THE CITY RECORD.

OFFICIAL JOURNAL.

VOL. X. NEW YORK, THURSDAY, MARCH 9, 1882. NUMBER 2,664.

DEPARTMENT OF PUBLIC WORKS.

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE, No. 31 CHAMBERS STREET,
NEW YORK, February 23, 1882.

Hon. WILLIAM R. GRACE, *Mayor:*

SIR—In the quarterly and annual report which I transmitted to you on the 13th instant, I stated that under the direction of Mr. Isaac Newton, Chief-Engineer of the Croton aqueduct, with the assistance of Mr. E. S. Chesbrough, as Consulting Engineer, careful investigations and surveys have been made during the past year, to ascertain the best method of securing an additional water supply for the city; that these investigations and surveys have led to a definite plan for a new aqueduct from the Croton river to the city, the outlines of which I briefly stated; that upon examination the plan has received the approval of Mr. John B. Jervis, the distinguished constructor of the Croton aqueduct, Mr. James B. Francis, President of the American Society of Civil Engineers, and that it was also examined and approved by Mr. Robert K. Martin, under whose direction a similar work, the Baltimore water-works tunnel, was recently successfully constructed. I have now the honor of transmitting to you Chief-Engineer Newton's report of the proposed plan, with the opinions and approval of the eminent engineers who have examined it in all its various features.

The facts and circumstances which have led to the immediate necessity of another aqueduct or conduit to bring a large additional supply of water to the city have been so often stated in previous reports of this Department, and they are so fully understood and appreciated by you, and I believe by the greater part of the people of this city, that they need no repetition here.

The only questions which remain open for discussion are, as to the source from which the supply should be obtained, and the means of collecting it and conveying it to the city.

I believe there is no difference of opinion among engineers and others who have given the subject attention and study, that in regard to geographical position, quality of water, and facility of means for conducting the water to the city, the Croton river and water-shed is the most desirable source of supply.

The only consideration which has led to the suggestion of other sources, is a supposition that the Croton water-shed can not be relied upon to furnish enough water at all times for a new aqueduct of the required capacity.

Let it be shown that this supposition or fear is groundless, and there can be no hesitation in rejecting, for very obvious and potent reasons, the propositions of obtaining pure fresh water from the upper Hudson river, from Lakes George, Erie, Ontario, or Champlain, from the Passaic, or Hackensack rivers in New Jersey, from the Housatonic river in Massachusetts, or Connecticut, or from the streams in Rockland and Orange Counties.

The project of using the salt water which surrounds the city, as an auxiliary to the city's water supply, continues to be brought forward from time to time, by persons who have evidently not given the subject sufficient consideration. The objections to it are so apparent and conclusive, that engineers do not consider it worthy of serious consideration.

In view of the many questions, however, which are put to me by citizens, why we do not propose or make preparations to use salt water, I will briefly state the objections to it.

We have now 512 miles of iron pipes, with 5,427 stop-cocks and 6,496 fire-hydrants, to distribute the Croton water in the streets of the city. To make the salt water of real service for the very limited purposes for which it can be used, it would be necessary to duplicate the greatest part of the distributing system, and to erect and maintain pumping machinery and stand pipes, at a total cost of probably not less than twelve to fifteen million dollars. Considering that less than five per cent. of the present water supply is used for extinguishing fires and for cleaning streets, the principal or almost exclusive uses to which salt water can be put, the cost of a salt-water system, as compared with any of the new projects for an additional fresh-water supply of ample proportions is so enormous as to place it out of the question on that ground alone. But there are other serious objections to it. The fire underwriters say that salt water used in extinguishing fires would be likely to do as much damage to merchandise as the flames themselves. The rapid corrosion of iron pipes along the river-front, where they come in contact with salt water, shows that it would soon corrode the mains, stop-cocks and hydrants, and, in the opinion of the Chief of the Fire Department, wear out the steam fire engines. For use on the streets it is so objectionable in a sanitary point of view, that several years ago the Board of Health prohibited and forbade street sprinkling with salt water.

An additional fresh-water supply will not only accomplish all that can be attained by utilizing salt water, but will meet the many other equally important objects of an adequate water system, for which salt water would be useless. The salt-water plan may, therefore, be dismissed without further reference.

The supposition or fear entertained by many that the Croton water-shed is not capable of furnishing a constant supply for a new and large aqueduct, shows an imperfect knowledge or misconception of the facts. Accurate observations and measurements of the rain-fall and of the quantity of water running over the Croton dam for the past sixteen years, prove that in the driest of these years, 1880, the average daily flow of the Croton river was 250,000,000 gallons. All that is needed to secure that supply every day in the year is sufficient storage capacity.

