

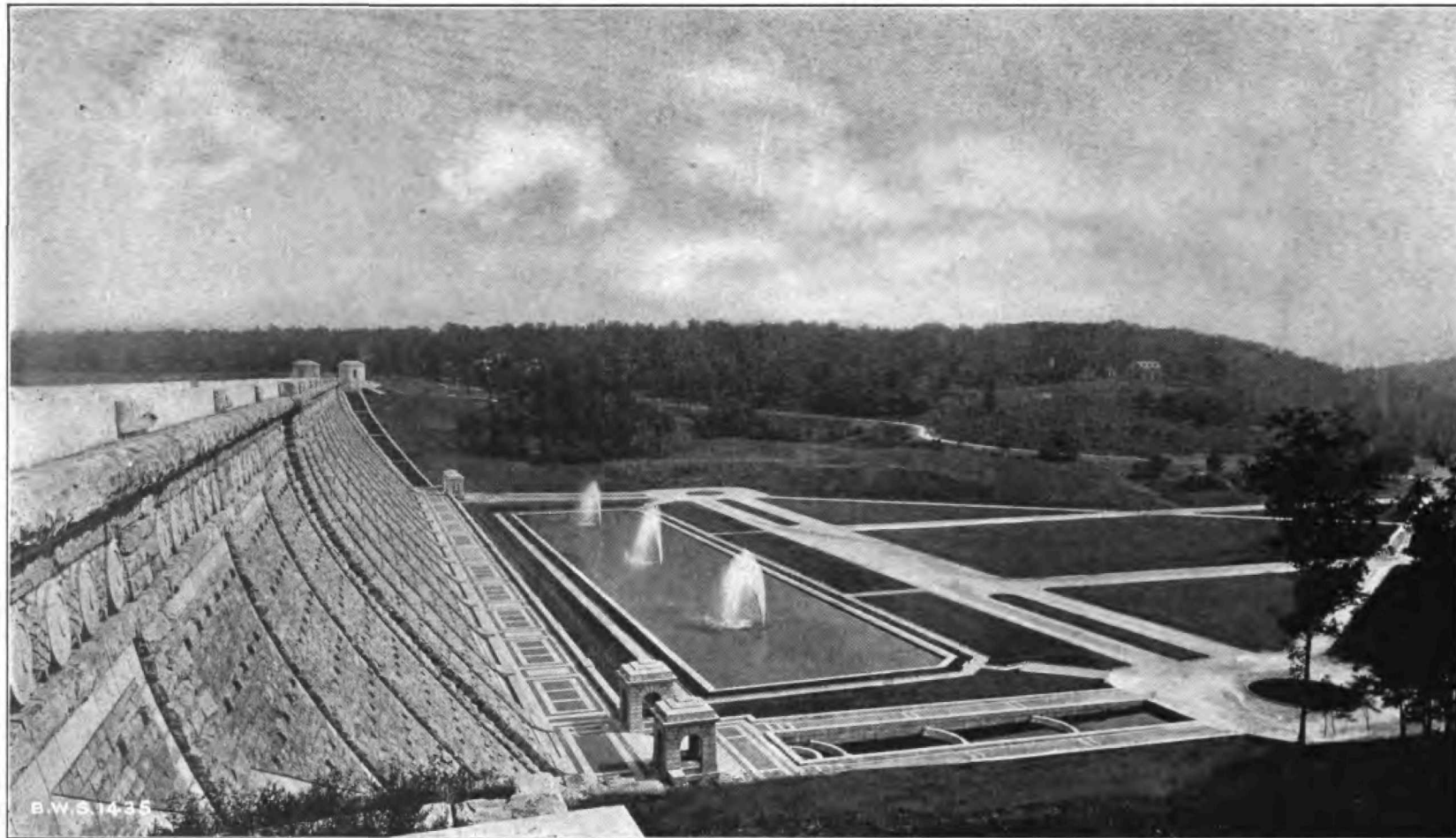
COMPLIMENTS OF THE

BOARD OF WATER SUPPLY

OF THE

CITY OF NEW YORK

MUNICIPAL BUILDING



KENSICO DAM—Down-stream face of the dam and the unfinished park below, looking from the pavilion at the west end of the dam across the terrace at the base of the dam, the pool and the cascade basins

TWELFTH ANNUAL REPORT
OF THE
Board of Water Supply
OF THE
CITY OF NEW YORK



Accompanied by Report of
THE CHIEF ENGINEER

January 1, 1918

NEW YORK CITY

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BOARD OF WATER SUPPLY CITY OF NEW YORK

Municipal Building,
NEW YORK, January 1, 1918.

HON. JOHN F. HYLAN,
Mayor of The City of New York,
Executive Chamber, City Hall, New York.

SIR:

Since early in last year and with but two brief interruptions, Catskill water has been continuously delivered into all five boroughs of the City. The aqueduct, with its appurtenant reservoirs and structures, sufficient for securing the first half of the Catskill supply, has been so far completed that it has now gone into regular service. For the final completion of the first stage there remains to be done however a material amount of important work.

On August 1, 1917, those parts of the work which had been entirely completed were formally turned over to the Department of Water Supply, Gas and Electricity for operation. This event was marked on October 12, 13 and 14, under the auspices of a committee appointed by the Mayor. On October 12, before a large assemblage of citizens, the Commissioners of the Board of Water Supply presented a brief, formal report to the Mayor, and officially announced the delivery of the first instalment of Catskill water to the City. On the afternoon of the same day a fountain of the Catskill water was opened in the upper Central Park reservoir of the Croton system. The jet from this fountain, rising to a height of more than 100 feet, gave visual evidence of the higher elevation at which Catskill water is delivered and the material economy which is thereby made possible through the elimination of pumping, both directly by the City and by individual consumers.

This first instalment of the Board's work, covering the development of the Esopus watershed, has been put into service within the anticipated time and at less than the estimated cost. Operations on the second stage, covering the development of the Schoharie watershed, have been actively begun. It seems appropriate, therefore, to very briefly review what has been accomplished.

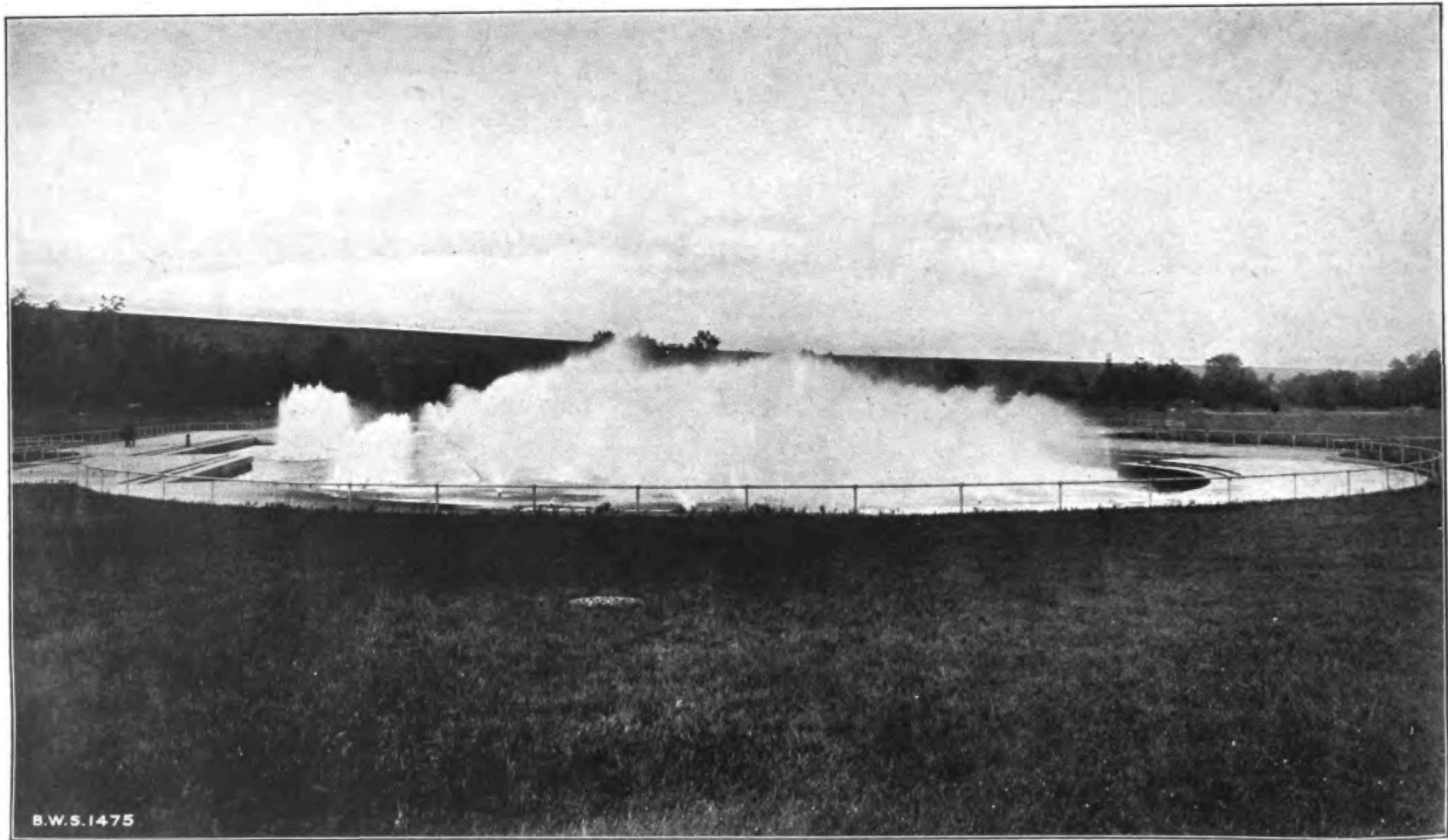
On June 3, 1905, the act under which the Board has conducted its work became a law, and on the 9th day of that month the first commissioners were appointed by Mayor George B. McClellan. On October 9 the Board presented to the Board of Estimate and Apportionment a special report containing a plan and estimate for a complete system of works for obtaining not less than 500 million gallons of water daily from sources in the Catskill mountains, this report being accompanied by a comprehensive map. Adoption by the Board of Estimate and Apportionment followed October 27, 1905, and the approval of the State authorities on May 14, 1906.

Streams west of the Hudson river in the Catskill mountains were chosen as the most available, economical and best sources of supply, for both legal and engineering reasons. To secure the quantity of water required daily the plan contemplated the construction of a storage reservoir, of 132 billion gallons capacity, known as the Ashokan, in the foothills of the Catskill mountains about 10 miles west of Kingston. From this reservoir the aqueduct was shown to extend 120 miles to Staten Island, crossing under the Hudson river $3\frac{1}{2}$ miles above West Point, and having a branch 7 miles long from the heart of Brooklyn to Queens borough. Three miles above White Plains in a suitable natural basin, the Kensico reservoir, of 38 billion gallons capacity, was to be constructed and to equalize the constantly fluctuating demands for water in the City against the steady flow of the aqueduct, the Hill View equalizing reservoir was provided for just north of Van Cortlandt park. At the extremity of the aqueduct on Staten Island the Silver Lake terminal reservoir was located.

Surveys, designs and investigations were progressed along with the legal preliminaries connected with the securing of the approval of the State authorities and the acquisition of the needed lands. The first important contract was awarded in March, 1907, and others followed in rapid succession.

Storage of water in the Ashokan reservoir began in 1913, and the filling of Kensico and Hill View reservoirs in November, 1915. Catskill water was first delivered into the distribution system of New York City in December, 1915. Large quantities of Catskill water were delivered somewhat irregularly during the year 1916 and the early part of 1917, the aqueduct being finally put into regular service during the summer of the latter year.

To effect the transfer of the Catskill aqueduct, Ashokan reservoir and appurtenances, to the Department of Water Supply, Gas



ASHOKAN RESERVOIR—Ashokan aerator; water issuing from all 1,600 nozzles. The basin is 500 feet long and 250 feet wide and is capable of aerating the entire flow of the aqueduct when there are undesirable tastes or odors to be removed from the water

and Electricity, for maintenance and operation, the Board of Water Supply, on July 24, 1917, adopted the following resolution:

“RESOLVED, That the Board of Water Supply hereby transfers to the Department of Water Supply, Gas and Electricity, which is the administrative department charged with the maintenance and operation of the water systems of The City of New York, the responsibility for, and control of, those portions of the Catskill water system with the appurtenant lands and structures listed in Chief Engineer’s Communication 12,042, with the exceptions noted, and it is further

“RESOLVED, That this transfer shall take effect August 1, 1917.”

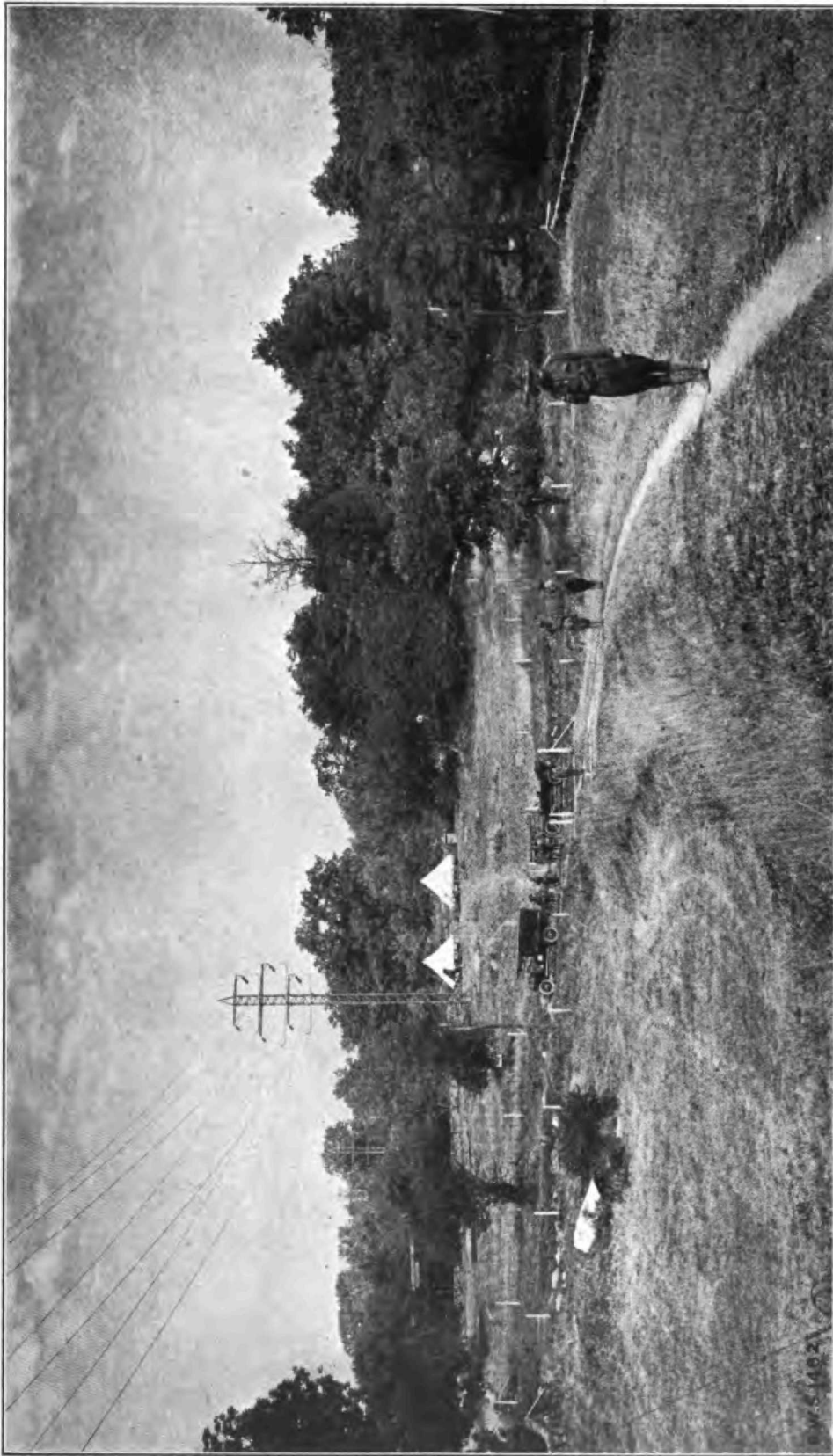
This resolution was transmitted to the Commissioner of the Department of Water Supply, Gas and Electricity on July 27, receipt of which was acknowledged by him under date of July 31, as follows:

“I acknowledge receipt of your letter of July 27 inclosing a copy of a resolution adopted by you July 24 transferring to this department the responsibility for and control of certain portions of the Catskill water system. The Department is prepared to assume such responsibility and exercise such control.”

In this very simple manner was the new water system delivered by the construction board to the operating department.

During 1916, final authorization of the source for the second half of the proposed additional supply was obtained, based upon the selection, late in 1915, of the site for a dam across the Schoharie creek at Gilboa, above which point there is a watershed of 314 square miles, sufficient to provide all the water needed to complete the full additional supply contemplated in the original plan filed in 1905. This fortunate outcome of the Schoharie investigations rendered unnecessary the construction of much more expensive works on Rondout and Catskill creeks. Schoharie Creek water is to be diverted into Esopus creek through a tunnel 18 miles long, penetrating the mountain ranges between the two drainage basins. The contract for the construction of this tunnel was awarded in November, 1917.

In connection with the Schoharie development, 192 parcels, having an aggregate area of 2,453 acres, have been acquired for the



CATSKILL, AQUEDUCT—Looking toward South portal of Millwood tunnel, showing electric transmission line along aqueduct

Schoharie reservoir and the Shandaken tunnel. Maps for these takings have been duly filed, the Commissioners of Appraisal have taken their oaths of office, and title to the land is now vested in the City.

It is estimated that about seven years will be required for the completion of the Schoharie work, so that this water will not be available for use until 1925, when it will be much needed.

When the Board began its operations the greater City had a population of 4,000,000. Its present population is almost 6,000,000 and there is no indication that the rate of the City's growth has been materially reduced, if at all. Its transient population was never so great and the use of water is at least keeping pace with the increase in population.

Military guards were placed on the Catskill aqueduct February 5, 1917, immediately following the severance of diplomatic relations with Germany by the United States government on February 3. Detachments from regiments of infantry and cavalry of the National Guard of New York were assigned to this duty. When these National Guard regiments were taken into Federal service, the guarding of the water-works was directed from the United States Army headquarters on Governors Island. When, however, the last detachment of these regiments was withdrawn under Federal orders, on August 10, a new organization, known as the First Provisional Regiment of the New York Guard, was ordered by the Governor to protect the City's water-works. August 1, this feature of the maintenance of the aqueduct, along with the others, passed to the Department of Water Supply, Gas and Electricity, excepting that since May 3 the Ashokan reservoir and the Headworks of the Catskill aqueduct have been guarded by the small remnant of the Aqueduct Police, pending the beginning of active construction on the Shandaken tunnel.

During the year 56 indirect and business damage claims, brought under the provisions of the statute and relating to the Esopus watershed, were tried by the Commissioners of Appraisal. These claims aggregated \$249,400 and the awards made were \$17,328.60. Fifty-one similar claims, aggregating over \$150,000, were dismissed.

For property acquired, construction, engineering, administration, and miscellaneous expenses the total disbursements to the end of the year 1917 amounted to \$138,154,089.52.

Detailed descriptions of the work which has been done have been printed in the preceding eleven annual reports of this Board

and in a booklet entitled "Catskill Water Supply—A General Description and Brief History," published by the Board in October, 1917, in connection with the civic celebration of the delivery of Catskill water.

The Board's official report of October 12, 1917, printed herein as Appendix A, furnishes a more complete review of the work and is referred to as a part of this report.

At the end of the year, the forces of the Board were divided as follows: Administration, 38, including Commissioners and the offices of the Secretary, Auditor, and Bureau of Claims; Police, 55; engineers and assistants, 261; mechanics and laborers, 173; total, 527.

Respectfully submitted,

CHARLES STRAUSS,	}	<i>Commissioners of the Board of Water Supply</i>
<i>President,</i>		
CHARLES N. CHADWICK,		
JOHN F. GALVIN,		

ADMINISTRATION BUREAU

Organization.—George Featherstone continued as Secretary, and Ralph T. Stanton as Assistant Secretary.

After August 1, the work formerly performed in the office of the Examiner of Real Estate, Taxes and Legislation, was turned over to the Secretary with the following exceptions: The examination of legislation affecting the Board or its work was referred to the Chief Engineer, and the collection of rents and the adjustment and payment of taxes were placed under the direction of the Auditor.

FORCE, EXCLUSIVE OF ENGINEERING AND POLICE BUREAUS, 1917

TITLE	JANUARY 1	DECEMBER 31
Secretary.....	1	1
Assistant Secretary.....	1	1
Auditor.....	1	1
Chief Clerk.....	1	1
Examiner of Real Estate, Taxes and Legislation.....	1	..
Confidential Secretaries.....	3	3
Bookkeeper.....	1	1
Clerks.....	18	18*
Stenographers and Typewriters.....	6	6
Assistant Engineers.....	2	2
Investigators of Claims.....	3	3
Messenger.....	1	1
Totals.....	39	38*

* Includes 2 employees in the military service of the United States, in accordance with Chapter 435, Laws of 1917

Contracts.—During the year 72 advertisements for 16 construction and 2 supply contracts were placed after the same had been approved as to form by the Corporation Counsel. On these contracts, pamphlets containing bid forms and specifications were issued to 221 prospective bidders against aggregate deposits of \$2,435. Competition was secured from 63 bidders and their bids were canvassed and examined as to formality. The single bid received for Contract 187 was rejected as excessive, but the remaining contracts, with bid prices amounting to \$12,854,978.82, were awarded and executed.

Supplies.—All requisitions for supplies and materials have been handled through the Chief Clerk's office. During 1917 there were received and issued 1,248 requisitions, and 1,983 orders were awarded, aggregating an expenditure of \$172,187.74.



ASHOKAN RESERVOIR—Substituted new highway, Road 20, looking easterly, at its junction with Tongore highway. Note Board of Water Supply Police officer and "Speeding" and Direction signs

POLICE BUREAU

FORCE IN POLICE BUREAU IN 1917

TITLE	JANUARY 1	APPOINTED	SEPARATED	DECEMBER 31 ON ACTIVE DUTY
Superintendent.....	1	...	1	...
Headquarters Sergeant.....	1	...	...	1
Veterinarian.....	1	...	...	1
Sergeants.....	*23	...	7	16
Patrolmen.....	**52	3	21	34
Clerks.....	1	...	...	1
Caretakers.....	5	...	3	2
Totals.....	***84	3	32	55

* Includes 8 on leave without pay
 ** Includes 12 on leave without pay
 *** Includes 20 on leave without pay

A motor-cycle squad was established at Valhalla, Westchester county, on January 31, at which time, on account of the construction work in the territory patrolled by the Kensico precinct having been completed, this station was discontinued and closed.

Similar completion of construction work in the territories patrolled by the Yonkers and Valhalla precincts and the motor-cycle squad, all in Westchester county, having been made, these stations were discontinued and closed and the personnel, equipment and mounts were transferred to the Brown's Station precinct at Brown's Station, Ulster county, on May 1, 1917, and extension of the patrol of the Headworks of the Catskill aqueduct was instituted on May 3, 1917, at which date the National Guard units at that point were relieved as far south as Davis Corners.

The entire force is now concentrated in Ulster county, in the Brown's Station precinct, where it is engaged in guarding the Headworks of the aqueduct.

The services of George F. Shradly, as Superintendent of Police, were dispensed with on April 15, 1917, on account of reduction of force, and Commissioner John F. Galvin took command of the force.

Two sergeants are absent with leave in the military service of the United States as commissioned officers.

At the end of the year there were in use by the Police bureau 42 horses, 7 motor-cycles and one automobile.

BUREAU OF CLAIMS

WALTER LEC. BOYER, *Chief of Bureau*

The Bureau of Claims continued on the preparation of the defense of claims arising out of the activities of the Board of Water Supply in the Catskill Mountain watersheds.

These claims are grouped generally in four classes: (1) Business; (2) Indirect Real Estate; (3) Wage; and (4) Diversion.

CLAIMS FILED TO DECEMBER 31, 1917

CLASS	ON FILE DECEMBER 31, 1916		RECEIVED DURING 1917		TOTAL ON FILE DECEMBER 31, 1917	
	Number	Amount	Number	Amount	Number	Amount
ESOPUS						
Business.....	690	\$3,482,651	5	\$5,800	695	\$3,494,451
Indirect Real Estate.....	250	906,200	50	90,200	300	996,400
Wage.....	106	30,549	.....	.....	106	30,549
Diversion.....	91	4,010,480	48	398,100	139	4,408,580
Totals.....	1,137	\$8,435,880	103	\$494,100	1,240	\$8,929,980
SCHOHARIE						
Business.....	.....	.....	9	\$52,000	9	\$52,000
Indirect Real Estate.....	.....	.....	2	500	2	500
Wage.....	.....	.....	.....	.....	.....	.....
Diversion.....	.....	.....	11	*	11	*
Totals.....	.....	.....	22	\$52,500	22	\$52,500
Grand Totals, Esopus and Schoharie.....	1,137	\$8,435,880	125	\$546,600	1,262	\$8,982,480

* No amounts specified in these claims

After thorough investigation reports were made—268 in all—and, before trial, turned over to the Corporation Counsel; of this number 218 were turned over during the year. This does not include many supplemental reports transmitted during the trial of water-power claims, nor any reports relating to the Schoharie development.

In addition to the investigation of individual claims, special studies included analyses of rainfall and stream flow, local topography and geological formations, and the general local power market conditions.

Ground-Water Investigations.—The measurement of the elevation of the ground-water table in Esopus valley was continued throughout the year, and the records and conclusions therefrom were frequently used in the trial of claims for diversion of the waters of Esopus creek.

Real Estate Transfers.—Investigation of real estate transfers was continued, and in connection with the condemnation of lands

for Schoharie reservoir and Shandaken tunnel, as well as the surveys of Esopus creek between Ashokan reservoir and the portal of Shandaken tunnel, deeds were looked up, searches made and information furnished to the Corporation Counsel and the Department Engineer of Reservoir department.

Commissions.—At the end of 1916 there were in existence two commissions for the trial of cases in the Esopus watershed: Damage Commission 4; and commission for trial of Parcel 801 (Coykendall quarry).

Damage Commission 4 held 60 daily sessions during the year. Its time for taking testimony expired on September 11, 1917. Since that time it has made its Third Report covering 48 claims, its Fourth Report covering one claim involving the statute of limitations and its Fifth Report covering 58 claims. Between the time of the resignation of one of the commissioners and the appointment of his successor, there was a period of two months when there were no meetings of this commission.

Much of this commission's time was devoted to the trial of the claim of James H. Sands, for a hypothetical water-power development at Glenerie Falls, for \$1,500,000. In all, the commission devoted 18 daily sessions to the trial of this claim.

Negotiations for a settlement of the claims of the Saugerties mill owners having failed, these cases were tried before Damage Commission 4.

These claims were:

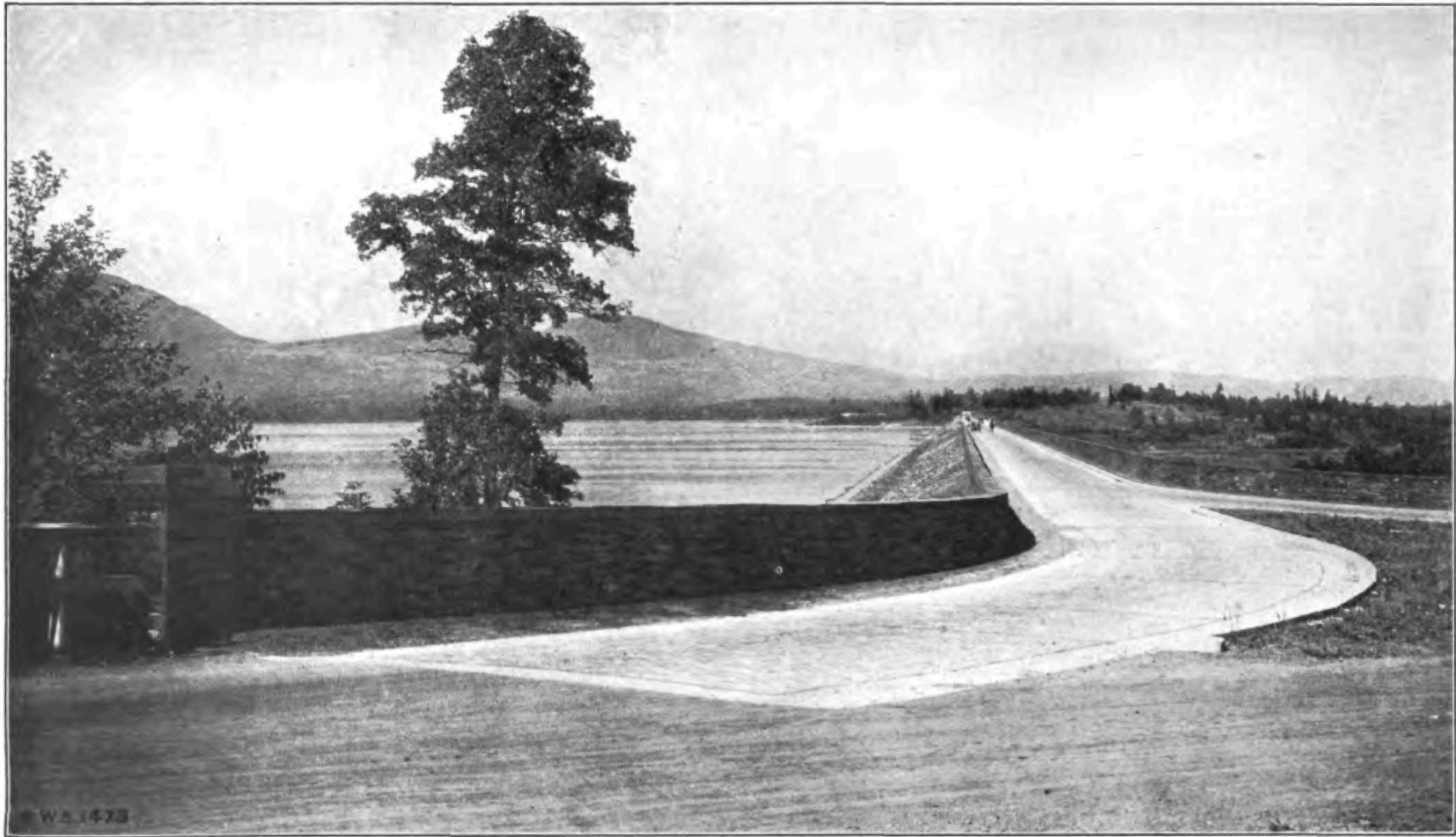
Martin Cantine Company	\$500,000
Diamond Mills Paper Company.....	530,080
Sheffield Estate	100,000

The commission has not yet reported upon these claims.

Commission for Trial of Parcel 801 (Coykendall Quarry).
The commission reported on Parcel 801, consisting of 58 acres, on April 27, 1917, as follows:

Two commissioners, in majority, award.....	\$10,162.25
Third commissioner, dissenting, award at least \$1,500	
per acre	87,000.00

In view of the vast amount of expert testimony introduced by the claimant in an attempt to prove a valuation of from \$2,000,000 to \$8,000,000 for the stone on this parcel, the award of the majority of the commission needs little comment.



ASHOKAN RESERVOIR—Highway along Olive Bridge dam. South wing of dam in foreground. Triangulation monument on Winchell hill in the right background. Water in the West basin at Elevation 584, or 6 feet below level when full

Damage Commission 5.—This commission took oath of office on May 16, 1917, has held 36 daily sessions, and tried or partially tried 47 claims.

Certiorari Proceedings.—In connection with the taxation of the City's properties, visits were made to the various town assessors, and examinations made of the assessment rolls. On Grievance Day the special counsel was accompanied to various town boards and assisted in the making of formal protests. In the Town of Cornwall comparisons of valuations of adjoining properties were made for this purpose. This was done in co-operation with the Auditor of the Board.

The trial of the Shawangunk certiorari proceedings before a referee was continued until it became apparent from testimony furnished by the Bureau that properties adjoining the aqueduct taking were assessed far below the City's land. At that point the case came to a close with a reduction of the assessment to the same figures as had been agreed upon by the Board of Supervisors for other years.

Schoharie Watershed.—During the year proceedings were instituted for the condemnation of property for Schoharie reservoir and Shandaken tunnel.

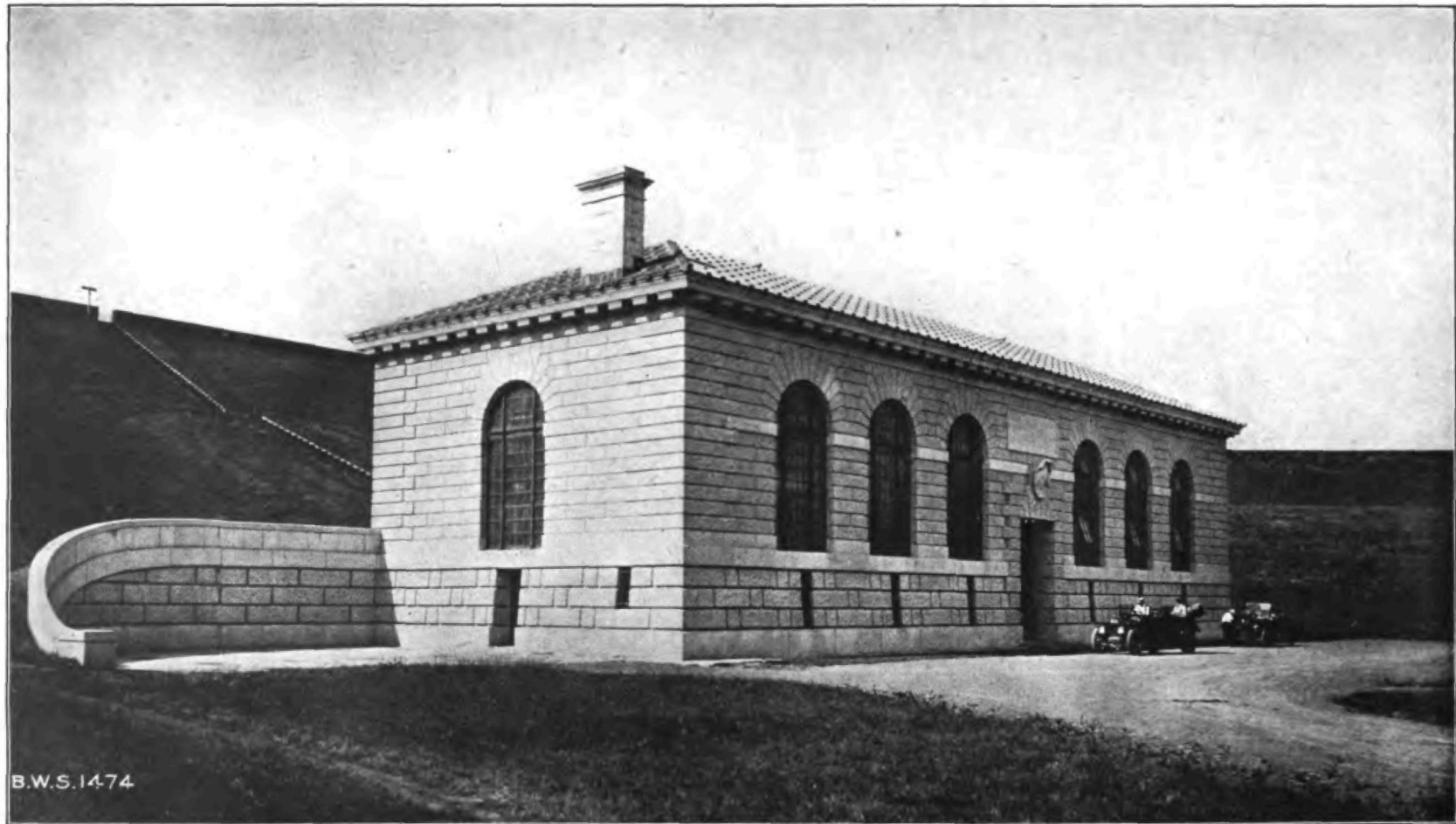
In anticipation of this taking, a thorough canvass was made in the fall of 1914 of the inhabitants of the Esopus valley between Ashokan reservoir and Shandaken, the Bushnellsville valley over the Shandaken Notch, through Lexington, West Kill, and in general in the vicinity around Prattsville and Gilboa.

