BUREAU OF WATER

A REVIEW OF THE YEAR'S WORK

FIVE POINTS TO REMEMBER

1 WASTE OF WATER IS THE PRINCIPAL OBSTACLE TO FURTHER IMPROVEMENT OF THE SUPPLY

2 COST OF OPERATION AND MAINTENANCE IN 1914 WAS $450,000 LESS THAN IN 1911

3 LOWEST TYPHOID RATE OF RECENT YEARS PROVES THE QUALITY OF WATER FURNISHED BY THE FILTERS

4 METER AND FIXTURE RATES SHOULD BE EQUALIZED AND METERS PLACED UPON WASTEFUL USERS

5 ADDITIONS TO THE WATER SYSTEM SHOULD BE PLANNED FOR 25 YEARS AHEAD

PHILADELPHIA
1914

BUREAU OF WATER STATISTICS

REVENUES

INCREASING RECEIPTS	1912	$4 947 649
	1913	4 949 701
	1914	5 191 345

COST OF OPERATION AND MAINTENANCE

DECREASING COSTS	1912	$2 271 658
	1913	2 013 322
	1914	1 826 754

COAL BURNED

SAVING OF COAL	1912	201 168 tons
	1913	183 686 tons
	1914	179 736 tons

NEW PIPE LAID

INCREASE OF SERVICE	1912	15 miles
	1913	19 miles
	1914	25 miles

PER CAPITA DAILY CONSUMPTION

CUTTING DOWN WASTE	1912	198 gallons
	1913	178 gallons
	1914	173 gallons

INDEX

BUREAU OF WATER

Carleton E. Davis, CHIEF

January 11, 1915

Director,
Department of Public Works.

I beg to submit a review of the Bureau of Water's operations for 1914.

The following portion is written for the purpose of being read. Data, statistics and tabular information which may be useful for study and reference will be found in an appendix.

FILTRATION

The gratifying decrease in typhoid fever in 1914 certifies to the good quality of water delivered by the filtration system of Philadelphia, as well as to the general sanitary conditions of the city. The typhoid death rate was eight per 100,000 population, a substantial lowering of the best previous record of 13 per 100,000. West Philadelphia had the remarkably low rate of five deaths per 100,000, with a correspondingly small number of cases. Other sections were likewise below the average for the city as a whole, a concentration in two or three districts bringing the combined figures up to eight per 100,000. Daily tests of the water indicated that it was of uniform quality throughout the city.

Some unpleasant tastes and odors developed in the last week of January and the first week of February in the Schuylkill River water, and again for a brief period and less extent in December. No harmful results are known to have followed at these times, but complaints naturally followed when the water failed to equal the customary high standard. The trouble was caused by gas held in solution, which probably originated from

waste products of one kind or another discharged into or near the river. Filtration will not remove such gas held in solution, and the chemists have not been able to isolate and fully identify its nature. As the State Department of Health gives assurance that no more gas-producing substance is being discharged into the river, it is reasonable to hope that less and less trouble will be experienced in the future from these discharges of former years.

Public horse watering troughs were temporarily closed by the Board of Health in June, following an increase in the number of cases of glanders in the city. The Water Bureau co-operated in emergency steps taken by the interested humane societies and a number of citizens, to provide substitute facilities whereby water for thirsty horses could be drawn into individual pails. There seems to be a growing feeling among veterinarians that the old style of horse watering trough should be abandoned in favor of a fountain of the individual type, and certain of these were installed experimentally.

Increased facilities along the Delaware River water front were provided to permit shipping to obtain water at any hour of the day or night. The Dock Department and Police Bureau have co-operated to keep a record of water thus drawn from public piers to enable the Water Bureau to make proper charges. Certain shipping is more or less elusive, and without the help of these other branches of the city service, there might be difficulty in collecting revenue for water furnished. The United States Government amended certain of its health rules with a view of insuring that vessels engaged in interstate commerce should use only water of known purity; and as this applies to practically all shipping coming to Philadelphia, it makes the general question of water for such shipping of increased importance.

Similar rules and standards were applied by the United States Government to the quality of water used by the railroads, all of which the city water fully met.

Weekly reports giving the standard routine analyses of the filtered water made by the bureau were furnished to the surgeon of the League Island navy yard. These comprised analyses of

the water as it left the filters, and as it was delivered in the mains at South Philadelphia, the latter being the same water that is furnished to the navy yard. These analyses satisfied the officials as to the quality of the water for potable purposes.

The detailed results of the operation of the filters is given in tabular form in the appendix to this report. These tables are in the form recommended by a committee of the New England Water Works Association, appointed in 1913 at the Philadelphia convention of that Association to suggest "Uniform Filtration Reports." Mr. Francis D. West, chemist at the Torresdale plant, is a member of that committee, of which Professor George C. Whipple, of Harvard University, is chairman.

The Schuylkill plants were operated satisfactorily and proved equal to all demands. The regular force of men was able to give some time to the grounds, buildings, fences, etc., so that the appearance of the plants was improved. The extension of the preliminary filters at Belmont was begun, and at the end of the year was well advanced toward completion. A more detailed description of this work is given under another heading.

While the Torresdale plant delivered all the water demanded of it, and while its product was of a satisfactory quality, it is increasingly evident that these filters with their present facilities are overloaded and need relief. The sedimentation basin, provided for at the November election, should be constructed and put in service as soon as possible. The preliminary filters need a thorough overhauling, a part of the pipe system must be replaced, and all of the gravel and sand removed from the beds, cleaned and replaced. Experience seems to prove that such a general renewing of the preliminary filters is periodically necessary and must be included as a part of the routine work of the operation.

The experience of the year in the final filters at Torresdale was unusual, and was apparently a culmination of the long period of necessary overloading and abuse to which these filters have been subjected during times of high turbidity in the river. In February and March deep cleaning, practically to the gravel, was required in all the beds. The situation was aggravated by a series of storms in the first two months of the year, the tur-

bidity of the Delaware going above 100 six times in January and four times in February, a maximum of 400 being reached on February 3.

In December a choking up of the final filters and decrease in length of run was experienced, the immediate cause in this instance apparently being an excessive number of micro-organisms and bacteria in the river, rather than the ordinarily recognized turbidity.

Micro-organisms are composed or surrounded by a jelly-like substance which forms hard, compact layers with the sand in the filters. The late summer and autumn of 1914 was an unusually dry period. The turbidity in the river was low, and very little organic growth was washed down by rains. Following heavy rainfalls early in December, micro-organisms and amorphous organic matter originating from decayed vegetation were present in unusual quantities, and for extended periods. This was accompanied by an unusually high bacteria count in the raw river water, 190,000 bacteria per c.c. being reached on December 25, while the average for the month was over 80,000. Tests indicated that these bacteria were not of the pathogenic type.

These river conditions were followed by a deep penetration in the sand filters and subsurface clogging akin to that caused by high turbidity. Deep cleaning is going on at the close of the year.

DISTRIBUTION

The water pressure throughout a large portion of South Philadelphia was materially increased by a rearrangement of the distribution mains between the Corinthian Reservoir and the East Park Reservoir. Since this rearrangement was effected, the pressure on the ground floor of the district office at Twelfth and Reed Streets has very rarely fallen below 20 pounds in the daytime. It reaches 40 pounds in the night time under normal conditions. While still leaving much to be desired along the lines of a satisfactory pressure, this increase is a step in the right direction.

An appropriation of $500,000 for the general improvement of

the South Philadelphia water supply was voted on favorably at the November election. The work to be done under this appropriation will be discussed later in this report. No radical improvement need be looked for, however, in South Philadelphia, or any other section of the city, until a material curtailment in the waste of water is brought about. An entire readjustment of the water-works facilities at a prohibitive cost for both construction and operation is the only alternative.

The general growth of the city and the development of the suburban sections was indicated by the fact that the Water Bureau laid 25½ miles of distribution mains in 1914, considerably more than in any recent year. In addition, several miles were laid by contract. At a time when the city is trying to keep its running expenses within its income, the amount of new work done by the Water Bureau and paid for out of current appropriations is worthy of some comment. Laying new pipe is a proper charge to capital outlay, yet the Water Bureau in 1914 expended about $70,000 out of its current appropriations for this purpose.

Water was turned into the pipe extensions in the Somerton and Byberry districts early in the year. The value of this extension has already been felt in the matter of fire protection and in the added comfort of the residents in that section. An appropriation was made and a contract let for additional pumps at the Wentz Farm station, which are needed to meet the increased demands on this station due to this added district.

Permanent supports under the pipes in Eva Street were completed, thus removing one source of danger to the supply for the Chestnut Hill and Germantown districts. The large mains feeding this territory, however, are far from satisfactory. The usual number of breaks occurred on the Hartwell Avenue line under particularly unfortunate circumstances. The break which took place about Christmas is the sixty-first that has occurred on this line since it was put in service, about twenty-one years ago. The foundry which furnished this pipe is no longer in business, though this fact probably gives but little satisfaction to those citizens of Philadelphia who are periodically deprived of water by reason of it. An additional line, of thoroughly

satisfactory quality and strength, should be laid to reinforce the existing unreliable line.

Though permanent trestles have been placed under the mains on Eva Street, a single line of 48-inch pipe is the only carrier of filtered water over a stretch of about one mile on this street, and the supply of Germantown and Chestnut Hill is dependent upon the maintained integrity of this pipe. Other wooden trestles supporting large distribution mains in several sections of the city which were mentioned in the last annual report came safely through the year. Repairs were made on a number of these, though it must not be forgotten that they are a continuing element of danger.

The general increase from year to year in the work of building underground structures results in disturbance of the water pipes and probably adds to the number of accidents, thereby adding to the importance of securing modern equipment for handling breaks, as well as for the general maintenance work of the distribution system. One additional automobile truck, purchased in the latter part of the year, has already proven its worth. A commissary was added to the facilities of the bureau so that men suddenly called upon for all night work can be furnished with hot coffee and food. This is not only a humane expedient, but good business policy as well, for men called unexpectedly from home, or required in an emergency to continue all night following an ordinary day's work, cannot supply themselves with proper food.

Under present ordinances, owners put in, maintain and are responsible for service pipes, from the main in the street to their properties. This means that private individuals dig up the streets when the pipes are originally laid, as well as subsequently when breaks or leaks occur. In 1914 there were more than two thousand leaks in service pipes within paved roadways. This is about the average number for an ordinary year. At present the Water Bureau cannot even repair a leak, and this frequently results in an anomalous situation. To illustrate: a report comes to the Water Bureau of a leak in the street, propably endangering traffic. The Water Bureau men proceed to the spot and dig up the street to locate the leak. If it is in the main pipe, or the

ferrule in the main, the Water Bureau men can make repairs and finish the job. If it is in the service pipe leading to a private property, they cannot make the repairs. The householder is notified, and if the leak is such as to cause damage or endanger property or traffic, the water is shut off at the main thereby depriving the property of water. The hole is then filled up so that traffic may not be interrupted. The property owner secures the services of a plumber, who proceeds to City Hall to take out the necessary permit, after which he returns to the leak and re-excavates the hole which the Water Bureau has filled up. After making repairs, the plumber notifies the Water Bureau and an employee is sent to turn on the water. The plumber then fills up the hole, and the Highway Bureau subsequently repairs the pavement.

This procedure could be very much simplified if the Water Bureau were authorized and equipped to make repairs in service pipes as soon as a leak is uncovered. This would save expense and annoyance to the householder, cause less interruption in traffic, and simplify the work of the bureau. An ordinance permitting this to be done has been prepared and will be introduced in Councils.

Another step in simplifying service pipe procedure would be for the city to lay, own and maintain all service pipes, at least from the main to the stop at the curb. This practice has much to commend it; the only question is whether public sentiment is ready for the step. It would increase the cost of running the bureau, but the property owner would be better served than at present.