The capacity of the Croton water-shed to furnish a minimum supply of 250,000,000 gallons per day being proven, the whole question is narrowed down to the selection of the plans and means to secure sufficient storage and to conduct the water to the city.

Chief-Engineer Newton's plan covers both the subject of storage, and that of a conduit from the Croton river to the city. In regard to storage it combines in the highest degree the merits of simplicity, efficiency and economy. Instead of constructing a number of smaller reservoirs on the slopes of the Croton water-shed, on sites established by surveys made under the direction of the Croton Aqueduct Board in 1857-58, it is proposed to build a dam on the Croton river at Quaker Bridge, about 4½ miles below the present dam, and 5 miles above the mouth of the river, forming a reservoir of 3,635 acres in area, with a storage capacity of about 32,000,000,000 gallons above the level of the proposed new aqueduct.

The advantages of this single reservoir as compared with a number of smaller ones in the upper portion of the water-shed are:

1st. It will receive the entire drainage of the 361 square miles of water-shed, including about 23 square miles below Croton lake, not included in any previous reports, plans, or calculations; on the other hand, the combined drainage area of a sufficient number of smaller reservoirs on the sites heretofore selected, to contain 32,000,000,000 gallons available water, would be less than 200 square miles. Consequently the large reservoir will fill much more rapidly than the smaller ones.

2d. The estimated cost of building this reservoir is $4,000,000, being at the rate of $125 per one million gallons capacity.

The cost of building the smaller reservoirs was estimated by my predecessor, the Hon. Allan Campbell, in his report of August 12, 1879, at $200 per 1,000,000 gallons or $6,400,000 for a storage capacity equal to the large reservoir.

3d. Purity of water is better secured by large reservoirs than by smaller ones.

4th. By taking the proposed site the length of aqueduct required to convey the water to the city is shortened about ten miles, as compared with the plans proposed in 1875.

Though the dam is to be of unusual height, and will have to resist the weight of a very large body of water, the eminent and experienced engineers who have examined the entire plan pronounce it entirely practicable, as well as the best that can be adopted. Dams of nearly the same height have been successfully built and used in France and elsewhere.

The conduit from the dam at Quaker Bridge to the Harlem River at High Bridge, is to be a masonry aqueduct, circular in shape, twelve feet in diameter, and capable of delivering about 250,000,000 gallons of water per day. The Harlem River and Manhattan Valley are to be crossed by syphons, and the remainder of the conduit between the Harlem River and the Central Park reservoir is to be in tunnel wherever possible. The distance from Quaker Bridge to the Harlem River, on the line selected, is 26½ miles, only 9-100 mile greater than an air line; it is ten miles shorter than the Sawmill river line, and 9½ miles shorter than the Bronx river line surveyed in 1875 under the direction of General Fitz John Porter. It has the further most valuable advantage of being almost wholly in rock tunnel, thus securing the greatest possible strength and stability of the structure, with the least cost for supervision and maintenance after it is completed.

The prominent features of the entire plan are:

1st. *Large capacity and facility for collecting and storing water.* The new reservoir will receive the entire drainage of the Croton water-shed, and hold 32,000,000,000 gallons of water above the level of the aqueduct, and can therefore supply 200,000,000 per day for 160 days, without recourse to the flow of the river. With the 9,000,000,000 gallons of water in existing storage reservoirs and lakes, and 5,000,000,000 gallons in the new reservoir about to be built on the east branch of the Croton, the total available storage capacity will be 46,000,000,000 gallons, sufficient to supply 200,000,000 gallons per day for 230 days.

2d. *Large capacity and utmost attainable strength and security of the conduit to convey the water to the city.* The new aqueduct will be capable of delivering 250,000,000 gallons per day, the entire minimun drainage of the Croton water-sheds. This will supply a population of 2,500,000 at the rate of 100 gallons daily per capita, or 3,300,000 at the present rate of consumption (about 75 gallons daily per capita). Add to it the capacity of the present aqueduct, 100,000,000 gallons per day, and we can, if needed in the far distant future, convey to the city that amount of water from the Housatonic river, or any other proposed auxiliary to the Croton, and supply a population of 4,660,000 at the present rate of consumption.

3d. *Economy of first cost of construction, as well as subsequent supervision and maintenance.*

The cost of the new dam, reservoir and aqueduct as above described, including everything necessary to deliver the water into the Central Park reservoir, is estimated at	$14,000,000 00
The cost of a new aqueduct of 150,000,000 gallons daily capacity by one of the two routes surveyed in 1875, with equal storage capacity as included in the new plan, and provision to deliver the water in the Central Park reservoir, is estimated as follows:	
Sawmill river route	19,493,000 00
Bronx river route	20,119,000 00
Cost of new plan per 1,000,000 gallons of conduit capacity	48,000 00
Cost of plans reported in 1875 per 1,000,000 gallons, conduit capacity:	
Sawmill river route	103,946 00
Bronx river route	108,121 00

The substitution of one large reservoir in place of eight or ten smaller ones, distributed over the entire water-shed, and the construction of the shortest practicable conduit, with the greatest proportion of rock tunnel, will involve much less labor for supervision and maintenance of the works after completion than the works proposed under any other plan.