General information was collected and a special census made of sawmills, creameries, grist mills and other places of business in the hamlets and villages in the surrounding territory. These census lists were supplemented by photographs.

Photographs.—A series of photographs of all buildings taken by the City was made by the official photographer of the Board. Prints were placed on file in the Bureau to be used as exhibits when the cases are tried.

In addition to the general series, photographs were taken of special features. In several instances claimants were pictured in the act of making extensive repairs and painting structures that had stood for years unpainted.

Schoharie Commissions.—Commission 1 took office on May 26, 1917. It has thus far tried 25 parcels, in whole or in part, and two business claims, holding 55 sessions.



ASHOKAN RESERVOIR—Lower gate-chamber at Headworks of the Catskill aqueduct. The building is of concrete-stone, with cement tile roof supported upon mortar-encased steel roof trusses. The valves within control the flow to the Screen chamber direct or divert it to the Ashokan aeration basin. The background is the Middle dike

Commission 2 took office on November 20, 1917, and has tried 5 parcels, two indirect real estate claims and 3 business claims, holding 15 sessions.

Neither commission has made a report.

In the trial before these commissions assistance was given the Corporation Counsel in engineering matters, in cross-examination of witnesses, and interpretation of maps. Testimony was given along the same lines, as to distances, roads, grades, traction and census data.

REPORT OF THE AUDITOR

NEW YORK, January 1, 1918.

BOARD OF WATER SUPPLY,
Municipal Building, New York.

GENTLEMEN :

There is transmitted herewith the annual report covering the financial operations of the Board of Water Supply for the year 1917 and for the period from June 9, 1905, to date, composed of 3 tables and 45 statements.

Tables 1, 2 and 3, and Statements 1, 1-A and 2 of said report have been prepared to present a comprehensive review of the financial and functional activities of the Board to date; the supporting statements to which reference is made disclose the cost of conducting operations in detail over the entire line of work on account of: (1) Surveys, maps, plans, etc.; (2) Acquisition of land; (3) Permanent construction; (4) Work by force account.

The following consolidated statement has been prepared to set forth the result of the Board's activities from the date of its organization, June 9, 1905, to December 31, 1917, in order that the outlay to date for conducting operations as a whole may be briefly reviewed:

DISBURSEMENTS FROM JUNE 9, 1905, TO DECEMBER 31, 1917

	AMOUNT	PER CENT. OF GRAND TOTAL	PER CENT. OF TOTAL FOR ESOPUS CONSTRUCTION AND SUPERVISION
ESOPUS SUPPLY			
CONSTRUCTION			
Contracts.....	\$96,183,790.21	69.621	72.359
Agreements.....	2,863,374.80	02.073	02.154
Work by force account.....	2,305,770.46	01.669	01.735
Acquisition of land and damages.....	17,343,679.69	12.554	13.047
Taxes.....	759,822.04	00.550	00.572
Total construction.....	119,456,437.20	86.467	89.867
SUPERVISION OF CONSTRUCTION			
ENGINEERING			
Salaries.....	8,307,100.40	06.013	06.249
Equipment.....	195,793.02	00.142	00.147
Supplies and expenses.....	1,204,959.48	00.872	00.907
Total engineering.....	9,707,852.90	07.027	07.303
ADMINISTRATION			
Salaries.....	1,159,748.46	00.839	00.872
Equipment.....	32,808.17	00.024	00.025
Supplies and expenses.....	233,609.40	00.169	00.176
Total administration.....	1,426,166.03	01.032	01.073
POLICE			
Salaries.....	1,945,922.80	01.408	01.464
Equipment.....	117,024.09	00.085	00.088
Supplies and expenses.....	272,069.34	00.197	00.205
Total police.....	2,335,016.23	01.690	01.757
Total supervision of construction.....	13,469,035.16	09.749	10.133
Total construction and supervision.....	\$132,925,472.36	96.216	100.00

	AMOUNT	PER CENT. OF GRAND TOTAL	PER CENT. OF TOTAL FOR ESOPUS SURVEYS, MAPS, PLANS, ETC.
Brought forward.....	\$132,925,472.36	96.216	.....
PRELIMINARY SURVEYS, MAPS, PLANS, ETC.			
ENGINEERING			
Contracts.....	299,856.59	00.217	06.770
Agreements.....	568,121.87	00.411	12.826
Salaries.....	2,589,971.77	01.875	58.471
Equipment.....	141,161.05	00.102	03.187
Supplies and expenses.....	600,249.09	00.434	13.551
Damages to land.....	6,340.92	00.005	00.143
Total engineering.....	4,205,701.29	03.044	94.948
ADMINISTRATION			
Salaries.....	174,283.32	00.126	03.934
Equipment.....	7,653.33	00.006	00.173
Supplies and expenses.....	41,858.77	00.030	00.945
Total administration.....	223,795.42	00.162	05.052
Total surveys, maps, plans, etc., Esopus supply.....	4,429,496.71	03.206	100.00
Total disbursements, account Esopus supply, for construction, supervision and surveys, maps, plans, etc.....	137,354,969.07	99.422	.....
PRELIMINARY SURVEYS, MAPS, PLANS, ETC., OTHER SOURCES			
SCHOHARIE SUPPLY			
Agreements.....	114,486.64	00.083	.....
Salaries.....	189,765.70	00.137	.....
Equipment.....	8,068.78	00.006	.....
Supplies and expenses.....	31,898.13	00.023	.....
Acquisition of land and damages.....	74,638.07	00.054	.....
Total, Schoharie supply.....	418,857.32	00.303	.....
RONDOUT AND CATSKILL CREEK SUPPLY			
Agreements.....	8,004.40	00.006	.....
Salaries.....	61,550.87	00.045	.....
Equipment.....	5,446.79	00.004	.....
Supplies and expenses.....	15,877.19	00.011	.....
Damages to land.....	500.00	00.000	.....
Total, Rondout and Catskill Creek supply..	91,379.25	00.066	.....
LONG ISLAND SUPPLY			
Agreements.....	19,169.27	00.014	.....
Salaries.....	196,391.16	00.142	.....
Equipment.....	15,159.26	00.011	.....
Supplies and expenses.....	58,079.19	00.042	.....
Damages to land.....	85.00	00.000	.....
Total, Long Island supply.....	288,883.88	00.209	.....
Total disbursements, all purposes, to December 31, 1917.....	\$133,154,089.52	100.00	.....

RECAPITULATION

	AMOUNT	PER CENT. OF GRAND TOTAL
DISBURSEMENTS, ACCOUNT ESOPUS SUPPLY		
Actual construction.....	\$119,456,437.20	86.467
Supervision of construction.....	13,469,035.16	09.749
Total construction and supervision.....	132,925,472.36	96.216
Preliminary surveys, maps, plans, etc., Esopus supply.....	4,429,496.71	03.206
Total, Esopus supply.....	137,354,969.07	99.422
PRELIMINARY SURVEYS, MAPS, PLANS, ETC., OTHER SOURCES		
Schoharie supply.....	418,857.32	00.303
Rondout and Catskill Creek supply.....	91,379.25	00.066
Long Island supply.....	288,883.88	00.209
Total disbursements to December 31, 1917.....	\$138,154,089.52	100.00

The funds disbursed to date, i. e., \$138,154,089.52, as indicated in the foregoing statement, were realized from the sale of corporate stock.

The actual cash requirements for interest and amortization purposes to cover the amount of corporate stock issued from 1905 to 1917, inclusive, aggregate \$33,075,525.33, as follows:

YEAR	FOR INTEREST	FOR REDEMPTION PURPOSES	TOTAL
1906.....	\$900.00	\$1,194.42	\$2,094.42
1907.....	19,650.00	26,150.47	45,800.47
1908.....	133,167.50	56,812.68	189,980.18
1909.....	277,077.50	86,967.29	364,044.79
1910.....	605,222.31	162,154.81	767,377.12
1911.....	1,232,106.45	304,319.71	1,536,426.16
1912.....	2,234,853.58	544,177.92	2,779,031.50
1913.....	2,901,621.61	683,265.64	3,584,887.25
1914.....	3,849,539.56	942,266.23	4,791,805.79
1915.....	4,660,001.84	1,111,328.56	5,771,330.40
1916.....	5,240,173.86	1,225,628.82	6,465,802.68
1917.....	5,497,613.81	1,279,330.76	6,776,944.57
Totals to December 31, 1917	\$26,651,928.02	\$6,423,597.31	\$33,075,525.33

During the year the Auditor's office has taken over the work involved in payment of taxes on lands acquired for construction purposes; also the collection of rents and other miscellaneous revenues formerly under the jurisdiction of the Examiner of Real Estate, Taxes and Legislation.

The valuations assessed upon lands acquired by the City by the various municipalities along the aqueduct from Westchester county north to Ulster county, have been carefully investigated and objections filed in each instance where the City's land appeared to be assessed in excess of the valuations placed upon land

of adjacent owners. Extracts covering the apparent over-assessment were prepared from the assessors' books in the following instances:

Towns of Woodstock, Kingston, Montgomery, Cornwall, Fishkill, Phillipstown, Mount Pleasant, North Castle, New Castle and Yorktown, City of Yonkers and the Village of Cornwall.

The data thus compiled were placed before the assessors in said municipalities on Grievance Day to prove the inequality of the assessments laid on the City's land, and satisfactory reductions to compare favorably with the valuations placed upon the land of adjacent owners, were secured, excepting in the Towns of Phillipstown, Mount Pleasant, North Castle and the City of Yonkers, in which cases certiorari proceedings to review the assessments are now pending.

Negotiations with the City of Yonkers, the Towns of Mount Pleasant and North Castle, also the Village of Cornwall, adjusting payment of arrears of taxes in said localities were successfully and advantageously concluded, notably in the Village of Cornwall, in which case a reduction in assessment from \$25,000 to \$1,300 was obtained. The portion of the aqueduct and reservoir lands turned over to the Department of Water Supply, Gas and Electricity for operation on August 1, 1917, was practically free from tax encumbrances, excepting only the municipalities in which certiorari proceedings are pending as stated.

Under dates of October 22 and October 30, 1917, there were transmitted to the Department of Water Supply, Gas and Electricity certain permits and agreements for rights granted by and to this Board; also advices as to rentals collected by the Board from tenants on the lands turned over.

During the year title was vested in the City to property located in the Towns of Gilboa, Prattsville, Shandaken, Roxbury and Lexington comprised in the Schoharie Tunnel and Reservoir proceedings. The assessed valuations for the year 1917 placed upon the lands taken over by the City remain the same as assessed against the former owners in said localities for the preceding year. This result is due to the activities of the engineering department in charge of the Schoharie Reservoir project in conjunction with this office, and the effect will be to facilitate the prompt settlement of taxes in said municipalities without resorting to certiorari proceedings.

Miscellaneous revenue during the year 1917, aggregating \$25,366, was collected and transmitted to the City Chamberlain.



B.W.S. 1477

CATSKILL AQUEDUCT—Storm King mountain, the Hudson river and Cold Spring village as seen from the aqueduct line

The campaign inaugurated by the City to help float the first Liberty Loan resulted in 342 subscriptions by the Board's forces, aggregating \$93,250, which equals 12 per cent. of the annual payroll. The collection of these funds with the work incidental thereto was delegated to and has been carefully undertaken and supervised in this office.

Respectfully submitted,

H. C. BUNCKE,
Auditor.

REPORT AND FINANCIAL STATEMENT OF THE BOARD OF WATER SUPPLY

DISBURSEMENTS FOR THE YEAR AND TOTAL DISBURSEMENTS FROM JUNE 9,
1905, TO DATE (CLASSIFIED BY BUREAUS, DEPARTMENTS, DIVI-
SIONS AND SUBDIVISIONS OF WORK, ETC.) AND ESTIMATED
LIABILITIES AT THIS DATE, DECEMBER 31, 1917

TABLE 1.....	Summary of the financial condition at the close of business December 31, 1917
TABLE 2.....	Comparative disbursements for personal services, supplies, etc., for the year 1917 and total to date, by departments
TABLE 3.....	Comparative disbursements for personal services, supplies, etc., from 1905 to 1917 and total to date by bureaus
STATEMENT 1.....	Classified disbursements of Administration bureau
STATEMENT 1-A.....	Disbursements of Police bureau for personal services, supplies, etc., by precincts
STATEMENT 2.....	Disbursements of Engineering bureau by departments and divisions
STATEMENT 3.....	Disbursements of Engineering bureau for personal services, supplies, etc., by departments and divisions, account surveys, maps, plans, etc.
STATEMENT 4.....	Classified disbursements of Engineering bureau by departments and divisions, account acquisition of property
STATEMENT 5.....	Disbursements of Engineering bureau for personal services, supplies, etc., by departments and divisions, account permanent construction
STATEMENT 6.....	Estimated liabilities on account of contracts and agreements in force as of December 31, 1917
STATEMENT 6-A.....	Completed contracts and agreements
STATEMENT 7.....	Classified disbursements of Headquarters department by divisions, and City Aqueduct department, account surveys, maps, plans, etc.
STATEMENT 8.....	Classified disbursements of Reservoir department by divisions, account surveys, maps, plans, etc.
STATEMENT 9.....	Classified disbursements of Northern Aqueduct department by divisions, account surveys, maps, plans, etc.
STATEMENT 10.....	Classified disbursements of Southern Aqueduct department by divisions, account surveys, maps, plans, etc.
STATEMENT 11.....	Classified disbursements of Long Island department by divisions, account surveys, maps, plans, etc.
STATEMENT 12.....	Classified disbursements of Rondout and Catskill Creek watersheds, account surveys, maps, plans, etc.
STATEMENTS 12-A, 12-AA, 12-AB, 12-AC and 12-AD..	Classified disbursements of Schoharie supply by divisions, and classified disbursements of the various divisions by subdivisions, account surveys, maps, plans, etc.
STATEMENT 13.....	Classified disbursements of Engineering bureau preliminary to its organization into departments and divisions, from June 9, 1905, to July 31, 1906, account surveys, maps, plans, etc.
STATEMENT 14.....	Classified disbursements of Headquarters department by divisions, account permanent construction
STATEMENT 15.....	Classified disbursements of Reservoir department, account permanent construction
STATEMENTS 16, 16-A, 16-B, 16-C, 16-D and 16-E.....	Classified disbursements of Northern Aqueduct department by divisions, and classified disbursements of the various divisions by subdivisions, account permanent construction
STATEMENTS 17, 17-A, 17-B, 17-C and 17-D.....	Classified disbursements of Southern Aqueduct department by divisions, and classified disbursements of the various divisions by subdivisions, account permanent construction
STATEMENTS 18, 18-A, 18-B and 18-C.....	Classified disbursements of City Aqueduct department by divisions, and classified disbursements of the various divisions by subdivisions, account permanent construction
STATEMENTS 19, 19-A, 19-B, 19-C and 19-D.....	Classified disbursements of Engineering bureau by departments, for work by force account
STATEMENT A.....	Comparative disbursements for acquisition of land and indirect damages
STATEMENT B.....	Comparative costs of acquiring land
STATEMENT C.....	Classified disbursements for acquisition of land and indirect damages by departments and proceedings

TABLE 1

SUMMARY OF THE FINANCIAL CONDITION AT THE CLOSE OF BUSINESS, DECEMBER 31, 1917

RESOURCES

Amount of corporate stock authorized to be issued, pursuant to Section 33 of Chapter 724, Laws of 1905, in accordance with the resolutions adopted by the Board of Estimate and Apportionment from June 16, 1905, to January 31, 1916, as follows:

DATE OF RESOLUTION	AMOUNT AUTHORIZED	
June 16, 1905.....	\$100,000.00	
November 24, 1905.....	500,000.00	
December 9, 1905.....	1,002,000.00	
November 23, 1906.....	10,000,000.00	
June 14, 1907.....	15,000,000.00	
March 20, 1908.....	11,000,000.00	
June 26, 1908.....	22,600,000.00	
February 26, 1909.....	41,200,000.00	
July 1, 1910.....	25,000,000.00	
March 6, 1913.....	14,715,000.00	
June 26, 1913.....	755,000.00	
January 29, 1915.....	3,000.00	
January 31, 1916.....	22,175,400.00	
	<u>\$164,050,400.00</u>	
Premium on sale of corporate stock.....		539,322.97
Miscellaneous revenue.....		166,299.59
		<u>\$164,754,022.56</u>

DISBURSEMENTS AND LIABILITIES

DISBURSEMENTS

	YEAR 1917	TOTAL TO DATE
Per Statement 1, Administration bureau.....	\$105,878.97	\$1,649,961.45
Per Statement 1-A, Police bureau.....	79,255.05	2,335,016.23
Per Statement 2, Engineering bureau.....	3,171,225.33	134,169,111.84
	<u>\$3,356,359.35</u>	<u>\$138,154,089.52</u>

LIABILITIES

Contracts—		
A. Registered after public letting, as per Statement 6.....	\$12,846,551.64	
B. Agreements, as per Statement 6.....	372,807.56	
Open market orders, as per order register.....	27,891.22	
Acquisition of property, as per register.....	3,050.56	
All other miscellaneous, as per register.....	321.40	
	<u>13,250,622.38</u>	
Total liabilities.....		<u>13,250,622.38</u>
Total disbursements and liabilities.....		<u>151,404,711.90</u>
January 1, 1918, amount available, i. e., excess of resources over disbursements and liabilities.....		<u>\$13,351,310.66</u>

STATEMENT 1

CLASSIFIED DISBURSEMENTS OF ADMINISTRATION BUREAU

	1917	TOTAL TO DATE
SALARIES		
Commissioners.....	\$36,000.00	\$450,598.60
Secretaries to Commissioners.....	5,800.00	71,348.09
Secretary's office.....	16,437.27	243,739.72
Auditor's office.....	20,355.56	225,834.00
Chief Clerk's office.....	12,112.09	201,830.35
Examiner of Real Estate, Taxes and Legislation's office.....	2,858.31	85,610.92
Messengers, cleaners, etc.....	1,200.00	39,435.27
Garage.....	1,120.52	7,128.19
Stenographic services, State Board hearings.....	.....	8,506.64
EQUIPMENT		
Furniture and fixtures.....	*110.34	19,332.50
Transportation equipment.....	.....	21,129.00
CONSUMABLE SUPPLIES AND EXPENSES		
Stationery and printing.....	6,491.89	78,520.15
Traveling expenses.....	361.57	19,229.99
Postage, telegrams, telephone and messenger service.....	961.55	20,668.98
Miscellaneous expenses.....	453.31	28,251.66
Rent of offices.....	.....	92,101.06
Advertising.....	155.41	3,133.76
Contingent fund.....	.....	5,000.00
Automobile hire.....	.....	3,686.45
Repairs and maintenance of automobiles.....	1,681.83	17,497.48
Advertising State Board hearings.....	.....	7,227.21
All other expenses, State Board hearings.....	.....	151.43
Totals.....	\$105,878.97	\$1,649,961.45

* Credit caused by adjustment of storeroom

STATEMENT 1-A
DISBURSEMENTS OF POLICE BUREAU BY PRECINCTS

	SALARIES		EQUIPMENT		CONSUMABLE SUPPLIES AND EXPENSES		TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
Headquarters.....	\$7,029.00	\$141,916.21	\$293.98	\$81,691.13	\$1,829.69	\$45,464.62	\$9,152.67	\$269,071.96
Inspector's office.....		24,950.29		801.91		7,772.56		33,524.76
Instruction squad.....		39,895.51		3,738.32		9,922.98		53,556.81
Olive Bridge—West Shokan precinct.....		125,183.20		5,887.65		19,291.43		150,362.28
Brown's Station precinct.....	47,025.15	97,098.23	283.25	730.44	6,389.72	15,077.70	53,698.12	112,906.37
Ashokan precinct.....		20,955.97		122.38		4,229.90		25,308.25
Stone Ridge precinct.....		32,942.51		1,162.47		4,866.61		38,971.59
High Falls precinct.....		35,438.17		1,180.19		5,260.48		41,878.84
Mohonk precinct.....		17,811.31		117.02		1,796.37		19,724.70
New Paltz precinct.....		74,980.02		1,800.25		12,319.82		89,100.09
West Hurley precinct.....		78,364.11		803.98		11,477.99		90,646.08
New Hurley precinct.....		26,180.89		949.32		3,354.87		30,485.08
East Coldenham precinct.....		40,492.51		541.71		7,499.73		48,533.95
Gardiner precinct.....		41,176.62		331.13		5,346.36		46,854.11
Cornwall precinct.....		90,644.89		2,246.00		13,114.91		106,005.80
Nelsonville—Cold Spring precinct.....		90,221.04		891.96		8,914.81		100,027.81
Garrison precinct.....		84,873.68		1,233.44		7,739.34		93,846.46
Sprout Brook precinct.....		45,812.29		567.01		5,808.50		52,187.80
Peekskill precinct.....		98,840.06		2,342.28		10,395.11		111,577.45
Yorktown Heights precinct.....		72,742.18		821.28		8,657.32		82,220.78
Kitchawan—Millwood precinct.....		60,241.03		826.44		5,897.32		66,964.79
Pleasantville precinct.....		81,327.14		820.08		6,497.04		88,644.26
Valhalla precinct.....	7,769.38	172,942.93		986.95	1,166.91	12,100.65	8,936.29	186,030.53
Kensico precinct.....	3,905.01	121,679.87		4,175.54	378.80	22,794.32	4,283.81	148,649.73
Elmsford precinct.....		98,406.47		1,398.61		9,880.51		109,685.59
Yonkers precinct.....	3,083.75	130,805.67		866.60	100.41	6,588.09	3,184.16	138,250.36
Totals.....	\$68,812.29	\$1,945,922.80	\$577.23	\$117,024.09	\$9,865.53	\$272,069.34	\$79,255.05	\$2,335,016.23

STATEMENT 6

ESTIMATED LIABILITIES ON ACCOUNT OF CONTRACTS AND AGREEMENTS IN FORCE DECEMBER 31, 1917 CONTRACTS

CONTRACT	CONTRACTOR	ESTIMATED COST	AMOUNT PAID ON ACCOUNT	AMOUNT RETAINED	AMOUNT EARNED	ESTIMATED LIABILITY
SCHOHARIE SUPPLY						
200.....	The Degnon Contracting Company.....	\$12,138,738.00				\$12,138,738.00
HEADQUARTERS DEPARTMENT						
AF.....	The J. W. Pratt Company.....	16,942.10	\$8,598.73	\$955.42	\$9,554.15	8,343.37
AG.....	Trow Directory, Printing and Bookbinding Company..	9,425.71	5,587.70	681.97	6,269.67	3,838.01
RESERVOIR DEPARTMENT						
3.....	MacArthur Bros. Co. and Winston & Co.....	12,276,259.17	12,275,849.19	409.98	12,276,259.17	409.98
10.....	Jules Breuchaud.....	1,085,282.10	1,084,826.59	455.51	1,085,282.10	455.51
60.....	MacArthur Brothers Company.....	806,898.70	805,398.70	1,500.00	806,898.70	1,500.00
151.....	State Highway Construction Co.....	659,080.00	634,910.81		634,910.81	24,169.19
112.....	Vulcan Rail and Construction Company.....	3,496.50	1,992.35	221.37	2,213.72	1,504.15
185.....	Alsen's American Portland Cement Works.....	34,500.00	19,434.86		19,434.86	15,065.14
NORTHERN AQUEDUCT DEPARTMENT						
WALLKILL DIVISION						
47.....	The Degnon Contracting Company.....	4,682,557.88	4,678,875.99	3,681.89	4,682,557.88	3,681.89
NEWBURG DIVISION						
45.....	Pittsburg Contracting Company.....	1,522,893.34	1,517,210.70	5,682.64	1,522,893.34	5,682.64
PEEKSKILL DIVISION						
2.....	Benjamin B. Odell, Jr., Receiver of Thomas McNally Company.....	3,979,242.28	3,970,326.49	8,915.79	3,979,242.28	8,915.79
SOUTHERN AQUEDUCT DEPARTMENT						
CROTON DIVISION						
23.....	Glyndon Contracting Co.....	1,111,916.71	1,110,954.23	962.48	1,111,916.71	962.48
24.....	Bradley Contracting Co.....	862,067.85	859,437.05	2,630.80	862,067.85	2,630.80
KENSICO DIVISION						
9.....	Empire Engineering Company, Inc., Assignee of H. S. Keaugh, Inc., Assignee of John C. Rodgers, James M. Rodgers and John J. Haggerty.....	8,003,050.00	7,965,793.07		7,965,793.07	37,256.93
123.....	Frederic W. Burnham.....	149,420.00	129,012.87	14,334.76	143,347.63	20,407.13
184.....	Henry E. Fox Construction Co.....	42,850.00	18,836.55	2,092.95	20,929.50	24,013.45

STATEMENT 6 (Concluded)

CONTRACT	CONTRACTOR	ESTIMATED COST	AMOUNT PAID ON ACCOUNT	AMOUNT RETAINED	AMOUNT EARNED	ESTIMATED LIABILITY
WHITE PLAINS DIVISION						
52.....	Pittsburg Contracting Company.....	\$2,025,199.40	\$2,016,196.80	\$9,002.60	\$2,025,199.40	\$9,002.60
53.....	Stephen L. Selden, Receiver of The Elmore & Hamilton Contracting Company.....	1,513,319.57	1,513,247.24	72.33	1,513,319.57	72.33
169.....	A. L. Guidone & Son, Inc.....	124,400.06	123,900.03	500.00	124,400.06	500.00
178.....	William Heyman.....	30,096.95	29,971.95	125.00	30,096.95	125.00
HILL VIEW DIVISION						
30.....	Keystone State Construction Company.....	3,213,865.16	3,213,840.58	24.58	3,213,865.16	24.58
128.....	William H. Egan.....	94,409.00	78,683.40	8,742.60	87,426.00	15,725.60
CITY AQUEDUCT DEPARTMENT						
146.....	Coldwell-Wilcox Company.....	154,642.60	148,027.96	.....	148,027.96	6,614.64
147.....	L. K. Comstock & Company, Inc.....	27,600.00	21,597.29	2,399.70	23,996.99	6,002.71
174.....	Charles Meads & Co.....	46,140.00	29,625.17	3,291.68	32,916.85	16,514.83
BRONX DIVISION						
63.....	Mason and Hanger Company.....	3,744,678.18	3,743,305.32	1,372.86	3,744,678.18	1,372.86
65.....	Pittsburg Contracting Company.....	5,386,157.54	5,348,157.54	38,000.00	5,386,157.54	38,000.00
181.....	John T. Brady and Company.....	51,870.00	13,770.00	1,530.00	15,300.00	38,100.00
129.....	John T. Brady and Company.....	65,581.50	24,981.39	2,775.71	27,757.10	40,600.11
CONDUIT AND RESERVOIR DIVISION						
89.....	Beaver Engineering and Contracting Co.....	668,601.66	667,404.08	1,197.58	668,601.66	1,197.58
189.....	Karlsson Bros.....	13,505.00	.....	.....	.....	13,505.00
APPURTENANT WORKS						
145.....	American Cement Tile Mfg. Co.....	110,947.00	98,195.50	.....	98,195.50	12,751.50
120.....	A. L. Guidone & Son, Inc.....	104,262.00	59,902.70	6,303.69	66,206.39	44,359.30
95.....	Lord Electric Co.....	34,500.00	27,618.00	.....	27,618.00	6,882.00
161.....	Lord Electric Co.....	32,991.24	32,891.24	100.00	32,991.24	100.00
176.....	Lupfer and Remick.....	57,310.00	5,282.58	586.95	5,869.53	52,027.42
168.....	Lord Electric Co.....	78,840.00	5,759.35	639.93	6,399.28	73,080.65
180-A.....	P. C. Osterhoudt & Company.....	51,563.00	44,969.40	4,996.60	49,966.00	6,593.60
180-B.....	Falkkill Construction Co., Inc.....	15,370.11	12,307.26	1,367.47	13,674.73	3,062.85
180-C.....	J. E. Butterworth.....	20,449.00	11,177.13	1,241.90	12,419.03	9,271.87
188.....	Coffin Valve Co.....	147,219.00	712.50	37.50	750.00	146,506.50
Totals.....		\$69,568,502.21	\$56,721,950.57	\$133,817.89	\$56,855,768.46	\$12,846,551.64

AGREEMENTS

AGREEMENT	CONTRACTOR	ESTIMATED COST	AMOUNT PAID ON ACCOUNT	ESTIMATED LIABILITY
R.....	New York Telephone Company.....	\$6,700.95	\$5,315.67	\$1,385.28
S.....	New York Telephone Company.....	993.75	817.23	176.52
37.....	Cranford Co.....	450,000.00	78,754.24	371,245.76
Totals.....		\$457,694.70	\$84,887.14	\$372,807.56

STATEMENT 6-A

COMPLETED CONTRACTS AND AGREEMENTS

CONTRACT	CONTRACTOR	COMPLETED COST
CONTRACTS		
ADMINISTRATION BUREAU		
A.....	The J. W. Pratt Company.....	\$1,713.52
D.....	Goldman & Steinberg Printing and Publishing Co....	1,668.74
W.....	Clarence S. Nathan.....	1,843.88
POLICE BUREAU		
C.....	Fiss, Doerr & Carroll Horse Company.....	8,187.50
O.....	Fiss, Doerr & Carroll Horse Company.....	8,437.50
T.....	Fiss, Doerr & Carroll Horse Company.....	32,500.00
AB.....	Fiss, Doerr & Carroll Horse Company.....	8,937.50
ENGINEERING BUREAU		
HEADQUARTERS DEPARTMENT		
B—Class A.....	Technical Supply Co.....	3,995.34
B—Class B.....	The J. W. Pratt Company.....	1,697.38
B—Class C.....	Continental Playing Card Company.....	1,956.50
B—Class D.....	Joseph N. Early.....	3,617.50
E.....	The J. W. Pratt Company.....	7,982.67
I—Class D.....	E. J. Brooks & Company.....	2,518.50
J—Class A.....	Keuffel & Esser Co.....	2,376.00
N—Class 1.....	Alexander Pearson.....	3,701.46
N—Class 2.....	John Wanamaker, New York.....	1,588.19
Q.....	The Martin B. Brown Company.....	6,897.59
X.....	Brooklyn Daily Eagle.....	9,036.90
Y—Class D.....	Hammacher, Schlemmer & Co.....	1,297.05
Y—Class O.....	Keuffel & Esser Co.....	3,598.74
Z—Class B.....	Tower Manufacturing and Novelty Company.....	3,629.25
AA.....	M. B. Brown Printing & Binding Co.....	15,373.69
AC.....	The J. W. Pratt Company.....	9,386.00
AE.....	M. B. Brown Printing & Binding Co.....	7,274.42
RESERVOIR DEPARTMENT		
5.....	Haggerty Contracting Co.....	13,653.22
31.....	Ogden Iron and Steel Manufacturing Company....	54,900.00
48.....	King, Rice and Ganey Co.....	171,776.25
49.....	The Harrison & Burton Company, Assignee of Harrison and Burton.....	246,363.20
56.....	L. K. Comstock & Company.....	12,770.00
59.....	The C. P. Bower Construction Company.....	306,193.60
72.....	J. F. Cogan Company, Contractors.....	383,472.90
76.....	Transit Construction Company.....	107,475.79
111.....	Ward and Tully, Inc.....	145,138.73
124.....	Michael Staub.....	345,230.36
143.....	Zadoc P. Boice.....	29,838.16
152.....	Winston & Company.....	178,552.70
182.....	State Highway Construction Co.....	8,427.00
186.....	Sprague & Henwood, Inc.....	55,105.00
NORTHERN AQUEDUCT DEPARTMENT		
1.....	The Phoenix Construction Company, Assignee of American Diamond Rock Drill Company.....	125,320.88
4.....	Daniel Carpenter.....	11,095.00
6.....	John J. McLean.....	8,965.00
11.....	H. S. Kerbaugh, Inc., Assignee of H. S. Kerbaugh, Assignee of Stewart-Kerbaugh-Shanley Co....	2,279,324.04
12.....	The T. A. Gillespie Company.....	6,281,517.19
15.....	Stephen L. Selden, Receiver of The Elmore & Hamilton Contracting Company.....	845,634.11
16.....	King, Rice & Ganey Company, Assignee of King, Rice & Ganey.....	578,624.77
17.....	American Pipe & Construction Co.....	655,530.60
18.....	American Pipe & Construction Co.....	751,312.55
20.....	Mason & Hanger Company.....	3,208,584.74
22.....	James G. Shaw and Benjamin Barker, Receivers of Patterson & Company.....	724,642.97
40.....	John J. Wilson.....	11,859.00
58.....	D'Olier Centrifugal Pump & Machine Co., Assignee of D'Olier Engineering Company.....	60,664.00
61.....	The Harrison and Boice Company, Assignee of Harrison and Boice.....	166,500.14
62.....	The Snare & Triest Co.....	1,601,467.55
80.....	The Dravo Contracting Company.....	398,264.18
90.....	The T. A. Gillespie Company.....	1,496,363.41
101—District 4.....	Abner M. Harper, Inc.....	48,708.56
109.....	A. L. Guidone and Company.....	80,185.29
117.....	Michael Staub.....	96,034.82
160.....	Oscar Daniels Company.....	313,751.60
165.....	Sullivan Machinery Company.....	12,205.06
G—Class 1.....	Parrish, Phillips & Company.....	23,379.58
G—Class 2.....	George D. Harris & Company.....	319.49
H—Class M.....	Erie City Iron Works.....	3,374.00
J—Class K.....	Arthur C. Jacobson & Sons.....	10,585.06
J—Class L.....	H. W. Palen's Sons.....	536.81
K—Class F.....	Alden S. Swan & Company.....	1,798.28
P—Class F.....	Alden S. Swan & Company.....	1,970.79
R.....	George D. Harris & Company.....	44,233.53

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STATEMENT 6-A (Concluded)

CONTRACT	CONTRACTOR	COMPLETED COST
CONTRACTS (Concluded)		
NORTHERN AQUEDUCT DEPARTMENT (Concluded)		
U—Class M.....	Godfrey, Keeler Co.....	\$5,380.00
V—Class K.....	Arthur C. Jacobson & Sons.....	5,058.09
SOUTHERN AQUEDUCT DEPARTMENT		
7.....	Shelley Brothers.....	8,360.00
25.....	Chas. W. Blakeslee & Sons.....	1,284,436.15
34.....	Fox-Hennessy Co.....	26,654.52
39.....	Lord Electric Co.....	34,384.00
50.....	Joseph A. Dassler.....	11,868.00
54.....	W. W. Crawford, Trustee in Bankruptcy of George W. Jackson, Incorporated.....	1,385,406.31
68.....	The T. A. Gillespie Company, Assignee of David Peoples.....	1,182,513.81
74.....	Joseph A. Dassler.....	8,065.00
77.....	Geo. L. Brown and T. J. Brown.....	53,352.63
79.....	Thomas O'Hern.....	95,783.08
81.....	John F. Hickey.....	18,402.00
100.....	Stobaugh Contracting Company.....	44,677.24
121.....	Joseph Balaban Co.....	78,817.75
135.....	J. E. Butterworth.....	23,153.24
142.....	Charles Cochar.....	11,900.00
148.....	Lord Electric Co.....	15,975.65
159.....	Guarantee Construction Company.....	21,480.00
162.....	H. S. Kerbaugh, Inc.....	24,300.00
171.....	H. S. Kerbaugh, Inc.....	36,587.52
173.....	William Heyman.....	13,658.02
179.....	Empire Engineering Co., Inc.....	36,046.46
AH.....	Electro Bleaching Gas Co.....	7,057.64
CITY AQUEDUCT DEPARTMENT		
38.....	The Snare & Triest Co.....	92,163.61
66.....	Grant Smith & Co. & Locher.....	4,376,968.63
67.....	Holbrook, Cabot & Rollins Corporation, Geo. B. Fry, Thos. B. Bryson.....	4,905,581.37
70.....	Paul S. Reeves and Co.....	146,374.00
73.....	Sprague & Henwood.....	58,665.96
75.....	F. V. Smith & Son, Inc.....	234,550.60
84.....	American Manganese Bronze Company.....	89,826.53
86.....	Beaver Engineering and Contracting Co.....	286,557.76
87.....	Wm. F. Donovan and Charles Cranford.....	340,893.71
88.....	Beaver Engineering and Contracting Co.....	67,386.63
98.....	The Healey Sewer Machine and Construction Company.....	21,078.01
99.....	Merritt & Chapman Derrick & Wrecking Co.....	879,049.30
103.....	Beaver Engineering and Contracting Co.....	343,813.64
105.....	The Exeter Machine Works.....	280,668.73
113.....	Sweeney & Gray Company.....	4,933.28
114.....	Coffin Valve Company.....	13,405.00
132.....	Healey Contracting Company.....	3,769.85
140.....	M. L. Bayard.....	34,823.00
144.....	P. T. Cox Contracting Co., Inc.....	40,721.12
154.....	Frederick N. Lewis.....	13,539.99
166.....	North-Eastern Construction Co.....	27,429.60
170.....	Lupfer and Remick.....	176,465.64
APPURTENANT WORKS		
41.....	Ogden Iron and Steel Manufacturing Company...	90,670.00
42.....	Coffin Valve Company.....	148,066.00
43.....	Coffin Valve Company.....	71,754.31
44.....	Coldwell-Wileox Co.....	182,950.27
83.....	Carpenter & Lindsay.....	11,256.49
91.....	Vulcan Rail and Construction Company.....	32,123.29
93.....	New York Telephone Company.....	51,526.31
94.....	J. Edward Ogden Company.....	17,028.87
101—Districts 1, 2, 3, 5 and 6.....	The Degnon Contracting Company.....	189,289.15
104.....	Coffin Valve Company.....	87,082.36
106.....	Charles Meads & Co.....	21,130.13
107.....	The Chapman Valve Manufacturing Co.....	123,260.49
110.....	Builders Iron Foundry.....	9,557.96
118.....	A. L. Guidone and Company.....	108,608.75
149.....	Concord Construction Co.....	17,245.97
156.....	The North-Eastern Forestry Company and Franklin Forestry Company.....	26,003.23
164.....	L. F. Bannon Plumbing, Heating and Contracting Co.....	5,434.32
172.....	American Manganese Bronze Company.....	12,845.00
	Total.....	\$40,128,681.76
AGREEMENTS		
Agreements completed prior to September 30, 1917 (See Statement 6-A, Quarterly Report).....		\$948,421.33
Agreement 99.....	The Moon Nursery Corp.....	2,332.21
Agreement 110.....	Sprague & Henwood, Inc.....	4,515.30
Agreement M.....	New York Telephone Company.....	12,609.01
Agreement Q.....	New York Telephone Company.....	789.94
	Total.....	\$968,667.79

STATEMENT 7

CLASSIFIED DISBURSEMENTS OF HEADQUARTERS DEPARTMENT BY DIVISIONS, AND CITY AQUEDUCT DEPARTMENT, ACCOUNT SURVEYS, MAPS, PLANS, ETC.