Thousands of complaints are made annually to the Water Bureau of water in cellars or of other annoyances of similar nature. Sometimes the water comes from leaking mains for which the bureau is responsible. Again the water may come from leaking service pipes or fixtures for which the householder is responsible. Sometimes the water comes from defective drainage. Sometimes rain water from the roof finds its way into cellars, or water carelessly used on one property will find its way into the cellar of the adjacent property. The Water Bureau is a repository of these complaints and in many cases is entirely helpless to remedy the difficulty.

At the present time no control can be exercised over the quality of service pipes, over the nature of yard hydrants, or of plumbing in general inside a property. To relieve the situation permanently requires the co-operation of householders, real estate men, plumbers, other interested parties, and a change in the present policy. Superficial remedies can be applied with only temporary results, but the seat of the trouble will not be reached until the proper pipes and fixtures correctly laid can be insisted upon as a requisite for obtaining city water. The United Gas Improvement Company will not turn gas on a property until it has an assurance that conditions inside a property meet its required standards. The city can demand that leaks in plumbing be repaired, but improper fixtures may start leaking again almost as soon as a repair is made, and in a general way the taxpayer who puts in poor plumbing is making his neighbor pay part of the bill.

Yard hydrants are a continuing source of trouble and a prolific source of waste. Cold weather in December is a forerunner of complaints from neighbors throughout the winter. Where yard hydrants are found in large numbers, ice on any cold day can be seen in thick layers in alleys, over sidewalks, and running out into the streets and gutters. The advent of cold weather means that yard hydrants are left open to prevent freezing, and where drainage is lacking, ice accumulates to an extent annoying to the community. Some cases were found where tenants were formally notified by owners or agents to let spigots run from ten o'clock at night until seven o'clock in the morning to prevent freezing of pipes. It is no wonder that the Water Bureau finds it difficult to maintain a good pressure in the mains.

Trouble from electrolysis became evident at certain points during the year. Some damage has already occurred, and only constant watchfulness and the aid of such public service corporations as are possible offenders can prevent serious results. The Electrical Bureau rendered efficient service in detecting the existence of currents on the water pipes and bringing it to the notice of the Water Bureau.

Material progress was made on record plans of the distribu-

tion system, particularly street intersection plans for use in the local work of the districts. Some two thousand intersections have already been accurately mapped and blue prints filed ready for immediate use. This readily available data is an invaluable aid in case of accidents, is useful in the everyday work of operation and maintenance, and extends the sphere of usefulness of many employes by making a number of men available for any piece of work, instead of depending solely upon a few men who may have all the information stored in their memories.

The general scheme of mapping pipes and valves in the distribution system provides three general features:

1. Data used chiefly for controlling and regulating the amount and pressure of water throughout the system, or in other words, data used in operating the supply.

Under this head are maps defining the limits of the several distinct distribution areas, which maps are accompanied by data showing the sources of supply for each area and a list of valves controlling the supply; likewise general maps showing all large mains, reservoirs and pumping stations, together with detail maps of the piping system and operating valves at the pumping stations, filters and reservoirs.

2. Data used chiefly for repairs and maintenance.

Under this head are detail maps showing the complete gridiron of distribution pipes on which the location of all valves and hydrants is indicated. The detail of such maps is expanded by intersection plans showing on a larger scale the situation at each street intersection. Each street intersection is mapped on a separate plan of a size convenient for use in the field.

3. Data used chiefly for the business relations between the consumer and the Bureau of Water.

Under this heading come data relating to service pipe connections, such as the location, depth, size, date of insertion, kind of pipe, etc. This data is listed in a card index and filed by streets and numbers.

The system likewise proposes under this head full plans of all pipes in important establishments which may have a special supply for sprinkler systems or other fire protection. These

plans will indicate the relations between pipes carrying city water and private pipes which may carry a possible polluted water from a private source, introduced for the purpose of fire protection or manufacturing. The necessity for the complete severance of these dual supplies can be readily seen.

The growth of the city towards the northwest made it desirable to establish a branch distribution office in Frankford. Temporary quarters were secured in a disused fire house on Church Street. The ability to locate a group of men in this section, near the centre of a district requiring considerable work, has cut down the time lost by transportation, and made the men more available in case of accident, as well as reduced the incidental carfare expenses to the men themselves.

PUMPING STATIONS

The most imminent source of danger to the water supply of the city was abated when the new Torresdale chimney was put in service. This chimney is working satisfactorily, and in addition to being a reliable structure is a distinct improvement to the architectural appearance of the station. The new chimney was built and the old stack removed without accident, and without shutting down the station for more than two hours.

A serious accident occurred at the Lardner's Point pumping station on May 28, when a 48-inch special pipe on the high service supply burst outside the No. 3 engine house. The pumps were immediately shut down without harm, but the water flowing from the broken pipe under the Oak Lane Reservoir head could not be stopped until two 48-inch valves were closed, no check valves or quick operating valves being on the line. Before the water was shut off, the basements of both pumping stations were flooded, covering the main steam pipes and auxiliary equipment. The floor of the basement is about eleven feet below tide water in the Delaware River, the main steam pipes themselves being about three feet below this level. No facilities for draining were available and special pumping equipment was necessary to free the basements from water and uncover the steam pipes before the station could be operated. This required about thirty hours' time, during which Lardner's Point

station was entirely shut down as far as supplying water to the city was concerned. Fortunately no serious fires occurred and the stored water in Wentz Farm, Oak Lane and East Park Reservoirs served in a measure to tide over the situation.

This accident emphasized certain of the weak points in the Lardner's Point pumping station, as well as brought out forcibly the necessity for large additional storage reservoirs with independent pipe connections. The vital need at Lardner's Point is an independent steam pipe system placed overhead which will permit the pumps to be operated even though a similar accident should occur in the future. Check valves, or quick operating valves, are likewise needed on the force mains as well as additional means and devices for controlling the flow of water from the Torresdale filters to the pumping station.

Appropriations for these vitally needed improvements have not been forthcoming. The bureau was, however, out of current appropriations, able to make some needed replacements where accidents were daily invited on account of ordinary deterioration of the original equipment. Chief among these repairs was the replacement of the boiler feed lines and the duplication of the underground supply by an overhead system of pipes. Some of the underground boiler feed lines were practically worn out and approaching a dangerous condition. It should be recognized that Lardner's Point has been running under high tension for eight or ten years, and that the time for renewals and repairs to the machinery is at hand.

An additional pumping unit at Lardner's Point, preferably of the turbo-centrifugal type, which can be installed at moderate cost for both equipment, foundations and housing, is urgently needed. The station will be badly crippled without such a reserve unit in case of a major accident to one of the present pumps, which might require the securing of new parts and an extensive dismantling of the machinery.

Many incidental improvements tending to increased economy and efficiency in operation were installed; notable among which is a better use of the coal handling apparatus, whereby coal placed in the outside storage yard can be handled at a cost of about ten cents a ton for unloading and reloading, instead of a

former cost of forty cents a ton. A readjustment of the feed water heating system materially raised the temperature of boiler feed water and resulted in a substantial saving of coal. The station in 1914 burned 54,817 tons of coal as against 60,974 tons in 1913, which year had shown a material decrease from the coal consumed in 1912.

Two accidents to engines at the Torresdale pumping station fortunately had no serious results. They emphasized the fact, however, that the cast-iron crossheads on these engines are not suitable for the work they are doing, and arrangements were made for replacing these original cast-iron crossheads with crucible steel castings. An appropriation was made for new sand washing pumps to replace an inefficient and unreliable pump which has handicapped both the station and the filters since it was placed at Torresdale about seven years ago. This old pump had seen service at other plants before being installed at Torresdale, it was not suitable for the service, and has been a constant source of trouble and expense.

The Shawmont pumping station was operated satisfactorily, barring the usual amount of trouble with the four five-million-gallon high duty Worthington pumps, which are unfitted for the service and conditions under which they work. These pumps are subject to an increasing number of accidents to be naturally expected as time goes on. They must be replaced at an early date. Closer attention to firing, and some minor changes in boiler room equipment, resulted in a material saving in coal. The station in 1914 burned 22,183 tons as against 23,100 tons in 1913.

The reconstruction of the last Queen Lane pump was completed, and the new boiler plant and accessories were substantially finished. During changes and alteration, the boiler room efficiency dropped, but at the close of the year had been brought up to a point materially better than that reached in any previous years. An acceptance test of the Badenhausen boilers showed an efficiency of 71.5 per cent. and these boilers appear to have normally a high evaporation efficiency.

The Belmont pumping station passed through the year satisfactorily, the nature of the equipment being considered. Con-

tracts were let and work started on the reconstruction of this station, the details of which will be described later in this report.

During the severe snow storm in March, when traffic on street car and steam railroad lines was seriously interrupted, the operating forces at a number of the outlying pumping stations and filters were unable to leave the stations for many hours nor could the relief shifts get there. These men come to work provided with only one meal. Naturally when their shift was increased from eight hours to twenty-four hours, the problem of securing food became urgent. To provide against such a situation in the future, arrangements have been made for placing certain standard food supplies at these outlying stations which may be drawn upon in case of such emergencies to aid the men to continue at work without exhaustion and keep the plants running.

Emphasis has been placed upon the safety first principle in all the bureau work. Safety appliances have been installed and there has been a reduction in the number of accidents.

RESERVOIRS

Repairs made to the East Park Reservoir in 1913 have proven satisfactory. These repairs were a result of leakage, serious sliding occurring on the outside slope of the south bank of this reservoir. Repairs were made by placing a heavy rock fill over the bank, together with some surface and under-drainage. Repairs on a small scale were made at Belmont Reservoir and George's Hill Reservoir, where leakage had produced incipient slides. In general, these repairs consisted of trenches dug into the face of the bank and filled with stones, the object being to intercept leakage and carry it away harmlessly to the toe of the slope before it reached the surface in sufficient quantities to cause sliding. All the reservoirs in Philadelphia have slopes steeper than is warranted by the best practice, and standard methods of making repairs in case of leaks and slides are required.

What might have been a serious leak in the west bank of the East Park Reservoir was found before damage resulted. As

this break occurred near the water line, repairs were easily effected after the water in the reservoir was lowered.

Ordinary repairs were made to the Queen Lane Reservoir, Wentz Farm Reservoir and Upper and Lower Roxborough Reservoirs. The inside slopes were weeded, fences repaired, and in general the appearance of the basins was improved.

A contract was let for repairing a serious slide in the Fairhill Reservoir, which occurred after the construction of a fire house near the toe of the slope.

HIGH PRESSURE

The high pressure fire system was operated satisfactorily and in every case responded to the demands of the firemen. Standard practice at both high pressure stations is to build up pressure to 175 pounds immediately upon the receipt of an alarm of fire within the zone covered by high pressure pipe. The pressure is held at 175 pounds until changes in pressure are ordered by the firemen at the point of the fire. In addition to the regular force of Water Bureau employees operating the equipment, firemen are detailed at each station to receive alarms, and transmit orders from the fire chiefs in the field to the Water Bureau employees at the pumps.

Pressure was built up during the year for 327 fires, though the system was called into use only 57 times.

The record plans of the high pressure distribution system were completed. These are in excellent shape and afford a complete index for the men in charge of the system in case of need.

Several breaks occurred during the year but none was followed by serious results.

The underwriters, in several conferences with the Water Bureau, considered the possibility of maintaining a standard pressure of perhaps 100 pounds in the high pressure lines at all times, with a view of permitting this system to furnish water for sprinklers in buildings. In order that such a procedure may be successful, pressure reducing valves are necessary to prevent the pressure inside buildings being unduly raised when the high pressure mains are put in service at time of fire. The under-

writers have experimented with certain proposed pressure reducing valves but as yet have not developed a satisfactory one.

Another obstacle to the introduction of such a high pressure service inside buildings lies in the fact that the Race Street station draws its supply from the Delaware River, a grossly polluted source. From a health standpoint this would make the plan undesirable as no assurance can be given that unwarranted connections by irresponsible employees would not be made to pipes carrying this river water, which might thus become a source of typhoid fever.

