering and clerical staff for the earnest and diligent manner in which he has endeavored to forward the work of the Bureau during the past year, and to say of those who are in responsible charge of the plans or contracts that the success of this great work, when completed, will be due very largely to the zeal and fidelity with which they have discharged the duties entrusted to them.

Respectfully submitted,

JOHN W. HILL,
Chief Engineer.

*List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of
January 12, 1900.*

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract	Limit of Contract.	Payment.	Date of Final Payment.
1 1 Sup.	A Testing Station.....	Thomas Parker....	Feb. 27, 1900..	Mar. 6, 1900...	\$9,000 00	} \$11,653 54	July 13, 1900.
	Extension to Testing Station.....	Thomas Parker.....	.....	May 7, 1900...	5,000 00		
2	Ice Refrigerating Machine.....	Newburg Ice Machine & Eng. Co...	July 20, 1900..	Aug. 20, 1900..	800 00	800 00	Nov. 19, 1900.
3	Filtering Sand and Gravel for Testing Station.....	Norcross & Edmunds	July 20, 1900..	Sept 4, 1900..	2 500 00	1,016 54	Nov. 2, 1900.
4	Platinum Ware for Testing Station....	Chas. Lentz & Sons..	July 20, 1900...	July 27, 1900..	674 50	649 50	Oct. 31, 1900.
5	Test Borings.....	Flaghouse & Beeson.	Aug. 7, 1900...	Sept. 6, 1900..	9,750 00	8,833 30	March 9, 1901.
6	Platinum Ware for Testing Station....	Arthur H. Thomas Co.....	Dec. 12, 1900..	.....	444 95	444 95	Feb. 6, 1901.
7	Lower Roxborough Filters.....	.....	Dec. 12, 1900..	No award made.	de. Readvertised as	Contract No. 10,	

*List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of
January 12, 1900—Continued.*

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
8	Sand Ejector	Patrick Gormly.....	April 17, 1901..	May 6, 1901...	\$1,800 00	\$1,712 03	Aug. 7, 1901.
9	Cast Iron Water Pipe, Special Castings, Stop Valves, Pipe-laying, etc...	Bids rejected on Pipe rest of contract.	e Lines "A" to	"J," inclusive	e. See Con	tracts "9A,"	"9B." and "9C" for
9 A	Cast Iron Stop Boxes.....	J. Alfred Clark.....	Feb. 11, 1901..	May 14, 1901..	2,100 00	1,563 80	Dec. 21, 1901.
9 B	Stop Valves.....	Eddy Valve Co.....	Feb. 11, 1901..	May 3, 1901...	17,000 00	14,403 06	Dec. 21, 1901.
9 C	Cast Iron Water Pipe and Special Castings for Lower Roxborough Filters..	Daniel J. McNichol ..	Feb. 11, 1901..	May 8, 1901...	7,500 00	7,483 14	Dec. 20, 1901.
10	Lower Roxborough Filters.....	Daniel J. McNichol..	Feb. 11, 1901..	Mar. 20, 1901..	250,000 00	229,880 20	March 1, 1902.
11	Pumping Engines and Boilers and Electric Traveling Crane for Lardner's Point Pumping Station.....	Holly Manufact'g Co.	May 1, 1901...	June 6, 1901...	360,000 00	33,871 63	Not completed.

List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of January 12, 1900—Continued.