(Disbursements prior to August 1, 1906, given in Statement 13)

	EXECUTIVE DIVISION		DESIGNING DIVISION		LABORATORY AND INSPECTION DIVISION		TOTALS, HEADQUARTERS DEPARTMENT		CITY AQUEDUCT DEPARTMENT	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES										
Engineering force.....		\$380,807.88		\$586,639.04		\$75,639.91		\$1,043,086.83	\$3,003.97	\$143,149.59
Laborers.....		3,175.84		330.42		27,923.93		31,430.19	211.50	20,048.05
Consulting engineers.....		108,767.02		1,980.00				110,747.02		3,125.00
Other expert services.....		20,979.30		515.00		83.40		21,577.70		16,062.50
EQUIPMENT										
Furniture and fixtures.....		12,251.42		10,226.83		1,951.14		24,429.39		1,977.00
Engineering instruments and tools.....		1,413.40		74.02		1,566.29		3,053.71		2,370.32
Boring rigs, machinery and tools.....		66.03				28.69		94.72		
Other machinery, tools, equipment and supplies.....		1,573.31		3,594.05		8,295.68		13,463.04		1,543.66
CONSUMABLE SUPPLIES AND EXPENSES										
Engineering supplies.....		1,534.14		26,474.14		13,905.94		41,914.22		1,892.99
Hardware supplies.....		110.99		11.37		2,688.89		2,811.25		57.21
Iron pipe, valves and fittings.....		8.31		7.90		417.60		433.81	6.63	19.83
Lumber.....		112.37		6.00		493.80		612.17		36.21
Fuel and light.....		68.87		1.75		2,899.48		2,970.10		14.59
Stationery and printing.....		20,865.65		4,357.34		1,678.68		26,901.67		1,295.21
Repairs to machinery and other implements		147.03		160.91		452.32		760.26		55.49
Repairs and maintenance of buildings.....		34.48						34.48		195.95
Team hire.....		147.00		9.50		63.75		220.25		236.50
Automobile hire.....		3,308.50		22.00				3,330.50		
Traveling expenses including board and lodging.....		11,581.92		4,017.54		5,341.84		20,941.30		2,725.85
Postage, telegrams, telephone and miscel- laneous expenses.....		29,273.74		968.01		3,547.78		33,789.53		1,454.58
Rentals, offices and buildings.....		71,717.31		17,764.20		6,615.00		96,096.51	30.00	1,628.72
Advertising.....		1,307.55				345.60		1,653.15		3,113.70
CONTRACTS										180,390.54
AGREEMENTS						7,106.33		7,106.33		
Totals		\$669,252.06		\$657,160.02		\$161,046.05		\$1,487,458.13	\$3,252.10	\$331,393.49

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STATEMENT 11

CLASSIFIED DISBURSEMENTS OF LONG ISLAND DEPARTMENT BY DIVISIONS, ACCOUNT SURVEYS, MAPS, PLANS, ETC.

(Disbursements prior to August 1, 1906, given in Statement 13)

	EXECUTIVE DIVISION		TOPOGRAPHIC SURVEYS		TEST BORINGS		STREAM GAGING		DEPARTMENT TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES										
Engineering force		\$28,208.85		\$93,982.86		\$10,987.78		\$6,638.70		\$139,818.19
Laborers		4,448.70		21,233.64		12,393.51		1,550.12		39,625.97
Consulting engineers		3,600.00		800.00		2,070.00				11,470.00
Other expert services.....		5,379.50		97.50						5,477.00
EQUIPMENT										
Furniture and fixtures		376.26		113.54		74.51				564.31
Engineering instruments and tools.....						123.50				123.50
Boring rigs, machinery and tools.....		259.80		5.30		12,697.36				12,962.46
Other machinery, tools, equipment and supplies		340.07		309.36		801.72		57.84		1,508.99
CONSUMABLE SUPPLIES AND EXPENSES										
Engineering supplies		2,315.00		3,067.85		2,036.73		1,104.35		8,523.93
Hardware supplies		20.91		300.66		453.62		3.60		778.79
Iron pipe, valves and fittings.....		25.50		5.42		3,385.80				3,416.72
Lumber		5.48		1,223.74		2,715.49		53.15		3,997.86
Fuel and light.....		703.89		5.50		1,726.02		21.16		2,456.57
Stationery and printing.....		1,736.72		355.94		50.13		97.91		2,240.70
Repairs to machinery and other imple- ments		21.15		130.32		246.36		297.80		695.63
Repairs and maintenance of buildings.....		26.40						20.47		46.87
Team hire		349.25		5,890.83		2,962.91		340.45		9,543.44
Automobile hire		5,977.40		60.00						6,037.40
Traveling expenses including board and lodging		1,899.57		5,184.42		1,941.26		841.32		9,866.57
Postage, telegrams, telephone and miscel- laneous expenses		2,958.94		605.36		748.21		505.69		4,818.20
Rentals, offices and buildings.....		991.74		2,120.76		900.00		60.00		4,072.50
Advertising		1,584.01								1,584.01
AGREEMENTS						18,416.87		752.40		19,169.27
DAMAGES TO LAND				85.00						85.00
Totals		\$66,229.14		\$135,578.00		\$74,731.78		\$12,344.96		\$288,883.88

STATEMENT 12

CLASSIFIED DISBURSEMENTS OF RONDOUT AND CATSKILL CREEK WATERSHEDS, ACCOUNT SURVEYS, MAPS, PLANS, ETC.

34

(Disbursements prior to August 1, 1906, given in Statement 13)

	RONDOUT SUPPLY							
	RESERVOIR DEPARTMENT		NORTHERN AQUEDUCT DEPARTMENT		TOTALS		CATSKILL CREEK SUPPLY	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES								
Engineering force.....	\$1,611.67	\$33,238.70	.....	\$1,695.78	\$1,611.67	\$34,934.48	\$1,611.31	\$14,170.11
Laborers.....	6.00	12,340.28	.....	.....	6.00	12,340.28	6.00	6.00
Other expert services.....	.....	100.00	.....	.....	.....	100.00	.....	.....
EQUIPMENT								
Engineering instruments and tools.....	3.18	156.31	.....	1.65	3.18	157.96	3.19	156.07
Boring rigs, machinery and tools.....	.....	2,142.34	.....	.....	.....	2,142.34	.....	.....
Other machinery, tools, equipment and supplies.....	.....	2,977.64	.....	.....	.....	2,977.64	.....	12.78
CONSUMABLE SUPPLIES AND EXPENSES								
Engineering supplies.....	.65	1,225.88	.....	7.42	.65	1,233.30	.....	134.31
Hardware supplies.....	.....	97.96	.....	.....	.....	97.96	.....	6.66
Iron pipe, valves and fittings.....	.....	733.81	.....	.....	.....	733.81	.....	.....
Lumber.....	.....	142.22	.....	.....	.....	142.22	.....	3.00
Fuel and light.....	1.10	1,439.59	.....	.....	1.10	1,439.59	.....	.....
Stationery and printing.....	.....	126.36	.....	6.18	.....	132.54	.....	87.56
Repairs to machinery and other implements.....	5.78	1,076.96	.....	.....	5.78	1,076.96	5.78	11.15
Team hire.....	.....	6,173.94	.....	72.00	.....	6,245.94	.....	148.76
Traveling expenses including board and lodging.....	42.90	2,861.85	.....	230.44	42.90	3,092.29	24.75	619.34
Postage, telegrams, telephone and miscellaneous expenses.....	.12	251.17	.....	.....	.12	251.17	.72	25.22
Rentals, offices and buildings.....	.....	312.50	.....	.....	.....	312.50	.....	25.00
Repairs and maintenance of automobiles.....	20.83	20.83	.....	.....	20.83	20.83	17.35	18.30
TAXES	18.78	18.78	.....	.....	18.78	18.78	.....	.....
AGREEMENTS.....	.....	8,004.40	.....	.....	.....	8,004.40	.....	.....
DAMAGES TO LAND.....	.....	500.00	.....	.....	.....	500.00	.....	.....
Totals.....	\$1,711.01	\$73,941.52	.....	\$2,013.47	\$1,711.01	\$75,954.99	\$1,669.10	\$15,424.26

STATEMENT 12-AA

CLASSIFIED DISBURSEMENTS OF EXECUTIVE DIVISION, SCHOHARIE SUPPLY, ACCOUNT SURVEYS, MAPS, PLANS, ETC.

	EXECUTIVE		RAINFALL AND RUN-OFF		DIVISION TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES						
Engineering force.....	\$13,653.54	\$29,072.75	\$1,728.34	\$18,807.98	\$15,381.88	\$47,880.73
Laborers.....	2,255.25	2,779.75	20.50	120.50	2,275.75	2,900.25
Consulting engineers.....		300.00				300.00
Other expert services.....	137.50	237.50			137.50	237.50
EQUIPMENT						
Furniture and fixtures.....	624.97	885.32			624.97	885.32
Engineering instruments and tools.....	200.00	328.09	3.19	4.27	203.19	332.36
Other machinery, tools, equipment and supplies.....	37.80	64.45		13.40	37.80	77.85
CONSUMABLE SUPPLIES AND EXPENSES						
Engineering supplies.....	229.79	346.31	47.43	56.60	277.22	402.91
Hardware supplies.....	60.51	84.20	.27	1.09	60.78	85.29
Iron pipe, valves and fittings.....	8.91	8.91			8.91	8.91
Fuel and light.....	325.55	325.80		1.25	325.55	327.05
Stationery and printing.....	58.09	156.23		16.18	58.09	172.41
Repairs to machinery and other implements.....	78.78	90.28	23.29	27.54	102.07	117.82
Repairs and maintenance of buildings.....	458.99	619.30	1.65	1.65	460.64	620.95
Team hire.....	461.40	672.90		183.04	461.40	855.94
Automobile hire.....			5.00	5.00	5.00	5.00
Traveling expenses including board and lodging.....	669.81	1,103.41	89.09	1,871.71	758.90	2,975.12
Postage, telegrams, telephone and miscellaneous expenses..	843.68	1,048.42	4.55	35.23	848.23	1,083.65
Rentals, offices and buildings.....		45.00				45.00
Advertising.....	1,185.05	3,877.91			1,185.05	3,877.91
Repairs and maintenance of automobiles.....	1,256.23	1,286.43	43.26	47.73	1,299.49	1,334.16
Purchased under contract.....	*300.00				*300.00	
TAXES	34.92	34.92			34.92	34.92
AGREEMENTS	4,475.25	4,995.00			4,475.25	4,995.00
Totals	\$26,756.02	\$48,362.88	\$1,966.57	\$21,193.17	\$28,722.59	\$69,556.05

* Credit caused by transfer

STATEMENT

CLASSIFIED DISBURSEMENTS OF PRATTSVILLE DIVISION, SC

	EXECUTIVE		SUBSURFACE INVESTI TIONS BY BOARD OF WATER SUPPLY	
	1917	Total to Date	1917	Total to
	SALARIES			
Engineering force.....	\$212.66	\$862.58	.....	\$105
Laborers.....	282.50	503.50	.....	90
Other expert services.....	337.50	337.50	.....	106
EQUIPMENT				
Furniture and fixtures.....	620.68	845.68	.....	.....
Engineering instruments and tools.....	200.00	300.00	.....	.....
Other machinery, tools, equipment and supplies.....	9.50	19.50	.....	250
CONSUMABLE SUPPLIES AND EXPENSES				
Engineering supplies.....	307.95	397.95	.....	.....
Hardware supplies.....	15.06	16.81	.....	.....
Iron pipe, valves and fittings.....	.....	.....	.....	53
Lumber.....	.....	1.11	.....	.....
Fuel and light.....	546.19	546.19	.....	173
Stationery and printing.....	124.09	124.09	.....	.....
Repairs to machinery and other implements.....	22.61	22.61	\$8.57	52
Repairs and maintenance of buildings.....	44.30	44.30	.....	.....
Team hire.....	62.50	90.50	.....	46
Traveling expenses including board and lodging.....	16.43	18.25	.....	5
Postage, telegrams, telephone and miscellaneous expenses	286.11	296.71	.26	45
Rentals, offices and buildings.....	250.00	339.00	.....	.....
Repairs and maintenance of automobiles.....	288.82	342.37	.....	.....
TAXES	4.20	4.20	.....	.....
AGREEMENTS.....	.....	.....	.....	.....
DAMAGES TO LAND.....	.....	.....	*148.37	.....
Totals.....	\$3,631.10	\$5,112.85	*\$139.54	\$927

* Credit caused by transfer

MENT 12-AC

SCHOHARIE SUPPLY, ACCOUNT SURVEYS, MAPS, PLANS, ETC.

STRA- 2 07 T	SUBSURFACE INVESTIGA- TIONS BY AGREEMENT		SURVEYS		DAMAGES TO LAND		DIVISION TOTALS	
	Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
103.04	\$163.50	\$2,270.17	\$685.26	\$4,168.03	\$86.00	\$86.00	\$1,147.42	\$7,491.82
90.00	.....	299.00	172.00	1,274.00	.....	.....	454.50	2,166.50
106.25	.....	.....	.....	.....	.....	.....	337.50	443.75
.....	.....	.....	.....	.....	.....	.....	620.68	845.68
.....	.....	.....	28.00	28.00	.....	.....	228.00	328.00
250.00	.....	.....	.....	.....	.....	.....	9.50	269.50
.....	.....	.60	8.25	10.65	.....	.....	316.20	409.20
.....	.75	.75	.....	.....	.....	.....	15.81	17.56
53.63	.....	.....	.....	.....	.....	.....	.....	53.63
.....	.....	.....	.....	.....	.....	.....	.....	1.11
173.65	.....	.....	.....	.....	.....	.....	546.19	719.84
.....	.....	.....	.....	20.00	.....	.....	124.09	144.09
52.07	.....	21.84	.....	.....	.....	.....	31.18	96.52
.....	.....	.....	.....	.....	.....	.....	44.30	44.30
45.00	.....	97.50	79.25	284.75	.....	.....	141.75	518.75
5.78	.....	9.25	.....	85.00	.....	.....	16.43	118.28
45.26	3.65	27.78	4.97	15.97	3.21	3.21	298.20	388.93
.....	.....	.....	.....	.....	.....	.....	250.00	339.00
.....	.....	15.33	.....	1.50	.....	.....	288.82	359.20
.....	.....	.....	.....	.....	.....	.....	4.20	4.20
.....	1,879.22	24,605.30	.....	.....	.....	.....	1,879.22	24,605.30
.....	.....	.....	.....	.....	326.77	326.77	178.40	326.77
1917.68	\$2,047.12	\$27,347.52	\$977.73	\$5,887.90	\$415.98	\$415.98	\$6,932.39	\$39,691.93

§

CLASSIFIED DISBURSEMENTS OF ALLABEN D

	EXECUTIVE		INV BOARD
	1917	Total to Date	19
SALARIES			
Engineering force.....	\$108.00	\$985.24	...
Laborers.....	34.00	158.00	...
Other expert services.....			...
EQUIPMENT			
Furniture and fixtures.....	613.06	838.06	...
Engineering instruments and tools.....	200.00	300.00	...
Other machinery, tools, equipment and supplies.....	4.70	14.70	...
CONSUMABLE SUPPLIES AND EXPENSES			
Engineering supplies.....	111.97	201.97	...
Hardware supplies.....	.40	1.40	...
Fuel and light.....			...
Stationery and printing.....	58.09	58.09	...
Repairs to machinery and other implements.....	22.61	22.61	...
Team hire.....	63.00	129.00	...
Traveling expenses including board and lodging.....		1.50	...
Postage, telegrams, telephone and miscellaneous expenses..	75.17	81.16	...
Rentals, offices and buildings.....		5.00	...
Repairs and maintenance of automobiles.....	88.17	131.19	...
TAXES	20.06	20.06	...
AGREEMENTS.....			...
DAMAGES TO LAND			*2
Totals.....	\$1,399.23	\$2,947.98	*2

* Credit caused by transfer

STATEMENT 13
PRELIMINARY DISBURSEMENTS OF ENGINEERING BUREAU FROM
JUNE 9, 1905, TO JULY 31, 1906, ACCOUNT
SURVEYS, MAPS, PLANS, ETC.

	AMOUNT
SALARIES	
Chief and division engineers.....	\$32,699.93
All other salaries.....	165,499.24
Consulting engineers.....	22,637.09
Expert services.....	1,200.10
Care of gages.....	501.82
EQUIPMENT	
Furniture and fixtures.....	12,339.00
Engineering and drafting instruments and tools.....	17,846.75
Engineering and drafting supplies.....	5,072.47
Laboratory equipment and supplies.....	3,343.30
Tools, machinery and hardware supplies.....	3,868.42
Floating equipment.....	1,350.00
CONSUMABLE SUPPLIES AND EXPENSES	
Iron pipe, valves and fittings.....	3,247.71
Books, maps and photographic supplies.....	1,542.89
Lumber and materials, constructing field buildings, boring rigs, etc...	1,745.69
Fuel.....	745.03
Oil and waste.....	86.63
Blasting material.....	373.63
Stationery and printing.....	2,547.50
Unclassified supplies.....	726.81
Repairs to machinery and tools.....	212.62
Hire of horses, wagons, etc.....	11,241.56
Hire of boats, etc.....	146.75
Auto hire.....	250.00
Traveling expenses.....	4,573.99
Board and lodging of field parties.....	3,257.05
Consulting engineers' expenses.....	670.16
Postage, telegrams and messenger service.....	827.30
Telephone service.....	646.63
Miscellaneous expenses.....	377.37
Express and freight charges.....	665.71
Sun printing.....	596.39
Rent of main offices.....	10,868.43
Rent of field buildings.....	2,350.21
Labor, constructing field buildings, boring rigs, etc.....	2,109.19
Wash borings for Hudson River crossing.....	19,866.80
Diamond drill borings for Hudson River crossing.....	16,318.77
Borings.....	49,222.98
Test-pits.....	70.50
DAMAGES TO LAND.....	492.38
Total.....	\$402,138.80

This statement covers the preliminary operations of the Engineering bureau before its organization into departments and divisions

STATEMENT 14

CLASSIFIED DISBURSEMENTS OF HEADQUARTERS DEPARTMENT BY DIVISIONS, ACCOUNT PERMANENT CONSTRUCTION

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	EXECUTIVE DIVISION		DESIGNING DIVISION		LABORATORY AND INSPECTION DIVISION		DEPARTMENT TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES								
Engineering force.....	\$83,968.24	\$716,873.28	\$111,402.05	\$1,089,553.28	\$24,692.95	\$241,152.06	\$220,063.24	\$2,047,578.62
Laborers.....		1,793.52	192.00	710.00	372.00	5,108.14	564.00	7,609.66
Consulting engineers.....	7,899.19	91,686.46		3,975.00			7,899.19	95,661.46
Other expert services.....	2,691.07	63,155.80	4,075.00	36,327.05			6,766.07	99,482.85
EQUIPMENT								
Furniture and fixtures.....	199.30	2,530.34	57.00	450.32	1.37	422.26	257.67	3,402.92
Engineering instruments and tools.....	1.69	455.13		194.10		168.89	1.69	818.12
Other machinery, tools, equipment and supplies.....	4,598.83	5,416.21	7.85	97.08	*.07	2,296.75	4,606.61	7,810.04
Storeroom account.....	605.35	16,220.28					605.35	16,220.28
Outside departments.....	793.70	27,997.23					793.70	27,997.23
CONSUMABLE SUPPLIES AND EXPENSES.								
Engineering supplies.....	1,808.45	7,085.31	3,564.07	28,710.04	5,554.98	30,293.44	10,927.50	66,088.79
Hardware supplies.....	4.07	84.85	34.17	150.08	69.26	562.60	107.50	797.53
Iron pipe, valves and fittings.....		7.42	.12	830.96	12.98	140.76	13.10	979.14
Lumber.....		118.10			15.85	385.25	15.85	503.35
Fuel and light.....	3.14	125.64		113.11	25.67	3,481.20	28.81	3,719.95
Stationery and printing.....	4,271.78	32,841.21	505.91	2,892.46	64.59	1,269.98	4,842.28	37,003.65
Repairs to machinery and other implements.....	114.39	745.23	6.65	588.72	89.66	1,040.87	210.70	2,374.82
Repairs and maintenance of buildings.....	88.52	1,592.24		97.22		1,075.30	88.52	2,764.76
Team hire.....	6.25	42.25		173.50			6.25	215.75
Traveling expenses including board and lodging.....	944.90	9,731.37	622.72	9,327.48	2,040.92	31,881.61	3,608.54	50,940.46
Postage, telegrams, telephone and miscellaneous expenses.....	3,910.46	39,721.37	190.42	2,453.91	286.11	15,229.75	4,386.99	57,405.03
Rentals, offices and buildings.....		33,725.44		32,442.20		6,943.55		73,111.19
Advertising proposals.....	244.80	3,596.56					244.80	3,596.56
Repairs and maintenance of automobiles.....			187.82	234.01			187.82	234.01
Totals.....	\$112,154.13	\$1,055,545.24	\$120,845.78	\$1,209,320.52	\$33,226.27	\$341,450.41	\$266,226.18	\$2,606,316.17

RECAPITULATION

	1917	TOTAL TO DATE
Disbursements, account permanent construction, as set forth in this statement.....	\$266,226.18	\$2,606,316.17
Disbursements, account surveys, maps, plans, etc. (see Statement 7).....		1,487,458.13
Disbursements, account acquisition of property (see Statement 4).....	4,186.17	144,365.78
Total disbursements, Headquarters department.....	\$270,412.35	\$4,238,140.08

*Credit caused by adjustment of storeroom

	EXECUTIVE DIVISION		1
	1917	Total to Date	
SALARIES			
Engineering force.....	\$8,998.94	\$273,632.14	\$1
Laborers.....	145.50	25,737.48	..
Consulting engineers.....	.....	87.50	..
Other expert services.....	500.00	7,973.66	..
EQUIPMENT			
Furniture and fixtures.....	40.00	104.94	..
Engineering instruments and tools.....	.....	1,445.17	..
Other machinery, tools, equipment and supplies.....	2,259.53	19,433.99	..
CONSUMABLE SUPPLIES AND EXPENSES			
Engineering supplies.....	508.50	3,365.79	..
Hardware supplies.....	26.88	764.17	..
Iron pipe, valves and fittings.....	747.11	1,001.36	..
Lumber.....	.....	1,218.31	..
Fuel and light.....	108.20	4,387.11	..
Stationery and printing.....	129.07	4,021.11	..
Repairs to machinery and other implements.....	76.21	2,343.76	..
Repairs and maintenance of buildings.....	.....	1,083.18	..
Team hire.....	223.60	8,335.60	..
Traveling expenses including board and lodging.....	267.11	3,305.07	..
Postage, telegrams, telephone and miscellaneous expenses	780.42	10,550.46	..
Rentals, offices and buildings.....	.....	.....	..
Advertising proposals.....	.....	219.96	..
Repairs and maintenance of automobiles.....	1,078.46	17,404.68	..
Expenses of municipalities in criminal actions.....	.....	.....	..
Advertising.....	.....	154.37	..
TAXES.....	10,434.41	162,083.22	..
CONTRACTS.....	.....	.....	507
AGREEMENTS.....	.....	.....	..
Totals.....	\$26,323.94	\$548,653.03	\$507

STATEMENT 19-A

CLASSIFIED DISBURSEMENTS OF WORK BY FORCE ACCOUNT, RESERVOIR DEPARTMENT

	UP-KEEP OF STRUCTURES		IMPROVEMENT OF CITY PROPERTY		SANITATION		OTHER WORK BY FORCE ACCOUNT		TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES										
Engineering force.....	\$7,077.08	\$27,870.39	\$554.67	\$3,195.17	\$3,890.19	\$8,750.26	\$7,306.06	\$20,143.48	\$18,828.00	\$59,959.30
Laborers.....	17,614.99	65,595.99	5,114.25	46,424.25	4,042.75	17,544.75	16,509.98	97,344.53	43,281.97	226,909.52
Other expert services.....	175.00	175.00				283.33			175.00	458.33
EQUIPMENT										
Furniture and fixtures.....		42.70								42.70
Engineering instruments and tools.....	8.85	167.47						19.00	8.85	186.47
Boring rigs, machinery and tools.....		250.00								250.00
Other machinery, tools, equipment and supplies.....	7,351.06	9,356.79		1,024.00	2,138.54	3,976.34	875.28	9,719.28	10,364.88	24,076.41
CONSUMABLE SUPPLIES AND EXPENSES										
Engineering supplies.....	2,004.06	5,043.24	10.00	2,005.63	384.36	1,658.07	22,164.66	25,918.23	24,563.08	34,625.17
Hardware supplies.....	409.34	1,364.69		133.25	84.91	388.30	121.88	1,454.20	616.13	3,340.44
Iron pipe, valves and fittings.....	2,351.24	3,317.66	21.75	21.75		87.98	1,362.62	1,909.77	3,735.61	5,337.16
Lumber.....		520.60						5,863.11		6,383.71
Fuel and light.....	402.28	730.72			37.46	41.06	815.34	1,119.74	1,255.08	1,891.52
Stationery and printing.....	138.36	138.36							138.36	138.36
Repairs to machinery and other imple- ments.....	1,029.02	2,893.60	1.05	14.90	10.75	25.05	138.28	142.28	1,179.10	3,075.83
Repairs and maintenance of buildings...		802.51	175.85	191.45	127.64	334.97	12.30	1,312.05	315.79	2,640.98
Team hire.....	1,408.20	9,286.70	576.80	8,237.80	1,440.00	3,920.50	2,611.40	15,335.40	6,036.40	36,780.40
Traveling expenses including board and lodging.....	27.16	164.24			391.79	2,963.28	5.46	129.03	424.41	3,256.55
Postage, telegrams, telephone and mis- cellaneous expenses.....	1,707.45	3,845.45	42.06	140.88	108.70	203.40	1,248.08	2,438.80	3,106.29	6,628.53
Advertising proposals.....	815.25	815.25							815.25	815.25
Repairs and maintenance of automobiles	362.47	390.11	25.00	69.22	276.19	288.72	348.05	348.05	1,011.71	1,096.10
Repairs and renewals.....	739.00	2,042.76							739.00	2,042.76
Seeding and fertilizing embankments...		99.60								99.60
CONTRACTS							55,055.00	55,055.00	55,055.00	55,055.00
AGREEMENTS	*4,801.50						4,801.50	4,801.50		4,801.50
Totals	\$38,819.31	\$134,913.83	\$6,521.43	\$61,458.30	\$12,933.28	\$40,466.01	\$113,375.89	\$243,053.45	\$171,649.91	\$479,391.59

* Credit caused by transfer

STATEMENT

CLASSIFIED DISBURSEMENTS OF WORK BY FORCE

	UP-KEEP OF STRUCTURES		IMPROVED PRO
	1917	Total to Date	1917
SALARIES			
Engineering force.....	\$4,560.92	\$31,791.18	\$293.62
Laborers.....	7,852.43	58,995.22	565.50
Consulting engineers.....			
Other expert services.....			
EQUIPMENT			
Furniture and fixtures.....		37.50	
Engineering instruments and tools.....	.80	1.05	
Boring rigs, machinery and tools.....		224.70	
Other machinery, tools, equipment and supplies.....	728.02	7,042.14	
CONSUMABLE SUPPLIES AND EXPENSES			
Engineering supplies.....	671.96	5,683.40	22.56
Hardware supplies.....	61.86	1,281.60	
Iron pipe, valves and fittings.....	47.01	796.67	11.38
Lumber.....	89.46	534.44	
Fuel and light.....		367.03	
Stationery and printing.....		5.67	
Repairs to machinery and other implements.....	41.81	993.56	
Repairs and maintenance of buildings.....	657.92	1,535.84	
Team hire.....	1,850.75	17,867.50	22.00
Automobile hire.....			
Traveling expenses including board and lodging.....	186.94	790.99	
Postage, telegrams, telephone and miscellaneous expenses..	4,239.42	12,159.53	
Rentals, offices and buildings.....	509.50	973.60	
Advertising proposals.....			
Repairs and maintenance of automobiles.....	235.85	886.44	
Seeding and fertilizing embankments.....	25.25	2,229.43	
Replacement of bronze.....		135.64	
Personal injuries.....			
AGREEMENTS.....			
DAMAGES TO LAND.....			
Totals.....	\$21,819.90	\$144,333.13	\$915.06

* There are included in this column the amounts disbursed for the East test-shaft and West test-shaft Hudson River division, East test-shaft.....
Hudson River division, West test-shaft.....
Hudson River division, pressure tunnel.....

Total.....