From a fire protection standpoint, general water pressures throughout the city are too low in the ordinary service mains. While this condition exists, it is reasonable to look for some agitation in favor of extending the zone of the high pressure service. While this may be expedient to a certain extent, better returns could probably be obtained from expenditures for an improvement of the ordinary service than for a radical extension of the high pressure.

REVENUES

The revenues of the Water Bureau were $5,242,081.31, an increase of $231,571.49 over those of last year. These revenues were derived as follows:

Collected by Receiver of Taxes, Bureau of Water Rents	1914	1913	Increase	Decrease
Water rents—Applied rates	$4 150 044 55	$4 074 787 13	$75 257 42	.....
Penalties—1914	47 996 92	46 318 68	1 678 24	.....
Water rents—Delinquent	78 715 62	77 469 85	1 245 77	.....
Penalties—Delinquent	12 097 12	11 798 12	299 99	.....
Liens	15 00	59 00	.....	$44 00
Interest on liens	113 30	154 42	.....	41 12
Permits—Fractional rents	124 744 62	148 068 41	.....	23 323 79
Meters	668 566 94	509 644 03	158 922 91	.....
Pipe frontage	105 871 60	75 289 00	30 582 60	.....
Special	3 229 73	6 112 85	.....	2 883 12
Total	$5 191 395 40	$4 949 701 49	$241 693 91	.....
Collected by miscellaneous tax office—Fees for searches	2 515 00	2 543 00	.....	28 00
Collected by City Solicitor—Pipe frontage	31 956 68	31 272 68	684 00	.....
Collected by Tax Office for Highways — Ferrules delivered	7 893 00	6 216 00	1 677 00	.....
Collected by Department of Supplies for material sold	8 321 23	20 776 65	.....	12 455 42
Total	$5 242 081 31	$5 010 509 82	$231 571 49	.....

Approximately 335,000 separate accounts were carried on the books of the bureau in 1914, of which 15,930 were metered accounts. The meters set during the year brought the total number of accounts to be carried under meter rating in 1915 up to about 27,500, thus making still more important the question of an adequate charge for water sold by meter measurement.

The established rate of four cents per thousand gallons, coupled with the minimum charges for metered connections, is too low and materially under the cost of furnishing water. On the other hand, ordinary dwelling house charges by the schedule or flat rates are too high, provided there is a reasonable use only

of water in such dwellings and no undue waste. The opportunity presented to the careful consumer to change from what may be a too high charge for water to one which is certainly too low, coupled with the active selling enterprise of the various meter companies will prove to be a serious matter for the Water Bureau revenues unless meter rates are raised sufficiently to bring a fair return for water sold under the meter method. In 1914 there was a net reduction of about $215,000 from metered properties from what the returns from those properties would have been under schedule rates.

Under the prevailing voluntary system, meters are not installed unless the consumer expects to save money and such consumers are not the wasteful users of water. That the city may obtain the benefits legitimately to be expected from meters, their optional introduction must be accompanied by compulsory change to meters for those properties which do not fully pay under the schedule rating for the water they use or waste. From such properties there may be anticipated both an increase of revenue and a saving of water.

Meanwhile, and in any event, four cents per thousand gallons is too low a charge for water under Philadelphia conditions, involving a heavy expense for both filtration and pumping. In fact, no city in the country working under similar conditions has so low a rate. Some of the meter rates charged in other cities are given below:

Boston	10c. to 18c.	per thousand gallons.
Pittsburgh	10c. to 18c.	"
Baltimore	8c. to 10c.	"
Cincinnati	10c.	"
Jersey City	10c. to 16c.	"
Rochester	10c. to 14c.	"
Providence	10c. to 20c.	"
Cleveland	5c.	"
Washington	5c.	"
Montreal	15c.	"
New York	12c.	"

As a suggestion, fair charges for Philadelphia would be 12 cents per thousand gallons, 8 cents per thousand gallons, and 4

cents per thousand gallons for domestic, intermediate, and manufacturing rates respectively. Twelve cents per thousand gallons should be charged for the first 500,000 gallons or any part thereof; eight cents per thousand gallons should be charged for the second 500,000 gallons or any part thereof, and four cents per thousand gallons should be charged for all consumption over one million gallons.

Under present fixture ratings, the minimum charge is $5, for which a hydrant and sink are allowed. At the proposed rate of twelve cents per thousand gallons, there would be no probability of increasing the charge for such dwelling if the same were metered, provided there were no waste of water. Larger dwellings with more fixtures at the proposed domestic rate of twelve cents per thousand gallons would still be able to use all the water possibly needed, provided, of course, there were no waste, and still pay less than the charges under the prevailing schedule rates.

EXPENDITURES

The total expenditures of the Water Bureau, excluding interest and sinking fund charges, but including materials furnished through the Department of Supplies, were $2,380,749.49, a decrease of $67,042.09 from those of last year.

These total expenditures include outlays for improvements as well as the expenditures for routine operation and maintenance. They likewise include two payments, totaling $55,290.12, in settlement for claims on account of work done in past years under Bureau of Filtration contracts. Excluding these two payments, the decrease in total expenditures becomes $122,332.28.

As operation and maintenance costs furnish an index to the conduct of the work of the bureau from year to year, they are given separately in the table below for the past four years:

	1911	1912	1913	1914
Operation and maintenance	$2 271 420 18	$2 271 657 62	$2 013 322 53	$1 826 754 16
New work	329 340 32	487 068 59	435 469 05	553 995 33
Total	$2 600 760 50	$2 758 726 21	$2 448 791 58	$2 380 749 49

The separation of the operation and maintenance cost for 1914 is given in the table below. A similar division for prior years is not available.

Operation	$1 540 892 76
Maintenance	285 861 40
Total	$1 826 754 16

A gratifying increase was made in the wage amounts available for maintenance but the demands upon the several wage items, however, for imperative improvements, such as laying new pipe, increased to such an extent as again to handicap the bureau in its necessary maintenance functions. It cannot be too strongly emphasized that the upkeep of the Water Bureau plant and equipment cannot be neglected with safety.

Arrangements should be made whereby such standard new work as pipe laying need not be paid for out of current funds thereby not infrequently embarrassing the routine work of the bureau for which the appropriations are supposedly made. It has been suggested that an appropriation of perhaps $100,000 be made as a nucleus for pipe line extensions. From this fund the cost of such lines, both for material and labor, should be paid, and to it should be credited frontage payments sufficient to keep the fund at the figure of $100,000. Frontage collections in excess of this sum should be paid into the general fund as at present. This suggestion is worthy of consideration.

New work and maintenance draw heavily upon materials and supplies furnished to the Bureau of Water from appropriations made to the bureau through the Department of Supplies. There was a serious decrease in the amount of such appropriations in 1914 from what was available in 1913, and the functions of the bureau were correspondingly handicapped. The appropriations for the two years are given in the following table:

APPROPRIATIONS THROUGH DEPARTMENT OF SUPPLIES

1913	$865 061 59
1914	761 494 50

The cost of coal consumed for pumpage was materially below the cost for 1913 or any previous year, as shown by the table herewith:

	1910	1911	1912	1913	1914
Cost	$618 381	$570 480	$616 601	$527 802	$509 145
Tons	210 263	201 452	201 168	183 686	179 736

It should be noted that the cost of coal consumed as given by the Water Bureau figures is the only adequate record of the actual outlay for coal burned in any one year and may or may not agree with the annual appropriation items for the purchase of coal. For instance: The Water Bureau started the year 1914 with coal bunkers practically empty. It closed the year with several thousand tons of coal on hand, a highly desirable condition in case of an emergency, such as a railroad blockade. Of course, no coal was in storage at the Queen Lane pumping station where the very limited bunker capacity is a constant menace in case railroad traffic is blocked by a blizzard, even for a day or two.

STORES

The storehouse system and the stores accounts have worked satisfactorily and demonstrated their value in added convenience and economy. A record of all stores, materials and supplies of every nature, shape and description is kept at a centralized point, thereby providing an element of elasticity in the distribution of articles, obviating unnecessary duplication and securing immediate delivery on the occasion of an emergency at any point of anything which may be in stock, regardless of the particular place at which it may be kept. In work as widely distributed as that of the Water Bureau, this proves invaluable.

Storage yards for pipes and specials have been systematized and kept in condition commensurate with their importance.

Progress has been made in the installation of a satisfactory accounting system for all work done in the bureau. This will be materially aided by the form in which the annual appropria-

tions to the Bureau of Water for 1915 have been made. These appropriations are now classified distinctly under the functions performed by the several divisions of the bureau and accounting will be thereby made easier. The accounting system in vogue is reasonably elastic, and while designed to furnish the controller of the city with the distribution of bureau expenditures in the form desired by him, permits at any stage of the development of the accounts a determination of the cost of any particular item of work. This accounting system will increase in value as time goes on, permitting comparison of costs from year to year. It is only by such comparisons that standards can be established and progress made, the essential thing being that a system once installed and working shall not be changed so as to impair its usefulness for such a purpose.

CONSUMPTION

The total consumption, as gauged by the water actually delivered into the distribution system, was 105 billion gallons, substantially the same as in 1913. This is equivalent to a per capita daily rate of 173 gallons for a population of 1,655,000. The corresponding figures for 1913 were 178 gallons for a population of 1,611,000.

Pitometer work was continued, as well as house to house inspection. With the present methods, further reductions in the per capita consumption must necessarily be at a slow rate; to hold the ground already gained may be all that can be hoped for. The next step forward must come through some method of reaching the large consumers, where the carelessness of one individual may cause the waste of more water than the neglect of several hundred persons in private dwellings. For instance: the janitor in one of the large schools may forget to turn off the automatic flushing devices Friday night and these may operate needlessly during the sixty hours until Monday morning. Actual cases of this kind are known and they are by no means confined to public institutions. Where there is no personal financial responsibility, requisite care will not be exercised to prevent waste.

It may not be out of place to instance again the central business section of the city, between South and Callowhill Streets, with its small resident population, where the demand for water during the twenty-four hours of Sunday is not very much below the demand during a week-day. Such a condition indicates waste not only on Sunday but throughout the entire week as well.

It behooves the water consumers of Philadelphia to recognize that it takes just as much coal, oil, waste and equipment to pump water to waste into the sewers as it does to furnish water for a useful purpose. As mentioned elsewhere, the Water Bureau should be furnished with the means of changing wasteful users from flat rates to meter rates, as the only feasible method of inducing reasonable care.

IMPROVEMENTS

Contracts were let for new equipment at the Belmont pumping station. This equipment includes the following:

two 20-million-gallon turbo-centrifugal pumps
six 500-h.p. boilers
blast fans
boiler feed pump
water softening tanks
piping
miscellaneous auxiliary pumps
coal and ash handling apparatus
alterations to boiler house
miscellaneous incidentals

As indicating the advance in the development of centrifugal pumping apparatus, a satisfactory guarantee was obtained in the above contracts that the main pumping units, when operating under a head of about 130 pounds, would give 145 million foot pounds duty per thousand pounds of steam at 200 pounds pressure and 100 degrees superheat. The change of equipment, while the Belmont station is in operation, presents some obstacles interfering with rapid work, but good progress has been made.

A contract was let, and work advanced toward completion, at the Belmont preliminary filters for an extension, adding about fifty per cent. to the filtering area. The plan provides for turning the coarse coke and sponge beds, which have never been efficient even as strainers, into gravel and fine coke filters similar to the effective portion of the preliminary plant. A transfer table is provided, permitting either one of the two Blaisdell Washing Machines to be moved into any bed. The piping system will enable a certain amount of pressure washing to be done through the under-drains.

Plans were practically completed for a sedimentation basin at the Torresdale filters, the construction of which was acted upon favorably at the November election.