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
12	Upper Roxborough Filters.....	Daniel J. McNichol..	April 17, 1901.	May 8, 1901...	\$540,000 00	\$511,372 15	Not completed.
13	Rotary Stop Valves, Patterns and Core Boxes.....	Eddy Valve Co.....	April 17, 1901.	June 1, 1901...	13,000 00	12,825 00	Nov. 22, 1902.
14	Torresdale Conduit.....	Daniel J. McNichol..	May 28, 1901..	Oct 4, 1901...	1,350,000 00	398,832 56	Not completed.
15	Test Pits at Lardner's Point.....	Contract abandoned.	Work done	by Water Bureau.			
16	Belmont Sedimentation Reservoir, Filters and Clear Water Basin.....	Ryan & Kelley... ..	May 28, 1901..	Aug. 7, 1901...	2,000,000 00	1,096,484 67	Not completed.
17	Extension of Distribution Pipe System.....	Daniel J. McNichol..	April 17, 1901.	June 4, 1901...	750,000 00	749,455 01	Oct. 24, 1902.
18	Low Service Pumping Machinery for Upper Roxborough Filters.....	Henry R. Worthington, Inc.....	July 29, 1901..	Aug 22, 1901..	23,500 00	.....	No payment made.

*List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of
January 12, 1900—Continued.*

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
19	Belmont Rising Mains, Upper Roxborough Connection Pipes, and Extension of Distribution Pipe System.....	Daniel J. McNichol..	Dec 18, 1901..	Jan. 30, 1902..	\$500,000 00	\$425,089 50	Not completed.
20	Triplex Pumps and Gasoline Driving Engines for Upper Roxborough Filters.....	Fairbanks, Morse & Co.....	Dec. 18, 1901..	Mar. 1, 1902...	10,800 00	.....	No payment made.
21	Low Service Pumping Station for Upper Roxborough Filters.....	Henderson & Co., Ltd	Sept. 25, 1901..	Oct. 21, 1901..	21,000 00	18,636 42	May 20, 1902.
22	Hand Traveling Crane for Low Service Pumping Station, Upper Roxborough Filters.....	Alfred Box & Co.....	July 29, 1901..	Dec. 19, 1901..	2,900 00	2,800 00	Aug. 14, 1902.
23 A	Administration Building and Pumping Station, Upper Roxborough Filters.	Daniel J. McNichol..	June 25, 1902..	Aug. 6, 1902...	43,000 00	17,943 24	Not completed.

*List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of
January 12, 1900—Continued.*

Contract No.	Description of Contract.	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
24	Filtering Materials and Collectors for Upper and Lower Roxborough Filters and Sand Washers for Lower Roxborough Filters.....	Daniel J. McNichol..	Dec. 18, 1901..	Jan. 30, 1902...	\$290,000 00	\$112,525 75	Not completed.
25	Torresdale Filters and Clear Water Basin.....	Daniel J. McNichol..	Dec. 18, 1901..	Jan. 18, 1902...	5,000,000 00	1,210,270 08	Not completed.
26	Torresdale Testing Station.....	Patrick Gornly.....	July 29, 1901..	Aug. 20, 1901..	9,000 00	8,643 00	Dec. 19, 1901.
27	Oak Lane Reservoir.....	R. A. Malone & Co....	Dec. 18, 1901..	Mar. 14, 1902..	550,000 00	112,108 00	Not completed.
28	Lardner's Point Distribution.						
29	Lardner's Point Pumping Station No. 2.	Geo. C. Deitrich.....	Sept. 17, 1902..	Oct. 4, 1902...	565,000 00	14,515 62	Not completed.
30	Lardner's Point Pumping Station No. 2.....		Feb. 26, 1902..	Readvertised as Contract		No. 29.	

List of Contracts, Improvement, Extension and Filtration of Water Supply, according to Ordinance of January 12, 1900—Continued.

Contract No.	Description of Contract	Contractor.	Date of Letting.	Date of Contract.	Limit of Contract.	Payment.	Date of Final Payment.
33	Addition to Testing Station at Spring Garden Pumping Station.....	.....	Sept. 25, 1901..	No award made.			
37	Lower Roxborough Preliminary Filters	Maignen Filtration Company.....	Sept. 23, 1902..	Oct. 27, 1902..	\$49,800 00	.....	No payment made.
62	Baffles for the Lower Roxborough Reservoir.....	.....	June 25, 1902..	No award made.			





to All