MENT 19-B

ACCOUNT, NORTHERN AQUEDUCT DEPARTMENT

PART OF CITY	UNWATERING PRESSURE TUNNELS		*OTHER WORK BY FORCE ACCOUNT		TOTALS		
	Total to Date	1917	Total to Date	1917	Total to Date	1917	
	\$1,373.47	\$2,576.67	\$13,135.36	\$2,943.62	\$80,224.94	\$10,374.83	\$126,524.95
	2,107.25	6,339.42	50,372.57	6,532.58	517,666.18	21,289.93	629,141.22
					137.50		137.50
					119.50		119.50
					830.97		868.47
			5.34		701.78	.80	708.17
					952.69		1,177.39
		558.65	10,682.12	863.72	68,978.92	2,150.39	86,703.18
	22.56	691.11	3,596.21	137.96	71,457.23	1,573.59	80,759.40
		17.70	27.27	6.12	3,055.22	85.68	4,364.09
	11.38		1,016.34		20,594.66	58.39	22,419.05
			250.73	115.32	34,006.87	204.78	34,792.04
		4.75	233.26	151.07	74,781.32	155.82	75,381.61
					567.15		572.82
		231.45	4,263.33	4.30	19,227.18	277.56	24,484.07
					1,112.27		2,648.11
	1,221.75	1,066.00	2,109.25	170.75	16,646.37	3,109.50	37,844.87
			26.00				26.00
		205.31	428.77	40.95	506.18	433.20	1,725.94
		16,029.01	86,338.46	3,800.45	15,480.33	24,068.88	113,978.32
					1,915.92	569.50	2,889.52
					2,292.90		2,292.90
		181.64	186.72	91.60	228.72	509.09	1,301.88
						25.25	2,229.43
							135.64
					2,500.00		2,500.00
			1,619.00		124,125.24		125,744.24
					1,000.00		1,000.00
	\$4,736.41	\$37,901.71	\$174,290.73	\$14,998.44	\$1,059,110.64	\$65,545.11	\$1,382,470.31

and portion of Hudson pressure tunnel, as follows:

	\$466,420.69
	458,492.08
	82,304.24
	\$1,007,217.01

STATEMENT 19-C

CLASSIFIED DISBURSEMENTS OF WORK BY FORCE ACCOUNT, SOUTHERN AQUEDUCT DEPARTMENT

	UP-KEEP OF STRUCTURES		IMPROVEMENT OF CITY PROPERTY		SANITATION		OTHER WORK BY FORCE ACCOUNT		TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES										
Engineering force.....	\$11,039.75	\$46,003.14	\$958.27	\$7,916.83	.....	\$360.66	\$4,390.31	\$12,927.55	\$16,388.33	\$67,208.18
Laborers.....	4,968.25	39,451.50	3,926.75	38,597.00	.....	3,795.75	6,962.56	9,691.31	15,857.56	91,535.56
EQUIPMENT										
Furniture and fixtures.....	102.08	102.08	.....	.....	.....	.....	.....	.....	102.08	102.08
Engineering instruments and tools.....	87.00	102.00	.....	.....	.....	.....	.....	.....	87.00	102.00
Other machinery, tools, equipment and supplies.....	9,562.49	10,890.08	10.45	170.23	.....	3,041.72	5,087.23	5,900.72	14,660.17	20,002.75
CONSUMABLE SUPPLIES AND EXPENSES										
Engineering supplies.....	3,582.14	8,207.72	629.75	4,637.80	\$7,061.36	11,014.29	3,881.19	4,010.24	15,154.44	27,870.05
Hardware supplies.....	671.26	1,380.86	.....	114.24	.....	.....	38.66	43.72	709.92	1,538.82
Iron pipe, valves and fittings.....	38.46	438.68	.....	.....	.....	282.69	2,482.66	2,482.66	2,521.12	3,204.03
Lumber.....	2,754.61	3,447.20	.....	320.81	.....	.....	.....	74.26	2,754.61	3,842.27
Fuel and light.....	55.69	628.52	.....	.....	.....	.....	3.77	4.03	59.46	632.55
Stationery and printing.....	.58	41.04	.....	.....	.....	.....	.....	.....	.58	41.04
Repairs to machinery and other implements	148.03	428.06	.....	.....	.....	17.20	105.06	105.56	253.09	550.82
Repairs and maintenance of buildings.....	62.87	455.84	.....	2,321.96	.....	105.66	9.17	9.17	72.04	2,892.63
Team hire.....	161.50	5,727.75	644.50	4,873.03	.....	.....	459.00	955.00	1,265.00	11,555.78
Traveling expenses including board and lodging.....	351.71	2,348.50	110.15	111.40	5.40	5.40	283.09	393.67	750.35	2,858.97
Postage, telegrams, telephone and miscellaneous expenses.....	1,677.62	8,220.46	13.80	8,778.83	.....	1,184.20	141.83	144.53	1,833.25	18,328.02
Rentals, offices and buildings.....	.....	95.00	.....	.....	.....	.....	.....	.....	.....	95.00
Advertising proposals.....	.....	.....	.....	.....	374.90	374.90	.....	.....	374.90	374.90
Repairs and maintenance of automobiles...	13.62	133.92	.....	.....	.....	.....	.....	.....	13.62	133.92
Seeding and fertilizing embankments.....	.....	199.59	.....	.....	.....	.....	.....	.....	.....	199.59
Repairs and renewals.....	.....	2,919.94	.....	.....	.....	.....	.....	.....	.....	2,919.94
Totals.....	\$35,277.66	\$131,221.88	\$6,293.67	\$67,842.13	\$7,441.66	\$20,182.47	\$23,844.53	\$36,742.42	\$72,857.52	\$255,988.90

STATEMENT 19-D

CLASSIFIED DISBURSEMENTS OF WORK BY FORCE ACCOUNT, CITY AQUEDUCT DEPARTMENT

	UP-KEEP OF STRUCTURES		IMPROVEMENT OF CITY PROPERTY		UNWATERING PRESSURE TUNNELS		OTHER WORK BY FORCE ACCOUNT		TOTALS	
	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date	1917	Total to Date
SALARIES										
Engineering force.....	\$29,312.65	\$52,814.00			\$4,408.13	\$9,048.27	\$119.82	\$1,190.23	\$33,840.60	\$63,052.50
Laborers.....	37,528.19	55,612.93			13,075.85	21,422.14			50,604.04	77,035.07
EQUIPMENT										
Furniture and fixtures.....	27.54	27.54			12.70	12.70			40.24	40.24
Engineering instruments and tools.....	251.32	253.02			10.13	10.13			261.45	263.15
Other machinery, tools, equipment and supplies	1,762.58	5,697.59			274.26	554.26			2,036.84	6,251.85
CONSUMABLE SUPPLIES AND EXPENSES										
Engineering supplies.....	7,744.36	11,475.65			1,411.83	1,512.64	3.75	3.75	9,159.94	12,992.04
Hardware supplies.....	383.45	1,283.18			120.19	143.68	.22	.22	503.86	1,427.08
Iron pipe, valves and fittings.....	6,151.49	7,337.78			387.96	445.76			6,539.45	7,783.54
Lumber.....	501.64	1,307.97			71.42	96.98			573.06	1,404.95
Fuel and light.....	240.87	377.74			61.07	61.07			301.94	438.81
Stationery and printing.....	144.76	195.56							144.76	195.56
Repairs to machinery and other implements...	197.76	882.46			13.20	13.20			210.96	895.66
Repairs and maintenance of buildings.....	3.17	167.05							3.17	167.05
Team hire.....	955.06	1,172.56			2.00	2.00			957.06	1,174.56
Traveling expenses including board and lodging	571.85	915.42			68.57	81.48	.30	.30	640.72	997.20
Postage, telegrams, telephone and miscellaneous expenses.....	2,506.87	9,387.85		\$135.00	61.95	66.95	.20	.20	2,569.02	9,590.00
Rentals, offices and buildings.....	40.00	40.00							40.00	40.00
Repairs and maintenance of automobiles.....	1,527.67	1,844.98							1,527.67	1,844.98
Replacement of bronze.....		62.86								62.86
AGREEMENTS	1,762.56	1,762.56							1,762.56	1,762.56
Totals	\$91,613.79	\$152,618.70		\$135.00	\$19,979.26	\$33,471.26	\$124.29	\$1,194.70	\$111,717.34	\$187,419.66

STATEMENT A

TOTAL DISBURSEMENTS FOR ACQUISITION OF PROPERTY PURSUANT TO CONDEMNATION PROCEEDINGS AND PRIVATE PURCHASE;
ALSO DISBURSEMENTS FOR INDIRECT DAMAGES, INDICATING THE ATTENDANT EXPENSE
INCURRED FOR ACQUISITION BY PERCENTAGES

	ESOPUS SUPPLY						SCHOHARIE SUPPLY			
	ACQUISITION OF PROPERTY			INDIRECT DAMAGES			ACQUISITION OF PROPERTY		INDIRECT DAMAGES	
	Amount	Per Cent. of Total	Per Cent. of Expenses to Awards	Amount	Per Cent. of Total	Per Cent. of Expenses to Awards	Amount	Per Cent. of Total	Amount	Per Cent. of Total
AWARDS										
50-per-cent. payments to obtain possession.....	\$183,895.31									
Final awards.....	10,185,235.99			\$210,053.10	35.210					
Purchased under contract.....	374,925.86						\$300.00	00.533		
Total awards, etc.	\$10,744,057.16	64.158								
Interest on awards.....	1,656,247.25	09.890	15.415	850.41	00.143	00.405				
Advertising.....	444,796.91	02.656	04.140	3,427.89	00.575	01.632	10,420.85	18.534		
Commissioners' fees.....	1,098,203.72	06.558	10.221	119,600.00	20.048	56.938				
Expenses of commissioners.....	81,254.40	00.485	00.756	4,074.77	00.683	01.940	47.01	00.084		
Stenographers and other clerks.....	70,424.72	00.421	00.655	9,655.85	01.618	04.597	911.67	01.621		
Special counsel fees.....	412,305.00	02.462	03.838	80,094.78	13.426	38.131	6,191.67	11.012		
Special counsel expenses.....	28,898.70	00.173	00.269	3,430.62	00.575	01.633	339.99	00.605		
Obtaining orders for 50-per-cent. deposits.....	8,375.00	00.050	00.078							
Closing titles.....	1,370.00	00.008	00.013							
Counsel fees on appeal.....	3,250.00	00.019	00.030							
Costs on appeal.....	4,499.97	00.027	00.042	1,300.12	00.218	00.619				
Searching titles.....	212,175.25	01.267	01.975							
Preparing abstracts.....	125,312.50	00.748	01.166							
Appraisers' fees.....	494,250.53	02.952	04.600	18,643.80	03.125	08.876	1,890.00	03.361		
Appraisers' expenses.....	5,859.41	00.035	00.055	1,683.46	00.282	00.801	559.70	00.996		
Rent of New York office.....	26,294.40	00.157	00.245							
Stenographic services and printing testimony.....	279,030.21	01.666	02.597	43,593.01	07.307	20.753	2,531.43	04.502		
Counsel fees of parcel owners.....	410,855.44	02.454	03.824	645.12	00.108	00.307				
Expenses and disbursements of parcel owners.....	273,745.06	01.635	02.548	8,239.34	01.381	03.923				
Engineering salaries and expenses.....	364,942.96	02.179	03.397	91,278.83	15.301	43.455	33,034.26	58.752	\$16,853.45	100.00
Totals	\$16,746,148.59	100.00	55.864	\$596,571.10	100.00	184.010	\$56,226.58	100.00	\$16,853.45	100.00
				Acquisition of property.....	\$16,746,148.59		Acquisition of property.....		\$56,226.58	
				Indirect damages.....	596,571.10		Indirect damages.....		16,853.45	
				Total, Esopus supply...	\$17,342,719.69		Total, Schoharie supply...		\$73,080.03	

The payment for awards for indirect damages, \$210,053.10, settled claims aggregating \$2,928,529.77, and the expense of \$386,518.00 or 184.01 per cent. of the amount paid for awards actually resulted in a saving thus far of \$2,718,476.67, plus the saving in the same ratio on awards which have not yet been confirmed

STATEMENT B

SHOWING ACREAGE OF LAND TO BE TAKEN FOR CONSTRUCTION PURPOSES, DISBURSEMENTS FOR ACREAGE UPON WHICH AWARDS HAVE BEEN PAID, EXPENSES INCIDENTAL THERETO, THE PERCENTAGE OF EXPENSES TO AWARDS AND AVERAGE PRICE AND EXPENSE PER ACRE

	ACREAGE			AMOUNT OF AWARDS PAID	AMOUNT OF EXPENSES PAID	TOTAL AWARDS AND EXPENSES	AVERAGE AWARD PER ACRE	AVERAGE EXPENSES PER ACRE	PER CENT. OF EXPENSES TO AWARDS
	Total to be Taken	Final Awards Paid	Balance to be Acquired						
ESOPUS SUPPLY									
Ashokan reservoir	15,221.305	14,863.427	357.878	\$3,611,770.18	\$2,307,427.02	\$5,919,197.20	\$243.00	\$155.25	63.88
Northern aqueduct	1,637.351	1,637.072	0.279	767,331.92	702,047.93	1,469,379.85	468.72	428.84	91.49
Southern aqueduct	956.566	955.236	1.330	1,900,465.63	768,683.33	2,669,148.96	1,989.52	804.70	40.45
Kensico reservoir	3,181.762	3,179.462	2.300	2,424,705.24	1,313,497.49	3,738,202.73	762.61	413.12	54.17
Hill View reservoir	163.380	163.380	.....	1,438,652.00	669,115.01	2,107,767.01	8,805.66	4,082.07	46.51
City aqueduct	166.332	*166.332	.....	601,132.19	96,954.87	698,087.06	6,652.63	1,072.98	16.13
Headquarters . . . . .	.....	.....	.....	.....	144,365.78	144,365.78	.....	.....	.....
Totals, Esopus supply	21,326.696	20,964.909	361.787	\$10,744,057.16	\$6,002,091.43	\$16,746,148.59	\$512.48	\$286.29	55.86
SCHOHARIE SUPPLY	2,452.556	0.370	2,452.186	\$300.00	\$55,926.58	\$56,226.58	.....	.....	.....

*The City was vested with the fee of 75.972 acres of this land when the taking maps were prepared. The amounts for awards and expenses are therefore computed for 90.360 acres

REPORT OF THE CHIEF ENGINEER

NEW YORK, January 1, 1918.

BOARD OF WATER SUPPLY,
Municipal Building, New York.

GENTLEMEN:

In its annual report for the year 1917 the Engineering bureau has to record numerous changes in the force and the successful completion of the first portion of the Catskill Mountain water system, excepting a few minor details. In February, the Catskill aqueduct was put into service conveying about 375 million gallons daily and has so continued excepting for one interruption of 20 days in May for the unwatering of the Wallkill pressure tunnel in order to make an inspection of the tunnel and minor changes in the valves at the bottom of the Drainage shaft, and for a second interruption of two days in July for hydrostatic tests of the pressure tunnels. At the beginning of the year the Ashokan and Kensico reservoirs were both full, but at the end of the year the former had been depleted 38 billion gallons and the latter 3 billion gallons, or to state their condition in other terms, the water in the West basin of the Ashokan reservoir was 16 feet below full reservoir level, in the East basin of that reservoir 12 feet, and in the Kensico reservoir, 5 feet. The City tunnel delivering water to all the boroughs was in commission from January 22 to the end of the year with the exception of 12 days when that section of tunnel south of Shaft 18 was out of service for inspection between Shafts 18 and 19.

Of the changes in the force the most important was that connected with the transfer of maintenance and operation of the completed portion of the system to the Department of Water Supply, Gas and Electricity August 1. On that date Ralph N. Wheeler, who had previously been Department Engineer of the Northern Aqueduct department, became Division Engineer of the Department of Water Supply, Gas and Electricity in charge of the aqueduct north of Bull Hill tunnel, the Headworks, the Ashokan reservoir and the Esopus watershed. With Mr. Wheeler, and subsequently, there have been transferred to the department a total of 98 employees of various classes. Alfred D. Flinn continued as Deputy Chief Engineer. Thaddeus Merriman continued as Department Engineer of Headquarters department and George G. Honness of Reservoir department, the latter department removing

its offices from Ashokan to Grand Gorge on May 1, 1917, in preparation for construction activities on the Schoharie project. Walter E. Spear remained Department Engineer of the City Aqueduct department. By draft and enlistment 41 members of the Engineering bureau entered the military service and 8 others at the end of the year were on leave of absence without pay in civilian service connected with Government war activities.

John R. Freeman, William H. Burr and Frederic P. Stearns continued as consulting engineers. R. J. Colony was reappointed as consulting engineer to continue the special investigations of cement and concrete begun in 1916. Consulting experts were retained by the Board as in previous years to assist on special problems: Professor Arthur H. Blanchard, of Columbia University, on highway construction, Professor Charles P. Berkey, of Columbia University, on geology, Allen Hazen and George W. Fuller on water purification, Edward P. York and Philip Sawyer, consulting architects, Charles W. Leavitt, landscape engineering, and Charles G. Young on hydraulic engineering in connection with water-power claims. George W. Tillson, consulting engineer to the Borough President, Brooklyn, also gave expert services on several occasions in connection with the construction and maintenance of the Ashokan highways.

SCHOHARIE DEVELOPMENT

Surveys.—In November a start was made on placing taking line monuments, defining the outside line of the property acquired in fee by the City. At the end of the year 70 of these monuments were set. They are built of concrete by the Board of Water Supply forces and are 4 by 4 inches at top, 7 by 7 inches at bottom, and 42 inches long and generally set 6 inches or less out of the ground.

Surveys and maps were made showing topography and property lines along Esopus creek from the outlet of the Shandaken tunnel to Ashokan reservoir at Cold Brook.

For this work, 127,000 linear feet (24 miles) of measured traverses, 46,700 linear feet (8.8 miles) of supplementary traverses, and 194,000 linear feet (36.7 miles) of property traverses were made; 8,200 acres were surveyed and mapped, including 1,300 acres showing the contours; and copies of 210 deeds were secured.

In making these surveys, measured traverses were made on each side of the creek which served as a base for locating the edges of the creek, the property lines adjacent to the creek, and stadia

traverses run to locate other features of the properties having a creek frontage. The contours were taken in the immediate vicinity of the creek in view of possible creek improvements to accommodate the additional flows from Shandaken tunnel. Levels were also taken on high and low water marks and water surface at each creek property at the same or similar normal flows by which the edge of the creek was located.

In December, similar surveys were started on the properties along the Schoharie creek from the Gilboa dam site to the Mohawk river.

Copies of deeds, with the aid of the Bureau of Claims, and miscellaneous data were compiled and furnished the Bureau of Claims for the use of the Corporation Counsel. Aid was also given the Corporation Counsel regarding inspection of properties and securing special measurement of buildings.

The following table shows the totals of work done in connection with the surveys on the Schoharie work:

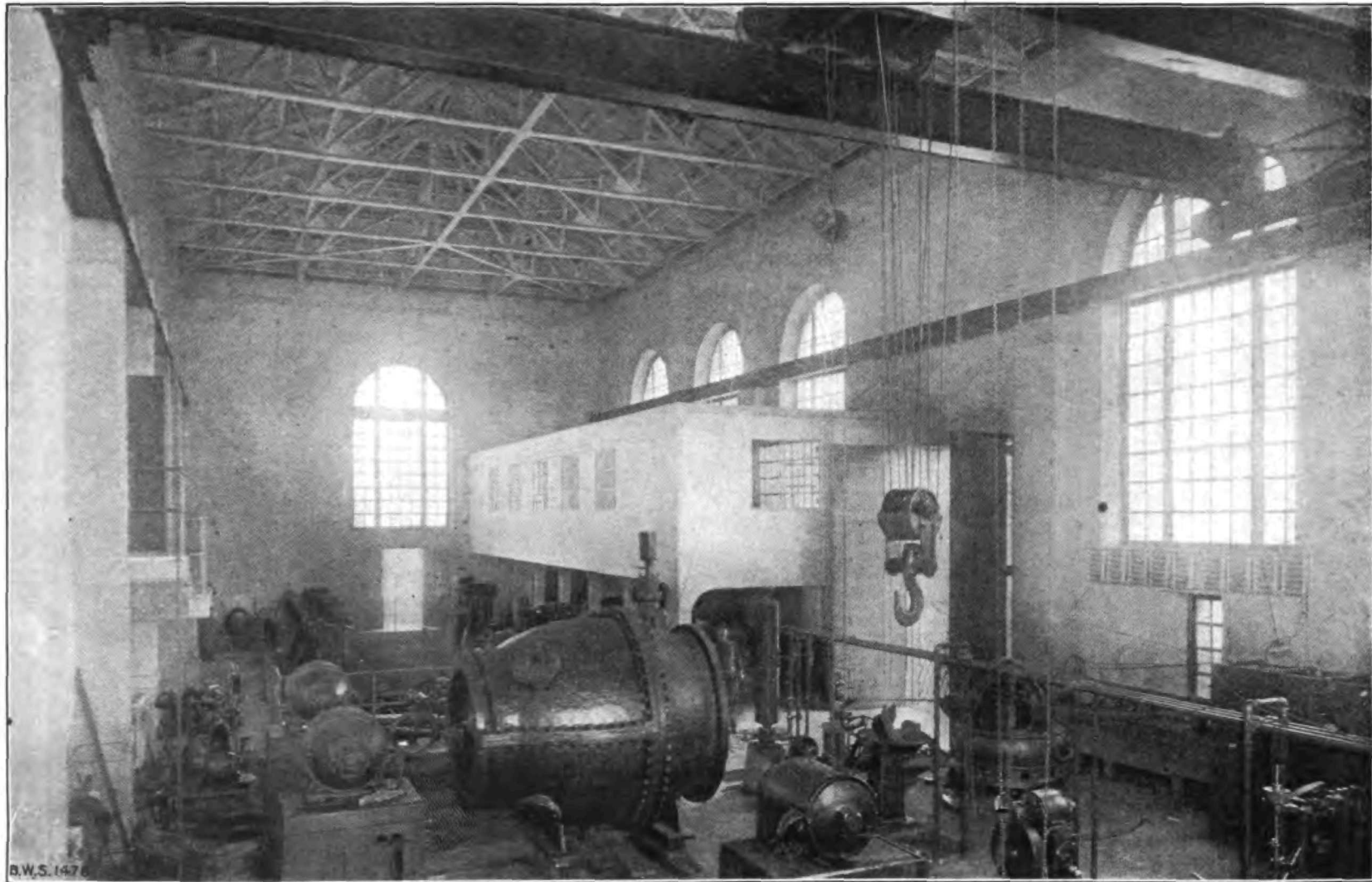
	1917		To Date	
	Linear Feet	Miles	Linear Feet	Miles
Traverse for topography.....	16,000	3.0	516,000	97.7
Traverse for real estate.....	272,000	51.5	622,000	117.8
Traverse for highways.....	25,430	4.8	85,700	16.2
Highways cross-sectioned.....	55,800	10.6	65,500	12.4
Highway profile.....	44,400	8.4	79,500	15.1
Miscellaneous traverse.....	21,700	4.1	21,700	4.1
Deeds copied.....	180		700	
Topography mapped (standard).....	.....		4,900	acres
Property for condemnation mapped and traced.....	2,073.9 acres		2,503.4 acres	
Total area covered by surveys of all kinds...	8,000 acres		13,300 acres	

Real Estate.—Work was completed on the real estate surveys and maps for land for the Schoharie reservoir and the Shandaken tunnel.

Where the parcels are a part only of a property, tracings were made showing the entire property.

Cemetery maps are being prepared indicating the individual burials as an aid in removals.

Real Estate Maps for Schoharie Section 1 (prepared in 1916) were adopted by the Board of Estimate and Apportionment on January 12; these maps were filed in Ulster and Greene counties on January 26 and in Delaware and Schoharie counties on January 31. Real estate maps for Schoharie Section 2 were prepared, approved by the Board of Water Supply on March 6 and by the



B.W.S. 1476

ASHOKAN RESERVOIR—Ashokan Lower gate-chamber, looking east. Note electrically-driven valve-stands and one of two vertical generators operated by water-turbine, in right foreground. The current produced is utilized for local purposes. The overhead traveling crane (not seen) is capable of handling the heaviest pieces in the building. Various machine tools provide for local repair work

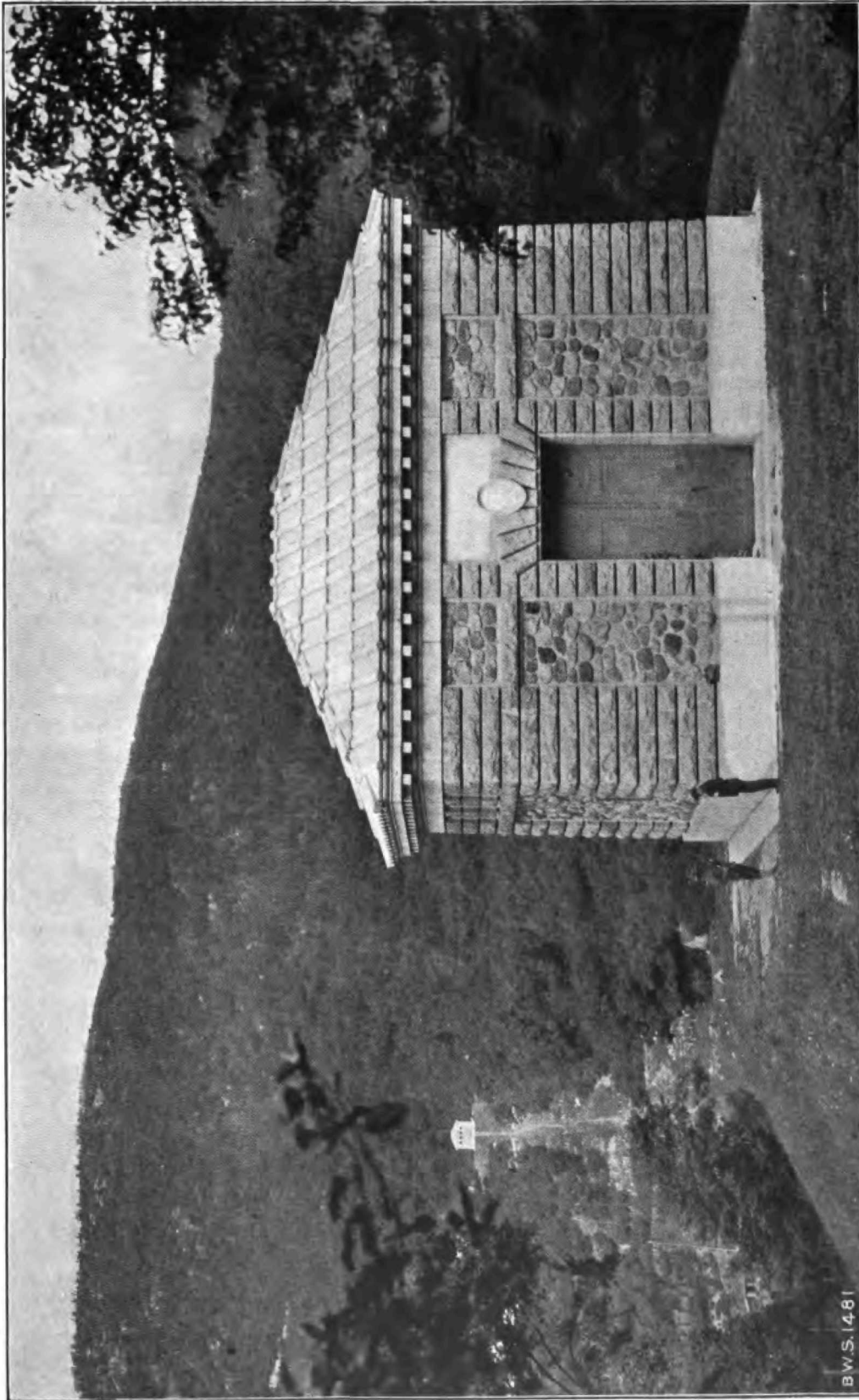
Board of Estimate and Apportionment on March 16, and filed in Schoharie county on March 19. This section consisted of a title sheet, index map and five maps showing 62 parcels amounting to 378 acres. Sections 1 and 2 were advertised together and one appraisal commission was appointed on May 21; the oaths of the commissioners of appraisal were filed on May 25, at which time the City became vested with the title to the real estate in these two sections.

Maps were also prepared for Schoharie Section 3 comprising the balance of real estate (111 parcels,—1,688 acres) necessary for the Schoharie reservoir. These maps were approved by the Board of Water Supply on May 1 and by the Board of Estimate and Apportionment on May 18 and were filed in Greene county on May 26, Delaware county on May 28 and Schoharie county on May 29. This section consisted of a title sheet, index map and 15 maps. A supplementary sheet of Schoharie Section 3 was prepared, approved by the Board of Water Supply on July 10 and by the Board of Estimate and Apportionment on July 19 and filed in Schoharie county on July 30. This sheet showed three parcels covering 7.87 acres of real estate to be acquired for substituted highways. Section 3 and the supplementary sheet were advertised together and the commissioners of appraisal were appointed on November 15 and filed their oaths on November 24, at which time the City became vested with the title to the real estate in this section.

The Schoharie highway maps were prepared, approved by the Board of Water Supply on September 18 and by the Board of Estimate and Apportionment on October 5. These maps were filed in Greene county on October 11 and in Delaware and Schoharie counties on October 13. This section was not advertised but reference was made to it in the description and approval asked for in the petition for Schoharie Section 3. These maps called for the abandonment of about 23 miles of roads and for the substitution therefor of 12 miles of new roads.

Borings.—Under Agreements 101, 108 and 110 the subsurface investigations along the Shandaken tunnel were completed and more detailed borings were made in connection with the development of the plans for the Gilboa dam. A number of wash borings and testpits were also made by forces of the Board.

Contract 203.—Drawings and specifications for Contract 203, for the construction of the Gilboa dam and appurtenances were



CATSKILL AQUEDUCT—Foundry Brook siphon, looking north

B.W.S. 1461

completed, the contract document approved as to form by the Corporation Counsel and the contract pamphlets printed. This dam is located in the Town of Gilboa, Schoharie county, about four miles northeast of the Grand Gorge station of the Ulster and Delaware railroad.

The dam is to be of two distinct types, an overfall masonry portion about 1,300 feet long and 160 feet high and an earth embankment section about 1,000 feet long. The masonry section is to be of concrete into which stones may be embedded in the sizes and proportions which may be found practicable. The overfall section is designed with steps on the down-stream side for the purpose of breaking up and safely conducting the overflowing water down the face of the dam to the Spillway channel below. All exposed surfaces are to be of selected native sandstone with mortar joints. The earth portion of the dam is of conventional design with masonry core-wall.

The Spillway channel along the toe of the dam which will discharge waste waters into Schoharie creek below is about 80 feet wide at the upper end and 300 feet at the lower; the rock bottom slopes rather steeply and will be protected where necessary with masonry and substantial paving. The side of the channel away from the dam will be defined by a masonry retaining-wall.

The contract includes also the construction of about three miles of highways which must be completed before active operations on the dam can begin.

Contract 200, for the Shandaken tunnel, was awarded November 9, 1917, to The Degnon Contracting Company of New York City at their bid price of \$12,138,738 based upon contract quantities and unit prices. This was the lowest of three bids received. As this is an unusually long tunnel it was considered advisable to divide the work into two parts upon which intending contractors might also bid separately; but the low bid for the entire tunnel was less than the sum of the separate bids received. The Shandaken tunnel, a little over 18 miles in length from inlet to outlet, will serve to convey water from the Schoharie reservoir beneath the intervening mountains to the upper reaches of Esopus creek, whence the water will flow along this natural channel a distance of about 11 miles into the Ashokan reservoir. The main parts of the contract comprise the intake works, the tunnel and the downtake works. The intake works consist of an Intake channel and Intake chamber with superstructure and an Intake shaft.

The chamber is built into the rock and houses eight 3-foot by 7-foot sluice-gates set radially in the wall of the central well or extension of the Intake shaft. The superstructure is of substantial and permanent character having a slate roof, rubble walls of native bluestone, reinforced-concrete floors, steel roof trusses and steel framing for the crane over the Intake shaft. The superstructure has two wings, providing living quarters, garage, office, machine-shop and storerooms. The Intake shaft is 14 feet in diameter, except where constricted near the top by a Venturi meter.

The tunnel is in rock except for about 350 feet in earth near the outlet. The waterway section is of horseshoe shape, 11 feet 6 inches high by 10 feet 3 inches wide. There are 7 shafts which will be permanent in order to provide ready access to the tunnel. Each shaft is 14 feet in diameter. Small superstructures will cap each shaft and guarded openings in the floor and walls will provide for air movements in the tunnel. The tunnel is depressed between the Intake shaft and Shaft 1 in order to pass in rock of good quality below the gorge of the Bear Kill.

The outlet works consist of about 500 feet of aqueduct of the cut-and-cover type, an Outlet chamber and an open Outlet channel. The cut-and-cover aqueduct is of horseshoe shape, 11 feet 6 inches high by 10 feet 3 inches wide. Near the lower end it becomes a reinforced-concrete waterway 11 feet 6 inches in diameter with a fall of 16½ feet, providing a water seal for the tunnel outlet. The Outlet chamber is an open flaring structure whose invert slopes upward to the channel invert. The channel has masonry side walls and local stone paving. A steel girder bridge carries the highway over the channel. Concrete masonry is used throughout except for the superstructures, which are of local bluestone.

ESOPUS DEVELOPMENT

Equipment for a chemical and bacteriological laboratory at the Ashokan reservoir was secured and, by the end of the year, the work of installation was practically completed.

Contract 193, for modifications of the Ashokan Spillway channel, was progressed.

Preliminary studies for the location of the second pipe-line across The Narrows were continued and soundings were made along tentative lines between Brooklyn and Staten Island.

Progress on the design of the Eastview filtration plant was continued and all of the main features of the work determined upon.

Preliminary investigations looking toward the landscape treatment of the area below the Kensico dam were made.

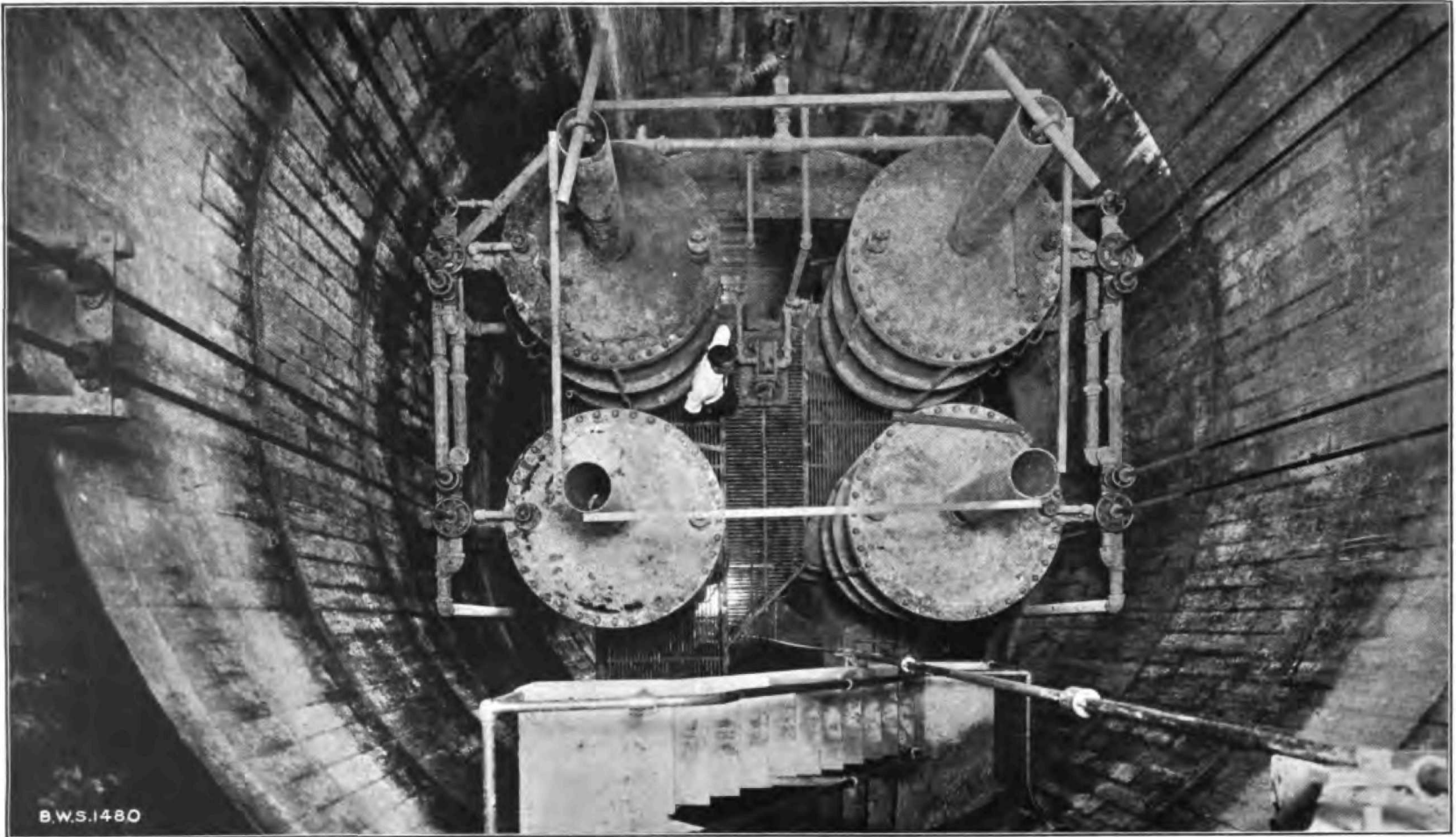
During the year there were added to the hydraulic information, arranged as an aid to operation and for purposes of record, capacity diagrams of the Ashokan, Kensico, Hill View and Silver Lake reservoirs; also, a diagram of the discharge capacity of the gates in Kensico Influent chamber, and a set of capacity diagrams for the Ashokan aerator.