In conclusion, I can only repeat what I stated in my last quarterly report, that the character and reputation of the eminent engineers who have been engaged in the preparation and elaboration of this plan, and in its examination, is a guarantee that their conclusions give the best results which patient investigation, guided by professional ability, experience and judgment can secure.

Very respectfully,

HUBERT O. THOMPSON,
Commissioner of Public Works.

Report of Isaac Newton, Chief Engineer of Croton Aqueduct.

ON PLANS PROPOSED FOR STORING AND CONVEYING AN ADDITIONAL WATER SUPPLY TO THE CITY.—OPINIONS OF THE CONSULTING ENGINEERS.—TABLES OF RAIN-FALL, ETC., ETC.

CHIEF ENGINEER'S OFFICE,
NEW YORK, January 30, 1882.

Hon. H. O. THOMPSON,
Commissioner of Public Works:

SIR—I beg leave to present the following report of the result of the investigation and surveys made under my direction since my appointment as Chief Engineer, for a new aqueduct from the Croton river to New York. The surveys and maps previously made, together with other data on record, have been of great value, not only in the positive information they afford, but in the suggestions they have led to.

Surveys for an additional supply made since the construction of the present aqueduct, have been those of the Croton water-shed of 1857–58, and those made in 1875 under General F. J. Porter, for the Sawmill river and Bronx river plans. The description and estimates of the cost of construction for both these plans will be found in Appendix "A," attached to this report.

At the beginning of my study of the subject of bringing additional water to the City of New York, the various sources from which it has been proposed to obtain this supply were carefully looked into. These sources are the Croton, the Passaic, the Housatonic, and the Hudson and Hackensack rivers, and Lakes George, Erie, Ontario and Champlain, also the streams in Rockland and Orange counties. The use of wells and salt water to be raised into reservoirs by pumps for auxiliary supply was likewise considered.

All the sources, *i. e.*, from these rivers and lakes, with the exception of the Croton and Housatonic, were set aside as being out of the question on account of the immense cost, or uncertainty of sufficient supply; although some of them might be used as auxiliaries.

Since becoming satisfied that the Croton river is by far the most available and the most economical source of supply, I have simply endeavored to determine the best plan for storing and conveying the water of this river to the city.

The quality of the Croton as a pure and wholesome water, as well as the geological and other characteristics of the river basin are so well understood, that nothing on the subject need to be mentioned.*

The meteorological history of the water-shed of the Croton, as far back as there are any records, shows that with adequate storage capacity at the head of the aqueduct, an average daily supply of about 250,000,000 † of gallons can be relied upon in the driest years. The area of over 23 miles which will be added to the existing water-shed—*i. e.*, to the area shown on the water-shed maps of 1857–58—by the plan to be hereinafter described, would increase the average daily supply from 15,000,000 to 20,000,000 of gallons, thus making the total average daily supply of about 265,000,000 to 270,000,000 of United States gallons.‡

The following views have formed the basis of my investigations and have led to the conclusions arrived at:

1st. The Croton water-shed is adequate to furnish all the city will need for many years to come, provided adequate storage capacity is provided.

2d. The storage reservoirs must ultimately be of sufficient capacity to hold all, or nearly all the water of the Croton in the driest years, so that none, or but very little, can waste over the dam. And eventually to carry over a portion of the surplus of wet years to supply the deficiency of dry ones.

3d. The nearer the storage reservoirs to the entrance of the aqueduct, if they are of sufficient capacity, the greater will be the quantity of water that can be gathered from the entire Croton basin, and the more rapidly will the reservoirs fill again after being drawn down. The time required to fill the existing storage reservoirs and lakes, after they have been drawn down, is a warning on this point which should be heeded. All the water which falls on that part of the basin situated below the several storage dam sites shown on the maps of 1857 and 1858, above what is necessary to supply the aqueduct, will run into the Hudson river over the waste-weir of the aqueduct dam, unless storage is provided at that point; so, without a reservoir at that locality, it will be impossible to secure storage in the dry years. Hence storage located at the entrance to the aqueduct is in the most advantageous position.

4th. The aqueduct capacity should be sufficient to convey all the water available from the Croton valley; it should also be enough to convey a portion of the water from other sources of supply, which can be led into the Croton basin.