The improvement of the water supply of South Philadelphia, likewise acted upon favorably at the November election, was taken up and material progress was made upon the development of plans for laying the large mains on the general perimeter of the southern district, the first step toward an increased pressure in South Philadelphia. While these new large mains will aid local distribution, additional feeder mains from the filters must be provided by a further appropriation to supply the increased demand for water which improved conditions and higher pressures will create.

It is probably a safe prediction that eventually the per capita consumption of water in Philadelphia will be materially reduced, and the effective usefulness of the present plants correspondingly lengthened. Meanwhile the city is face to face with the problem of increasing its filter and pumping station capacities, or having a shortage of water. But entirely apart from the question of the present extravagant use, or rather waste of water, is the necessity of insuring the integrity of any supply and a reasonable safeguarding against cutting off water from a large section of the city in case of accidents. Sixty-five per cent. of the water used in Philadelphia now comes from Torresdale by way of Lardner's Point, and there are too many links in this chain where a single break or accident would throw the whole system out of commission. This holds true in a large measure whether the city uses 200 gallons per capita or 125 gallons per capita.

A large storage reservoir is needed, with reserve pumping stations and filters and independent pipe connections. Any large new work for the water supply, such as the improvement for South Philadelphia, should be planned as an integral part of such a future system, and with due regard to the expansion of the city into the undeveloped sections.

APPENDIX

FILTER STATISTICS

TABLE I—OPERATING COSTS

	Upper Rox.		Lower Rox.		Belmont		Queen Lane		Torresdale	
	1913	1914	1913	1914	1913	1914	1913	1914	1913	1914
Pre-filters	.....	.....	$5 185	$6 129	$9 399	$8 705	$3 192	$3 149	$15 137	$14 814
Final filters	$14 872	$14 108	12 223	11 062	38 242	41 722	42 764	44 282	117 643	134 153
Total cost	$14 872	$14 108	$17 408	$17 191	$47 641	$50 427	$45 956	$47 431	$132 780	$148 967
Million gallons filtered	4 443	4 674	2 998	3 364	13 288	13 884	17 792	17 948	68 538	66 612
Cost of million gallons	$3 35	$3 02	$5 80	$5 10	$3 58	$3 62	$2 57	$2 65	$1 93	$2 23

TABLE II—METHODS OF OPERATION OF FINAL FILTERS

1914	Total quantity filtered, million gallons	Daily average, million gallons	Average rate per acre per day, entire area	Maximum rate per acre per day for area in service	Average number cleanings per filter	Average number days in service between cleanings	Average number cleanings, by Nichols method, per filter	Average number cleanings, by Brooklyn method, per filter	Average number cleanings by ejecting per filter	Average number rakings between cleanings
Torresdale	66 611.585	182.498	3.668	4.761	4.60	73.04	4.46	0.14	.....	2.00
Queen Lane	17 948.475	49.174	3.054	4.224	1.86	201.33	1.86	.....	.....	1.68
Belmont	13 884.485	38.040	2.977	4.159	7.12	48.43	1.06	6.06	.....	0.37
Upper Roxborough	4 673.968	12.805	2.287	3.615	6.00	58.36	0.63	5.38	.....	0.19
Lower Roxborough	3 363.920	9.216	3.478	5.531	10.6	33.44	1.00	9.60	.....	0.09

TABLE III—CHEMICAL AND MICROSCOPICAL CHARACTER OF DELAWARE RIVER WATER

Parts per Million

1914	Chlorine	Total solids	Total hardness	Alkalinity			Free CO_2	Dissolved oxygen	Iron	Suspended matter	Oxygen consumed	Micro-organisms	
				Average	Maximum	Minimum						Number per c. c.	Standard units per c. c.
January	5.1	134	62	22	27	19	3	13.0	2.86	55	3.50	248	315
February	4.7	140	44	20	26	16	3	13.2	3.68	72	3.90	118	186
March	4.6	102	43	20	26	10	3	12.6	1.35	29	2.90	114	174
April	3.2	77	31	12	16	10	4	10.9	.96	16	3.00	106	178
May	3.0	82	35	18	21	16	4	8.7	1.13	23	3.25	280	578
June	4.3	103	57	33	38	29	4	6.8	1.19	26	3.30	536	750
July	5.4	110	57	33	41	27	4	7.0	1.23	23	3.80	950	1196
August	4.6	119	60	37	41	34	4	6.9	.78	19	2.90	844	1062
September	5.3	116	58	38	44	33	4	7.0	.85	21	2.45	643	864
October	8.5	130	73	49	53	45	4	7.7	1.00	27	2.75	408	716
November	7.4	159	78	51	54	49	4	10.4	1.80	43	3.50	628	850
December	5.1	155	60	34	47	22	3	13.0	2.16	57	4.85	726	1000
Average	5.1	119	55	31	.....	.....	4	9.8	1.58	34	3.35	467	656

TABLE IV—CHEMICAL CHARACTER OF WATER IN EFFLUENTS FROM TORRESDALE PLANT

Parts per Million

1914	Chlorine	Hardness	Alkalinity		Iron	Oxygen consumed	CO_2	Dissolved oxygen
			Average	Minimum				
January	5.0	62	23	19	.28	1.65	2	13.3
February	4.7	44	21	15	.37	1.70	3	13.3
March	4.6	43	21	11	.17	1.70	3	13.1
April	3.1	31	12	10	.14	2.00	3	10.8
May	3.0	36	17	16	.06	2.05	6	8.8
June	4.5	56	33	27	.02	1.50	7	7.1
July	5.6	57	34	28	.06	1.80	7	6.9
August	5.0	60	37	34	.04	1.30	8	6.9
September	5.4	57	38	34	.03	1.20	6	7.8
October	8.5	74	49	46	.06	1.10	5	8.6
November	7.7	81	51	49	.06	1.35	5	10.7
December	5.6	64	34	24	.10	2.00	3	13.2
Average	5.2	55	31	.....	.12	1.60	5	10.0

TABLE V—TURBIDITY AND COLOR OF DELAWARE RIVER WATER

Parts per Million

1914	Turbidity									Color						
			Variations: No. of test days									Variations: No. of test days				
	No. of test days	Mean turbidity	0 to 10	11 to 25	26 to 50	51 to 100	101 to 250	251 to 500	Above 500	No. of test days	Mean color	0 to 10	11 to 20	21 to 50	51 to 100	Above 100
January	31	46	.....	18	6	1	6	.....	.....	4	14	.....	4	.....	.....	.....
February	28	46	10	8	5	1	3	1	.....	4	16	.....	4	.....	.....	.....
March	31	33	15	4	6	3	3	.....	.....	5	14	.....	5	.....	.....	.....
April	30	21	.....	21	8	1	.....	.....	.....	4	16	.....	4	.....	.....	.....
May	31	9	22	8	.....	.....	.....	.....	.....	4	18	.....	4	.....	.....	.....
June	30	10	16	14	.....	.....	.....	.....	.....	5	15	.....	5	.....	.....	.....
July	31	19	5	21	4	1	.....	.....	.....	4	19	.....	3	1	.....	.....
August	31	8	26	5	.....	.....	.....	.....	.....	4	14	.....	4	.....	.....	.....
September	30	7	28	2	.....	.....	.....	.....	.....	5	15	.....	5	.....	.....	.....
October	31	9	23	8	.....	.....	.....	.....	.....	4	12	.....	4	.....	.....	.....
November	30	13	10	20	.....	.....	.....	.....	.....	4	14	.....	4	.....	.....	.....
December	31	22	4	16	11	.....	.....	.....	.....	5	17	.....	5	.....	.....	.....
Total	365	.....	159	146	40	7	12	1	.....	52	.....	.....	51	1	.....	.....
Average	.....	20.2	.....	.....	.....	.....	.....	.....	.....	.....	15	.....	.....	.....	.....	.....
Per cent. time	.....	.....	44	40	11	2	3	.3	.....	.....	.....	.....	98	2	.....	.....

Note—Maximum daily average turbidity 400.
Maximum, single test, turbidity 520.

TABLE VI—TURBIDITY OF APPLIED WATER TO FINAL FILTERS—TORRESDALE

Parts per Million

1914	Turbidity								Per cent. removed
	No. of test days	Mean turbidity	Variations: No. of test days						
			0 to 10	11 to 25	26 to 50	51 to 100	101 to 200	Above 200	
January	31	29.	11	14	0	4	2	0	37
February	28	32.	14	8	1	2	2	1	30
March	31	17.	16	10	1	4	.....	.....	48
April	30	11.	19	9	2	.....	.....	.....	48
May	31	2.	31	.....	.....	.....	.....	.....	78
June	30	1.6	30	.....	.....	.....	.....	.....	84
July	31	5.	28	2	1	.....	.....	.....	74
August	31	0.7	31	.....	.....	.....	.....	.....	92
September	30	0.7	30	.....	.....	.....	.....	.....	90
October	31	0.8	31	.....	.....	.....	.....	.....	91
November	30	4.	30	.....	.....	.....	.....	.....	69
December	31	10.	18	13	.....	.....	.....	.....	55
Total	365	.....	289	56	5	10	4	1	.....
Average	.....	9.5	.....	.....	.....	.....	.....	.....	.....
Per cent. time	.....	.....	79	15	1	3	1	.3	.....

Note—Maximum daily average 300.
Maximum single test 400.

TABLE VII—TURBIDITY AND COLOR OF WATER IN EFFLUENTS FROM TORRESDALE PLANT

Parts per Million

1914	Turbidity					Color						
	No. of test days	Mean turbidity	Variations: No. of test days			No. of test days	Mean color	Variations: No. of test days				
			0	0.5 to 5	Above 5			0	1 to 10	11 to 20	21 to 50	Above 50
January	31	2	19	7	5	4	10	.....	3	1	.....	.....
February	28	2	9	16	3	4	11	.....	2	2	.....	.....
March	31	4	16	15	.....	5	11	.....	5	.....	.....	.....
April	30	0	21	9	.....	4	11	.....	2	2	.....	.....
May	31	0	30	1	.....	4	12	.....	2	2	.....	.....
June	30	0	30	0	.....	5	9	.....	5	.....	.....	.....
July	31	0	31	0	.....	4	10	.....	5	.....	.....	.....
August	31	0	31	0	.....	4	9	.....	4	.....	.....	.....
September	30	0	30	0	.....	5	9	.....	5	.....	.....	.....
October	31	0	31	0	.....	4	8	.....	4	.....	.....	.....
November	30	0	30	0	.....	4	9	.....	4	.....	.....	.....
December	31	0	22	9	.....	5	10	.....	1	4	.....	.....
Total	365	.....	300	57	8	52	.....	.....	41	11	.....	.....
Average	.....	.....	.....	.....	.....	.....	10	.....	.....	.....	.....	.....
Per cent. time	.....	.....	82	16	.....	.....	.....	.....	79	21	.....	.....

Note—Maximum turbidity 14. No. of tests above 1=15.

TABLE VIII—NUMBER OF BACTERIA IN DELAWARE RIVER WATER

1914	Number of bacteria on gelatin at 20° C.									Bacillus coli						
				Variations: No. of test days							0.01 c. c. tests		0.1 c. c. tests		1.0 c. c. tests	
	No. of test days	Mean per c. c.	Median per c. c.	0 to 100	101 to 300	301 to 1000	1001 to 10000	10001 to 100000	Above 100000	No. of test days	+ Total No.	+ Per cent.	+ Total No.	+ Per cent.	+ Total No.	+ Per cent.
January	31	34 000	24 000	0	0	0	6	23	2	12	1	8	12	100	12	100
February	28	17 000	13 000	0	0	0	10	18	0	11	1	9	9	82	11	100
March	31	22 000	13 000	0	0	0	11	20	0	14	0	0	2	14	14	100
April	30	4 900	3 600	0	0	0	27	3	0	13	0	0	1	8	13	100
May	31	6 000	3 800	0	0	0	28	3	0	12	0	0	3	25	12	100
June	30	4 800	3 500	0	0	2	25	3	0	14	3	21	12	86	14	100
July	31	12 000	9 000	0	0	0	15	16	0	13	2	15	12	92	13	100
August	31	7 000	6 900	0	0	0	25	6	0	13	1	8	12	92	13	100
September	30	2 900	2 500	0	0	1	29	0	0	13	5	38	13	100	13	100
October	31	3 200	2 500	0	0	2	29	0	0	12	4	33	12	100	12	100
November	30	6 200	5 000	0	0	0	25	5	0	13	5	38	13	100	13	100
December	31	80 000	60 000	0	0	0	1	20	10	14	2	14	14	100	14	100
Total	365	.....	.....	0	0	5	231	117	12	154	24	.....	115	.....	154	.....
Average	.....	16 800	5 500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Per cent. time	.....	.....	.....	.....	.....	1	63	32	3	.....	.....	16	.....	75	.....	100

Median for year = 5500.