Drawings were prepared, completely detailing a wooden flume and support for the temporary, quick repair of a possible break in the aqueduct, and all necessary material therefor was made available. In this connection, there was also prepared and filed for ready reference, a list of tools available and needed for such emergency use.

Record Drawings.—The standard aqueduct drawings for the Kensico and White Plains divisions of the Southern Aqueduct department and the Manhattan division of the City Aqueduct department were completed. Those of the Bronx and the Conduit and Reservoir divisions of the City Aqueduct department were well advanced. Considerable progress was made on record drawings arranged with particular reference to the information requirements of those engaged in operating the works. The character of these drawings is suited to the display of reproductions of them upon the chamber walls. Of these operating drawings, eight covering steel-pipe siphon chambers were completed, and four of pressure-tunnel drainage shafts and chambers were well advanced.

There were completed 66 record drawings, including the complete aqueduct set from the Ashokan reservoir to Hunters Brook siphon. The aqueduct drawings from Hunters Brook siphon to Hill View reservoir are nearly completed, and those for the City tunnel and conduits are well under way.

Operation Drawings.—Operation drawings for the Fort Hill, Kensico and Elmsford North and South Siphon chambers, and the Sprout Brook and Bryn Mawr North Siphon chambers were completed. The operation drawing for the City Tunnel riser-valve control was completed. Other drawings under way comprise both chambers of the Esopus and Foundry Brook siphons, the Drainage chambers at Shaft 21 of the City tunnel and the west shaft of the Hudson as well as the Croton Downtake chamber, the Croton Drainage plant and the refill operations at the Rondout and Wallkill Drainage chambers.



CATSKILL AQUEDUCT—Wallkill full-capacity blow-off chamber, showing the four 54-inch hydraulically-operated gate-valves connecting the Catskill aqueduct to the Wallkill Blow-off channel

City Tunnel Location.—Surveys of the location of the center line of the City tunnel, as built, were continued. Monuments were set along the line where it passes through City parks. Bench-levels were run to each shaft chamber and bench-marks established.

General Up-Keep Work.—A float well was placed in the Down-take shaft at the Hill View reservoir. Float-well pipes and a Venturi meter recorder were installed at the Kensico Screen chamber and at the Pleasantville coagulating plant.

The engineering and labor forces were also engaged at various times during the year on monumenting the aqueduct and taking lines, on stadia surveys, on the field location of the City's telephone line and the Edison power line. Reclassification of office records and stenciling of final stations on structures in the Croton, Kensico and White Plains divisions were also done.

During the year Ross regulating valves were installed in the chambers of the City tunnel. The operation of the pumping equipment at Shaft 11 was carried on by forces of the Board, and upon the completion of this work it was dismantled, removed, re-assembled and operated at Shaft 21.

Real Estate.—Maps showing real estate at Storm King to be acquired by the City from the New York Central Railroad Company were approved by the Board of Water Supply on October 2, and together with an optional agreement from the railroad company were approved by the Board of Estimate and Apportionment on November 9. These maps showed 4 fee parcels (6.08 acres) and 2 easement parcels (0.31 acre) and were filed in Dutchess and Putnam counties on November 22. A proposed form of deed from the railroad company conveying the property referred to in the optional agreement and shown on the maps is in the hands of the Corporation Counsel for approval as to form.

The following parcels of real estate were turned over to the Commissioners of the Sinking Fund for disposal:

Parcel 311-B, Northern Aqueduct department, was turned over on November 13, and sold on December 31 for \$575.

Parcels 107 and 108, City Aqueduct department, which were turned over prior to 1917, were sold on March 23 for \$35,000.

Parcel 912-B, Southern Aqueduct department, was turned over on September 21. The offer made for this property was not accepted and it still remains in the hands of the Commissioners of the Sinking Fund.



CATSKILL AQUEDUCT—Wallkill North cut-and-cover aqueduct, looking north toward South portal of Bonticou tunnel; completed backfilling over aqueduct in Freer cut

Parcels 450 and 451, Southern Aqueduct department, turned over prior to 1917, were sold on November 21 for \$2,000.

Parcels 1016-A, 1016-B, 1016-C, 1016-D and 1017, Southern Aqueduct department, were turned over on April 2 and sold on June 29 for \$4,000 to the County of Westchester and an agreement was entered into with the county giving it permission to use Parcel 1016-E.

In connection with taxes and assessments, the school district lines and a table showing the assessable property by school districts have been shown on the tax maps of the Northern Aqueduct and Southern Aqueduct departments in towns where there was a question as to the tax and a possibility of certiorari proceedings. A personal examination of the assessment roll and a comparison of the assessment to the City and the abutting owners were made for the Towns of Mount Pleasant, Cortlandt, North Castle, Harrison, New Castle, Yorktown and Greenburg and the Villages of Elmsford, Nelsonville and Pleasantville.

Hearings of the Kensico highway commission and the Commission on Damages at Hill View were attended by representatives of the Engineering bureau and maps were prepared and data furnished to the counsel for the City.

Contracts 185 and 186, for furnishing the necessary cement for grouting and for the required borings at the Woodstock and Glenford dikes of the Ashokan reservoir were awarded during May, 1917, to the Alsen's American Portland Cement Works, of New York City, and Sprague & Henwood, Inc., of Scranton, Pa. During the year all of the borings called for under Contract 186 were completed and practically all of the cement needed under Contract 185 was delivered.

Contract 9.—Empire Engineering Co., Inc., of New York City, contractor. This contract, covering the construction of the Kensico dam and appurtenant works, was practically completed during the year.

Contract 95, for traveling-crane equipment in the structures at the Ashokan, Kensico and Hill View reservoirs, was carried on to substantial completion by the Lord Electric Co., of New York City.

Contract 89.—This contract, for the construction of the Silver Lake reservoir and part of the Richmond conduit, being carried on by the Beaver Engineering and Contracting Co., of New York City, was completed.



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CATSKILL AQUEDUCT—Peekskill siphon. North chamber in background

Contract 99, Merritt & Chapman Derrick & Wrecking Co., of New York City, contractor, for 36-inch flexible-jointed pipe across The Narrows, was completed early in the year.

Contract 120, for the construction of the two superstructures for the Hudson and Croton Lake Drainage chambers, A. L. Guidone & Son, Inc., of New York City, contractor, was advanced during the year. The masonry of the Hudson chamber was completed and much of the fabricated material was delivered. The Croton Lake superstructure was erected and substantially completed by the end of the year.

Contract 123.—This contract covers the construction of 6 superstructures at the Kensico Influent, Upper and Lower Effluent and Screen chambers, and at the Kensico siphon. The contractor is Frederic W. Burnham, of New York City. Work under this contract was delayed through financial difficulties encountered by the contractor. The work is being finished by the lienors and at the end of the year was well advanced.

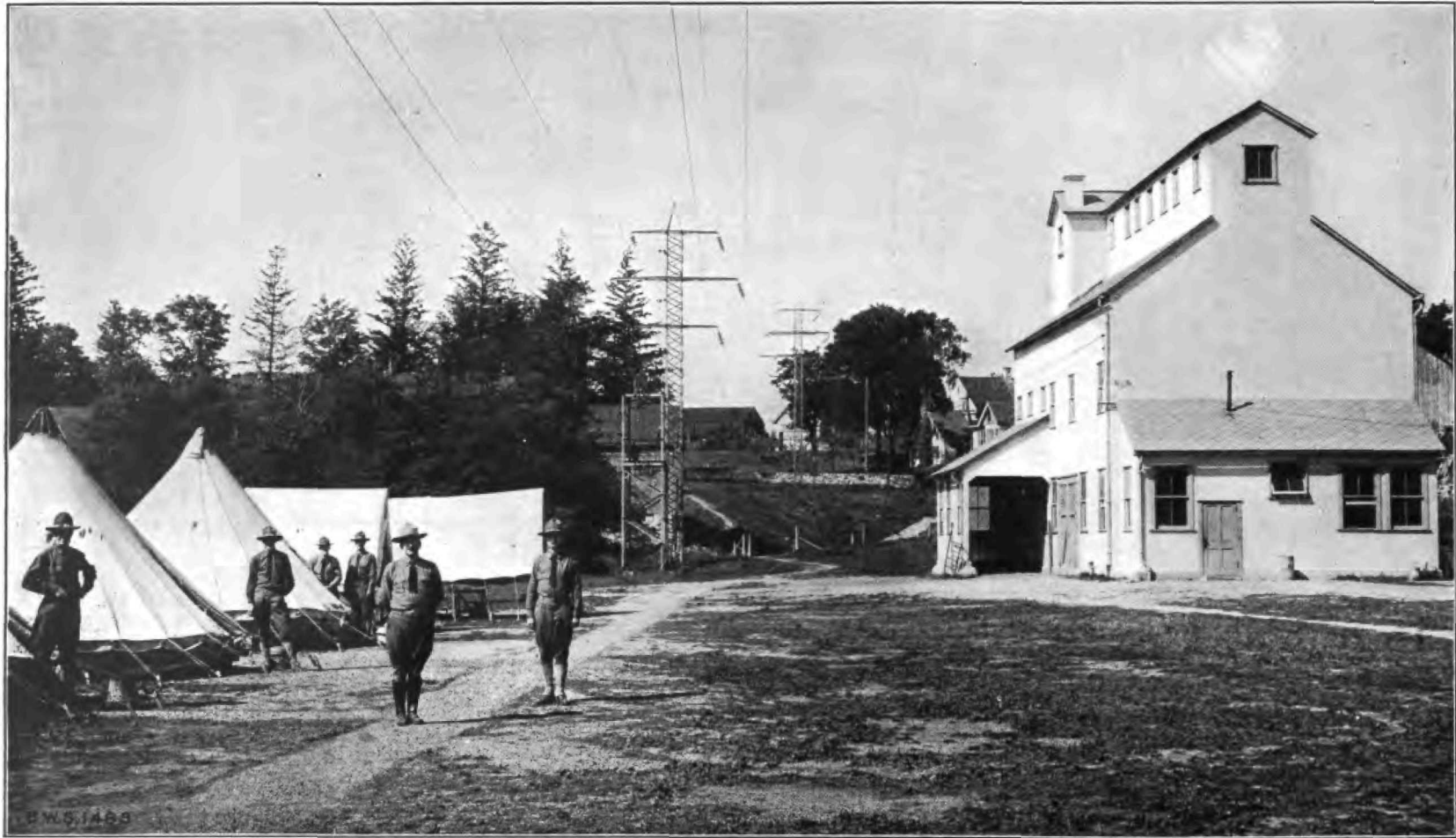
Contract 124.—This contract, covering the construction of the superstructures at the Ashokan reservoir and at the Esopus and Tongore siphons, was completed on August 2.

Contract 128, for the construction of 2 superstructures at the Hill View reservoir, was continued by William H. Egan, of New York City, the contractor. Financial difficulties met by the contractor led to delay, but by the end of the year work was again resumed.

Contract 129, for the completion of the superstructure at Shaft 21 of the City tunnel, was awarded on July 24, 1917, to John T. Brady & Company, of New York City, and some progress was made before the end of the year.

Contract 144, for the erection of 2 superstructures at the Silver Lake reservoir, was completed by the P. T. Cox Contracting Co., Inc., of New York City.

Contract 145 covers the roofing with concrete tiles of the various superstructures along the Catskill aqueduct. During the year work was completed at the Kensico Influent and Upper Effluent chambers, at Kensico Siphon chamber, and at the Croton Gaging chamber. Some work was also done at the Hill View Reservoir chambers.



CATSKILL AQUEDUCT—Coagulating plant at Pleasantville where aqueduct flow is treated before its entrance into Kensico reservoir 1½ miles down-stream

Contract 147, for riser-valve control apparatus, was continued by L. K. Comstock & Co., Inc., of New York City, and practically completed by the end of the year.

Contract 151.—Work for the year under this contract, the State Highway Construction Co., of Beacon, N. Y., contractor, was confined to complying with the contract provisions for the maintenance of paving placed during previous years.

Contract 152, for surfacing with brick and macadam parts of the highways about the Ashokan reservoir was completed in 1916. During the past year such repairs as were called for under the maintenance provisions of the contract were made.

Contract 156.—This contract, for furnishing and planting tree transplants at the Ashokan and Kensico reservoirs, The North-Eastern Forestry Company and Franklin Forestry Company, of Cheshire, Conn., contractors, was completed. A summary of the work done under this contract is shown in the tables on pages 82 and 83.

Contract 159.—Pleasantville coagulating plant, Guarantee Construction Co., of New York City, contractor, was completed and finally tested during April, 1917.

Contract 161, covering the furnishing, delivering and installing of operating equipment for valves and sluice-gates at the Ashokan, Kensico, Hill View and Silver Lake reservoirs, was completed on February 9, 1917; Lord Electric Co., of New York City, contractor.

Contract 164, for installing steam-heating systems in the Ashokan and Kensico gate-chambers, was entirely completed during the year. The contractor was L. F. Bannon Plumbing, Heating and Contracting Co., of Kingston, N. Y.

Contract 168, for furnishing, delivering and installing electric lighting apparatus at the Ashokan, Kensico, Hill View and Silver Lake reservoirs and in the superstructures along the aqueduct, was awarded on May 1, 1917, to the Lord Electric Co., of New York City. By the end of the year the work under this contract was well advanced.

Contract 170.—This contract, for furnishing and placing copper lining in the City tunnel near Shaft 18, was entirely completed during the year by the contractors, Lupfer and Remick, of Buffalo, N. Y.

Contract 174, for furnishing, delivering and installing riser-valve control mechanisms at the shafts of the City tunnel, was car-

ried on by the contractor, Charles Meads & Co., of New York City. At the end of the year it had been well advanced.

Contract 176, covering fences around the Hill View and Silver Lake reservoirs, was awarded on April 17, 1917, to Lupfer and Remick, of Buffalo, N. Y., and by the end of the year fair progress had been made.

Contract 178, covering grouting a portion of the Eastview tunnel, was completed on January 29, 1917, by the contractor, William Heyman, of Jersey City, N. J.

Contract 179, for brick surfacing of the East Hill drive at the Kensico dam was awarded on July 12, 1917, to the Empire Engineering Co., Inc., of New York City. This work was completed on November 5, 1917.

Contract 180, for maintenance buildings located along the line of the Catskill aqueduct, covered the erection of various buildings and the remodeling of existing buildings for the use of the maintenance force. By the end of the year most of the work to be done under this contract, which was awarded in three parts, was completed.

Contract 181, for furnishing and delivering a portable steel building for use at Shaft 11, was awarded to John T. Brady & Company, of New York City, on August 8, 1917. This contract also covered the construction of a storage building in the yard of the Department of Water Supply, Gas and Electricity, at Fifth avenue and 140th street, for storage of the portable steel building and unwatering equipment. Field work has begun on August 22, and at the close of the year some progress had been made.

Contract 182, for applying surface treatment to the water-bound macadam pavements at Ashokan reservoir, was awarded April 10, 1917, and completed October 20, 1917. The contractor was the State Highway Construction Co. of Beacon, N. Y.

Contract 184, covering the placing of a brick pavement laid in tar and mastic on the concrete bottom of the Kensico aerator, was awarded on July 12, 1917, to the Henry E. Fox Construction Co., of New York City. At the end of the year 62 per cent. of the work had been completed.

Contract 188.—This contract, for furnishing and delivering gate and pressure-regulating valves for the City tunnel, was awarded to the Coffin Valve Company, of Boston, Mass., on August 8, 1917, and by the end of the year fair progress had been made.

Contract 189, for the construction of maintenance buildings at the Silver Lake reservoir, was awarded on October 30, 1917, to Karlsson Bros., of Tompkinsville, Staten Island, N. Y.

Contract AH.—Under this contract liquid chlorine was furnished by the Electro Bleaching Gas Co., of New York City.

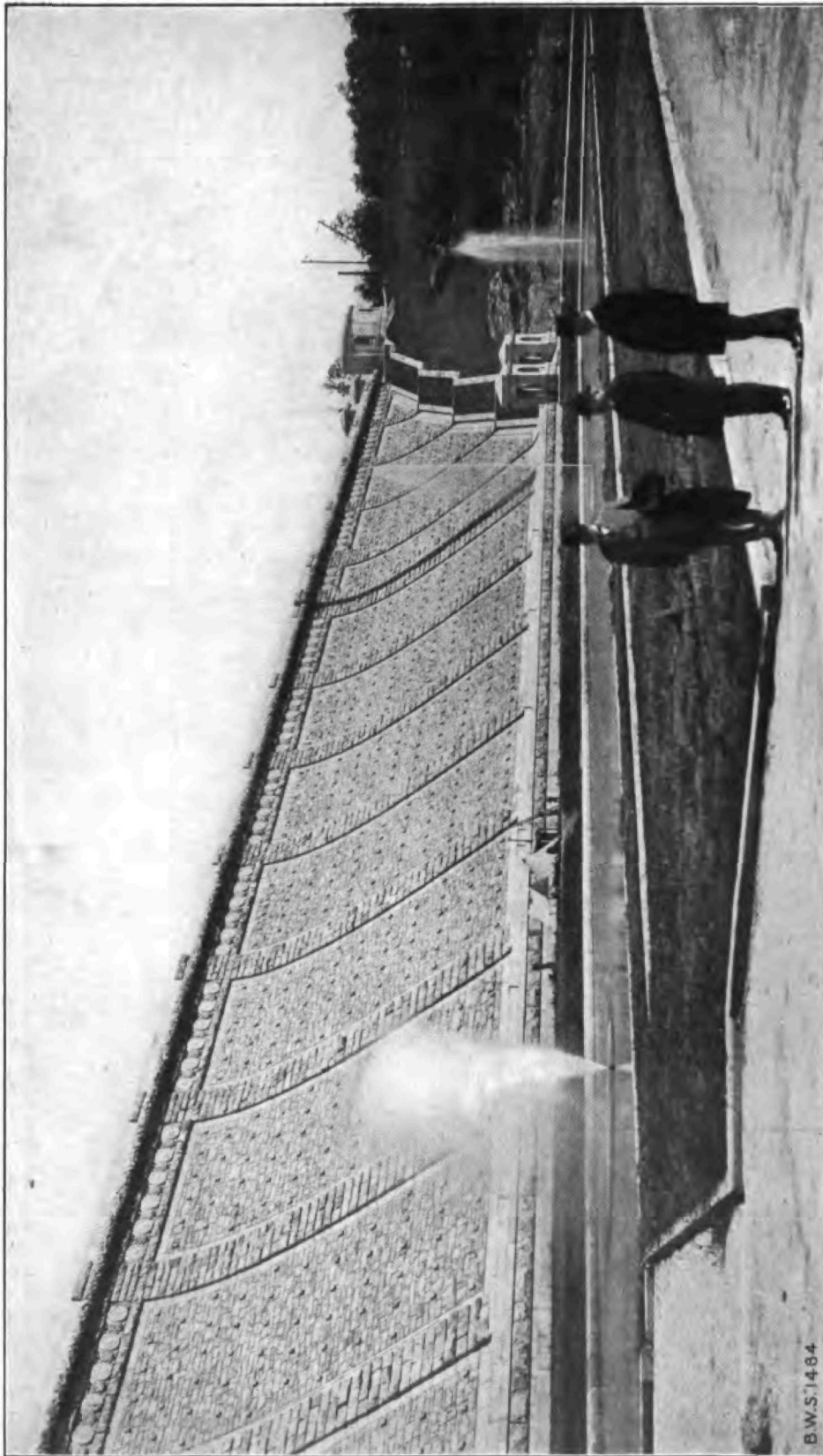
Agreement 107.—The delivery of material and the erection of a storage building at the Ashokan Screen chamber was completed early in the year by Charles Meads & Co., of New York City.

Agreement 109, for sinking wash borings in Madison Square park and vicinity, was completed on March 27 by Edward A. Clark, of New York City.

Miscellaneous Work at the Ashokan Reservoir.—Among much other work in the vicinity of the Ashokan reservoir are to be mentioned: The placing of flashboards on the Dividing weir and on the Spillway; the installation of a Venturi meter registering apparatus in the Ashokan Gaging chamber; and the building of an air-vent in the aqueduct just north of the Venturi meter. The slope paving of the Main dam, injured during the winter by the unusual wave action, was repaired, thermophone readings were continued at the Spillway bridge, color and turbidity determinations were made of daily samples from the East and West basins, and water samples were collected weekly from about 30 points around the reservoir and on the watershed, these samples being forwarded for examination to the Mt. Prospect laboratory of the Department of Water Supply, Gas and Electricity. The overhauling, refitting and adjusting of the 48-inch control valves were completed, and a short section of steel pipe was installed downstream from one of the low-level control valves, and machine tools were erected in the Lower gate-chamber.

Grouting Woodstock and Glenford dikes.—The work of grouting at the Woodstock and Glenford dikes, in order to reduce the seepage, was actively prosecuted during the year, and including that previously done, 12,913 barrels of cement have been used. The maximum amount of cement taken by one hole is 508 bags, the average being generally 50. The results obtained were satisfactory and the seepage was perceptibly reduced.

Liquid Chlorine Apparatus at the Kensico Screen Chamber.—Apparatus and equipment for the application of liquid chlorine for sterilization purposes were installed at the Kensico Screen chamber by Wallace & Tiernan Company. This apparatus consists of 4 manually controlled units, so arranged that they may be operated



KENSICO DAM, showing pool and Upper and Lower East pavilions and experimental jets in pool

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singly or in combination and have a capacity of supplying gas for any quantity up to 1,200 pounds per day.

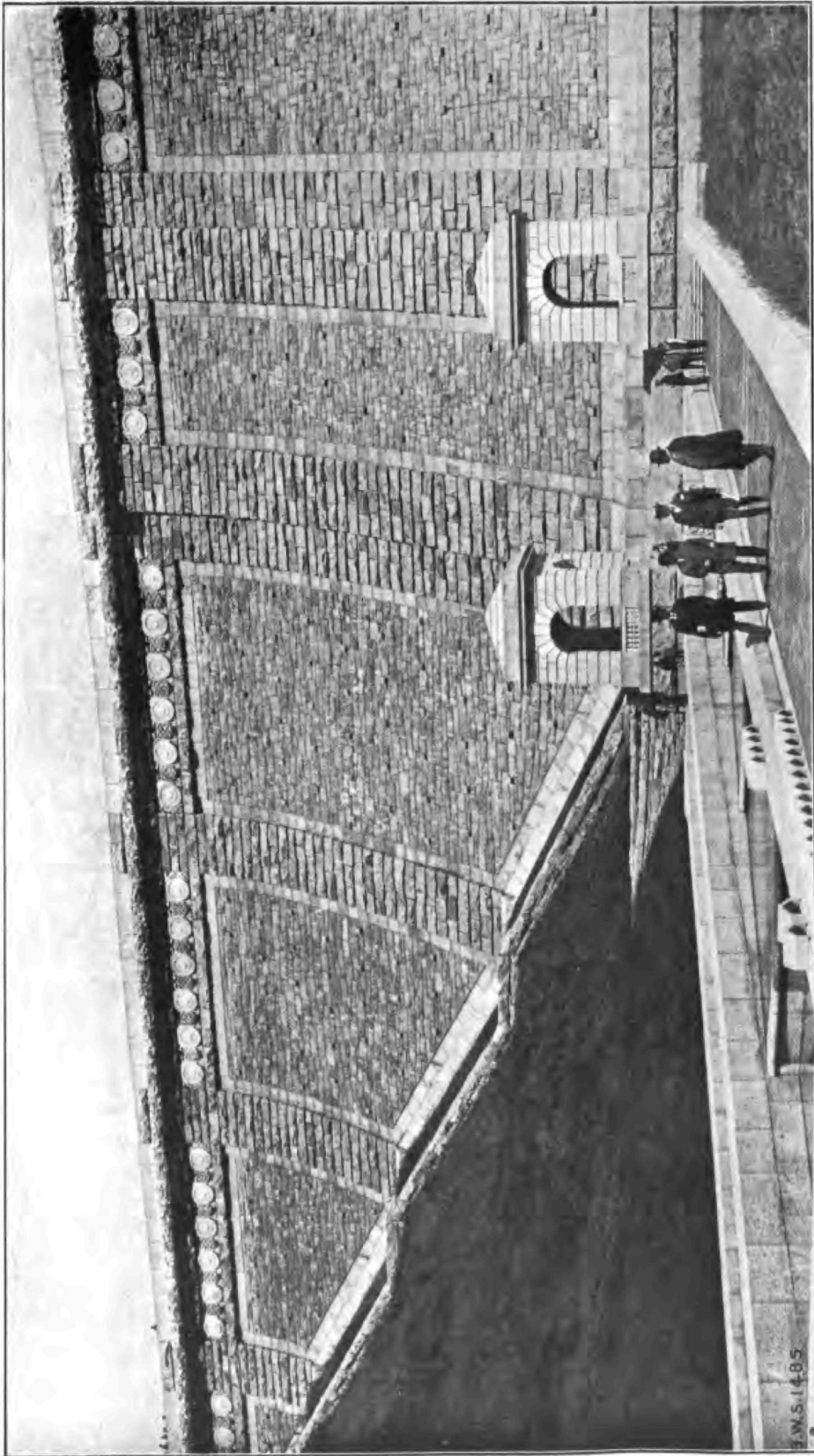
Highways.—A number of roadway culverts around the Ashokan reservoir were found to have been damaged by frost action during the preceding winter and steps were taken so as to remedy these conditions and prevent further injury. A large number of boulders were also removed from beneath the subgrade of the highways, it having been found that alternating frost action caused them to be raised vertically and to result in very decided roughness of the pavement surface.

Repairs to Hudson Drainage Shaft.—During 1916, conditions of leakage east of the Hudson river led to repairs in the Breakneck pressure tunnel and in the Hudson Drainage shaft as noted in the last annual report. Briefly, these repairs in the pressure tunnel consisted of calking the cracks in the lining with lead, drilling holes about 10 feet into the surrounding rock and grouting with thin grout under high pressure. In the shaft these operations were to be supplemented by the placing of a short stretch (60 feet) of copper lining from 0.053 inch to 0.064 inch thick. At the end of 1916 all of this work except the installation of the copper lining in the shaft had been accomplished with satisfactory results as far as inward leakage was concerned.

The work of repairs in the Hudson Drainage shaft was continued on a three-shift basis. The placing of anchor rings in grooves cut in the shaft lining at Elevations —338 and —398 was in progress. The steel angle rings which had been furnished bent to true circles required some shaping to fit the periphery of the shaft. By January 8 the anchor rings and all bolt anchors for fastening the copper lining and wooden guides to the shaft walls had been set. The removal of concrete guides was then begun.

The float guides were removed together from the top downward. Sections of oak guide approximately 10 feet in length were installed as the removal of concrete progressed. Pumping was conducted so as to keep the steel pipe guides engaged throughout the operation. Work on the float guides was completed January 14. Strips of copper lining about 44 inches in width were next placed under the wooden guides. This required rehandling all of the timber guides as the copper was placed in lengths of two sheets (about 20 feet).

The copper lining under the float guides was completed January 20. Copper sheets were then made up into strips of full length,



KENSICO RESERVOIR—Lower West pavilions, West pool and fountain

(60 feet) and lowered into the shaft. The horizontal joints were lap riveted and sweated with pure tin solder. The vertical joints were flanged outward in a bend of 1-inch radius. The edges of the sheets when in place projected 2 inches from the wall of the shaft. These joints provided the expansion which the pressure in the shaft would require. Alternate sheets were punched for vertical joint riveting before being placed and the adjacent sheet was punched in place. The rivets were $\frac{1}{4}$ -inch copper and were spaced on 1-inch centers.

While the operations of lining the east side of the shaft were in progress the concrete cage guides were removed, oak guides were substituted and copper sheets placed under them. Work on the east half was carried on from a platform suspended from the roof of the superstructure over the shaft and in the west half from a wooden double-deck cage which was built for the purpose, the steel cage having been removed from the shaft. The completed lining consisted of 17 vertical strips of copper of various widths, none over 44 inches. Riveting was finished February 4 and part of the vertical joints were also sweated with solder. The work of soldering was difficult and it was not until February 10 that the lining was finished.

Nine 2-inch flap check-valves were placed in the copper-lining opening into the shaft close to the bottom anchor-ring to provide relief from external pressure when there is a decrease of internal pressure as when the shaft may be unwatered. Upon the completion of the work the total discharge from these valves was only 0.44 gallon per minute. The flow from Breakneck pressure tunnel did not exceed 2 gallons per minute. A reduction of inflow of probably 250 gallons per minute resulted from the repair work.

Moodna-Hudson-Breakneck Pressure Tunnel.—At the beginning of the year the pumps were being operated in parallel an average of about 35 hours per week to keep the surface of the water in the Hudson pressure tunnel between Elevations —612 and —630 while the work of repairs in the shaft was carried on. While work proceeded on cutting out concrete float guides, their replacement by wooden guides and the placing of copper lining under them, pumping was required at more frequent periods. After February 8 pumping was discontinued, there being sufficient capacity in the Moodna supplementary tunnel to take care of the inflow until repairs were finished. The inflow measured 306 gallons per minute at an elevation just above the supplementary tunnel.

Water was admitted to the tunnel at the Downtake shaft from storage back of Washington Square siphon gates on February 10 to hasten the filling of the tunnel. On the afternoon of February 11, just after the tunnel had filled to the top of Shaft 7-A, a surge occurred which drove pipe No. 12 (then in line) against the roof beams of the temporary superstructure. An overflow into Break-neck tunnel prevented the swamping of the float. Some damage was done to switchboard apparatus by a fire which started from a short circuit caused by water from the discharge line, the pumps having been started to aid in keeping the water-level down in the shaft. The shaft covers were placed and bolts stressed by February 16.

After sufficient time had elapsed for tests of the tightness of the aqueduct the unwatering plant was dismantled and shipped to Walkill pressure tunnel.

Walkill Pressure Tunnel.—The machinery arrived at Forest Glen, N. Y., on April 5 and hauling to the Drainage chamber was immediately begun.

The float was placed in the shaft on April 19. Installation was carried on by an average force of 8 men and the master machinist, working one shift. Considerable work was required which would be unnecessary at a future unwatering on account of this being the primary installation in this superstructure.

The plant was ready for operation and pumping was begun May 10 at 10 A. M. By six o'clock that evening the Drainage shaft had been unwatered. The end shafts had been unwatered with the Drainage shaft until the tunnel level was reached; then the 16-inch stop-valve was closed thus shutting off the tunnel from the shaft and the Drainage shaft itself emptied. Water was then supplied to the pumps through the 10-inch valve.

Motor No. 2 went out of commission on the first day of pumping due to excessive sparking, and the upper thrust-bearing ran hot. It was not until 5 P. M. May 18 that this motor was put into service, after which both pumps were continuously operated 16 hours per day, work being on a two-shift basis. The tunnel was empty at 4.15 A. M. May 24, an extra shift being employed to complete the work. The unwatering was done in less than 14 days elapsed time or in 317.63 pump-hours. The average net discharge was 1,563 gallons per minute per pump. The inflow in the tunnel with the tunnel empty measured 104 gallons per minute, probably two-thirds of which occurred in the vicinity of the tunnel between Shafts 4 and 5.

The 16-inch bronze stop-valve was removed to make way for a new valve having a greater discharge opening.

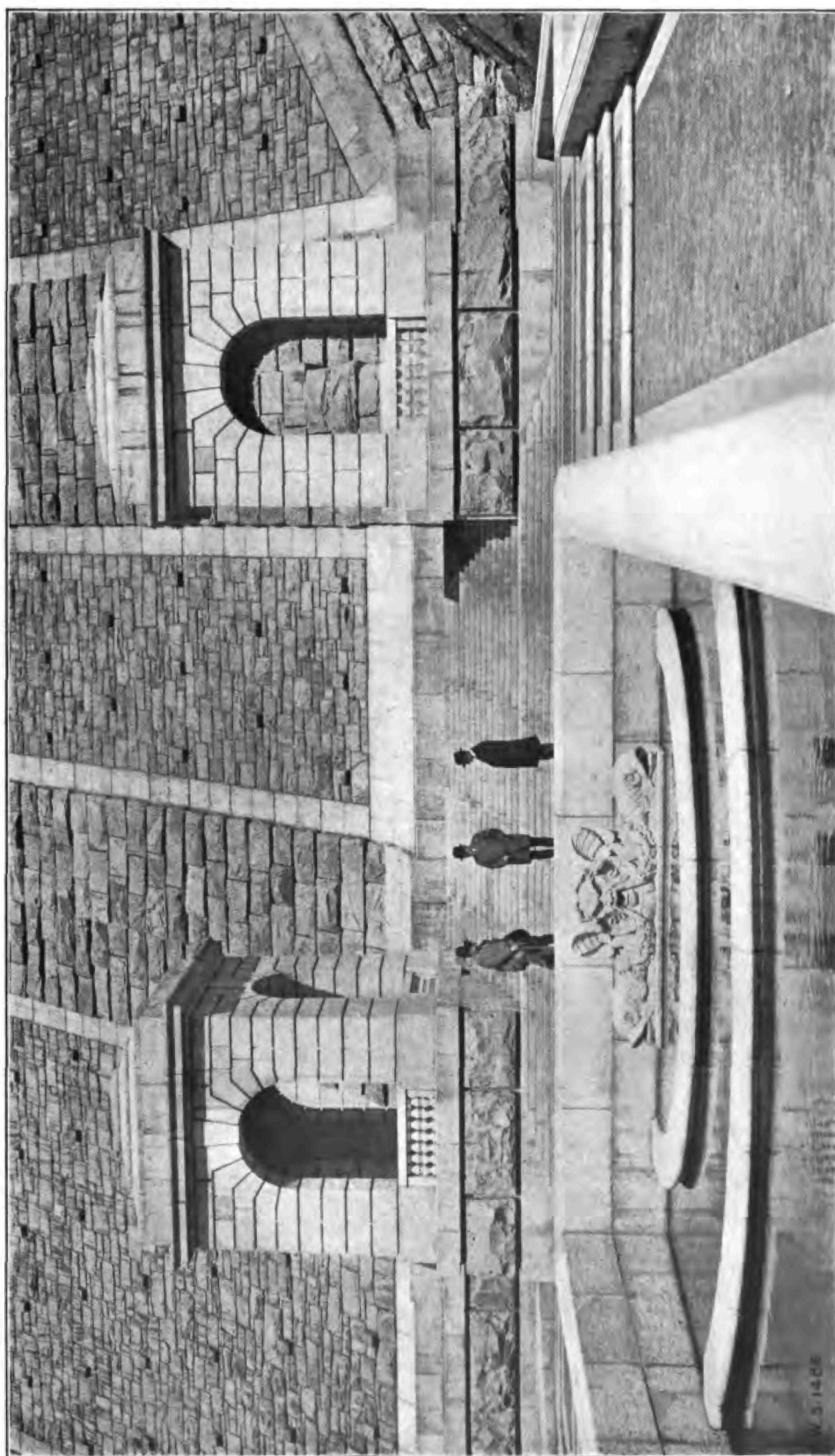
The tunnel was filled to the blow-off elevation on May 28 and the float was raised to the top of the Drainage shaft by means of the refill valve.