The capacity of an aqueduct 10 feet in diameter, with an inclination of 1 foot to the mile, is about 168,000,000 of gallons in 24 hours; while the capacity of an aqueduct 12 feet in diameter, with the same inclination, is no less than 270,000,000 in the same time. The excess of cost of the 12 feet over the 10 feet conduit is believed to be of much less importance than the greater capacity obtained.

5th. The aqueduct, as far as possible, should be in tunnel, this construction being the safest, most durable, and the least exposed to malicious damage. The difference in the cost between tunneling and excavation, because of the improved appliances now available, has been greatly reduced since the Croton aqueduct was constructed; and the saving in length of conduit which can be effected by tunneling over a construction on a line located on or near the surface of the ground, added to the decreased land damages, will probably make the former fully as economical even in first cost.

6th. Wherever it is necessary to cross depressions in the line, the aqueduct should be carried on masonry laid in mortar, or beneath the surface by syphons.

7th. Storage in the Croton basin is preferable to bringing water from the Housatonic for the purpose of providing against deficiency in the natural flow of the Croton.§

LOCATION OF NEW AQUEDUCT DAM.

It is evident this dam must be on one of three general sites: 1st. It may be above the present dam. 2d. The present dam may be used or another built immediately below it so as to raise the level of the Croton lake. 3d. It may be on the river considerably below the existing Croton dam and embrace an additional drainage area to that which now supplies the city.

As to the first site, taking that chosen by the surveys of 1875 to be the most eligible for this locality. It is 5 68–100 miles above the entrance to the existing aqueduct. Here the topography of the country is such that it is not practicable to raise the dam sufficiently above the grade of the proposed aqueduct to make a reservoir which would store any considerable amount. A large area of country would be flooded merely to get water into the aqueduct, and large portions of this area would be shoal water.

The plans of 1875 contemplated a dam 30 feet higher than the present one, with no storage above the level required to keep the aqueduct full.

Those plans require 10.6 miles on Sawmill river route, and 13 98–100 miles on the Bronx to be in tunnel, and would increase the length of the aqueduct from its commencement on the Croton to the High Bridge 3 21–100 miles more than the present one, and nearly 10 miles more than the line located this year.

An aqueduct might be supplied from the level of the present lake, and about 1¾ miles above the present dam near Trout brook, and join the new line near the Pocantico river, making the length of conduit to High Bridge about 27¾ miles.

Take next the second site, near the present dam. It is regarded as impracticable to raise this dam, and the valley immediately below is not well adapted for another of much greater height. These plans moreover, would be inadequate without the construction of large storage reservoirs on the various branches of the Croton to secure a full supply of water for the aqueduct.

Take the third site; a considerable distance below the present dam. An examination of the Croton river below this point to the Hudson, pointed out an apparently favorable dam site near Quaker Bridge, about 4 50–100 miles below the Croton dam, provided a rock foundation could be found.

The geological characteristics of the valley and the sinking of pits led to making surveys for a dam at this place. The top water-line for the reservoir, or lake, as it would truly be, was run at 200 feet above mean tide, Croton grade. The present Croton lake is 166 17–100 feet above same datum. Calculations based upon these surveys show that the reservoir would contain over 32,000,000,000 of United States gallons of storage, above the level, necessary to supply an aqueduct capable of conveying about 250,000,000 per day to the city; or with a delivery of 200,000,000 per day (twice our present supply), the aqueduct would be supplied for 160 days without a gallon from the natural flow of the Croton. The existing storage in reservoirs and lakes is 9,000,000,000; the reservoir which will be begun in the spring, in order to place the full daily supply of 100,000,000, the full capacity of present aqueduct, beyond all doubt, and which is to contain about 5,000,000,000, would make the total storage nearly 46,000,000,000 of gallons; sufficient to keep up a daily supply of 200,000,000, for nearly 230 days without the natural flow of the Croton.

The great area, 3,635 acres, and great average depth of this new Croton lake would make it exceedingly valuable as a settling basin. The benefits of such a condition of the water supply can scarcely be overestimated, and hence the earnest efforts to take advantage of them.

The dam now proposed is a work that would have been considered, at the time of the construction of the present aqueduct, of too great magnitude to be undertaken. The remarkable progress of engineering since then makes such a structure the most advisable in this case. Successful works of the same character in France have given great satisfaction, and confirm fully the theories on this subject of Messrs. Montgolfier and Delocre, of France, and Professor Rankine, of England. The estimate of the cost of this dam has been based upon no untried principles, but upon those so ably advocated by the eminent engineers above mentioned, and so signally justified by actual experience.