TABLE IX—NUMBER OF BACTERIA IN EFFLUENTS FROM TORRESDALE PLANT

1914	Gelatin at 20° C.									Agar at 37½° C.							
	No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days						No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days				
				0 to 10	11 to 25	26 to 50	51 to 100	100 to 250	Above 250				0 to 10	11 to 25	26 to 50	51 to 100	Above 100
January	31	230	93	5	5	3	3	7	8	26	26	15	10	9	1	6	0
February	28	99	54	3	4	4	5	10	2	28	25	17	6	11	8	3	0
March	31	27	16	10	12	6	2	1	0	31	19	14	8	16	6	1	0
April	30	12	8	20	8	0	2	0	0	29	14	12	6	22	1	0	0
May	31	12	8	22	6	3	0	0	0	30	13	9	19	8	2	1	0
June	30	5	4	30	0	0	0	0	0	30	5	4	30	0	0	0	0
July	31	9	7	22	8	1	0	0	0	31	7	6	24	7	0	0	0
August	30	5	4	29	1	0	0	0	0	31	6	5	27	4	0	0	0
September	30	4	3	30	0	0	0	0	0	30	5	4	29	0	0	1	0
October	31	4	2	30	0	1	0	0	0	30	3	2	28	2	0	0	0
November	30	5	4	28	1	1	0	0	0	30	4	3	28	1	1	0	0
December	31	200	35	5	9	2	4	2	9	31	16	18	8	19	4	0	0
Total	364	.....	.....	234	54	21	16	20	19	357	.....	.....	223	99	23	12	0
Average	.....	51	.....	.....	.....	.....	.....	.....	.....	.....	12	.....	.....	.....	.....	.....	0
Per cent. time	.....	.....	.....	64	15	6	4	6	5	.....	.....	.....	63	28	6	3	.....

Median for year =7. **Median for year =8.**

TABLE X—COMPARISON BETWEEN BACTERIAL COUNTS ON GELATIN AND AGAR, TORRESDALE

1914	Average temperature degrees Fahr.	Bacteria per cubic centimeter					
		Delaware River		[1]Effluent of filters		[2]Filtered water basin	
		Gelatin	Agar	Gelatin	Agar	Gelatin	Agar
January	36	34 000	.....	750	.....	230	26
February	36	17 000	890	460	35	99	25
March	35	22 000	350	300	27	27	19
April	51	5 000	260	89	17	12	14
May	59	6 000	2400	43	19	12	13
June	72	4 800	3700	24	19	5	5
July	75	12 000	6900	34	42	9	7
August	76	7 000	6000	42	30	5	6
September	70	2 900	3800	20	20	4	5
October	62	3 200	4600	29	35	4	3
November	48	6 200	1600	65	23	5	4
December	36	80 000	1500	1100	68	200	16
Average	55	16 800	2900	246	30	51	12

[1]Untreated. Agar 24 hours at 37½° C.
[2]Treated with liquid chlorine. Gelatin 48 hours at 20° C.

TABLE XI—BACTERIA RESEMBLING B. COLI COMMUNIS IN EFFLUENTS FROM TORRESDALE PLANT

1914	Bacillus Coli						
		One c. c. tests			Ten c. c. tests		
	No. of test days	Total number	Number +	Per cent. +	Total number	Number +	Per cent. +
January	31	31	2	6	31	5	16
February	28	28	0	0	28	4	14
March	31	31	0	0	31	3	10
April	30	30	0	0	30	1	3
May	31	31	0	0	31	3	10
June	30	30	0	0	30	1	3
July	31	31	0	0	31	1	3
August	31	31	0	0	31	5	16
September	30	30	0	0	30	0	0
October	31	31	0	0	31	2	6
November	30	30	0	0	30	2	7
December	31	31	0	0	31	4	13
Total	365	365	2	.....	365	31	.....
Average	.....	.....	0.17	.....	.....	2.6	.....
Per cent. time.	.....	.....	.....	0.5	.....	.....	8.5

Note—Effluent of final filters (before treatment) 347 tests, 1 c.c. + in 81 tests = 23 per cent.

Effluent of final filters (before treatment) 347 tests, 10 c. c. + in 213 tests = 61 per cent.

TABLE XII—CHEMICAL CHARACTER OF SCHUYLKILL RIVER WATER

Intake at Belmont Pumping Station. Parts per million

1914	Chlorine	Total hardness	Permanent hardness	Alkalinity			Iron	Suspended matter	Total solids	Oxygen consumed
				Average	Maximum	Minimum				
January	4.6	77	40	37	48	25	4.88	103	228	4.66
February	4.4	70	37	33	40	26	6.25	136	264	4.41
March	4.4	73	36	37	46	28	1.67	32	161	2.20
April	3.9	66	36	30	32	28	1.01	20	145	1.68
May	4.2	78	42	36	38	34	.70	10	140	1.50
June	6.9	109	52	57	64	48	.64	11	198	2.19
July	7.3	105	45	60	64	50	.81	14	209	2.52
August	8.5	115	51	64	70	60	.63	11	228	2.48
September	9.6	120	47	73	80	62	.68	13	223	2.89
October	10.8	138	55	83	85	80	.45	8	253	2.64
November	10.3	144	67	77	83	64	.48	6	255	2.63
December	7.0	100	59	41	62	30	.86	14	176	2.35
Average	6.8	100	47	52	59	45	1.59	32	207	2.68

TABLE XIII—CHEMICAL CHARACTER OF WATER IN EFFLUENTS FROM SCHUYLKILL PLANTS

Parts per Million

1914	Lower Roxborough Filters		Upper Roxborough Filters Auxiliary Pumping Station		Belmont Filters		Queen Lane Filters	
	Oxygen consumed	Total solids	Oxygen consumed	Total solids	Oxygen consumed	Total solids	Oxygen consumed	Total solids
January	.65	140	.88	138	1.28	122	1.08	134
February	1.12	137	1.18	126	.80	130	.90	132
March	.88	135	.77	132	.85	120	.85	124
April	.68	127	.75	120	.68	114	.90	122
May	.72	138	.65	128	.62	122	.72	126
June	.72	190	.60	178	.80	183	.80	181
July	1.20	184	.78	190	1.02	192	1.15	190
August	.98	193	1.00	190	1.08	200	1.08	200
September	1.00	233	.95	209	1.05	200	1.12	204
October	.88	242	.88	238	.98	238	1.05	237
November	1.32	233	1.00	244	.98	244	1.08	242
December	1.05	180	1.20	201	1.43	181	1.60	184
Average	.93	178	.89	174	.96	170	1.03	173

Analyses made once in two weeks—Lower Roxborough–Upper Roxborough and Belmont–Queen Lane, alternating.

TABLE XIV—TURBIDITY AND COLOR OF SCHUYLKILL RIVER WATER

Parts per Million

1914	Turbidity										Color				
			Variations: No. of test days										Variations: No. of test days		
	No. of test days	Mean turbidity	0 to 10	11 to 25	26 to 50	51 to 100	101 to 500	501 to 1000	1001 to 1500	1501 to 2000	No. of test days	Mean color	0 to 10	11 to 20	21 to 50
January	31	84	4	11	10	.....	6	.....	.....	.....	5	12	3	1	1
February	28	110	12	5	5	2	1	2	1	.....	4	14	3	.....	1
March	31	61	13	2	8	3	5	.....	.....	.....	5	8	5	.....	.....
April	30	24	.....	22	7	1	.....	.....	.....	.....	4	9	4	.....	.....
May	31	14	8	21	2	.....	.....	.....	.....	.....	4	6	4	.....	.....
June	30	14	2	27	1	.....	.....	.....	.....	.....	5	9	5	.....	.....
July	30	47	.....	21	5	2	2	.....	.....	.....	4	10	3	1	.....
August	31	14	1	29	1	.....	.....	.....	.....	.....	5	10	5	.....	.....
September	30	17	.....	30	.....	.....	.....	.....	.....	.....	4	8	4	.....	.....
October	31	12	13	18	.....	.....	.....	.....	.....	.....	4	9	3	1	.....
November	30	13	14	14	2	.....	.....	.....	.....	.....	5	11	4	1	.....
December	31	27	10	7	11	2	1	.....	.....	.....	4	9	4	.....	.....
Total	364	.....	77	207	52	10	15	2	1	.....	53	.....	47	4	2
Per cent. time	.....	.....	21	57	14	3	4	1	0.3	.....	.....	.....	.....	.....	.....

TABLE XV—TURBIDITY OF WATER IN EFFLUENTS FROM SCHUYLKILL PLANTS

Parts per Million

1914	Lower Roxborough					Upper Roxborough Auxiliary Pumping Station					Belmont					Queen Lane				
	No. of test days	Mean turbidity	Variations: No. of test days			No. of test days	Mean turbidity	Variations: No. of test days			No. of test days	Mean turbidity	Variations: No. of test days			No. of test days	Mean turbidity	Variations: No. of test days		
			0+	0.5–5	Above 5			0+	0.5–5	Above 5			0+	0.5–5	Above 5			0+	0.5–5	Above 5
January	31	1.	24	4	3	31	0.5	11	20	.....	31	1.	23	5	3	31	2.	4	25	2
February	28	0.5	19	9	.....	28	1.	4	24	.....	28	1.	8	20	.....	28	0.5	1	27	.....
March	30	0+	30	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....	30	0+	16	14	.....
April	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	24	6	.....
May	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....
June	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....
July	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....
August	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....
September	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	29	1	.....
October	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....	31	0+	31	.....	.....
November	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....	30	0+	30	.....	.....
December	31	0+	30	1	.....	31	0+	31	.....	.....	31	0+	22	9	.....	31	1	15	16	.....
Total	364	....	347	14	3	365	....	321	44	.....	365	....	328	34	3	364	....	273	89	2
Per cent. time	.....	....	95	4	1	.....	....	88	12	.....	.....	....	90	9	1	.....	....	75	24	1

TABLE XVI—NUMBER OF BACTERIA IN SCHUYLKILL RIVER WATER

Intake at Belmont Pumping Station

1914	Number of bacteria on gelatin at 20° C										Bacteria resembling B. Coli Communis					
				Variations: No. of test days							0.1 c. c. tests			1.0 c. c. tests		
	No. of test days	Mean per c. c.	Median per c. c.	0 to 100	100 to 500	500 to 1000	1000 to 10000	10000 to 100000	100000 to 500000	Above 500000	Total No.	No. +	Per cent. +	Total No.	No. +	Per cent. +
January	31	25 000	12 000	.....	.....	.....	15	15	1	.....	31	21	70	31	27	87
February	28	13 000	5 300	.....	.....	3	16	9	.....	.....	28	16	57	28	28	100
March	31	19 000	10 000	.....	.....	.....	17	14	.....	.....	31	19	61	31	29	94
April	30	14 000	12 000	.....	.....	.....	12	18	.....	.....	30	15	50	30	22	73
May	31	18 000	16 000	.....	.....	.....	10	21	.....	.....	31	18	58	31	26	84
June	30	3 000	2 800	.....	.....	2	28	.....	.....	.....	30	16	53	30	22	73
July	31	8 000	5 000	.....	.....	1	23	7	.....	.....	31	20	65	31	30	97
August	31	4 700	1 600	.....	.....	9	22	.....	.....	.....	31	12	39	31	23	74
September	30	1 700	1 200	.....	.....	11	19	.....	.....	.....	30	7	23	30	22	73
October	31	2 300	1 500	.....	.....	10	21	.....	.....	.....	31	14	45	31	20	65
November	30	21 000	10 000	.....	.....	.....	16	13	1	.....	30	7	23	30	17	57
December	31	43 000	39 000	.....	.....	.....	.....	31	.....	.....	31	21	68	31	30	97
Total	365	.....	.....	.....	.....	36	199	128	2	.....	365	186	.....	365	296	.....
Average	.....	14 000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Per cent. time	.....	.....	.....	.....	.....	10	55	35	0.6	.....	.....	51	.....	.....	81	.....