After this unwatering the force was decreased and the men who remained were employed variously over the whole department. Wallkill Drainage chamber was maintained as a general headquarters until late in the year. Here some of the force were continuously employed in thoroughly overhauling the pumping machinery. This plant had experienced a very extended operation from the fall of 1914 to the end of May, 1917, and while repairs were made as required to keep the pumps in operating condition a material deterioration of many parts due to wear and tear had occurred.

Reservoir Storage and Water Delivered to Aqueduct.—At the beginning of 1917 both basins of Ashokan reservoir were full, representing an available storage of 127,900 million gallons, the elevation of the West Basin on January 1 being 590.15, and of the East basin, 587.26, the latter representing a depth of about 2 inches over the Spillway crest.

During the year water was delivered through the Catskill aqueduct in the following monthly totals:

MONTH	MILLION GALLONS
January	43
February	4,388
March	11,023
April	9,185
May	3,904
June	11,247
July	11,267
August	11,662
September	10,849
October	11,629
November	11,249
December	11,708
Total for year.....	108,154



KENSICO DAM—Lower East pavilions, East fountain and cascade

The average daily rate passing into the aqueduct under normal operating conditions ranged between 375 and 377 million gallons. The draft was generally from the West basin, but occasionally water was drawn from the East basin in order to facilitate repair work at Woodstock and Glenford dikes, or because of objectionable organisms in the West basin.

Water was wasted over the Spillway during the following periods: January 1 to February 21; March 26 to June 25; and June 27 to July 5.

At the end of the year the West basin stood at Elevation 574.11, and the East basin at 575.31, the available storage in both basins being 94,323 million gallons, a reduction during the year of 33,577 million gallons.

Use of Aqueduct.—On February 16, immediately after completion of repairs to Breakneck pressure tunnel and Hudson Drainage shaft, the aqueduct was put in commission and continued to deliver water to Kensico reservoir at a daily rate ranging up to 378 million gallons daily to the end of the year, excepting when brief shut-downs were made in July, for the purpose of conducting hydrostatic tests of pressure tunnels, and for a period in May when unwatering of Wallkill pressure tunnel was in progress. The total amount of water passing south from Ashokan reservoir to July 31 inclusive, as recorded by the Ashokan meter, was 51,057 million gallons. From August 1 to December 31, inclusive, the total was 57,097 million gallons, or a total for the year of 108,154 million gallons. The maximum depth recorded in the aqueduct between Ashokan and Kensico reservoirs was about 16.50 feet at the North chamber of Sprout Brook siphon. Depths at the north chambers of several steel-pipe siphons were recorded, and these, when compared with records of previous years, appeared to indicate a slight increase in fouling. Wooden shutters to a height of about 6 feet were maintained in the uptake chambers of Rondout, Wallkill and Moodna-Hudson-Breakneck pressure tunnels. These shutters apparently have a good effect in reducing surge.

Water Temperatures in the Kensico Reservoir.—The following table shows the water temperatures in the Kensico reservoir in degrees Fahrenheit:



KENSICO DAM—The East pylon and cascade basin showing details of the architectural design and the rugged character of the stonework in keeping with the massiveness of the structure.

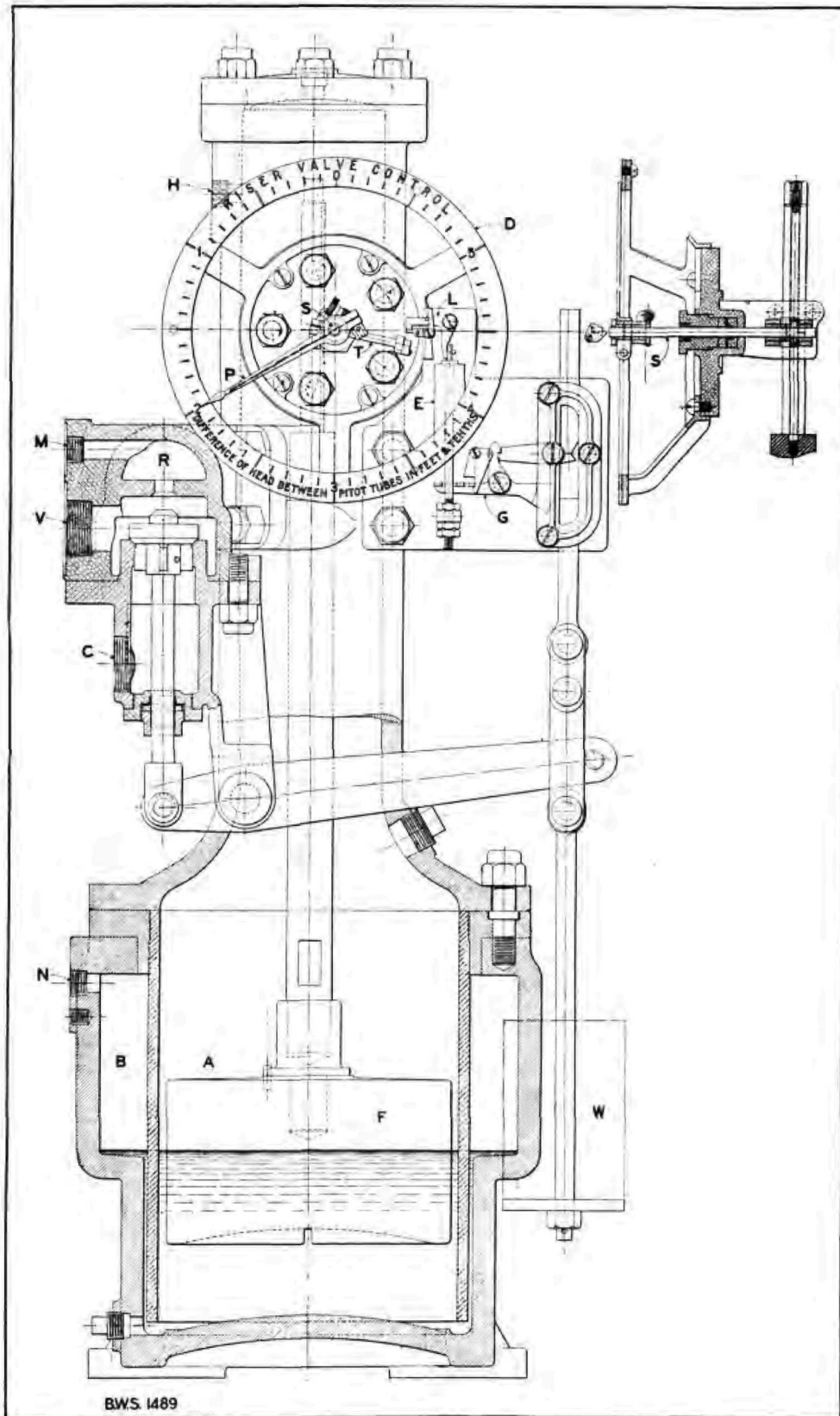
WATER TEMPERATURES IN KENSICO RESERVOIR
IN DEGREES FAHRENHEIT

DEPTH FEET	SURFACE ELEVATION AND DATE							
	347.0 on Jan. 30	345.0 on Feb. 27	355.0 on Apr. 4	356.5 on May 3	350.5 on Jun. 12	350.0 on Jul. 13	348.6 on Aug. 25	359.6 on Nov. 14
0.5.....	37.6	33.2	39.5	45.3	66.3	71.6	76.6	49.0
5.0.....	39.3	35.6	39.1	45.3	64.2	71.5	76.6	....
10.0.....	37.4	35.6	39.1	45.3	63.7	67.0	75.6	49.0
15.0.....	37.3	35.6	38.9	45.4	61.9	62.6	69.3	....
20.0.....	37.3	35.6	38.9	45.4	56.8	61.5	65.3	49.0
25.0.....	37.3	....	38.8	45.4	55.9	60.5	64.0	....
30.0.....	37.3	35.6	38.8	45.5	54.8	60.1	63.3	49.0
35.0.....	....	....	....	45.5	53.8	59.2	62.5	....
40.0.....	37.7	35.6	38.8	45.8	52.7	57.6	61.7	49.0
45.0.....	....	....	....	45.8	51.6	55.8	60.5	....
50.0.....	37.8	35.6	38.8	45.8	50.1	53.8	59.1	49.0
55.0.....	....	....	....	....	49.3	51.7	55.4	....
60.0.....	37.8	35.6	38.8	44.9	48.1	49.0	52.0	49.0
65.0.....	....	....	....	....	46.8	48.1	49.0	....
70.0.....	37.9	35.6	38.8	44.5	46.1	....	47.6	48.9
75.0.....	....	....	....	....	45.7	....	....	....
80.0.....	38.1	35.9	38.8	44.0	45.6	....	45.8	48.5
90.0.....	38.1	36.1	....	43.2	45.3	....	45.3	48.0
100.0.....	38.1	36.3	38.7	43.1	45.0	....	45.3	47.7
110.0.....	38.1	36.5	38.7	41.6	45.0	....	45.0	47.4
120.0.....	38.3	36.7	38.7	41.4	45.0	....	45.0	46.2
130.0.....	....	36.9	38.7	41.5	44.9	....	45.0	45.4
140.0.....	....	....	38.7	41.6	44.8	....	....	....
150.0.....	....	....	38.7	41.5	44.7	....	....	....
*Mean.....	37.8	35.7	38.8	43.8	49.9	....	55.2	48.2

* Represents average of 10-foot intervals

Operation of City Tunnel.—Daily readings were taken and records kept of the elevation of water in Hill View and Silver Lake reservoirs, and the quantity of water passing the full-capacity Venturi meter in the tunnel at Shaft 2. Records were also taken of the quantity of water fed from the tunnel to the distribution system of the City from the shaft connection lines and to the Silver Lake reservoir until August 1, when the Department of Water Supply, Gas and Electricity assumed control.

The unwatering of the section of the tunnel draining to Shaft 11 was completed on January 6. This section of the tunnel was then given what cleaning was found necessary and final inspection of the tunnel was made. Water was again admitted to this section on January 15, and the water allowed to rise to the elevation of Jerome Park reservoir, preparatory to feeding water to Brooklyn during repairs to Hill View Downtake shaft. Up to this time on account of a shortage of water in Brooklyn, the section of tunnel south of Shaft 18 was used as soon as the work of installing copper lining was completed, to carry Croton water to Brooklyn by way of the 20-inch connection line to the distribution system at this shaft. This delivery was begun December 27, 1916, the average



CITY TUNNEL—Cross-section of riser-valve controlling-mechanism assembly

flow being from 17 to 24 million gallons daily, and on January 6, was suspended temporarily to permit of hydrostatic test on the section of tunnel south of Shaft 18 in which copper lining was placed. The test and work appurtenant to this section of the tunnel were completed sufficiently on January 18 to permit delivery of Croton water from Jerome Park reservoir to Brooklyn at the rate of 40 million gallons daily until January 22, when Catskill water was again supplied to the Manhattan and Bronx services and for the first time to the Brooklyn services; the draft from Hill View reservoir being at the rate of 110 million gallons daily; 20 million gallons daily going to the Bronx services, 25 million gallons daily to the Manhattan services and the remainder to Brooklyn.

The average daily flow in the tunnel from the time it was placed in service until taken over by the Department of Water Supply, Gas and Electricity was over 300 million gallons—distributed to the boroughs as follows: The Bronx, 50 million gallons daily; Manhattan, 90 million gallons daily; Brooklyn and Queens, 150 million gallons daily; and Richmond, 12 million gallons daily. At the end of the year the flow from Hill View reservoir to the City distribution system was at the rate of about 460 million gallons daily, 240 million gallons daily of which was carried to Brooklyn, this latter amount being distributed about as follows: 30 million gallons daily to Queens, 14 million gallons daily to Richmond and 196 million gallons daily to Brooklyn. The large increase in consumption of water may be accounted for by the extreme winter weather. It should be noted, however, that the daily consumption of Brooklyn borough exceeded by a considerable quantity the minimum yield of the Ridgewood system watersheds, namely, 140 million gallons daily.

Leakage in Riser in Shaft 17 of City Tunnel.—On December 11 a considerable quantity of water was discovered flowing from several points in Bryant park and in the subway in the vicinity of Shaft 17 chamber. Upon investigation this water was discovered to be coming from the shaft above the riser valves. When these valves were closed the leakage ceased.

Filling Silver Lake Reservoir.—Preparation for filling Silver Lake reservoir having been completed on January 27, Catskill water at this time was permitted for the first time to flow into the reservoir; the maximum flow into the reservoir at the beginning being at the rate of 29 million gallons daily. The flow, however, was throttled at the reservoir to raise the hydraulic gradient

to permit a flow of water to the Clove pumping-station. From this station it was pumped to the higher services of Richmond borough. Operation in this way was continued and the reservoir was filled to flow line (Elevation 228), on February 20. On February 25, flashboards having been placed on the overflow weirs, the flow line was raised to Elevation 229. The valves to the reservoir were then closed and observation begun and records kept on leakages from the reservoir.

COMPUTED AVAILABLE CAPACITY OF SILVER LAKE RESERVOIR

ELEVATION BOARD OF WATER SUPPLY DATUM	CAPACITY IN MILLION GALLONS		TOTAL
	South Basin	North Basin	
228.....	270.2	167.9	438.1
229.....	281.2	174.7	455.9
230.....	292.4	181.6	474.0

During the filling of the reservoir it was noted that the loss of head through the Narrows pipe-line (that is, the section of pipe-line between the Venturi meter on either shore consisting of 9,740 feet of 36-inch flexible-jointed pipe and about 650 feet of standard 36-inch cast-iron pipe) was 34.5 feet when carrying 28 million gallons daily.

Hydrostatic Tests of Pressure Tunnels.—Three times during the year,—March 3, July 24 and September 28,—the flow in the aqueduct was interrupted to make hydrostatic tests of the Rondout, Wallkill and Moodna pressure tunnels. Tests were also made in all these tunnels on May 9 just after the stoppage of flow for the unwatering of Wallkill pressure tunnel. A test of the Moodna tunnel alone was made just after the repairs to Breakneck pressure tunnel and Hudson Drainage shaft were completed February 16. No hydrostatic tests of cut-and-cover aqueduct were made.

Hydrostatic Tests of City Tunnel.—On March 8, a pressure equivalent to the flow-line gradient of Hill View reservoir was applied through the high-pressure fire-service mains, to the section of the City tunnel between Shafts 13 and 18. The test was continued for a period of 2½ hours and the leakage was at the rate of 180 gallons per minute.

On January 6, the section of tunnel south of Shaft 18, which includes the portion lined with copper, was placed under hydrostatic test with a pressure corresponding to the flow line gradient of Hill View reservoir (Elevation 295). The pressure was applied through a connection to the high-pressure fire-service, and was continued until January 8, a period of 50 hours, the outward leakage during that period decreasing from 742 gallons per minute to 654

gallons per minute. A test, with the same pressure, was made again on January 9 for a period of 8 hours, with a leakage of 662 gallons per minute, when, on account of the demands upon the distribution system, which caused interruptions in the test, it was discontinued. On March 7 this section was again tested for a period of 4½ hours under a gradient at Elevations 267 and 277, respectively, with corresponding leakages of 525 gallons per minute and 620 gallons per minute.

Rainfall Observations.—With the exception of a few changes, the rainfall stations during 1916 were continued through 1917. New rainfall stations were established as follows: The tipping-bucket gage formerly in use at Ashokan was installed at the Reservoir Department office at Grand Gorge (Elevation 1460) on May 2; standard 8-inch United States Weather Bureau gages were located at Stamford (Elevation 1775) on July 2; at Manorkill (Elevation 1515) on August 19; at Elka Park (Elevation 2170) on November 13; and at Esperance (Elevation 580) on November 14.

PRINCIPAL HYDROGRAPHIC DATA OF THE FOUR CATSKILL MOUNTAIN WATERSHEDS—1917

	WATERSHED			
	Esopus	Rondout	Schoharie	Catskill Creek
Area in square miles above gaging station...	192	100	236	97
Average number of rainfall stations.....	*7	5	**4	***5
Rainfall, inches.....	48.77	48.65	39.61	34.54
Run-off, inches.....	31.47	29.76	24.27	15.14
Run-off, in billion gallons.....	105.0	51.7	99.5	25.5
Per cent. of rainfall appearing as run-off....	64.5	61.2	61.3	43.8
Equivalent yield per day per square mile, in million gallons.....	1.5	1.4	1.2	0.7
Maximum discharge, date.....	Oct. 30	Mar. 27	Oct. 30	Oct. 30
Maximum discharge, cubic feet per second...	11,450	4,800	16,276	4,300
Minimum discharge, date.....	Feb. 25	Feb. 23	Oct. 11	Feb. 25
Minimum discharge, cubic feet per second...	47	42	25	1

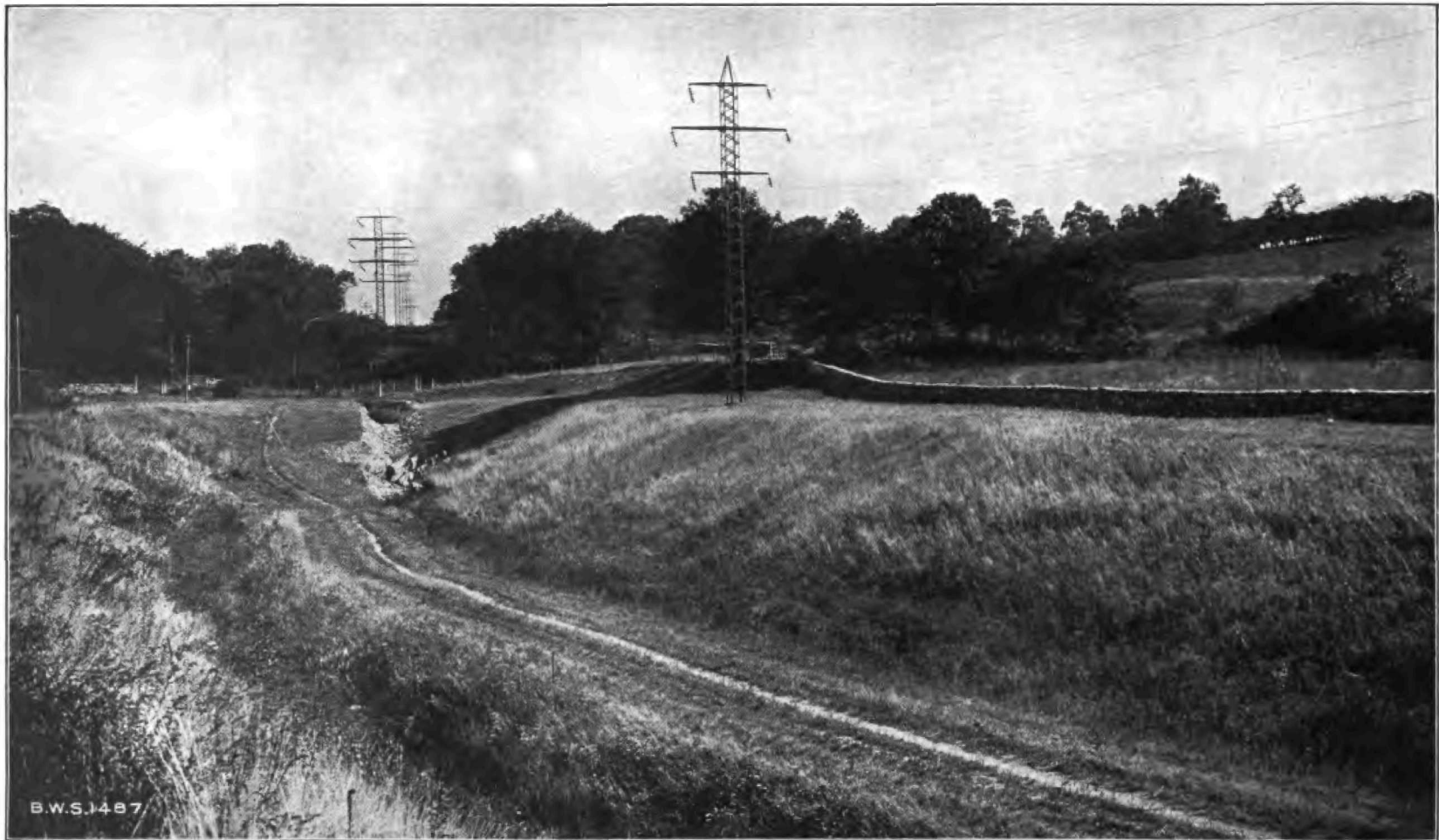
*January and February, 8

**May and June, 5; July and August, 6; September and October, 7; November and December, 8

***September to December, inclusive, 6

The Badger weighing gage, formerly located at Beechford, was installed at the Prattsville division office on December 1, to continue the record from the standard 8-inch Friez gage formerly located at the Prattsville bridge.

The following stations were discontinued: On June 6 at Ashokan; on July 1 at High Falls; on October 1 at Peekskill; on November 1 at Nelsonville; and on December 31 at Claryville, Franklinton, Haines Falls, Pleasant Valley, Silvernails and Overlook Mountain. The new station at Elka Park will give records which more fully cover the territory of the upper Schoharie creek than those from the discontinued station at Haines Falls.



CATSKILL AQUEDUCT—North portal of Reynolds Hill tunnel showing portal grading and paved channel in middle distance

The following rainfall stations in the Esopus watershed will be transferred to the Department of Water Supply, Gas and Electricity in January, 1918: Brown's Station, Edgewood, Highmount, Lake Hill, Moonhaw, Phoenicia, Slide Mountain, West Hurley and Zena.

Photographs to supplement location sketches were taken showing the locations of the various rain gages.

The precipitation in the Esopus watershed from February 1 to June 1 fell gradually behind the 12-year average, the loss amounting to 2.6 inches. By July 1 it was up to normal and continued so during July. By September 1 it was 2.0 inches above the 12-year average, but fell 0.8 inch behind during the month; in October it exceeded the 12-year average by 2.4 inches. During November, precipitation for the year became normal but fell behind 1.3 inches at the end of the year.

Stream-Flow Observations.—The stream-flow stations of 1916 were continued in 1917. Gagings in the Ashokan Waste channel and at the Spillway were discontinued, this work being done by the Department of Water Supply, Gas and Electricity. On October 23, the Bristol water level gage, formerly located at Cold Brook was installed at Esperance, after some changes in scale of chart and readjustment of pressure bulb had been made by the Bristol Company. The present range is about 12 feet and permits ready interpretation for variations of 0.05 foot. The record was started at 5:20 P. M. on October 23.

Ice conditions during the winter of 1916-1917 were quite severe and began on December 4, 1916, continuing at some stations until March 22. The ice in some instances reached a thickness of 3 feet and with low water went out gradually, like a glacier, scouring the stream bed in its course.

A severe freshet occurred in the Schoharie watershed on October 30, after a heavy rainfall, which reached a maximum of 4.1 inches at Haines Falls in less than 24 hours.

From time to time river-gage elevations were checked to insure correct relation with datum. Hydrographs for the principal stations were brought up to date. New rating curves were established from field measurements during the year for all stations, to correct any variations due to changes of the river beds. Meter measurements of dike drainage and seepage of the Ashokan reservoir in the vicinity of West Hurley were made to check the weir flows.

Turbidity.—Turbidity readings were taken as in 1916 at Cold Brook on Esopus creek, the highest turbidity recorded being 500

on October 30; and since April 1 at Prattsville on the Schoharie creek, the highest turbidity recorded being 1,000 on October 30; from March 15 to October 20, records of turbidity were obtained at Esperance on Schoharie creek, the highest recorded being 2,000 on August 18. Records of turbidity in the Ashokan reservoir at the Headworks were continued by the Department of Water Supply, Gas and Electricity.

Temperature at Prattsville.—The mean temperature for the year at the Prattsville division office was 42.9 degrees Fahrenheit, being 4 degrees and 5 degrees, respectively, lower than temperatures for 1915 and 1916. December was exceptionally low, with a mean temperature of 13.4 degrees. On 14 days of the month, temperatures below zero were recorded, with a minimum of 26 degrees below zero on December 30. Killing frosts occurred in the spring as late as May 18 and in the fall on September 10.

Analyses of Water.—Prior to August 1 samples of water for analysis were obtained from Hill View reservoir at regular intervals by the forces of the Board of Water Supply and taken to the laboratory of the Department of Water Supply, Gas and Electricity.

Clearing.—The wooded areas around Ashokan reservoir, principally in the vicinity of West Hurley, were cleared of undergrowth and fallen limbs and a general improvement was effected in the greater part of the wood lots, especially where dead chestnut and other trees were removed. Considerable portions of the wooded areas are already self-sustaining and require but little attention. They are practically safe from forest fires.

No serious forest or brush fires occurred in the marginal areas, owing to the efficiency of the labor patrolmen and the ready access to installed telephones. Many incipient fires were reported and put out before any appreciable damage was done. The majority of the fires were due to sparks and cinders from the Ulster and Delaware railroad trains or carelessness on the part of automobile drivers or hunters in leaving unextinguished fires or dropping sparks from lighted pipes along the highways.

Planting.—There were 187,300 trees transplanted from the nursery at Brown's Station, as follows: 94,500 arbor vitae were planted around the marginal strip of the East and West basins of Ashokan reservoir, in two rows staggered 6 feet apart, in approximately 76 acres, making this work practically complete around both basins; 92,800 conifers of several varieties, in approximately 74 acres, were planted in the vicinity of the Main dams, Hurley dikes and Boiceville.

There are at present in the nursery 75,000 white pine, 75,000 arbor vitae, 5,000 hemlock, 5,000 red pine and 5,000 blue spruce, all one-year transplants; 6,000 selected large trees of various varieties of conifers; and 1,000 deciduous, maple transplants 10 feet high, seedling oaks 4 feet high and seedling ash 1 foot high; 172,000 trees in all. In addition, there are 25,000 Douglass fir, 5 years old, which are subject to winter-kill and will probably be destroyed or allowed to remain undisturbed in the nursery as they are now of no value for transplanting. From Brown's Station nursery there were shipped to Valhalla in April 3,000 Colorado blue spruce and 3,000 red pine for planting around Kensico reservoir.

There were purchased from the State Conservation Commission and shipped from Saranac Inn, 20,000 Norway spruce trees, 4 to 6 years old. These were planted in rough areas around the Ashokan Lower gate-chamber and the Screen chamber, and at the foot of the dikes. It is expected that they will make an interesting background to the various structures.

ACREAGE OF FOREST LAND—ASHOKAN RESERVOIR

	ACRES
Forest planting done under Contract 156.....	502
Forest planting done by Board's forces.....	525
Total forest planting done.....	1,027
Forest planting to be done.....	73
Total forest planting.....	1,100
Standing forest under-planted by Board's forces...	100
Standing forest otherwise improved.....	3,100
Standing forest not improved.....	1,700
Total standing forest.....	4,900
Final area of forested land.....	6,000
Final open-land area, including roads, railroads, etc....	754
Acreage within flow line.....	8,500
Total acreage within taking lines.....	15,254

During the year the forestry work, except tree planting and nursery work, was mostly done under the direction of the Northern Aqueduct department and later under the Department of Water Supply, Gas and Electricity.

The table on page 83 gives the number and varieties of trees planted to date.

TREES PLANTED DURING 1914, 1915, 1916 AND 1917—3, 4 AND 8 YEAR OLD VARIETIES

SOURCE	PINE						SPRUCE		EUROPEAN LARCH	ARBOR VITAE	TOTALS
	Bull	Austrian	Red	Scotch	White	Jack	Norway	Blue			
Contract 156.....	42,100	51,500	155,900	96,600	174,600	.....	106,800	.....	.....	.....	627,500
Purchased from New York State Conservation Commission and The North-Eastern Forestry Company.....	.....	.....	.....	186,000	.....	.....	20,000	.....	.....	.....	206,000
Ashokan nursery of Board of Water Supply...	13,500	.....	88,700	56,500	23,000	12,000	50,000	26,600	7,500	156,500	434,300
Totals.....	55,600	51,500	244,600	339,100	197,600	12,000	176,800	26,600	7,500	156,500	1,267,800

Besides the above, there are 200 shade trees (maple, bass, tulip and white ash)

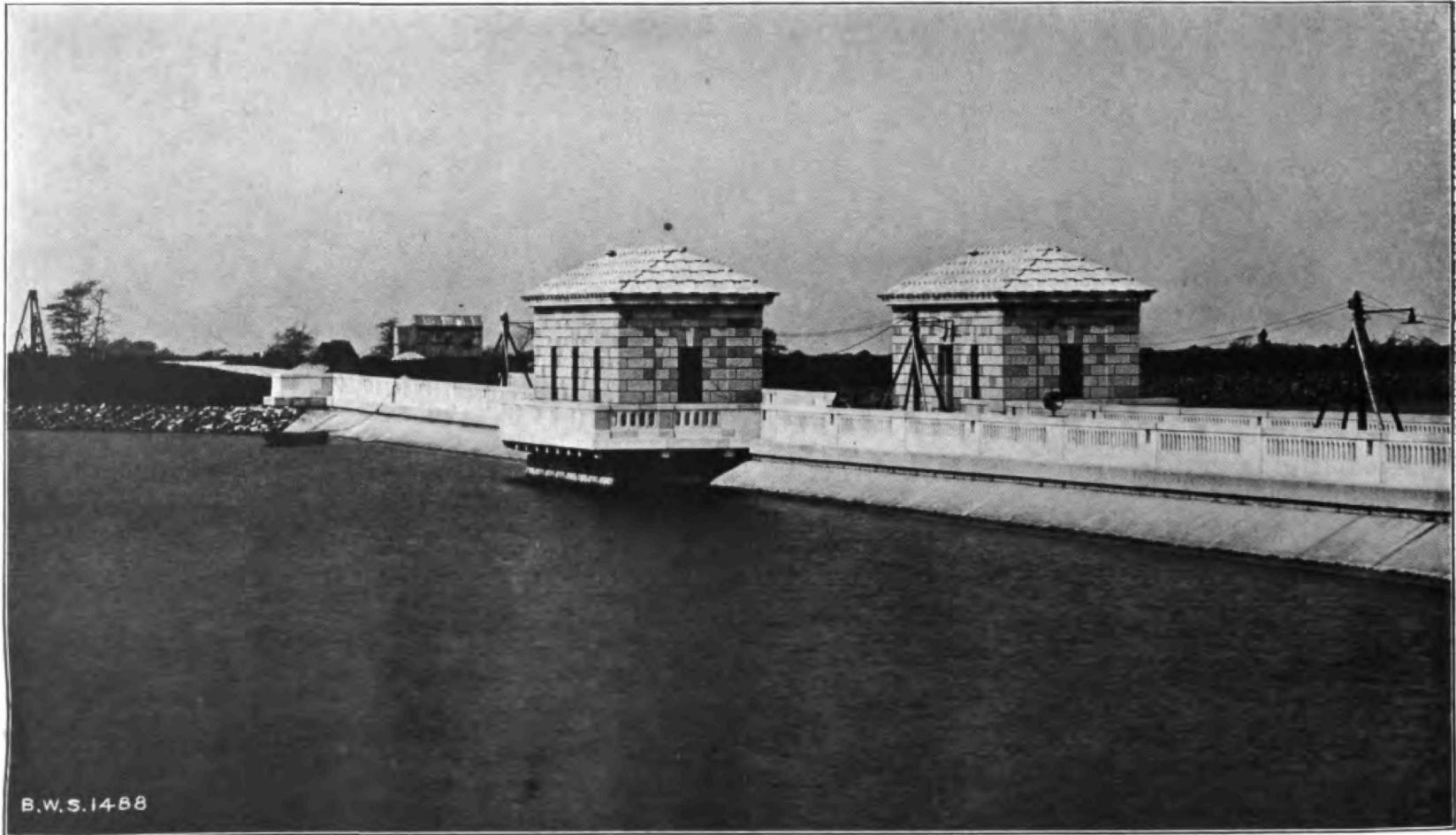
At the Kensico and Hill View reservoirs 22 tripartica and 24 Irish junipers were planted near the Kensico Lower Effluent and Hill View Downtake chambers, respectively, during October, under Agreement 99, to cover shortages in plants previously estimated for payment. Under Open-Market Order 502 the American Nursery Company furnished 29,000 evergreens for planting at Hill View reservoir. These plants were received in April and were



KENSICO RESERVOIR—Kensico Influent chamber and weir, at the northern extremity of the reservoir. The weir is formed by a slot in the aqueduct arch over which the water flows when gates in the Influent chamber (down-stream) are closed. To divert the aqueduct flow from the reservoir, the gates are opened and the water flows through Kensico by-pass

planted, with an additional 1,000 transplants from Kensico Reservoir nurseries, by the Board of Water Supply labor forces prior to May 4. In the spring of the year replacement planting under Contract 156 at Kensico reservoir was completed, the greater number of the trees set out being red pine instead of white pine, which latter were not planted because of damage done to previous planting by white pine weevil.

Guarding of Aqueduct.—Early in February and immediately following the breaking of diplomatic relations with Germany, a



SILVER LAKE RESERVOIR, seen from southeast. Middle Dike roadway, Gate-chambers and parapets. South basin in foreground. The elevation of the water surface, when the reservoir is full, is 228 feet above mean sea-level

military guard was established along the aqueduct, troops from the National Guard being assigned in response to the request of the Mayor. During the winter troops were quartered in nearby villages, farmhouses and in buildings along the line formerly used for office purposes. Details of guarding varied under different military commands, but in general the policy of continuously guarding vulnerable points, such as culverts, exposed portions of pipe siphons, etc., was followed, with necessary incidental patrol. From time to time during the year different military bodies were assigned to the work.

Comparatively early in the year the troops guarding the Headworks at Ashokan reservoir were superseded by a detachment of Board of Water Supply Police, who continued to guard this region until the end of the year. In addition the police took over in the summer the strip of aqueduct from the Screen chamber to the South chamber of Tongore siphon.

Endurance Test on Manganese Bronze.—An endurance test on cast manganese bronze was started at the Board's laboratory on January 21, 1916. The test was conducted upon hollow cylinders 24 inches long, $\frac{3}{4}$ inch thick and of three different diameters, 10 inches, 18 inches and 40 inches, there being three specimens of each size. The two smaller sizes were tested during 1916 and the 40-inch cylinders during 1917. Each set of three specimens of the smaller sizes was placed between two bulkheads, the cylinders resting one on top of another and being held together by outside bolts. By means of an automatically governed pump and an accumulator, a hydrostatic pressure of 1,100 pounds per square inch was maintained. The unit stress thus produced in the metal was 7,300 pounds in the 10-inch cylinder and 13,200 pounds in the 18-inch cylinder. One of the 18-inch cylinders had a porous spot about $1\frac{1}{2}$ inches in diameter, which leaked when the pressure was applied. This spot was peened tight and remained so until July 28, 1916, when a longitudinal crack opened in this porous spot to a width of about $\frac{1}{32}$ inch. This crack was peened tight and the test was continued.