It may here be mentioned that stone dams of nearly this height have existed in Spain for a long time, and have been proposed elsewhere. In fact, we find, that as far back as 1835, a dam 150 feet high was proposed near the mouth of the Croton, for an aqueduct to supply this city. That dam, however, as far as the existing plans show, was entirely different in character from the one now recommended, not being in accordance with the principles so successfully caried out in France. Besides, it did not provide for any important amount of storage above the level of top water in the aqueduct; whereas, the great value of the one now recommended consists in storage capacity, sufficient to furnish 200,000,000 gallons daily for 160 days. Without this capacity it would probably be much cheaper to draw the city's supply from the present Croton lake.

* See Report, App. "A."

† See Rain-fall and other tables in Appendix.

‡ The utmost safe capacity of present conduit is about 100,000,000.

§ Should the Croton basin ever prove inadequate to supply the city, it is possible that a supply may be obtained within the State of New York by crossing the Hudson by tunnel near Croton Point. When the time arrives this no doubt will be carefuly examined befo e it is finally decided to con-truct conduits f om other sour.es.

Area and Capacity of Proposed New Croton Lake near Quaker Bridge.

Elevation * above Mean Tide, Feet.	No. of Acres. †	Cubic Feet, Not Including Croton Lake.	U. S. Gallons, Not Including Croton Lake.
30	7	2,230,000	16,680,400
40	37	14,080,000	105,318,400
50	55	31,690,000	237,041,200
60	85	58,850,000	440,198,000
70	146	105,600,000	789,888,000
80	201	169,960,000	1,271,300,800
90	262	253,790,000	1,898,349,200
100	334	360,730,000	2,698,260,400
110	398	488,160,000	3,651,436,800
120	417	639,130,000	4,780,692,400
130	562	819,007,000	6,126,643,600
140	649	1,026,860,000	7,680,912,800
150	733	1,261,540,000	9,436,319,200
160	1,245	1,600,140,000	12,417,847,200
170	1,756	2,222,350,000	16,623,178,000
180	2,412	2,994,590,000	22,399,533,000
190	3,037	3,966,930,000	29,672,636,400
200	3,635	5,130,740,000	38,377,935,200

* Croton datum.
† The area of present Croton lake is include l after the level of present dam is reached.

Your predecessor, the Hon. Allan Campbell, an engineer of large experience, and who gave great attention to the water supply in his report of August 12, 1879, referring to the storage reservoirs laid down on the water-shed maps of 1857, says: "It is estimated that the average cost per million gallons of all reservoirs projected in the Croton basin will be $200," and in the same report, referring to the storage capacity required for the proposed aqueduct of 1857: "To supply another aqueduct with 15,000,000 daily, also on the basis of the driest years, additional storage to the amount of about 30,000,000,000 gallons must be provided," which would then make the cost of the necessary storage $6,000,000.

When it is remembered that the reservoirs projected in the Croton basin would flood for the most part fertile valleys, probably the best land in Putnam County, $200 per 1,000,000 gallons can hardly be considered too large an estimate for the total expense of all kinds necessary for impounding water. If a reservoir can be built on the site above pointed out and contain, as above stated, 32,000,000,000 of storage, the city can then afford to expend nearly $6,500,000 for such a work considered as a storage reservoir dam.

Owing to the sterile and rocky character of most of the land this reservoir will flood, as well as its vast dimensions as compared with the size of the dam, it is estimated as hereinafter stated that the total cost of the reservoir, including dam, will not be over $4,000,000.

But the storage it will contain is not the only advantage of a reservoir of this capacity, and located in this place.

1st. It saves nearly 10 miles in length of aqueduct over the location of dam made in 1875, and this saving would go far towards paying the whole cost of this reservoir.

2d. It is at the lowest end of the drainage of the Croton, and would collect water more rapidly and completely than other plans.

3d. It would add about 23 square miles to the area of the water-shed, equivalent to an average daily supply of from 15,000,000 to 20,000,000 of gallons.

4th. It would afford a settling basin of the grandest proportions; the loss would be much less from evaporation and other sources on account of greater average depth. It would avoid conveying the water through miles of rivers, brooks, and, in many cases swamps, before it reaches the aqueduct, while in very cold weather the supply from such sources might be wholly cut off by frost, as was the case (with the water from the storage reservoirs) in the winter of 1880–81.

The difference in the cost between a dam and land necessary to raise the water near Quaker bridge 142 feet above tide—which is the level necessary to fill the aqueduct—and what would be necessary to raise it 200 feet, is estimated to be about $2,000,000. Hence the cost of the storage for 32,000,000,000 would be about $60 per million of gallons, instead of $200, the cost per million by building on the sites far up in the Croton basin; or $2,000,000 instead of $6,400,000, for the same amount of storage, even if it could be collected in reservoirs higher up in the basin, as laid down on the Water-shed Map.