TABLE XVII—NUMBER OF BACTERIA IN EFFLUENTS FROM SCHUYKILL PLANTS

1914	Gelatin at 20° C														
	Lower Roxborough								Upper Roxborough Auxiliary Pumping Station						
	No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days					No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days				
				0 to 10	11 to 50	51 to 100	101 to 500	Above 500				0 to 10	11 to 50	51 to 100	101 to 500	Above 500
January	31	62	13	13	12	3	2	1	31	5	5	30	1	.....	.....	.....
February	28	17	10	15	11	2	.....	.....	28	4	3	27	1	.....	.....	.....
March	26	5	4	24	2	.....	.....	.....	30	2	1	30	.....	.....	.....	.....
April	30	3	2	30	.....	.....	.....	.....	30	1	2	30	.....	.....	.....	.....
May	31	3	2	31	.....	.....	.....	.....	31	1	1	31	.....	.....	.....	.....
June	30	4	4	28	2	.....	.....	.....	30	1	1	30	.....	.....	.....	.....
July	31	4	3	30	1	.....	.....	.....	31	11	2	24	[1]4	[1]1	[1]2	.....
August	30	1	1	29	1	.....	.....	.....	31	2	2	30	1	.....	.....	.....
September	30	1	1	30	.....	.....	.....	.....	30	2	2	30	.....	.....	.....	.....
October	29	2	2	29	.....	.....	.....	.....	31	1	1	31	.....	.....	.....	.....
November	30	5	4	28	2	.....	.....	.....	30	3	2	29	1	.....	.....	.....
December	31	36	13	14	9	6	2	.....	31	4	3	30	1	.....	.....	.....
Total	357	.....	.....	301	40	11	4	1	364	.....	.....	352	9	1	2	.....
Average	.....	12	.....	.....	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....
Per cent. time	.....	.....	.....	84	11	3.1	1.1	0.3	.....	.....	.....	97	2.5	0.3	0.6	.....

[1] Probably due to repairs on pipe line.

TABLE XVIII—NUMBER OF BACTERIA IN EFFLUENTS FROM SCHUYLKILL PLANTS

1914	Gelatin at 20° C.															
	Belmont								Queen Lane							
	No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days					No. of test days	Mean per c. c.	Median per c. c.	Variations: No. of test days				
				0 to 10	11 to 50	51 to 100	101 to 500	Above 500				0 to 10	11 to 50	51 to 100	101 to 500	Above 500
January	31	63	16	12	12	2	4	1	31	27	17	7	21	2	1	.....
February	28	15	6	25	2	....	1	.....	28	6	6	25	3	.....	.....	.....
March	31	5	4	30	1	.....	.....	.....	29	5	5	28	1	.....	.....	.....
April	30	2	2	30	.....	.....	.....	.....	30	4	4	29	1	.....	.....	.....
May	31	2	2	31	.....	.....	.....	.....	31	6	5	28	3	.....	.....	.....
June	30	2	2	30	.....	.....	.....	.....	30	5	4	28	2	.....	.....	.....
July	31	1	1	31	.....	.....	.....	.....	31	4	3	30	1	.....	.....	.....
August	31	1	1	31	.....	.....	.....	.....	31	3	2	31	.....	.....	.....	.....
September	30	1	1	30	.....	.....	.....	.....	30	3	2	29	1	.....	.....	.....
October	31	2	1	31	.....	.....	.....	.....	31	3	2	29	2	.....	.....	.....
November	30	9	3	23	6	1	.....	.....	30	21	16	6	23	1	.....	.....
December	31	69	26	6	13	3	9	.....	24	140	56	3	9	4	[1]7	[1]1
Total	365	.....	.....	310	34	6	14	1	356	.....	.....	273	67	7	8	1
Average	.....	14	.....	.....	.....	.....	.....	.....	.....	19	.....	.....	.....	.....	.....	.....
Per cent. time	.....	.....	.....	85	9	1.6	4	0.3	.....	.....	.....	77	19	2	2	0.3

[1] Samples during portion of December irregularly collected.

TABLE XIX—BACTERIA RESEMBLING B. COLI COMMUNIS IN EFFLUENTS FROM SCHUYLKILL PLANTS

1914	Lower Roxborough Filters						Upper Roxborough Filters Auxiliary Pumping Station					
	No. of test days	One c. c. tests		No. of test days	Ten c. c. tests		No. of test days	One c. c. test		No. of test days	Ten c. c. tests	
		Total number	Per cent. +		Total number	Per cent. +		Total number	Per cent. +		Total number	Per cent. +
January	31	0	0	31	2	6	31	0	0	31	2	6
February	28	0	0	28	0	0	28	0	0	28	0	0
March	29	0	0	29	0	0	30	0	0	30	0	0
April	30	0	0	30	0	0	30	0	0	30	0	0
May	31	1	3	31	0	0	31	0	0	31	0	0
June	30	0	0	30	0	0	30	0	0	30	0	0
July	31	1	3	31	3	10	31	0	0	31	[1]1	3
August	31	0	0	31	0	0	31	0	0	31	0	0
September	30	0	0	30	0	0	30	0	0	30	0	0
October	31	1	3	31	2	6	31	0	0	31	1	3
November	30	0	0	30	0	0	30	0	0	30	0	0
December	31	1	3	31	10	32	31	0	0	31	0	0
Total	363	4	.....	363	17	.....	364	.....	.....	364	4	.....
Per cent. time	.....	.....	1.1	.....	.....	4.7	.....	.....	.....	.....	.....	1

[1] Probably affected by repairs to plant.

TABLE XX—BACTERIA RESEMBLING B. COLI COMMUNIS IN EFFLUENTS FROM SCHUYLKILL PLANTS

1914	Belmont Filters						Queen Lane Filters								
		One c.c. test			Ten c.c. tests			One c. c. test					Ten c. c. tests				
								Total number		Per cent. +			Total number		Per cent. +	
	No. of test days	Total number	Per cent. +	No. of test days	Total number	Per cent. +	No. of test days	N. Basin	S. Basin	N. Basin	S. Basin	No. of test days	N. Basin	S. Basin	N. Basin	S. Basin
January	31	0	0	31	2	6	31	1	1	3	3	31	3	1	10	3
February	28	0	0	27	0	0	28	0	1	.....	4	28	0	0	.....	.....
March	31	0	0	31	0	0	29	0	0	.....	.....	29	0	1	.....	3
April	30	0	0	30	0	0	30	0	0	.....	.....	30	0	0	.....	.....
May	31	0	0	31	0	0	31	0	0	.....	.....	31	1	1	3	3
June	30	0	0	30	0	0	30	0	0	.....	.....	30	0	0	.....	.....
July	31	0	0	31	1	3	31	0	0	.....	.....	31	2	7	6	23
August	31	0	0	31	0	0	31	0	0	.....	.....	31	0	7	.....	23
September	30	0	0	30	0	0	30	1	0	3	.....	30	2	3	7	10
October	31	0	0	31	0	0	31	0	0	.....	.....	31	1	1	3	3
November	30	0	0	30	1	3	30	2	0	7	.....	30	2	6	7	20
December	31	1	3	31	7	23	31	[1]5	[1]3	16	10	31	[1]16	[1]14	52	45
Total	365	1	.....	364	11	.....	363	9	5	.....	.....	363	27	41	.....	.....
Per cent. time.	.....	.....	0.3	.....	.....	3	.....	.....	.....	2.5	1.4	.....	.....	.....	7.4	11.3

[1] Samples during portion of December irregularly collected.

Station	Description					Rated capacity M.G. per 24 hrs.	Working conditions			
	No. of units	Year installed	Builder	Type			Steam pressure lbs. per sq. in.	Vacuum in mercury.	Total head feet	
				Steam end	Water End					
Belmont	2	1908	Bethlehem	Hor. cross comp	Dble. plung.	10	150	26	316	R
	3	1900	Holly	Hor. comp	2 plung	10	150	27	316	R
	1	[1] 1895	Worthington	Duplex comp	2 plung	20	100	24	316	R
Queen Lane	4	1896	Southwark	Ver. trip. exp	3 plung	20	150	27	271	R
Shawmont	1	[2] 1887	Gaskill	Hor. comp	2 plung	10	100	24	400	R
	4	1901	Worthington	Hor. comp. high duty duplex	2 plung	5	150	26	400	R
	2	1908	Snow	Hor. cross comp	2 plung	5	150	26	400	R
Lardner's Pt. No. 2	6	1903–4	Holly	Vert. trip. exp	3 plung	20	150	28	184	D
Lardner's Pt. No. 3	4	1908	Holly	Vert. trip. exp	3 plung	20	175	28	.....	D
	2	1908	Holly	Vert. trip. exp	3 plung	20	175	28	184	D
Torresdale	6	1907	Reeves eng., wood pumps	Vert. cross comp	Centrifugal	40	175	26	42	R
	1	1908	Bates eng., Allis-Chalmers pump	Vert. cross comp	Centrifugal	40	175	26	42	R
	1	1910	DeLaval	Hor. turbine	Centrifugal	50	175	28	42	R
Roxborough L. S.	3	1902	Buckeye eng. Worthington pump	Vert. cross comp	Centrifugal	10	100	26	17	R
George's Hill	1	1908	Allis-Chalmers	Hor. cross comp	Dble. plung.	6	100	27	136	H
	1	1900	Worthington	Hor. comp. H.D. dup	Dble. plung.	5	100	27	136	H
Roxborough H. S.	1	1900	Worthington	Hor. comp	Dble. plung.	5	100	27	118	H
	1	[3] 1866	Worthington	Hor. comp. H.D. dup	Dble. plung.	5	100	27	118	H
Wentz Farm	1	1900	Holly	Hor. comp	Dble. plung.	3	110	28	140	H
	1	[4] 1899	D'Auria	Hor. duplex comp	Dble. plung.	4	110	25	140	H

[1] Moved from Spring Garden in 1895.
[2] Moved from Spring Garden in 1908.
[3] Moved from Delaware Station in 1890 and from Spring Garden in 1895.
[4] Moved from Shawmont in 1902.
R—Raw water to filters. H—High service direct. D—Direct.

BOILERS

Station	Description					Working conditions		
	No. of boilers	Year installed	Kind of boilers	Kind of grates	Rated horse power	Steam pressure	Method of firing	Draft
Belmont	26	1899–12 1900–04 1906–10	Furnace flue tubular	Stationary	100	5–100 21–150	Hand	Natural
Queen Lane	8	1912	Badenhausen water tube	Dumping	300	150	Hand	Forced
Shawmont	4	1908	Edgemoor water tube	Stationary	500	150	Hand	Induced
Lardner's Pt. No. 2	8	1905	Furnace flue tubular	Stationary	110	150	Hand	Natural
Lardner's Pt. No. 2	6	1907	Edgemoor water tube	Wetzel stoker	500	150	Stoker	Natural
Lardner's Pt. No. 3	8	1908	Edgemoor water tube[1]	Wetzel stoker	500	150	Stoker	Induced
Torresdale	9	1907–6 1908–3	Heine water tube[2]	Murphy	325	175	Stoker	Natural
Roxborough H. S.	6	1891–2 1895–4	Furnace flue tubular	Stationary	4–80 2–100	100	Hand	Natural
George's Hill	4	1895	Furnace flue tubular	Stationary	80	100	Hand	Natural
Wentz Farm	3	1900	Furance flue tubular	Stationary	100	110	.....	Natural

[1]Green economizers. [2]Sturtevant economizers.