During 1917, the three 40-inch cylinders were similarly put under test with a hydrostatic pressure of 1,000 pounds, producing a unit stress of 26,700 pounds per square inch in the metal. After being subjected to this pressure for $1\frac{1}{2}$ months, one cylinder cracked longitudinally at a point where a weld had been previously made. After the cracked cylinder had been removed, the test was

continued with the remaining two cylinders for one month, when a second cylinder cracked also where a weld had been made.

The tests can be taken to indicate that where brass castings are repaired by welding, the cooling of the metal leaves initial stresses in the casting even when the weld is made with the greatest care and that castings repaired in this way are not dependable when subjected to applied stress.

As no further break beyond that previously mentioned occurred in either of the two sets of smaller cylinders, the opinion that manganese bronze is a reliable metal when not stressed to excess was confirmed.

METAL-WORK INSPECTED DURING 1917

	INSPECTED	REJECTED	SHIPPED
Cast-iron pipe.....	14½ tons	7¾ tons	6¾ tons
Rolled steel.....	258 tons	16 tons	242¾ tons
Cast bronze.....	6 tons	1¼ tons	5¼ tons
Rolled bronze.....	¼ ton	.....	¼ ton
Copper.....	3 tons	.....	3 tons
Gates and valves.....	40	4	38
Cranes.....	12	.....	12
Pump.....	1	.....	1

Inspection.—Inspections of a routine nature carried on at the various places of manufacture included principally: Mill and shop inspection made on structural steel; mill inspection on reinforcing steel; inspection of steel castings at foundries and foundry and shop inspection on valves and gates.

All Portland cement used in construction was inspected and tested, as described in the report for the year 1910. Following is a summary for the past twelve years:

CEMENT INSPECTION, 1906-1917

Barrels tested	7,814,249
Barrels shipped	6,753,506
Barrels rejected	584,957

Causes for rejection:

Low strength	1.7 per cent.
Lack of increase between 7-day and 28-day strength	1.8 per cent.
Excess of anhydrous sulphuric acid and magnesia..	1.2 per cent.
Quick setting	1.0 per cent.

Falling off in strength.....	0.2 per cent.
Unsoundness	1.0 per cent.
Coarseness	0.5 per cent.

Total rejections, all causes..... 7.4 per cent.

Organization.—The maximum number of employees in the entire Engineering bureau of the Board of Water Supply during the year was reached January 17, when the force was 628. The minimum number during the year was 430, on December 19. A schedule of employees in the Engineering bureau on January 1 and December 31 forms Table 1.

FORCE IN ENGINEERING BUREAU

	1916	1917
January 1.....	591	618
December 31.....	621	434
Maximum.....	722 (Feb. 24)	628 (Jan. 17)
Minimum.....	544 (Apr. 31)	430 (Dec. 19)
Additions.....	248	137
Separations.....	213	321

CLASSIFICATION OF APPOINTMENTS AND SEPARATIONS DURING 1917

CLASS	MADE	RESCINDED	REPORTED	SEPARATED
Exempt.....	2	...	2	2
Competitive.....	35	3	32	115
Labor.....	104	8	96	198
Temporary and Miscellaneous.....	7	...	7	6
Totals.....	148	11	137	321

Equipment Transferred.—Transfers to other City departments through the Sinking Fund Commission of equipment amounting to \$3,594.15 in value were made, bringing the total amount to date to \$29,798.68.

Bills and Estimates.—A total of 2,457 bills was passed, amounting to \$189,747.91; 118 estimates on construction and supply contracts were passed, the value of the work done being \$809,636.08, and a total of 23 certificates on agreements were passed, amounting to \$47,251.21.

AMOUNTS OF CONTRACTS AND VALUE OF WORK DONE

YEAR	AMOUNT OF CONTRACTS	NUMBER OF CONTRACTS OPERATIVE DURING YEAR	VALUE OF WORK DONE UNDER OPERATIVE CONTRACTS
1906.....	\$79,775.00	1	\$22,983.75
1907.....	16,912,086.35	5	228,132.60
1908.....	9,746,103.67	12	1,877,789.58
1909.....	38,233,463.40	39	7,713,422.82
1910.....	6,031,795.11	43	15,600,268.21
1911.....	22,250,129.41	54	19,104,290.26
1912.....	1,359,344.55	62	19,459,969.70
1913.....	2,471,850.16	58	15,053,256.33
1914.....	2,668,106.43	51	11,026,494.57
1915.....	727,194.36	47	4,307,497.17
1916.....	675,767.22	39	1,816,067.92
1917.....	12,906,303.72	43	809,636.08
Totals.....	\$114,061,919.38	...	\$97,019,808.99

SCHEDULE OF CONTRACTS AND AGREEMENTS

	CONSTRUCTION		SUPPLY	
	Number	Amount	Number	Amount
Contracts in force January 1, 1917.....	25	\$21,850,998.50	1	\$16,942.10
Contracts entered into during 1917.....	15	12,839,678.11	2	16,483.35
Contracts completed during 1917.....	17	*12,039,443.74	1	*7,057.64
Contracts in force December 31, 1917.....	23	22,105,342.71	2	26,367.81
Agreements in force January 1, 1917.....	7	69,651.00	...	.....
Agreements entered into during 1917.....	2	12,650.00	...	.....
Agreements completed during 1917.....	9	80,671.00	...	.....
Agreements in force December 31, 1917.....	0	.....	...	.....

* Amount of final estimates

Respectfully submitted,

J. WALDO SMITH,
Chief Engineer

TABLE 1
EMPLOYEES BY DEPARTMENTS IN ENGINEERING BUREAU IN 1917

CLASS	ACTIVE MILITARY SERVICE Dec. 31	HEADQUARTERS		RESERVOIR		NORTHERN AQUEDUCT		SOUTHERN AQUEDUCT		CITY AQUEDUCT		TOTAL			
		Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	NUMBER		PER CENT.	
		Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31	Jan. 1	Dec. 31
Engineers—Assistant engineers and higher rank	14	52	51	16	15	7	1	18	11	26	17	119	109	19.3	25.1
Engineering Assistants—Draftsmen, rodmen and axemen.....	12	30	30	21	20	11	1	33	10	24	16	119	89	19.3	20.5
Clerks—Clerks, stenographers and miscellaneous	4	44	40	7	7	5	3	8	5	7	4	71	63	11.5	14.5
Labor Class.....	5	3	3	57	65	115	10	35	19	68	39	278	141	44.9	32.5
Gage Keepers.....	..	2	2	29	30	..	..	..	..	..	..	31	32	5.0	7.4
Totals.....	35	*131	*126	130	137	138	15	94	45	125	76	618	434	100.0	100.0

* Including Chief Engineer and 1 Deputy Chief Engineer, 4 Consulting Engineers, 2 Assistant Engineers, 1 Private Secretary and 1 Stenographer on staff of Chief Engineer; also 2 Gage Keepers in Long Island
Minimum, 430, December 19; Maximum, 628, January 17

TAB
RAINFALL

WATERSHED AND STATION	1917									
	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.
CATSKILL MOUN										
ESOPUS										
Phoenicia.....*	4.60	2.06	3.66	2.84	4.40	7.32	2.70	10.00	1.18	8.90
Slide Mountain.....**	4.88	2.72	4.61	3.58	5.18	7.54	4.02	6.20	1.22	12.00
Highmount.....**	2.94	1.08	2.75	2.28	4.26	7.92	2.66	8.05	1.40	9.67
Edgewood.....**	4.61	1.83	3.80	2.34	5.00	6.16	3.74	5.44	1.06	9.61
Lake Hill.....**	4.70	1.90	3.16	2.04	3.91	8.73	4.92	5.02	1.10	7.72
Overlook Mountain.....**	4.76	1.77	3.24	2.36	4.62	6.90	5.23	4.72	0.88	5.99
Kingston.....**	3.57	2.80	3.15	2.34	3.82	4.45	4.02	5.64	0.99	5.53
West Hurley.....**	3.46	2.18	2.95	2.19	3.68	5.53	4.02	5.04	1.01	5.65
Brown's Station.....***	3.60	2.46	3.16	2.01	3.38	5.80	2.86	7.73	0.70	5.77
Ashokan.....†	4.18	2.72	3.45	2.12	3.56	.....	.....	.....	.....	.....
Moonhaw.....§**	4.28	2.59	4.68	2.76	4.96	6.41	4.42	8.36	1.29	7.60
Zena.....†††	3.72	2.34	3.34	2.70	4.00	6.06	6.08	5.43	1.01	5.22
Beechford.....‡	3.98	2.12	.....	.....	.....	5.56	3.76	6.36	1.15	6.61
RONDOUT										
Grahamsville.....**	3.92	2.64	3.52	1.81	2.62	6.55	6.12	7.32	1.33	6.63
Bull Run.....†††	4.11	3.04	4.08	2.18	3.10	7.00	4.90	7.89	1.24	6.84
Peekamoose.....**	4.74	3.30	4.68	2.80	4.60	7.52	5.28	10.95	1.32	8.53
Lackawack.....†**	3.43	2.34	3.44	2.08	3.14	5.77	5.57	5.18	1.13	6.24
Claryville.....**	4.02	2.50	3.89	1.87	3.16	6.94	5.66	8.90	1.54	7.24
High Falls.....‡**	3.88	2.42	3.07	1.81	3.16	4.76	.....	.....	.....	.....
Rosendale.....†††	3.90	2.73	3.39	2.62	3.65	4.30	3.93	5.17	0.85	5.77
SCHOHARIE										
Windham.....**	1.98	1.02	2.31	1.60	3.96	4.96	1.34	6.50	0.92	8.12
Haines Falls.....**	5.39	1.58	3.04	1.86	4.43	5.42	2.31	4.60	1.47	10.22
Lexington.....**	2.66	1.20	2.30	1.54	3.99	6.72	1.74	5.72	1.25	7.42
Prattville.....**	2.40	1.40	2.84	1.84	3.92	5.48	2.36	6.44	1.05	7.96
Grand Gorge.....□	.....	.....	.....	.....	3.90	5.56	2.95	6.10	0.96	7.64
Stamford.....□□	.....	.....	.....	.....	.....	.....	4.94	6.83	1.44	8.11
Manorkill.....△	.....	.....	.....	.....	.....	.....	.....	.....	0.98	8.29
Elka Park.....△△	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Esperance.....△△△	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
CATSKILL										
Preston Hollow.....**	1.36	1.16	2.81	2.00	4.43	2.76	1.18	5.52	0.98	7.08
Oak Hill.....†**	1.90	2.12	3.12	2.42	4.46	3.28	1.11	4.00	0.80	6.82
Franklinton.....**	2.33	1.70	2.08	2.11	3.70	5.28	2.45	7.36	1.64	7.34
Westerlo.....**	1.24	1.31	2.13	2.21	4.06	3.77	1.55	4.87	1.16	6.66
WATERSHEDS WEST OF HUDSON RIV										
WALLKILL										
New Paltz.....♠**	3.44	2.46	4.03	2.12	2.81	5.02	3.34	3.57	0.90	5.31
Sherwood Corners.....‡**	3.60	2.92	3.28	1.97	3.46	3.60	2.84	4.84	0.85	5.31
MOODNA										
Cornwall.....♠♠**	2.76	1.72	3.14	1.64	3.70	3.80	3.68	4.27	0.76	5.28

INCHES

	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	
DEC.	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	
IN WATERSHEDS													
00	3.11	51.77	47.50	54.74	42.26	50.21	50.43	41.04	48.56	45.93	45.13	46.78	44.52
92	3.26	56.13	56.05	62.60	44.72	58.10	61.85	48.97	57.82	54.62	50.87	53.45	58.72
50	1.96	45.47	40.32	49.35	39.15	39.47	45.07	37.27	40.32	35.55	34.72	41.56	42.82
05	2.65	47.29	49.14	53.00	41.13	50.36	53.13	40.56	48.64	46.43	46.98	52.90	47.85
98	2.21	46.39	42.85	49.28	37.93	46.76	47.86	42.65	46.71	50.23	46.52	49.25	46.30
38	2.48	44.33	42.88	48.31	38.80	46.12	46.77	41.52	49.18	54.82	46.37	.....	.....
80	2.42	39.53	39.40	47.13	37.63	40.31	41.84	42.43	40.98	41.85	37.18	42.85	.....
98	1.86	38.55	43.54	.....	35.54	42.87	46.81	40.07	43.85	46.67	42.05	47.40	.....
24	2.09	40.80	46.73	53.25	38.95	46.73	46.57	45.38	45.23	48.79	42.01	47.01	.....
..	.....	.....	45.39	51.58	38.26	46.28	49.98	45.96	51.30	51.76	44.13	50.59	47.91
89	3.12	52.36	49.17	52.80	42.24	61.86	60.90	56.49	58.63	62.31	54.80	.....	.....
96	2.41	43.27	40.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
96	1.84	.....	42.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
59	2.06	46.11	52.65	52.33	41.26	50.34	45.36	46.55	42.46	44.10	41.73	43.24	44.68
44	2.45	48.27	50.62	53.22	32.67	49.20	40.71	42.69	45.25	43.61	40.52	47.07	46.96
82	2.90	58.44	56.38	59.64	43.75	61.62	61.08	57.19	57.71	56.06	58.71	.....	.....
05	2.13	41.50	48.67	50.29	38.41	48.44	41.68	41.89	43.75	39.35	39.19	44.45	42.55
49	1.80	49.01	49.48	50.82	40.42	52.79	48.31	46.12	47.09	44.16	44.27	50.23	.....
..	.....	.....	44.66	49.21	37.70	38.58	36.75	43.79	39.35	42.77	38.93	.....	.....
91	2.58	39.80	41.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
54	2.05	35.30	37.95	41.44	38.05	35.32	35.39	28.86	41.14	36.68	36.26	37.98	.....
92	2.95	44.19	46.80	52.09	38.22	42.52	40.85	38.38	48.19	47.32	48.51	52.64	.....
66	2.00	37.20	38.99	45.36	36.64	44.01	38.85	30.14	38.72	37.41	32.47	36.94	.....
24	1.72	38.65	38.03	40.75	37.45	33.80	33.37	30.44	37.01	32.07	28.25	.....	.....
00	1.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
90	2.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
86	2.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
90	3.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	2.34	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
86	2.28	32.42	34.20	39.40	33.56	35.96	33.46	32.41	31.78	34.16	30.81	34.41	.....
79	2.30	33.12	36.96	41.43	35.43	34.91	35.99	32.92	33.73	35.38	31.97	36.68	.....
90	2.36	39.25	37.50	41.05	35.45	35.66	30.95	28.91	31.59	31.49	28.27	37.68	.....
92	2.00	31.68	35.89	40.26	34.22	32.35	39.08	30.30	31.02	33.11	31.53	35.28	.....
t (OTHER THAN CATSKILL MOUNTAIN)													
86	1.40	35.26	40.99	52.37	37.42	43.00	40.27	42.12	40.73	40.00	40.74	46.50	.....
44	2.82	35.93	47.19	45.39	.....	.....	35.29	35.86	40.21	36.26	29.14	.....	.....
55	3.15	34.45	44.34	50.79	38.23	44.40	39.74	44.81	42.77	44.57	37.60	51.92	.....

TABLE 2 (C)

WATERSHED AND STATION	1917										
	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.
WATERSHEDS EAST OF HUDSON RIVER (
ROELIFF JANSEN											
Silvernails.....**	2.73	2.32	2.55	1.86	3.46	4.04	5.26	5.30	1.10	5.47	0.1
WAPPINGER											
Pleasant Valley.....**	2.66	2.42	2.87	2.15	4.06	4.11	5.99	3.26	0.83	5.23	0.
PEEKSKILL											
Nelsonville.....§§**	2.86	1.70	3.88	1.51	3.47	4.43	3.24	4.50	0.68	6.05	..
Peeckskill.....¶¶**	2.87	1.80	3.38	3.34	5.04	6.18	4.87	2.56	0.96	.....	..
CROTON WATERSHED											
Boyd's Corners.....††	3.10	1.87	4.25	1.81	3.80	3.21	2.92	2.96	0.87	6.60	1
Middle Branch.....††	2.83	2.10	3.66	2.25	3.72	3.12	3.57	2.24	0.96	6.00	2
East Branch.....††	2.56	1.88	3.32	2.47	3.70	3.27	3.25	3.38	0.85	6.92	2
West Branch.....||††	2.72	1.89	3.52	1.80	3.67	2.95	2.47	2.01	0.91	6.25	2
Amawalk.....††	3.14	2.27	4.08	2.50	5.42	4.10	2.85	1.73	1.04	6.21	2
Croton Falls.....††	2.88	2.55	3.63	1.85	3.80	3.25	4.18	2.18	1.00	6.57	2
Titicus.....††	3.05	2.07	3.92	2.16	3.90	4.08	2.99	2.92	0.99	6.80	2
Cross River.....||††	2.99	1.71	4.15	2.08	3.65	3.60	2.14	3.06	1.14	6.33	2
Croton Lake.....||††	3.24	2.63	4.83	2.54	5.15	4.84	2.75	2.49	1.53	7.20	2
BRONX WATERSHED											
Kensico.....††	3.28	2.13	4.52	2.76	3.69	3.48	1.73	1.74	1.74	5.69	1
SUFFOLK COUNTY											
Babylon.....†††	3.24	2.53	5.26	2.67	3.66	2.16	7.11	2.96	2.51	4.98	0
Lake Ronkonkoma.....†††	3.62	1.75	6.60	2.96	4.33	1.49	4.00	2.64	2.31	5.25	2

* New England Water Works Association Badger make weighing gage
 ** Friez standard 8-inch gage
 *** Friez 12-inch automatic tipping-bucket gage and Friez standard 8-inch gage until July 1, 1913; latter gage only thereafter
 † Friez standard 8-inch gage; also Friez 12-inch automatic tipping-bucket gage after July 1, 1913. Records prior to July 1, 1913, are for West Shokan station, which was superseded by Ashokan; station discontinued June 6, 1917
 †† Records of Department of Water Supply, Gas and Electricity
 ††† Standard 8-inch United States Weather Bureau gage
 # New England Water Works Association Badger make weighing gage discontinued and standard 8-inch United States Weather Bureau gage installed at Cold Brook (Elevation 645) May 19, 1917
 ## Station discontinued July 1, 1917
 □ Friez 12-inch automatic tipping bucket gage established (Elevation 1460) May 2, 1917
 □□ Standard 8-inch United States Weather Bureau gage established (Elevation 1775) July 2, 1917
 △ Standard 8-inch United States Weather Bureau gage established (Elevation 1515) August 19, 1917
 △△ Standard 8-inch United States Weather Bureau gage established (Elevation 2170) November 13, 1917
 △△△ Standard 8-inch United States Weather Bureau gage established (Elevation 580) November 14, 1917

included)

	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906
DEC.	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
NEITHER THAN CROTON AND BRONX)												
1	1.81	37.08	37.64	47.41	36.15	36.11	41.70	41.50	35.70	36.33	30.64	.....
2	3.02	37.23	40.43	49.43	36.20	42.58	39.11	47.95	41.82	38.49	33.55	.....
3	.....	.....	.....	47.79	.....	48.91	48.17	46.37	39.56	42.63	39.89	40.45
4	.....	.....	46.49	61.32	40.67	50.01	43.41	46.39	40.07	43.09	43.66	.....
WATERSHED												
1	1.92	35.28	42.57	55.93	41.74	51.17	50.29	52.89	42.15	51.55	40.11	56.19
2	2.48	35.74	39.74	49.73	39.38	46.89	44.53	51.72	45.14	51.55	41.92	59.86
3	1.68	35.56	36.85	46.29	39.20	47.71	43.86	45.25	42.01	50.09	38.80	56.41
4	1.46	31.79	39.82	50.60	38.59	49.61	48.13	50.07	44.91	51.91	39.07	57.94
5	1.80	37.39	48.42	50.85	39.21	50.36	43.98	48.13	41.89	48.15	45.06	57.59
6	1.76	35.85	40.71	49.29	37.51	47.35	44.38	44.48	39.73	46.90	36.01	.....
7	2.24	37.36	41.49	51.14	40.11	49.79	43.78	46.92	41.24	56.58	47.41	65.07
8	2.56	35.53	41.11	56.87	39.65	52.21	46.00	46.90	41.60	47.98	43.23	54.14
9	2.42	42.02	46.01	55.22	39.55	49.15	45.43	46.14	44.70	51.05	48.66	61.17
WATERSHED												
4	3.11	35.81	41.43	51.25	37.87	50.56	46.98	50.11	43.97	52.70	53.28	58.30
WATERSHED												
3	3.03	40.54	35.29	45.62	40.00	45.45	46.78	51.06	41.39	37.44	32.54	42.06
5	2.23	39.33	42.88	50.27	42.65	50.85	51.63	55.40	40.37	42.93	32.71	.....

o Gage removed to Shaft 1 of Walkill pressure tunnel (Elevation 476) June 9, 1917; figures for December, 1917, recorded at Walkill blow-off

o o Records from February 4 to 13, 1917, inclusive, supplied from Nelsonville

¶ Records prior to May 25, 1915, are for Sundown station, which was superseded by Bull Run; rain gage removed to Elevation 1780, 1¼ miles south of Sundown, September 1, 1917

¶¶ Station discontinued October 1, 1917

‡ Records for 1909 and prior are for Napanoch station, which was superseded by Lackawack

‡‡ Records for 1909 and prior are for East Durham station, which was superseded by Oak Hill

§ Rain-gage removed from Maltby hollow (Elevation 915) to Watson hollow (Elevation 1,000), two miles distant, November 30, 1913

§§ Records for this station were kept at Garrison during 1912 and 1913 and at Cold Spring at all other times prior to September 1, 1916, when the gage was moved to Foundry Brook siphon; station discontinued November 1, 1917

+ Records prior to September 16, 1915, are for Walden station, which was superseded by Sherwood Corners; figures for December, 1916, are Cornwall record; figures for October, 1917, recorded at Shaft 1 of Walkill pressure tunnel

|| Prior to January 1, 1915, the West Branch station was known as Carmel Reservoir station, the Cross River station was known as Katonah station and the Croton Lake station was known as Old Croton Dam station

TABLE 3
STREAM FLOW—CATSKILL MOUNTAIN WATERSHEDS
 MEAN MONTHLY DISCHARGE IN CUBIC FEET PER SECOND

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	*THE YEAR
§ESOPUS CREEK AT OLIVE BRIDGE DAM—DRAINAGE AREA 239 SQUARE MILES													
1906.....										**363	426	359	.....
1907.....	743	202	633	543	594	416	90	30	423	847	1,439	1,116	590
1908.....	642	803	1,140	961	1,567	242	136	56	36	176	191	203	513
1909.....	811	1,539	820	1,279	838	388	78	106	57	56	42	158	514
1910.....	1,077	606	1,704	1,958	460	407	92	65	101	48	146	92	563
1911.....	579	349	548	1,000	336	504	130	88	159	909	578	527	476
1912.....	327	460	1,494	1,737	819	188	77	232	155	352	576	705	594
1913.....	1,155	277	1,485	768	462	231	41	44	95	701	1,401	498	596
ESOPUS CREEK AT COLD BROOK—DRAINAGE AREA 192 SQUARE MILES													
1914.....	195	389	843	2,008	643	112	91	77	45	32	106	199	393
1915.....	1,283	1,031	284	561	242	97	478	747	237	177	327	610	504
1916.....	823	908	505	1,194	496	560	449	171	86	130	280	406	498
1917.....	472	144	906	1,061	536	729	224	151	113	468	354	170	445
§ESOPUS CREEK AT MT. MARION—§§DRAINAGE AREA 368 SQUARE MILES													
1907.....				***836	953	652	162	50	859	1,352	2,177	1,681	.....
1908.....	1,240	1,323	2,157	1,406	2,392	401	242	99	43	223	243	239	834
1909.....	1,247	2,824	1,527	1,757	1,278	661	138	168	99	100	83	316	850
1910.....	1,608	678	3,029	3,356	791	761	147	105	133	76	204	146	920
1911.....	784	544	952	1,504	406	818	192	152	268	1,506	936	824	740
1912.....	496	719	2,360	2,383	1,181	305	94	258	191	522	916	1,022	871
1913.....	1,833	511	2,787	1,378	803	373	101	98	168	837	1,978	898	972
1914.....	191	1,324	1,401	3,367	996	74	48	23	15	81	103	76	633
1915.....	683	1,169	441	183	92	49	671	729	683	1,365	365	472	573
1916.....	522	518	495	629	224	826	583	247	45	79	186	11467	401
1917.....	1,032	314	1,099	1,289	800	675	175	86	63	163	163	101	498
§RONDOUT CREEK AT HONK FALLS—DRAINAGE AREA 102 SQUARE MILES													
1906.....		†184	310	601	202	198	128	73	37	85	93	102	.....
1907.....	251	252	359	172	172	119	23	19	149	279	479	380	221
1908.....	260	322	516	468	459	84	39	30	14	31	38	72	194
1909.....	383	680	335	372	347	140	47	26	27	27	28	58	206
1910.....	354	258	725	623									
§RONDOUT CREEK AT LACKAWACK—DRAINAGE AREA 100 SQUARE MILES													
1910.....					246	142	39	38	70	34	91	154	.....
1911.....	251	210	304	484	128	204	51	39	79	387	276	273	224
1912.....	273	333	616	555	288	97	40	108	76	126	190	282	249
1913.....	522	208	691	394	209	105	42	65	76	266	517	224	277
1914.....	166	196	532	831	316	87	75	51	27	35	54	140	209
1915.....	569	557	160	198	123	50	293	349	108	82	135	307	243
1916.....	411	384	301	631	228	344	350	112	78	88	138	222	273
1917.....	228	103	471	442	198	245	214	142	105	164	189	124	219

TABLE 3 (Concluded)

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	*THE YEAR
§SCHOHARIE CREEK AT PRATTSVILLE—DRAINAGE AREA 236 SQUARE MILES													
1907.....	††485	††160	††648	††605	510	352	114	22	255	778	1,333	1,238	542
1908.....	429	763	992	720	957	145	75	33	17	129	100	194	380
1909.....	628	1,220	771	1,045	674	291	51	37	27	30	28	91	408
1910.....	796	802	1,312	1,394	376	490	80	49	56	53	311	337	505
1911.....	649	204	578	1,063	286	481	41	34	142	614	365	600	422
1912.....	270	517	1,410	1,573	592	137	42	94	84	315	376	594	500
1913.....	1,057	241	1,402	675	347	150	33	34	88	507	1,200	439	514
1914.....	319	488	1,120	2,351	814	52	57	60	24	24	129	200	468
1915.....	1,311	1,201	296	735	276	60	609	896	267	216	298	879	585
1916.....	1,192	897	623	1,454	461	314	354	186	144	181	306	378	539
1917.....	431	223	805	936	648	649	128	83	63	564	412	113	422
CATSKILL CREEK AT OAK HILL—DRAINAGE AREA 97 SQUARE MILES													
1910.....	.....	.....	.....	.....	81	156	11	6	7	8	42	35	.....
1911.....	97	83	121	224	52	206	5	2	5	57	75	105	86
1912.....	46	90	378	456	153	38	6	8	12	59	123	157	127
1913.....	360	124	469	191	83	27	3	2	2	38	293	16	134
1914.....	70	114	574	937	321	9	14	7	3	2	5	8	172
1915.....	228	271	89	202	58	6	184	199	53	51	65	138	128
1916.....	318	173	206	461	119	42	40	9	10	11	30	49	122
1917.....	57	62	274	227	200	138	12	32	19	161	90	24	108

* Values for 1914, 1915, 1916 and 1917 are derived by dividing total annual flow by the number of days; for prior years the values are a mathematical average of the monthly records.

** 13 days' record

*** 27 days' record

† 16 days' record

†† From United States Geological Survey records

‡ Conduit of Olive Bridge dam was closed September 9, 1913; from this date flow was influenced by storage and waste.

††† The water-level in the East basin of Ashokan reservoir reached the Waste Weir crest, Elevation 587, on December 12, 1916; several days prior to this water was wasted over crest, due to wave action.

§ A re-determination of drainage areas was made, based on the United States Geological Survey quadrangles, some of which were not available when the original areas were determined. These new areas were made effective January 1, 1913. The following is a comparison with previous published values:

CREEK AND STATION	AREAS USED TO DECEMBER 31, 1912, SQUARE MILES	AREAS USED, 1913 AND AFTER, SQUARE MILES
Esopus creek at Olive Bridge dam..	239	239
Esopus creek at Mt. Marion.....	378	§§368
Rondout creek at Honk Falls.....	105	102
Rondout creek at Lackawack.....	104	100
Schoharie creek at Prattsville.....	240	236

§§ The drainage area of the Esopus creek at Mt. Marion does not include the Sawkill diversion for the Kingston water-supply (33 square miles), nor Plattkill diversion for Saugerties water-supply (17 square miles). Total drainage area above Mt. Marion is 418 square miles.

TABLE 5

AGREEMENTS PREPARED OR IN PREPARATION DURING 1917

AGREEMENT	DESCRIPTION OF WORK	CONTRACTOR	BIDS OPENED, 1917	DATE OF AWARD, 1917	DATE OF AGREEMENT, 1917	AMOUNT
*109	Furnishing and driving 2-inch well casings in Madison Square Park and vicinity, New York City...	Edward A. Clark, 13 Park Row, New York City.....	.....	.....	Mar. 8	†\$5,000.00
110	Test borings in vicinity of Gilboa dam.....	Sprague & Henwood, Inc., Scranton, Pa.....	Jun. 19	Jun. 19	Jun. 22	†7,650.00
**111	Delivering horse manure in New York City.....	Barnett D. Feinberg, 205 West 42nd Street, New York City.....	.....	.....	Aug. 20	†4,500.00
R	Telephone service and maintenance of telephone lines and apparatus for 1917, in Putnam, Westchester, Bronx and New York counties.....	New York Telephone Company, 15 Dey Street, New York City.....	.....	.....	Jan. 1	6,700.95
S	Telephone service for 1917, west of Hudson river...	New York Telephone Company, 15 Dey Street, New York City.....	.....	.....	Jan. 1	993.75
Contract 9, third modification..	Correcting defects in specifications relating to moldings on dimension stones, Item 39.....	H. S. Kerbaugh, Inc., 6 Church Street, New York City.....	.....	.....	May 7	.....
Contract 70, modification..	Adjusting matters in dispute arising out of defective valves.....	Paul S. Reeves and Co., 1415 Catherine Street, Philadelphia, Pa.....	.....	.....	Mar. 26	††.....

*Work was awarded on open-market order; agreement was made afterwards
 **Contractor made oral bid, which was accepted; agreement abandoned by contractor, who failed to make any deliveries
 †Unit Prices:
 Agreement 109—Casing left in place in accepted wells, \$2.88 per linear foot
 Agreement 110—Boring, \$3.00 per linear foot; casing ordered left in place, \$0.10 per pound
 Agreement 111—Manure delivered, \$1.50 per ton
 ††\$15,115.18 deducted from final certificate of contract

TABLE 6

CANVASS OF BIDS OPENED JULY 10, 1917, FOR **Contract 129**, FOR THE COMPLETION OF THE SUPER-
STRUCTURE OVER THE DRAINAGE CHAMBER AT SHAFT 21 OF THE CITY TUNNEL OF THE CATSKILL
AQUEDUCT, IN THE BOROUGH OF MANHATTAN, NEW YORK CITY

ITEM	DESCRIPTION	UNIT	QUANTITY	A	*B	C	D	AVERAGE
1	Gray Portland cement.....	Barrel.....	850	\$2.50	\$2.25	\$2.80	\$2.80	\$2.59
2	White Portland cement.....	Barrel.....	80	4.65	4.55	5.00	5.10	4.83
3	Reinforcing steel.....	Pound.....	15,000	.07	.065	.08	.10	.08
4	Elevator.....	Lump sum.		5,757.00	5,210.00	5,669.00	6,000.00	5,659.00
5	Shortening and placing electric travel- ing crane.....	Lump sum.		1,370.00	1,280.00	1,200.00	1,400.00	1,312.50
6	Superstructure and appurtenances com- plete, exclusive of Items 1 to 5, inclusive.....	Lump sum.		50,842.00	55,840.00	69,493.00	76,378.00	63,138.25
	Amounts of bids.....			\$61,516.00	\$65,581.50	\$80,342.00	\$88,066.00	.....

Time: 6 months Bond required: \$30,000 * Awarded contract A—Lustig & Weil, 103 Park Avenue, New York City
 B—John T. Brady and Company, 103 Park Avenue, New York City C—Thomas J. Waters Co., 271 West 125th Street,
 New York City D—Columbus Circle Construction Corporation, 51 East 42nd Street, New York City

TABLE

CANVASS OF BIDS OPENED APRIL 24, 1917, FOR Contract 11
TESTING ELECTRICAL LIGHTING APPARATUS AT ASHOKA
RESERVOIRS AND AT VARIOUS STRUCTURES

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B
1	Electric lighting of structures at Ashokan reservoir	Lump sum	.....	\$4,000.00	\$4.00
2	Electric lighting of Hudson and Croton Lake Drainage chambers.....	Lump sum	.....	1,200.00	1.20
3	Electric lighting of structures at Kensico reservoir and dam and roadway on Kensico dam.....	Lump sum	.....	11,400.00	11.40
4	Electric lighting of structures at Hill View reservoir	Lump sum	.....	1,300.00	1.25
5	Electric lighting of valve-chambers of the City tunnel.....	Lump sum	.....	3,000.00	2.54
6	Electric lighting of structures at Silver Lake reservoir	Lump sum	.....	2,100.00	2.20
7	Outdoor lighting systems for Hill View and Silver Lake reservoirs.....	Lump sum	.....	20,200.00	15.00
8	Parapet lighting units for Kensico dam.....	Unit.....	139	116.00	15
9	Roadway lighting units, Type O. R.....	Unit.....	12	164.00	14
10	Roadway lighting units, Type R.....	Unit.....	51	158.00	14
11	Pathway lighting units, Type P.....	Unit.....	29	142.00	14
12	Fence lighting units, Type F.....	Unit.....	44	83.00	4
13	Motor and gearing for sluice-gate in Ashokan Screen chamber.....	Lump sum	.....	1,250.00	8
14	Pump for Lower gate-chamber of Kensico dam.	Lump sum	.....	470.00	8
Amounts of bids.....				\$78,840.00	\$78

Time: 8 months Bond required: \$40,000 *Awarded contract **The
 Co., 105 West 40th Street, New York City B—T. Frederick Jackson, Inc.,
 Ellicott Square, Buffalo, N. Y. D—Heyman and Goodman Co., 15 Exchange
 Row, New York City F—Watson Flagg Engineering Co., 120 Liberty Street

**3, FOR FURNISHING, DELIVERING, INSTALLING AND
KENSICO, HILL VIEW AND SILVER LAKE RES-
ALONG CATSKILL AQUEDUCT**

	C	D	E	**F	AVERAGE
.00	\$4,945.00	\$8,000.00	\$7,400.00	\$3,842.00	\$5,866.80
.00	1,230.00	2,000.00	2,400.00	832.00	1,604.40
.00	14,100.00	13,000.00	17,000.00	15,335.00	13,368.40
.00	1,420.00	2,000.00	2,500.00	1,135.00	1,689.00
.00	3,595.00	8,000.00	7,800.00	2,886.00	4,989.00
.00	3,100.00	2,500.00	4,900.00	2,855.00	2,963.80
.00	21,480.00	19,000.00	32,800.00	20,044.00	22,416.00
.00	100.00	115.00	165.00	19,133.00	124.80
.00	148.00	115.00	180.00	1,706.00	153.00
.00	152.00	115.00	190.00	7,133.00	153.60
.00	142.00	115.00	170.00	3,520.00	141.00
.00	92.00	70.00	120.00	6,000.00	91.60
.00	1,185.00	800.00	1,900.00	1,019.00	1,202.00
.00	340.00	400.00	900.00	458.00	539.00
.00	\$82,989.00	\$85,345.00	\$122,595.00	\$3,458,228.00	.....