STORAGE.

The water-shed survey executed in 1857–58, as before stated, was made chiefly for the purpose of selecting the most available sites for storage reservoirs.

The following table contains a list of the sites then selected, together with other information of the utmost importance in studying this subject in order to reach a safe determination respecting the the quantity of storage that can be secured in the Croton water-shed by those reservoirs.

RESERVOIR SITES.

Table from Water-shed Map of 1857-58 *of Croton Basin above the present Croton Aqueduct Dam.*

Reservoir.	Area.	Capacity.	Drainage Area.	Extreme Depth of Dam.	Extreme Length of Dam.	Length of Reservoir.	Distance from Croton Dam.	Elevation above Mean Tide.
	Acres.	Gallons.	Sq. Miles.	Feet.	Feet.	Feet.	Miles.	Feet.
A	485.00	5,211,015,625	20.45	64	1,500	12,300	9.500	390
B	192.00	1,701,835,337	15.2000	55	1,700	6,000	12.750	500
C	730.00	6,589,101,562	13.7100	43	1,700	16,600	14.300	550
D	1,008.00	9,033,632,812	41.9500	48	770	21,000	20.250	500
E	303.00	3,369,206,857	20.3700	64	700	7,500	23.750	600
F	600.75	6,120,335,937	12.5100	20.90	1,560	10,600	15.500	560
G	452.19	4,861,035,156	20.9045	73	541	12,200	18.700	375
H	384.67	2,490,062,500	75.4574	40	545	14,748	19.390	375
I	449.00	4,205,820,654	70.5230	62	331	12,745	20.447	415
J	191.38	2,314,074,703	11.9171	69	1,311	11,616	28.710	500
K	512.74	5,671,449,219	78.9000	72	904	14,809	15.215	275
L	262.75	2,328,217,733	26.8600	74	757	13,120	16.539	295
M	492.25	4,392,131,445	23.3449	72	925	12,300	13.831	316
N	197.00	1,676,049,171	30.9620	60	686	8,650	7.708	250
O	239.47	2,182,337,109	17.3170	90	1,170	7,629	9.970	305

Entire drainage area of Croton Basin, 338 82-100 square miles.

The total drainage area of all these reservoirs foots up 480.30 square miles, while the entire area of the Croton basin is 338.82 square miles; this is because the computed drainage of some of the reservoirs overlaps that of others, which shows that the Croton Aqueduct Board did not contemplate that all of these sites could be made available as reservoirs to the extent indicated by this table.

The drainage of some of them is so small that in a dry year they probably would not fill; for example, reservoir F, which has a drainage area of but 12 51-100 square miles with a capacity of 6,120,000,000 gallons. An inspection of this map shows that if every one of these reservoirs were built they would not receive the drainage of over about 200 square miles, because they do not furnish storage for the waters of large areas for which reservoir sites have not been found. The total estimated capacity of these reservoirs is 62,000,000,000 of gallons; of this amount 8,230,000,000 is already secured by reservoirs E and G, which have been built, one at Boyd's Corners, the other on the middle branch of the Croton; this leaves 53,770,000,000 as the remaining storage, assuming the drainage to be adequate to fill the reservoirs. It has been estimated that to supply another aqueduct on the basis of the driest years, with 150,000,000 daily, additional storage to the extent of about 30,000,000,000 must be provided; but, as before stated, if all these reservoirs could be built they could only receive the drainage of about two-thirds of the Croton basin. The balance of the drainage above the quantity necessary to supply the conduits would find its way into the Hudson over the waste-weir of the dam if not secured near the mouth of the Croton. It is extremely doubtful if even 30,000,000,000 gallons could be secured beyond all peradventure by constructing storage reservoirs in the water-shed many miles above the entrace of the aqueduct. In short, the only way to secure the entire flow of the Croton in the driest years, is to have large storage capacity near the mouth of the river.

THE HOUSATONIC AS A FEEDER FOR NEW AQUEDUCT.

As stated in the quarterly report for August, 1879, surveys were made for diverting the waters of the Housatonic into the Croton water-shed as a feeder for a new and large aqueduct. The plan proposed for conveying this water to the Croton, in general terms, was mainly an open canal with a sectional area of 80 square feet, and an inclination of one foot to the mile, the calculated capacity being 100,000,000 gallons daily. The comparison of this plan of obtaining water for the new aqueduct with that of storage has been carefully studied in all its bearings.