COAL PURCHASED AND CONSUMED

Station	Classification	Price per ton	Purchased			Consumed		
			Tons	Cost	Total	Tons	Cost	Total
Spring Garden	Pea	$3 68	.....	.....	.....	624.00	$2 296 32	$2 296 32
Belmont	Pea	3 73	17 965.35	$67 010 75	.....	17 965.35	67 010 75	.....
Belmont	Pea	3 74	.....	.....	.....	779.90	2 916 83	.....
Belmont	Buckwheat	2 42	4 849.00	11 734 58	.....	1 276.85	3 089 97	.....
Belmont	Buckwheat	2 45	10 994.35	26 936 17	.....	10 994.35	26 936 17	.....
Belmont	Buckwheat	2 46	.....	.....	$105 681 50	1 018.55	2 505 63	102 459 35
Queen Lane	Pea	2 63	30 411.30	79 981 73	.....	29 939.95	78 743 38	.....
Queen Lane	Rice	1 95	29.05	56 65	80 038 38	29.05	56 65	78 800 03
Shawmont	Bituminous	2 62	2 544.451	6 666 46	.....	1 677.407	4 394 81	.....
Shawmont	Bituminous	2 65	89.643	237 55	.....	89.643	237 55	.....
Shawmont	Bituminous	2 69	15 114.15	40 657 07	.....	15 114.15	40 657 06	.....
Shawmont	Bituminous	2 69	2 089.24	5 620 06	.....	2 089.24	5 620 06	.....
Shawmont	Bituminous	2 98	.....	.....	.....	1 523.214	4 539 78	.....
Shawmont	Bituminous	3 17	.....	.....	53 181 14	1 696.346	5 377 42	60 826 68
Lardner's Point	Bituminous	2 59	353.00	914 27	.....	.....	.....	.....
Lardner's Point	Bituminous	2 635	.....	.....	.....	187.05	443 62	.....
Lardner's Point	Bituminous	2 65	3 408 212	9 031 76	.....	1 989.794	5 272 95	.....
Lardner's Point	Bituminous	2 67	4 509.45	12 040 23	.....	.....	.....	.....
Lardner's Point	Bituminous	2 74	45 411.104	124 426 43	.....	43 932.839	120 375 97	.....
Lardner's Point	Bituminous	2 95	.....	.....	.....	3 551.562	10 477 11	.....
Lardner's Point	Bituminous	3 00	.....	.....	.....	936.474	2 809 42	.....
Lardner's Point	Bituminous	3 12	.....	.....	146 412 69	4 219.281	13 164 16	152 543 23
Totals and averages	.....	$2 79	137 768.30	$385 313 71	$385 313 71	139 628.00	$396 925 61	$396 925 61

HIGH SERVICE STATIONS

Station	Classification	Price per ton	Purchased			Consumed		
			Tons	Cost	Total	Tons	Cost	Total
George's Hill	Buckwheat	$3 05	37.25	$113 61				
George's Hill	Buckwheat	3 07	447.65	1 374 29				
George's Hill	Buckwheat	3 08				170.21	$524 25	
George's Hill	Buckwheat	3 10	1 756.05	5 443 77		1 393.90	4 321 09	
George's Hill	Buckwheat	3 25				39.89	129 65	
George's Hill	Pea	3 68			6 931 67	39.00	143 52	$5 118 51
Roxborough	Buckwheat	2 54						
Roxborough	Buckwheat	3 02	1 481.30	4 473 54		1 381.00	4 170 62	
Roxborough	Buckwheat	3 03			4 473 54	142.00	430 26	4 600 88
Wentz Farm	Buckwheat	3 03				184.40	558 73	
Wentz Farm	Buckwheat	3 05	1 291.45	3 938 93	3 938 93	1 066.60	3 253 13	3 811 86
Totals and averages		$3 06	5 013.70	$15 344 14	$15 344 14	4 417.00	$13 531 25	$13 531 25

LOW SERVICE STATIONS

Station	Classification	Price per ton	Purchased			Consumed		
			Tons	Cost	Total	Tons	Cost	Total
Roxborough	Buckwheat	$2 54	116.65	$296 29		116.65	$296 29	
Roxborough	Buckwheat	2 63	15.50	407 65		15.50	40 76	
Roxborough	Buckwheat	3 02	2 887.05	8 718 89		2 887.05	8 718 89	
Roxborough	Buckwheat	3 03	88.20	267 25		88.20	267 25	
Roxborough	Pea	4 31	5.60	24 14	$9 714 22	5.60	24 14	$9 347 33
Torresdale	Bituminous	2 505				395.15	989 85	
Torresdale	Bituminous	2 52	6 221.00	15 676 92		4 950.82	12 476 07	
Torresdale	Bituminous	2 53	4 789.00	11 989 17				
Torresdale	Bituminous	2 59	10 962.00	28 391 58		10 962.00	28 391 58	
Torresdale	Bituminous	2 74	9 646.76	26 432 11		9 646.76	26 432 12	
Torresdale	Bituminous	2 95				781.83	2 306 40	
Torresdale	Bituminous	3 00				2 148.44	6 445 32	
Torresdale	Bituminous	3 17			82 489 78	694.00	2 198 98	79 240 32
Totals and averages		$2 65	34 731.76	$92 204 00	$92 204 00	32 692.00	$88 587 65	$88 587 65

FILTERS

Station	Classification	Price per ton	Purchased			Consumed		
			Tons	Cost	Total	Tons	Cost	Total
Upper Roxborough	Pea	$4 25	47.80	$203 15		9.00	$38 25	
Upper Roxborough	Pea	4 31			$203 15	41.00	176 71	$214 96
Lower Roxborough	Pea	4 25	78.60	334 05		30.30	128 78	
Lower Roxborough	Pea	4 31			334 05	60.70	261 62	390 40
Belmont	Buckwheat	3 10	693.45	2 149 71		693.45	2 149 71	
Belmont	Buckwheat	3 13				20.70	64 79	
Belmont	Buckwheat	3 25				154.00	500 50	
Belmont	Pea	4 30	607.15	2 610 76	4 760 47	242.85	1 044 25	3 759 25
Queen Lane	Buckwheat	3 05	1 695.75	5 172 06		1 438.30	4 386 82	
Queen Lane	Buckwheat	3 24			5 172 06	262.70	851 15	5 237 97
Totals and averages		$3 35	3 122.75	$10 469 73	$10 469 73	2 953.00	$9 602 58	$9 602 58
Grand totals		$2 78	180 636.51	$503 331 58	$503 331 58	179 690.00	$508 647 09	$508 647 09
Increase								
Decrease		9	19 220 541	$71 373 62	$71 373 62	3 996.00	$19 155 06	$19 155 06

ANNUAL PUMPAGE, COAL, LUBRICANTS, ETC.

Stations	Pumpage				Coal		Lubricants		
	Total million gallons	Average daily million gals.	Million gallons raised 100 feet per lb. of coal	Mean head feet	Total tons	Average daily tons	Grease pounds	Engine oil gallons	Cylinder oil gallons
Belmont	15 116	41	1.49	316	32 035	87	1 387	8 288	7 241
Queen Lane	17 892	49	1.55	271	29 969	82	8 388	3 801	4 280
Shawmont	8 858	24	1.59	400	22 183	61	2 675	3 428	5 183
Lardner's Point	66 878	183	2.55	209	54 817	150	3 119	14 004	11 654
George's Hill	1 089	3	.90	136	1 643	4	420	344	733
Roxborough High	1 317	4	1.01	118	1 523	4	334	54	448
Wentz Farm	733	2	.81	138	1 251	3	7	589	412
Roxborough Low	4 674	13	.26	17	3 113	8	24	785	592
Torresdale	70 178	192	1.18	42	26 387	72	75	4 560	2 560
Totals and averages	186 735	511	1.77	162	172 921	471	16 429	35 853	33 103

COAL CONSUMED FOR PUMPAGE

Stations	Coal—Tons		Pumpage—M. gallons	
	Increase	Decrease	Increase	Decrease
Belmont	1079	.....	316	.....
Queen Lane	1240	.....	220	.....
Shawmont	.....	917	627	.....
Lardner's Point	.....	6157	.....	1595
Total	2319	7074	1163	1595

HIGH SERVICE STATIONS

George's Hill	143	.....	53	.....
Roxborough	.....	157	.....	75
Mt. Airy	.....	.....	.....	.....
Wentz Farm	202	.....	138	.....
Total	345	157	191	75

LOW SERVICE STATIONS

Roxborough	74	.....	231	.....
Torresdale	.....	23	.....	1595
Totals	74	23	231	1595
Grand totals	2738	7254	1585	3265

A

Station	Pumpage, million gallons	Average lift	Engines	Boilers	Buildings	Grounds	Total	Average cost per M. G. 100 ft. H.
Spring Garden	.....	.....	.....	.....	$8 589 36	$551 28	$9 140 64	.....
Belmont	15 116	316	$25 833 92	$139 320 61	8 366 36	2 307 10	175 827 99	$3 70
Queen Lane	17 892	271	22 091 52	110 522 57	6 682 31	481 05	139 777 45	2 99
Shawmont	8 858	400	28 562 95	90 503 85	7 926 36	651 40	127 644 56	3 60
Lardner's Point, No. 2	32 200	184	26 266 85	101 754 47	9 040 21	682 82	137 744 35	2 32
Lardner's Point, No. 3	34 678	232	23 961 73	106 527 21	7 239 58	211 52	137 940 04	1 71
Torresdale	70 178	42	26 789 82	97 820 79	8 533 53	929 81	134 073 95	4 54
George's Hill	1 089	136	6 247 94	8 779 74	1 490 10	145 73	16 663 51	11 25
Roxborough High	1 317	118	6 134 09	9 062 66	2 181 79	20 20	17 398 74	11 23
Roxborough Low	4 674	17	4 369 71	11 953 90	522 57	.....	16 846 18	20 69
Wentz Farm	733	138	4 403 65	7 358 74	1 436 04	53 98	13 252 41	13 05
Mount Airy	.....	.....	18 82	95 00	1 846 33	.....	1 960 15	.....
Totals and averages	186 735	162	$174 681 00	$683 699 54	$63 854 54	$6 034 89	$928 269 97	$3 05

B

Station	Pumpage, million gallons	Average lift	Labor	Coal	Oils, grease and waste	Packing, rubber valves, etc.	Sundries	Total	Average cost per M. G. 100 ft. H.
Spring Garden	.....	.....	$6 503 39	$2 296 32	.....	.....	$340 93	$9 140 64	.....
Belmont	15 116	316	62 995 04	102 459 35	$3 150 76	$2 308 32	4 914 52	175 827 99	$3 70
Queen Lane	17 892	271	51 032 80	78 800 03	2 300 72	2 222 50	5 421 40	139 777 43	2 99
Shawmont	8 858	400	54 805 08	60 826 68	1 992 20	2 463 44	7 557 16	127 644 56	3 60
Lardner's Point, No. 2	32 200	184	55 429 21	72 093 86	2 276 02	1 167 26	6 778 00	137 744 35	2 32
Lardner's Point, No. 3	34 678	232	46 238 54	80 449 37	2 345 85	1 848 08	7 058 20	137 940 04	1 71
Torresdale	70 178	42	58 073 44	70 702 98	1 490 58	569 96	3 236 99	134 073 95	4 54
George's Hill	1 089	136	10 852 65	5 118 51	289 48	175 36	227 51	16 663 51	11 25
Roxborough High	1 317	118	11 532 45	4 600 88	177 35	258 91	829 15	17 398 74	11 23
Roxborough Low	4 674	17	6 699 47	9 714 22	304 54	32 55	95 40	16 846 18	20 69
Wents Farm	733	138	8 767 78	3 811 86	228 86	96 41	347 50	13 252 41	13 05
Mount Airy	.....	.....	1 742 64	.....	.....	.....	217 51	1 960 15	.....
Totals and averages	186 735	162	$374 672 49	$490 874 06	$14 556 36	$11 142 79	$37 024 27	$928 269 97	$3 05