Items of this bid are not included in average bid A—Lord Electric
9 John Street, New York City C—Lupfer and Remick, 594
e Place, Jersey City, N. J. E—Charles Meads & Co., 38 Park
New York City

TABLE 8

CANVASS OF BIDS OPENED APRIL 10, 1917, FOR **Contract 176**, FOR FURNISHING AND ERECTING FENCES AROUND HILL VIEW RESERVOIR, IN THE CITY OF YONKERS, WESTCHESTER COUNTY, NEW YORK, AND SILVER LAKE RESERVOIR, IN THE BOROUGH OF RICHMOND, NEW YORK CITY

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B	C	D	E	F	AVERAGE
1	Concrete masonry.....	Cubic yard.....	1,000	\$7.25	\$6.00	\$10.45	\$9.83	\$10.60	\$19.00	\$10.52
2	Galvanized steel and iron.....	Pound.....	250,000	.11	.105	.12	.13125	.112	.11	.115
3	Reinforcing steel.....	Pound.....	20,000	.0525	.04	.06	.1025	.08	.06	.066
4	Wire fencing.....	Pound.....	160,000	.0675	.06	.06	.0775	.075	.08	.07
5	Painting fence.....	Linear foot.....	17,000	.12	.16	.30	.15	.40	.40	.255
6	Concrete guard-rail.....	Linear foot.....	5,000	.75	2.00	.95	1.45	1.77	1.75	1.45
7	Repairing existing Knox fence...	Lump sum.....	.....	1,050.00	100.00	400.00	250.00	500.00	500.00	466.67
8	Portland cement.....	Barrel.....	1,800	2.15	2.00	2.85	2.02	2.80	3.00	2.47
Amounts of bids.....				\$57,310.00	\$59,070.00	\$66,630.00	\$70,778.50	\$73,390.00	\$81,950.00	.....

Time: 18 months Bond required: \$30,000 *Awarded contract **A**—Lupfer and Remick, 594 Ellicott Square, Buffalo, N. Y. **B**—Heyman and Goodman Co., 15 Exchange Place, Jersey City, N. J. **C**—P. T. Cox Contracting Co., Inc., 154 Nassau Street, New York City **D**—James MacArthur Co., 22 Ormond Place, Brooklyn, N. Y. **E**—Hudson River Co., Inc., 149 Broadway, New York City **F**—William H. Egan, 147 East 145th Street, New York City

TABLE 9

CANVASS OF BIDS OPENED JULY 10, 1917, FOR **Contract 179**, FOR SUR-
FACING WITH VITRIFIED BRICK BLOCK THE EAST HILL
DRIVE AT THE KENSICO DAM, IN THE TOWN OF NORTH
CASTLE, WESTCHESTER COUNTY, NEW YORK

ITEM	DESCRIPTION	UNIT	QUANTITY	*A
1	Excavating and grading (rolling, preparation and shallow excavation).....	Linear foot of road.....	1,900	\$0.95
2	Excavating and grading (excavation not included in Item 1).....	Cubic yard...	100	2.50
3	Concrete masonry for pavement foundations..	Cubic yard...	800	12.25
4	Concrete masonry for edgings, etc.....	Cubic yard...	50	19.00
5	Portland cement.....	Barrel.....	1,900	3.10
6	Vitrified brick pavement.....	Square yard..	4,000	3.90
7	Rubble paving.....	Cubic yard...	250	10.40
8	Concrete guard-rail.....	Linear foot...	2,000	.90
9	Concrete posts with sign-boards.....	Post.....	10	20.00
10	Reinforcing steel.....	Pound.....	8,000	.10
	Amount of bid.....			\$39,695.00

Time: 6 months Bond required: \$6,000 * Awarded contract A—Empire Engineering Co., Inc., 6 Church Street, New York City

TABLE

CANVASS OF BIDS OPENED JUNE 19, 1917, FOR **Contract 180**
ALONG THE CATSK

ITEM	DESCRIPTION	UNIT	QUANTITY	1A	1B
1	Rock excavation:				
	For work under Item 4.....	Cubic yard	50	\$5.00	
	For work under Item 5.....	Cubic yard	20		
	For work under Item 6.....	Cubic yard	20		
	For work under Item 7.....	Cubic yard	20		
	For work under Item 8.....	Cubic yard	20		
	For entire work (Item 9).....	Cubic yard	130		
2	Earth excavation and refill:				
	For work under Item 4.....	Cubic yard	4,600	\$1.00	
	For work under Item 5.....	Cubic yard	1,300		
	For work under Item 6.....	Cubic yard	200		
	For work under Item 7.....	Cubic yard	300		
	For work under Item 8.....	Cubic yard	300		
	For entire work (Item 9).....	Cubic yard	6,700		
3	Portland cement:				
	For work under Item 4.....	Barrel.....	600	\$2.40	
	For work under Item 5.....	Barrel.....	200		
	For work under Item 6.....	Barrel.....	50		
	For work under Item 7.....	Barrel.....	100		
	For work under Item 8.....	Barrel.....	100		
	For entire work (Item 9).....	Barrel.....	1,050		
4	Erecting 5 dwellings, 5 carriage houses, 1 horse-shed, 1 garage and 1 storage shed, remodeling 1 building, removing 2 buildings and laying water-main, exclusive of Items 1, 2 and 3....	Lump sum		\$45,273.00	42
	Amounts of bids.....			\$51,563.00	\$52
5	Erecting 2 dwellings, 1 carriage house and 1 garage, exclusive of Items 1, 2 and 3.....	Lump sum			112
	Amounts of bids.....				\$15
6	Remodeling 1 building and erecting 1 carriage house, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
7	Remodeling 2 buildings, erecting 1 barn and removing 2 buildings, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
8	Remodeling 1 building and erecting 1 barn, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
9	For work as a whole, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				

§Awarded Contract 180-A §§Awarded Contract 180-B §§§Awarded Contract 180-C
 N. Y. B—Fallkill Construction Co., Inc., 1 Washington Street, Poughkeepsie, N. Y.
 Adelphi Street, Brooklyn, N. Y. E—Guggolz-Delaney Company, Inc., 32 West Fordham
 York City G—G. A. Glantz, 1213 Elder Avenue, New York City H—Mead & Taft C

TABLE

CANVASS OF BIDS OPENED JUNE 19, 1917, FOR **Contract 180**
ALONG THE CATSK

ITEM	DESCRIPTION	UNIT	QUANTITY	1A	11
1	Rock excavation:				
	For work under Item 4.....	Cubic yard	50	\$5.00	
	For work under Item 5.....	Cubic yard	20		
	For work under Item 6.....	Cubic yard	20		
	For work under Item 7.....	Cubic yard	20		
	For work under Item 8.....	Cubic yard	20		
	For entire work (Item 9).....	Cubic yard	130		
2	Earth excavation and refill:				
	For work under Item 4.....	Cubic yard	4,600	\$1.00	
	For work under Item 5.....	Cubic yard	1,300		
	For work under Item 6.....	Cubic yard	200		
	For work under Item 7.....	Cubic yard	300		
	For work under Item 8.....	Cubic yard	300		
	For entire work (Item 9).....	Cubic yard	6,700		
3	Portland cement:				
	For work under Item 4.....	Barrel.....	600	\$2.40	
	For work under Item 5.....	Barrel.....	200		
	For work under Item 6.....	Barrel.....	50		
	For work under Item 7.....	Barrel.....	100		
	For work under Item 8.....	Barrel.....	100		
	For entire work (Item 9).....	Barrel.....	1,050		
4	Erecting 5 dwellings, 5 carriage houses, 1 horse-shed, 1 garage and 1 storage shed, remodeling 1 building, removing 2 buildings and laying water-main, exclusive of Items 1, 2 and 3....	Lump sum		\$45,273.00	42
	Amounts of bids.....			\$51,563.00	\$52
5	Erecting 2 dwellings, 1 carriage house and 1 garage, exclusive of Items 1, 2 and 3.....	Lump sum			112
	Amounts of bids.....				\$15
6	Remodeling 1 building and erecting 1 carriage house, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
7	Remodeling 2 buildings, erecting 1 barn and removing 2 buildings, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
8	Remodeling 1 building and erecting 1 barn, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				
9	For work as a whole, exclusive of Items 1, 2 and 3.....	Lump sum			
	Amount of bid.....				

§Awarded Contract 180-A §§Awarded Contract 180-B §§§Awarded Contract 180-C
 N. Y. B—Fallkill Construction Co., Inc., 1 Washington Street, Poughkeepsie, N. Y.
 Adelphi Street, Brooklyn, N. Y. E—Guggolz-Delaney Company, Inc., 32 West Fordham
 York City G—G. A. Glantz, 1213 Elder Avenue, New York City H—Mead & Taft C

E 10

O, FOR ERECTING, REMODELING AND REMOVING BUILDINGS
KILL AQUEDUCT

B	C	D	E	F	G	H
\$5.00		\$6.00				
†5.00	\$1.00	6.00				
	†1.00					
	†1.00					
	†1.00		\$8.00			
1.80		1.00				
†1.80	1.10	1.00				
	†1.10					
	†1.10					
	†1.10		1.25			
2.53		2.50				
†2.53	2.50	2.50				
	†2.50					
	†2.50					
	†2.50		2.75			
100.69		59,500.00			\$41,546.00	\$58,300.00
†148.69		\$65,900.00				
424.11	18,771.00	18,142.00				18,800.00
†370.11	\$20,721.00	\$20,062.00				
	†3,525.00					3,780.00
	\$3,890.00					
	†8,982.00			\$7,970.00		
	\$9,582.00					
	†6,377.00					
	\$6,977.00					
			109,927.00			
			\$122,229.50			

C †Items included in contract **Informal bid A—P. C. Osterhoudt & Co., Kingston, N. Y. B—J. E. Butterworth, 1665 Nelson Avenue, New York City D—C. L. Dooley, Inc., 257 Road, New York City F—Neptune B. Smyth, Incorporated, 417 East 34th Street, New York City G—Cornwall Landing, N. Y.

TABLE 11
CANVASS OF BIDS OPENED AUGUST 7, 1917, FOR Contract 181, FOR FURNISHING AND DELIVERING A PORTABLE STEEL BUILDING AND A TRUCK, ERECTING A BRICK STORAGE BUILDING AT 140TH STREET AND FIFTH AVENUE, AND DOING MISCELLANEOUS WORK, IN THE BOROUGH OF MANHATTAN, NEW YORK CITY

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B	C	AVERAGE
1	Brick storage building.....	Lump sum.....	.....	\$25,500.00	\$24,575.00	\$23,135.00	\$24,403.33
2	Truck for hauling float.....	Lump sum.....	.....	2,750.00	3,125.00	2,915.00	2,930.00
3	Portable steel building.....	Lump sum.....	.....	18,500.00	26,172.00	20,657.00	21,776.33
4	Grading.....	Cubic yard.....	1,100	.60	.655	2.00	1.09
5	Mold.....	Cubic yard.....	900	1.40	1.58	4.00	2.33
6	Sodding.....	Square foot.....	38,000	.04	.063	.15	.084
7	Surfacing gravel walks.....	Square yard.....	1,400	1.20	1.89	3.00	2.03
Amounts of bids.....				\$51,870.00	\$61,054.50	\$62,407.00	.....

Time: 10 months Bond required: \$20,000 * Awarded contract **A**—John T. Brady and Company, 103 Park Avenue, New York City
B—Hamilton & Chambers Co., Inc., 29 Broadway, New York City **C**—Thomas J. Waters Co., 271 West 125th Street, New York City

TABLE 12

CANVASS OF BIDS OPENED APRIL 10, 1917, FOR **Contract 182**, FOR APPLYING SURFACE TREATMENT TO WATERBOUND MACADAM PAVEMENTS AT THE ASHOKAN RESERVOIR, IN THE TOWNS OF OLIVE AND MARBLETOWN, ULSTER COUNTY, NEW YORK

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B	C	AVERAGE
1	Cleaning and preparing road surfaces.....	Square yard.....	30,000	\$0.08	\$0.20	\$0.25	\$0.177
2	Bituminous surface treatment.....	Square yard.....	30,000	.17	.15	.20	.173
3	Bitumen in refined tar.....	Ton.....	65	37.50	30.00	28.00	31.83
Amounts of bids.....				\$9,837.50	\$12,450.00	\$15,320.00	.....

Time: 3 months Bond required: \$4,000 *Awarded contract **A**—State Highway Construction Co., Beacon, N. Y. **B**—John F. Gallagher, Kingston, N. Y. **C**—The Barrett Co., 17 Battery Place, New York City

TABLE 13

CANVASS OF BIDS OPENED JULY 10, 1917, FOR **Contract 184**, FOR VITRIFIED
BRICK PAVEMENT IN THE KENSICO AERATOR, IN THE TOWN
OF MT. PLEASANT, WESTCHESTER COUNTY, NEW YORK

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B
1	Excavation of concrete.....	Cubic foot...	11,000	\$0.50	\$1.00
2	Concrete in aerator.....	Cubic foot...	11,000	.40	.90
3	Surfacing aerator apron.....	Square foot..	4,000	.40	.50
4	Waterproofing concrete surfaces.....	Square yard..	4,400	.50	.60
5	Steel embedded in concrete.....	Pound.....	1,000	.15	.35
6	Aerator pavement.....	Lump sum...	.....	29,000.00	33,000.00
Amounts of bids.....				\$42,850.00	\$58,890.00

Time: 4 months Bond required: \$14,000 *Awarded contract A—Henry E. Fox Construction Co., 81 East 125th Street, New York City B—Lupfer and Remick, 594 Ellicott Square, Buffalo, N. Y.

TABLE 14

CANVASS OF BIDS OPENED MAY 22, 1917, FOR **Contract 185**, FOR FURNISHING AND DELIVERING PORTLAND CEMENT FOR USE AT WOODSTOCK AND GLENFORD DIKES OF THE ASHOKAN RESERVOIR

NAME OF BIDDER	ADDRESS	QUANTITY	PRICE	AMOUNT OF BID
*Alsen's American Portland Cement Works.....	45 Broadway, New York City.....	15,000 barrels	\$2.30	\$34,500.00
**The Atlas Portland Cement Company.....	30 Broad Street, New York City..	15,000 barrels	2.37	35,550.00
Vulcanite Portland Cement Co....	8 West 40th Street, New York City.	15,000 barrels	2.385	35,775.00
The Alpha Portland Cement Co....	Easton, Pa.....	15,000 barrels	2.42	36,300.00
Ajax Portland Cement Co.....	103 Park Avenue, New York City.	15,000 barrels	2.49	37,350.00

Bond required: \$15,000

*Awarded contract

**Informal bid

TABLE 15

CANVASS OF BIDS OPENED MAY 22, 1917, FOR **Contract 186**, FOR BORINGS AT WOODSTOCK
AND GLENFORD DIKES OF THE ASHOKAN RESERVOIR, IN THE TOWN OF HURLEY,
ULSTER COUNTY, NEW YORK

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B
1	Setting shallow grout pipes.....	Pipe.....	120	\$50.00	\$38.43
2	Sinking 4-inch casing.....	Linear foot.	5,000	2.50	2.75
3	Setting 2½-inch deep grout pipes.....	Linear foot.	2,500	1.00	.95
4	Sinking and setting 2½-inch deep grout pipe .	Linear foot.	8,000	2.75	1.63
5	Drilling core borings.....	Linear foot.	11,700	2.50	9.45
	Amounts of bids.....			\$72,250.00	\$144,341.60

Time: 15 weeks Bond required: \$32,000 *Awarded contract **A**—Sprague & Henwood, Inc., Scranton, Pa. **B**—Powers Kennedy Contracting Company, 149 Broadway, New York City

TABLE 16

*CANVASS OF BIDS OPENED JULY 10, 1917, FOR **Contract 187**,
 FOR FITTING UP A CHEMICAL AND BACTERIOLOGICAL
 LABORATORY IN THE LOWER GATE-CHAMBER OF
 ASHOKAN RESERVOIR, IN THE TOWN OF
 OLIVE, ULSTER COUNTY, NEW YORK

NAME OF BIDDER	ADDRESS	AMOUNT OF BID
Lord Electric Co.....	105 West 40th Street, New York City.	\$14,839.00
Bond required: \$2,500		
Time: 12 weeks		
* Bid rejected		

TABLE 17
CANVASS OF BIDS OPENED AUGUST 7, 1917, FOR Contract 188, FOR
FURNISHING AND DELIVERING GATE AND PRESSURE-REGULATING
VALVES AND APPURTENANCES FOR THE CITY TUNNEL OF THE
CATSKILL AQUEDUCT, IN THE CITY OF NEW YORK

ITEM	DESCRIPTION	UNIT	QUANTITY	*A
1	48-inch bronze gate-valves.....	Valve.....	1	\$14,220.00
2	30-inch bronze gate-valves.....	Valve.....	2	6,255.00
3	48-inch iron gate-valves.....	Valve.....	4	5,075.00
4	30-inch iron gate-valves.....	Valve.....	6	2,700.00
5	16-inch iron gate-valves.....	Valve.....	6	725.00
6	16-inch steel gate-valves.....	Valve.....	4	1,115.00
7	12-inch iron gate-valves.....	Valve.....	1	575.00
8	8-inch iron gate-valves.....	Valve.....	3	95.00
9	6-inch iron gate-valves.....	Valve.....	6	69.00
10	4-inch iron gate-valves.....	Valve.....	9	30.00
11	3-inch iron gate-valves.....	Valve.....	6	20.00
12	4-inch bronze gate-valves.....	Valve.....	6	215.00
13	16-inch pressure-regulating valves.....	Valve.....	8	750.00
14	24-inch pressure-regulating valves.....	Valve.....	4	1,200.00
15	Steel castings.....	Pound....	150,000	.23
16	Miscellaneous bronze.....	Pound....	7,000	.75
17	Miscellaneous iron and steel.....	Pound....	20,000	.25
18	Bronze billets.....	Pound....	3,500	.65
19	Bronze shaft-cap covers, elbows and connecting pipes.....	Pound....	18,000	.80
Amount of bid.....				\$147,219.00

Time: 44 weeks Bond required: \$60,000 * Awarded contract A—Coffin Valve Company, Boston, Mass.

TABLE 18

CANVASS OF BIDS OPENED OCTOBER 23, 1917, FOR **Contract 189**, FOR THE CONSTRUCTION OF THE MAINTENANCE BUILDINGS AT SILVER LAKE RESERVOIR, IN THE BOROUGH OF RICHMOND, NEW YORK CITY

ITEM	DESCRIPTION	UNIT	QUANTITY	*A	B	C	D	E
1	Excavation.....	Cubic yard	300	\$0.75	\$0.75	\$1.75	\$2.20	\$1.00
2	Portland cement.....	Barrel.....	150	2.80	2.80	2.90	2.92	1.90
3	Keeper's house, exclusive of Items 1 and 2....	Lump sum.		8,535.00	8,995.00	8,950.00	10,445.00	11,258.00
4	Garage, exclusive of Items 1 and 2.....	Lump sum.		3,975.00	6,195.00	6,950.00	6,437.00	7,700.00
5	Removal of buildings.....	Lump sum.		350.00	95.00	1,200.00	172.00	**150.00
Amounts of bids.....				\$13,505.00	\$15,930.00	\$18,060.00	\$18,152.00	\$19,393.00

ITEM	DESCRIPTION	UNIT	QUANTITY	F	G	H	I	AVERAGE
1	Excavation.....	Cubic yard	300	\$1.65	\$1.25	\$2.00	\$3.00	\$1.59
2	Portland cement.....	Barrel.....	150	2.60	4.50	2.00	3.00	2.82
3	Keeper's house, exclusive of Items 1 and 2....	Lump sum.		11,300.00	10,850.00	10,000.00	11,000.00	10,148.11
4	Garage, exclusive of Items 1 and 2.....	Lump sum.		7,700.00	8,300.00	8,600.00	9,000.00	7,206.33
5	Removal of buildings.....	Lump sum.		200.00	500.00	1,500.00	1,000.00	627.12
Amounts of bids.....				\$20,085.00	\$20,700.00	\$21,000.00	\$22,350.00	.....

Time: 8 months Bond required: \$6,000 *Awarded contract **A credit of \$150 bid for the buildings of Item 5 A—Karlsson Bros., 30 Havenwood Road, Tompkinsville, Staten Island, N. Y. B—U. W. Osborn & Son, 74 South Avenue, Mariner's Harbor, Staten Island, N. Y. C—Thomas J. Tully, 305 East 166th Street, New York City D—B. Diamond, 12 Bergen Street, Brooklyn, N. Y. E—John F. Ferguson, 602 West 110th Street, New York City F—J. M. Knopp, 544 West 43rd Street, New York City G—Werner-Hubert Company, Inc., 50 Court Street, Brooklyn, N. Y. H—Burke Bros. Construction Co., Inc., 62 West 42nd Street, New York City I—P. T. Cox Contracting Company, Inc., 154 Nassau Street, New York City

TABLE 21

CANVASS OF BIDS OPENED MARCH 6, 1917, FOR **Contract AH**, FOR FURNISHING AND DELIVERING LIQUID CHLORINE FOR USE AT THE KENSICO SCREEN CHAMBER OF THE CATSKILL AQUEDUCT

NAME OF BIDDER	ADDRESS	QUANTITY	PRICE	AMOUNT OF BID
*Electro Bleaching Gas Company.....	18 East 41st Street, New York City..	50,000 pounds	\$0.1175	\$5,875.00
Arnold, Hoffman & Co., Incorporated.....	55 Canal Street, Providence, R. I..	50,000 pounds	.123	6,150.00

Time: 6 months

Bond required: \$2,500

*Awarded contract

APPENDIX A

REPORT OF THE BOARD OF WATER SUPPLY TO THE
MAYOR OF THE CITY OF NEW YORK ON THE COM-
PLETION OF THE FIRST STAGE OF THE CATSKILL
WATER SUPPLY SYSTEM

BOARD OF WATER SUPPLY CITY OF NEW YORK

Municipal Building

HON. JOHN PURROY MITCHEL,
Mayor of The City of New York.

SIR:

The Commissioners of the Board of Water Supply, appointed pursuant to Chapter 724 of the Laws of 1905, and charged with the duty of furnishing to the City of New York an additional supply of pure and wholesome water, beg leave to report the completion of the first stage of the work, and the actual delivery of an additional supply of water, exceeding 300 million gallons daily, from the Catskill mountains to all boroughs of the Greater City.

This result has been accomplished more than one year ahead of the estimated time and about \$7,000,000 below the estimated cost.

Immediately upon the appointment of the Commissioners by Mayor George B. McClellan, in whose administration and under whose guidance this work was inaugurated, the Board of Water Supply became charged with the duty of determining the sources of supply from which the water was to be taken. The City then had in round figures four million inhabitants, and the practicable limit of its water resources had for some time been reached. Numerous previous City administrations had attempted to solve the problem and there had been collected a vast amount of data

which it remained for the Board of Water Supply to investigate and reduce to practice.

It created an administrative department to handle contracts and the legal and financial matters of the Board, which ran into colossal figures; and it organized a great engineering force, at the head of which it placed J. Waldo Smith, who, as Chief Engineer for the Aqueduct Commissioners, had had immediate charge of all the engineering work connected with the Croton supply.

Realizing the critical situation that would confront the City before any additional supply of water could be obtained, the Commissioners proceeded with all possible speed to locate the most desirable sources. In exactly four months after appointment they determined that the Catskill Mountain region offered the most available and best source of supply, and submitted to the Board of Estimate and Apportionment, for its approval, a map, plan and estimate of cost for obtaining this water from the Esopus, Rondout, Catskill and Schoharie watersheds, in the amount of at least 500 million gallons a day. Later, more detailed studies determined that this quantity of water could most economically be developed from the Esopus and Schoharie creeks, leaving the other watersheds available for possible future development.

The plans thus made were unanimously approved by the Board of Estimate and Apportionment on October 27, 1905, and by the State Water Supply Commission in May, 1906, after necessary legislation had been secured, thus paving the way for the Board to proceed actively with the surveys and investigations and the preparation of the detail plans upon which the actual construction was to depend.

With such speed were these preparations pushed that the first contract, covering 11 miles and known as Contract No. 2 of the Catskill aqueduct, was awarded March 27, 1907. On June 20, 1907, the first sod on the line of the work was turned by Mayor McClellan, with appropriate ceremonies, near Garrison.

The Board of Water Supply at that time undertook to deliver the first increment of 250 million gallons daily within ten years from the date of the award of the first contract, but long before this time the water delivery was in fact accomplished. Catskill water was turned into Kensico reservoir, north of White Plains, on November 22, 1915; into Hill View reservoir, near

Yonkers, on November 30, 1915; and was actually distributed for use in small quantities in the City of New York on December 27, 1915, and turned into general use in all the five boroughs of the City in January, 1917.

Throughout the prosecution of the work the greatest care was exercised to co-ordinate the contracts so that, in case of any exigency, Catskill water might be delivered into the City through the Croton aqueduct, although the construction work was far from completion. In point of fact, Catskill water could have been delivered into Croton reservoir over four years ago, if a drought like that of 1911 had occurred.

The main supply of the new system is drawn from the Ashokan reservoir, located in the Catskill mountains about 16 miles west of Kingston. This reservoir has a capacity of 132 billion gallons, or enough to cover the island of Manhattan to a depth of 30 feet; and its contents could supply the whole of Greater New York, at the present rate of consumption for about eight months. It is 12 miles long and has a maximum depth of 190 feet. Before the water was impounded therein, seven villages were removed and eleven miles of the Ulster and Delaware railroad were relocated. The problems involved in the removal and relocation of the railroad were complicated, but, after negotiations covering several years, were satisfactorily solved by the Board acting in co-operation with the Board of Estimate and Apportionment.

The construction of the aqueduct, which is 120 miles in length from the Ashokan reservoir to the terminal reservoir, Borough of Richmond, was divided into a number of parts, the most difficult being the tunnels under the Rondout valley, the Wallkill valley and the Hudson river. The Hudson river, with its deep rock gorges, flowing between the mountains and New York City, had to be crossed. Here engineering skill, rejecting the more obvious but less secure and more costly means of crossing by bridges or pipes, sank shafts 1,200 feet deep and drove a tunnel in the granite rock beneath the river, through which the water flows under pressure. These tunnels are 14 feet in diameter inside. The interior dimensions of the cut-and-cover aqueduct are 17 feet high by 17½ feet wide.

For the City's security, with so long an aqueduct, it was very important to have a large store of water near by. Branching valleys three miles north of White Plains afforded a site for Kensico reservoir, which was formed by constructing one of the

great masonry dams of the world, 1,850 feet long, with a maximum height of 307 feet. The water held in reserve here could supply the City's present rate of draft for nearly two months. This Kensico reservoir is the objective point of the Bronx Parkway, a beautiful highway from New York City.

The third important reservoir is that of Hill View, in Yonkers, at the New York City line, which is an equalizing reservoir for the varying consumption of New York City during the day and night.

One of the great works of the Board was the City tunnel, which carries the water under the Borough of The Bronx, the Harlem river, the Borough of Manhattan and the East river to terminals in Brooklyn at Fort Greene Park and Flatbush avenue, from which conduits extend to the Boroughs of Queens and Richmond. Instead of delivering the water within the City limits in the usual pipe-lines, of which a great number of the largest size would have been needed, with the intolerable digging up of important avenues and streets, a great pressure tunnel 18 miles long and from 200 to 750 feet in depth, was constructed beneath the busy thoroughfares of the City. This construction required about six years, and during the first three years involved the use daily of over ten thousand pounds of dynamite, which was exploded in the heart of the City without serious accident. The only surface indications were the 24 shafts with temporary buildings at their tops. Through these shafts the water is now flowing into distribution pipes beneath the streets.

The last barrier to be crossed before the water could be supplied to Staten Island was The Narrows of New York harbor. Here a 10,000-foot line of 36-inch-diameter cast-iron pipes, each 12 feet long and having a ball-and-socket joint, was laid in a trench dredged in the harbor bottom and covered over with sand and gravel. Severe tests have proved this pipe-line to be remarkably watertight, due to the special devices employed.

For these great achievements over physical obstacles tribute is due to the vision, skill and resourcefulness of the Board's engineers and the experts who aided them; to the energy and ability of the contractors; to the ingenuity of many manufacturers of equipment and materials, and to the faithfulness of thousands of mechanics and laborers who wrought by day and by night.

In the course of its operations it became necessary for the Board of Water Supply to acquire title for the City to 21,330

acres, comprising 2,866 parcels of real estate. Most of these were acquired by condemnation proceedings and the amounts awarded directed to be paid by the Supreme Court after hearings before commissioners. The amounts thus paid out, including indirect damages, aggregate \$17,307,614, the detail of which has been minutely segregated in the annual reports prepared by the Auditing bureau of the Board. It is the first time in the City history that such information has been published and submitted to the Mayor and to the Comptroller of the City.

Hardly had the Board begun to push its work forward when the Legislature of 1906 passed the Eight-hour Law. All the estimates which were made in the previous year were based upon a ten-hour day for labor.

In the same year also, and after the estimates had been made, the Legislature passed a mandatory law compelling the organization of a constabulary force for the protection of the communities in the places where the work of the Board was to be carried on. This resulted in what is known as the Aqueduct Police force, an organization now well known throughout the river counties.

The original estimate of cost for completing the works to full capacity was.....		\$176,633,000
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To this must be added the actual disbursements to date for maintaining the Aqueduct police.....	\$2,315,251	
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Also on account of the Eight-hour Law calculated upon actual disbursements for labor.....	5,759,289	8,074,540
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Making a total of.....		\$184,707,540
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Actual disbursements to September 30, 1917, including all present known liabilities	\$138,977,273	
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Add for work unfinished, included in the original estimate, viz.:

Steel-pipe siphons and miscellaneous items to complete the Catskill supply	\$5,700,000
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Proposed Schoharie supply, as authorized

by the Board of Estimate	22,175,400	
Filtration	9,000,000	36,875,400
	<hr/>	<hr/>
Total.....		\$175,852,673
		<hr/>
Leaving a margin of safety of.....		\$8,854,867

less than the total estimates of cost, subject, however, to the payment of various outstanding claims for real estate and business damage, the total amount of which, however, cannot reduce this balance substantially.

The accounts of the Board of Water Supply, aggregating cash payments of \$137,560,058, have been examined and audited and found correct.

The maximum number of employees of the Board of Water Supply at any time was 1,757, and the maximum contractors' forces ran at times as high as 17,000. To these must be added men in manufactories specially engaged on this work, bringing the grand total to 25,000.

It is with great satisfaction we are able to report that the entire work has been so far completed without strike or labor disturbance of any kind worthy of mention. This is perhaps largely due to the fact that the contracts provided for camps with sanitary comforts for the workmen and their families, and that camp schools were established to teach the English language and impart a knowledge of the laws and institutions of the country in the interests of good citizenship. In stipulating by contract that the contractors provide sanitary quarters, medical attendance and other facilities looking to the welfare of their employees, the Board established a precedent which is now pretty generally employed in all contracts for public work.

It is notable that all the contracts, of a total value of \$100,000,000, were completed by the original contractors or their legal representatives, without intervention by the City, at a cost approximately five per cent. less than the amounts bid.

Within the scope of a report of this character it is impossible to treat of the many branches of related service which the building of the aqueduct entailed, as, for instance, the persistent annual efforts to secure legislation to prevent unwarranted discrimination in the matter of taxation against the City in the

counties north of the City line; the treatment of the innumerable claims for direct and indirect damages which were presented against the City and which amounted to several millions of dollars, and to handle which a special bureau was organized to act in co-operation with the Corporation Counsel; the work of sanitation, involving surveys of miles of country north of the Ashokan reservoir and resulting in the amendment of existing health laws and the making and promulgation, in co-operation with the State Health Department, of an entirely new set of rules and regulations having for their object the promotion of the purity of the water supply; the installation of two aeration plants, composed of 1,600 fountains, at Ashokan and Kensico, as a further aid in purifying the supply.

The taking of the Catskill waters has been so accomplished that the immediate regions from which the waters have been diverted have been benefited and beautified, rather than laid waste. Extensive highways of improved character, which are the pride of their localities, have been built by the City, sources of pollution affecting the general health have been cleaned up, and the dams and reservoirs have been so constructed that they enhance the beauties of the landscape. Moreover, all those whose property has been taken or damaged have received just, and even liberal, compensation.

This new Catskill water supply is a gravity system. It has been made the means of connecting and combining all existing water systems. The aqueduct is, in fact, so interconnected with the old systems as to form a main trunk line, and thus the City, instead of being limited at any time to any one supply, will be enabled to utilize water from all its water sources in combination, thereby practically eliminating any possibility of a water famine.

The plan and scope which controlled the building of the Catskill aqueduct were daring and magnificent, and many phases of the work have been absolutely without technical precedent. It may be said that the Catskill aqueduct is in a class by itself, and no other aqueduct, ancient or modern, approaches it in size and capacity. For this achievement the Chief Engineer and his staff should be awarded the greatest credit.

The Commissioners of the Board of Water Supply have always recognized the fine spirit of self-sacrifice and loyalty which has characterized the entire organization since its inception, and made it possible to accomplish the results herein reported.

Nor could this progress have been made without the support of the great Departments of the City of New York, the offices of the Mayor, Comptroller and Corporation Counsel, the Board of Estimate and Apportionment and the Municipal Civil Service Commission. To these must be added the great civic bodies of New York, for without the practical support frequently extended by them our progress would have been prejudiced and our work delayed. *

Thus the work is finished so far as the building of the reservoirs and the aqueduct for the delivery of the first instalment of water is concerned.

To supply the remaining 250 million gallons per day to make up the total complement of 500 million gallons originally provided for, there remains the development of the Schoharie watershed by the construction of a dam at Gilboa and the building of a tunnel 18 miles long under the Shandaken mountain. The details of this operation, for which the Board of Water Supply has already laid the foundations, will be the subject of a future report.

And now, Mr. Mayor, the Commissioners of the Board of Water Supply on their own behalf and representing the Chief Engineer and his staff, and all the forces, administrative and engineering, which have contributed to this work, deliver to you this new Catskill Water Supply, the greatest system of municipal water works in all the world, to be enjoyed for all time by the citizens of New York.

CHARLES STRAUSS,	} <i>Commissioners</i>
<i>President,</i>	
CHARLES N. CHADWICK,	
JOHN F. GALVIN,	} <i>of the</i>
	} <i>Board of</i>
	} <i>Water Supply</i>
	} <i>of The City</i>
	} <i>of New York</i>

Dated, New York,
October 12, 1917