The Housatonic is in Massachusetts and Connecticut, out of the authority of this State, which could, therefore, exercise no control over it, to prevent pollution, or enforce any regulations. The water would have to traverse about eighty miles with exposed surface before reaching the aqueduct, and in very cold weather there would be great danger of the supply being cut off or greatly diminished when the demand would be greatest.

This river is no doubt liable to the same fluctuations of volume as the Croton, and there is no probability that in a season of extreme drought 100,000,000 per day estimated could be obtained; but if it could, the damages to mill rights would doubtless swell the cost much beyond the estimate. It would be necessary not only to pay for all rights injured below the point of intake, but for preventing mill owners above from holding back water nights and Sundays during seasons of drought. The yield of the Croton basin averaged during August, 1878, 123,000,000 of gallons daily; in December, 1880, its average was but 33,000,000, showing a falling off of 73 per cent. This proportion applied to the Housatonic shows that it could not be relied upon to furnish more than 54,000,000 a day, because the available area of the Housatonic basin in only about double that of the Croton. If the lowest daily yield of the Croton be taken, now known to be only about 10,000,000, then the Housatonic could not be relied upon for more than about 20,000,000 daily.

The following table gives an estimate of storage required to supply conduits with 300 millions daily, supposing a year as dry as that of 1880, the driest yet known in the Croton basin.

For May	3,797,500,000	gallons.
For June	5,962,500,000	"
For July	6,130,560,000	"
For August	6,200,000,000	"
For September	6,000,000,000	"
For October	6,200,000,000	"
For November	5,820,000,000	"
For December	6,147,000,000	"
Drawn from storage reservoirs	8,530,000,000	"
	54,787,560,000	gallons.

Existing storage ponds and reservoirs	$9,000,000,000
Quaker Bridge reservoir	32,000,000,000
Reservoir I, to be built	5,000,000,000
Still required	9,000,000,000
	$55,000,000,000

If the difference in cost was in favor of the Housatonic plan, as compared with that of constructing storage reservoirs on the Croton, the disadvantages the former presents are so great as to be decisive against it.

HEAD OR LEVEL OF THE NEW SUPPLY IN NEW YORK CITY.

It is seen by the description of the Sawmill river and Bronx river plans, that the aqueduct proposed was to end near Jerome Park, 3 01-100 miles from High Bridge and 7 88-100 miles from the receiving reservoir in the Central Park. At Jerome Park there was to be constructed a receiving reservoir of 600,000,000 gallons capacity. The elevation of the new aqueduct at Jerome Park was to be thirty feet higher than the present one; but a small proportion of this increased head would be available in the circulation on Manhattan Island, because the water was to be conveyed from Jerome Park reservoir to High Bridge, and from thence under the Harlem river to the Central Park reservoir in cast-iron pipes 48 inches in diameter.

If ten lines of pipes of this diameter were laid for this purpose it is calculated that the loss of head or pressure from friction alone would be about twenty feet, when the aqueduct is discharging its full capacity, by the time the water reached the south side of Harlem river. As the main discharge would be into the Central Park reservoir, the pressure at which water could be delivered from that source would not be increased.

The new works, wholly independent of the Croton, now being constructed, to convey the waters of the Bronx and Byram rivers, will deliver water into reservoirs to be built at William's Bridge at an altitude of about 180 feet above tide, or about fifty feet higher than the present aqueduct, and the water which will be supplied from this source will suffice for the more elevated portions of the Twenty-third and Twenty-fourth Wards.*

No provision has been made in the Quaker bridge plans for additional storage reservoirs within the city limits. The principal function of such reservoirs is to keep a supply in the city in case it is necessary to shut off the aqueduct. Hence the necessity for storage at this end will not be increased by building another aqueduct.

Any important change, with the view of raising the level of the top water-line of the Central Park reservoir, would involve great expense, and could not in any event materially diminish the high service area necessary to be supplied by pumping.

THE AQUEDUCT.

Several lines have been run in order to get the best location for an aqueduct, as far as possible in rock tunnel, from the Quaker bridge reservoir to the High Bridge. A favorable line was found which measures 26½ miles to High Bridge, or only about 91-100 mile greater than an air line.

This line is remarkable for the comparatively small depth of the shafts necessary for constructing the tunnels, which is a matter of great importance, both with respect to the cost and time required to execute the work.

There would be required thirty-three shafts, averaging 101 feet in depth, between the entrance of the aqueduct and the High Bridge.

It is proposed to cross the Harlem river by a syphon, either tunnel through rock, or pipes laid on river bottom; to cross Manhattan valley by a similar syphon, and to build the rest of the aqueduct between the south side of Harlem and Central Park reservoir in tunnel wherever possible, the same as in Westchester county.