A

Station	Pumpage, million gallons	Average lift	Engines	Boilers	Buildings	Grounds	Total	Average cost per M. G. 100 ft. H.
Spring Garden	.....	.....	$36 25	.....	$571 33	$253 45	$861 03	.....
Belmont	15 116	316	10 300 56	3 217 28	2 181 35	134 88	15 834 07	$0 33
Queen Lane	17 892	271	24 877 40	6 235 32	2 078 39	178 91	33 370 02	71
Shawmont	8 858	400	13 788 78	5 125 47	769 77	285 25	19 969 27	56
Lardner's Point, No. 2	32 200	184	6 873 77	8 375 91	3 043 84	11 46	18 304 98	30
Lardner's Point, No. 3	34 678	232	7 400 56	8 028 64	1 913 42	7 61	17 350 23	21
Torresdale	70 178	42	10 567 49	11 265 15	1 303 60	736 36	23 872 60	80
George's Hill	1 089	136	392 82	329 33	499 64	231 13	1 452 92	98
Roxborough High	1 317	118	891 70	972 26	203 12	30	2 067 38	1 33
Roxborough Low	4 674	17	960 10	3 83	17 69	1 37	982 99	1 20
Wentz Farm	733	138	447 96	63 67	173 54	39 00	724 17	71
Mount Airy	.....	.....	37 23	.....	4 11	93 63	134 97	.....
Totals and averages	186 735	162	$76 574 62	$43 616 86	$12 759 80	$1 973 35	$134 924 63	$0 44

B

Station	Labor	Sundries	Total	Average cost per million gallons, 100 feet high
Spring Garden	$827 87	$33 16	$861 03	.....
Belmont	12 948 24	2 885 83	15 834 07	$0 33
Queen Lane	25 613 81	7 756 21	33 370 02	71
Shawmont	15 912 01	4 057 26	19 969 27	56
Lardner's Point, No. 2	13 714 97	4 590 01	18 304 98	30
Lardner's Point, No. 3	12 982 03	4 368 20	17 350 23	21
Torresdale	16 666 89	7 205 71	23 872 60	80
George's Hill	1 275 22	177 70	1 452 92	98
Roxborough High	1 474 41	592 97	2 067 38	1 33
Roxborough Low	930 44	52 55	982 99	1 20
Wentz Farm	580 47	143 70	724 17	71
Mount Airy	134 97	.....	134 97	.....
Totals and averages	$103 061 33	$31 863 30	$134 924 63	$0 44

WORK DONE DURING 1914

Service main laid	113 376 by city
Service main laid	21 968 by private contract
Total	135 344

Private Contract

6 inch	14 607 feet.
8 inch	6 754 "
10 inch	443 "
12 inch	164 "
	21 968 "

Laid by Contract

Bustleton Line

Supply main	8 inch	7 459 feet.
	10 inch	5 327 "
	12 inch	1 445 "
	16 inch	13 "
	Total	14 244 "
Fire hydrant connections 6 inch		186 "
Grand total		14 430 "

Belmont Plateau—Contract 194

Pumping Main Connections

30 inch	36 inch	48 inch	
60 feet	50 feet	75 feet	= 185 feet

Fire Hydrants in use December 31, 1914

Old Style	New Style	
323	17 092	or 98 per cent.

TOTAL FEET OF PIPE IN USE DECEMBER 31, 1914

Size in inches	Total in use Dec. 31, 1913	Extensions and Relays during 1914			Deductions during 1914		Total	Total in use December 31, 1914
		Laid	Relaid	Total	Taken up	Abandoned		
1	175	.....	.....	.....	.....	.....	.....	175
1¼	3 566	.....	.....	.....	.....	.....	.....	3 566
2	3 655	.....	.....	.....	.....	.....	.....	3 655
3	77 858	199	.....	199	.....	152	152	77 905
4	154 681	149	.....	149	588	198	786	154 044
6	5 983 325	57 238	933	58 171	1238	2632	3870	6 037 626
8	534 057	69 951	163	70 114	70	.....	70	604 101
10	575 450	17 475	2947	20 422	14	121	135	595 737
12	607 258	10 417	177	10 594	39	166	205	617 647
16	201 610	13	.....	13	.....	.....	.....	201 623
18	16 044	.....	.....	.....	.....	.....	.....	16 044
20	285 452	406	.....	406	.....	.....	.....	285 858
22	1 084	.....	.....	.....	.....	720	720	364
23	27	.....	.....	.....	.....	.....	.....	27
24	23 360	.....	.....	.....	.....	30	30	23 330
30	297 042	60	.....	60	.....	.....	.....	297 102
36	106 464	50	.....	50	.....	.....	.....	106 514
42	564	.....	.....	.....	.....	.....	.....	564
48	344 526	164	.....	164	.....	.....	.....	344 690
60	43 801	.....	.....	.....	.....	.....	.....	43 801
Total	9 259 999	156 122	4220	160 342	1949	4019	5968	9 414 373

Purposes for which used	Size in inches						
	3	4	6	8	10	12	16
New pipe or feet added:							
Service mains	.....	.....	52 062	62 228	12 143	8 911	.....
Supply mains	.....	.....	.....	7 459	5 327	1 445	13
Service main connections	.....	.....	44	218	.....	.....	.....
Supply main connections	.....	.....	.....	46	5	61	.....
Pumping main connections	.....	.....	.....	.....	.....	.....	.....
By-pass connections	.....	.....	.....	.....	.....	.....	.....
Fire hydrant connections	.....	.....	4 538	.....	.....	.....	.....
Fire connections (private)	16	20	447	.....	.....	.....	.....
Supply connections (private)	163	129	77	.....	.....	.....	.....
Drains	20	.....	70	.....	.....	.....	.....
Total:							
Feet	199	149	57 238	69 951	17 475	10 417	13
Pounds	2985	2980	1 717 140	3 147 795	1 048 500	833 360	1495
Pipe used but adding nothing to feet underground:							
Pipe relaid	.....	.....	933	163	2 947	177	.....
Repairs, general	.....	40	2 513	73	62	102	21
Pipe taken up	.....	588	1 238	70	14	39	.....
Pipe lowered	.....	.....	188	.....	.....	.....	.....
Pipe shifted	.....	.....	.....	.....	.....	.....	.....
Total:							
Feet	.....	628	4 872	306	3 023	318	21
Pounds	.....	12 560	146 160	13 770	181 380	25 440	2415
Total handled:							
Feet	199	777	62 110	70 257	20 498	10 735	34
Pounds	2985	15 540	1 863 300	3 161 565	1 229 880	858 800	3910
Pipe cut off and abandoned	152	198	2 632	.....	121	166	.....

WORK ON WATER PIPES—*Continued*

Purposes for which used	Size in inches							Totals in feet and pounds
	18	20	22	24	30	36	48	
New pipe or feet added:								
Service mains								135 344
Supply mains							89	14 333
Service main connections								262
Supply main connections								112
Pumping main connections					60	50	75	185
By-pass connections		406						406
Fire hydrant connections								4 538
Fire connections (private)								483
Supply connections (private)								369
Drains								90
Total:								
Feet		406			60	50	164	156 122
Pounds		62 930			19 800	21 000	106 600	6 964 585
Pipe used but adding nothing to feet underground:								
Pipe relaid								4 220
Repairs, general	5	75			5	698		3 594
Pipe taken up								1 949
Pipe lowered						138	504	830
Pipe shifted		887						887
Total:								
Feet	5	962			5	836	504	11 480
Pounds	650	149 110			1 650	351 120	327 600	1 211 855
Total handled:								
Feet	5	1 368			65	886	668	167 602
Pounds	650	212 040			21 450	372 120	434 200	8 176 440
Pipe cut off and abandoned			720	30				4 019

FIRE HYDRANTS BY WARDS

Wards	O. S.	No. 1	No. 2	No. 3	No. 4	No. 5	High pressure	Set during 1914	Total
1	1	204	65	8	.....	.....	.....	.....	278
2	1	136	89	15	.....	.....	.....	.....	241
3	3	83	43	6	.....	.....	.....	.....	135
4	1	68	35	14	.....	.....	.....	.....	118
5	13	117	56	2	.....	.....	29	.....	217
6	8	105	37	4	.....	.....	81	.....	235
7	5	162	72	3	.....	.....	.....	.....	242
8	8	149	77	3	.....	1	35	.....	273
9	.....	156	57	2	.....	1	60	.....	276
10	.....	121	57	.....	.....	4	43	.....	225
11	4	80	23	1	.....	.....	10	2	118
12	7	79	14	2	.....	.....	.....	.....	102
13	23	96	43	5	.....	.....	.....	.....	167
14	.....	107	71	.....	.....	.....	21	1	199
15	.....	260	183	4	1	2	13	.....	463
16	2	97	25	3	1	.....	26	2	154
17	11	100	18	1	.....	.....	38	.....	168
18	11	226	52	6	.....	.....	51	.....	346
19	31	373	90	4	.....	.....	198	1	696
20	16	162	117	.....	.....	.....	27	.....	322
21	34	461	35	7	.....	.....	.....	4	537
22	40	1355	136	14	.....	.....	.....	10	1545
23	36	423	77	5	.....	.....	.....	8	541
24	8	371	142	8	.....	.....	.....	4	529
25	.....	323	52	2	.....	.....	15	1	392
26	.....	254	125	14	.....	.....	.....	.....	393
27	2	207	58	6	.....	1	.....	.....	274
28	.....	187	125	25	.....	.....	.....	.....	337
29	.....	129	99	3	.....	1	.....	2	232
30	5	130	111	5	.....	.....	.....	.....	251
31	.....	269	59	4	.....	.....	43	.....	375
32	5	149	88	7	.....	1	13	.....	263
33	15	541	103	9	1	.....	110	9	779
34	5	526	40	4	.....	1	.....	23	576
35	.....	248	22	5	.....	.....	.....	44	275
36	2	277	74	17	.....	.....	.....	3	370
37	2	125	68	4	.....	.....	22	2	221
38	7	602	95	12	.....	.....	.....	9	716
39	.....	282	96	7	.....	.....	.....	14	385
40	5	496	67	2	.....	.....	.....	41	570
41	.....	71	8	7	.....	.....	.....	2	86
42	.....	477	36	8	.....	.....	.....	56	521
43	6	420	57	5	.....	.....	15	12	503
44	1	260	59	8	.....	.....	.....	.....	328
45	.....	379	71	3	.....	.....	10	11	463
46	.....	465	73	14	.....	.....	.....	13	552
47	4	122	93	1	.....	.....	4	.....	224
48	1	156	36	9	.....	.....	.....	4	202
Total	323	12 586	3329	298	3	12	864	278	17 415

VALVES IN USE

Pattern		Total 1914
Department		31 839
Butterfly B. of W		148
Barton		64
Viney		543
Smith Patent		629
Ludlow		71
Eddy		312
Eddy Rotary		5
Rensselaer		51
Rensselaer Rotary		1
Pratt & Cady		17
Van Winkle		5
Water Works Equipment Co		1
Chapman		14
Kennedy Electric		1
Kennedy		21
Nelson		129
Fairbanks		27
Belfield		1
American		2
Wood		2
High Pressure	Williamsport	263
	Chapman	18
	Smith	433
	Ludlow	4
Grand total		34 601