It is proposed to make the aqueduct a circle in sections lined with brick, twelve feet in diameter, and to have it leave Quaker bridge reservoir of New Croton lake at the level of about 142 feet above tide, thus permitting fifty-eight feet of storage to be drawn, and to discharge into the Central Park reservoir at 119 feet above the same datum.

Such a conduit would have the capacity to deliver about 250,000,000 of United States gallons daily when filled to within a few inches of the top.

I need hardly call attention to the great advantages a conduit in tunnel presents over any other mode; such a construction would be as imperishable as any structure can be, and it is no small matter that it would be removed as far as possible from the danger of injury by evil-doers.

In preparing plans and making estimates for this conduit, I have had the invaluable aid of unrestricted access to all the plans and other data connected with the construction of the Baltimore aqueduct tunnel from Gunpowder creek, kindly granted me by Robert K. Martin, the Chief Engineer of the work. As this tunnel is in rock, and of the same size and character as the one herein proposed, we have a safe guide for estimates of cost. While the Croton tunnels are considerably longer in the aggregate than the Gunpowder (Baltimore) tunnel, they would have shafts of much less average depth and could consequently be worked more rapidly and advantageously.

	Acres.
*Area of Twenty-third and Twenty-fourth Wards, New York City	12,317
Number of acres below 100 feet mean tide, Croton datum, to be supplied from aqueduct	8,352
Number of acres between 100 and 160 feet, to be supplied from Bronx	2,617
Number above 160 feet, to be supplied from Yonkers, or by pumping	1,348

TIME REQUIRED TO COMPLETE THE PROPOSED WORK.

The time required to construct the Baltimore tunnel may be taken as a guide in estimating the time necessary to complete the proposed Croton tunnels; as the drifts in the proposed work would be about the same length and through the same character of rock, while the shafts would be considerably less in depth, it can be executed in less time, other things being equal. Taking the most difficult section on the proposed line as the portion which would require the most time, and which would consequently govern the completion, it is estimated that the New York aqueduct can be constructed in three and a half years from time of commencement. It should be remembered that in tunnel construction the work would be carried on day and night, winter and summer.

It is more difficult to estimate the time which would be required to complete the dam; it would probably be found necessary to suspend the work during the winter, say from three to four months each year; but when this dam has reached the height of 135 feet above mean tide, or 119 feet above the ground, Croton datum, it can be made to supply the new conduit with about 100,000,000 gallons per day; it is probable, with a systematic prosecution of the work, it can be raised to this height in three and a half years, while a year and a half more would probably complete the work to the full height.*

The estimated cost of the proposed aqueduct from Quaker bridge reservoir to the receiving reservoir in the Central Park is $10,000,000. As before stated, in making these estimates, I have had the aid of the experience gained in the construction of the Baltimore tunnel; the above estimate being based largely on that data, and on liberal prices for both labor and materials, it is believed that it may confidently be taken as the amount within which the work can be done.

The proposed dam would be constructed wholly of masonry; were it not for the contingencies which may arise in securing a proper foundation, a very close estimate could be made of its cost. This being the case, and with the knowledge of the ground obtained by over one hundred test pits and explorations with diamond drills, I have estimated an amount for the dam and reservoir hereinbefore described which should place it beyond contingencies. The estimate for the dam and reservoir is $4,000,000,† which, added to the estimate for the aqueduct, would make the cost of the new water supply $14,000,000. The details of these estimates are ready for your inspection.

I estimated early last summer that an aqueduct of 150,000,000 daily supply, with the necessary storage capacity, could be built for $12,000,000; subsequent examination has shown that such a work could be constructed for less than that amount. But increasing the size of conduit to convey 250,000,000 per day, instead of 150,000,000, the total cost was augmented somewhat over $2,000,000; the excess in cost was considered small to expend for an additional daily supply of 100,000,000 of gallons.

With such an aqueduct in use and with pipes already laid, it is safe to say that the head (or pressure) which existed when the Croton water was introduced would be again enjoyed, provided the waste does not exceed the present amount. It is expected that the Department will be able to diminish the waste.

* The Furens dam in France, 164 feet high, was completed its full height in four years.
† Should the dam, owing to unexpected difficulties in the foundation, cost one, or even three millions more than the estimate, the Quaker Bridge plan would still retain its decided superiority.

The following tables give the comparative cost and other particulars of the three plans mentioned in this report:

Table of Comparison of the Plans which have been proposed for an Aqueduct from the Croton Basin; with Extension from High Bridge to Central Park Reservoir.

	Quaker Bridge, 1881 Plan.	Sawmill River. 1875 Plan.	Bronx River. 1875 Plan.
1. Total length, miles	31.35	*42.31	*41.17
2. Capacity in million gallons daily	250	150	150
3. Total storage provided by plan in Croton basin, with dams just high enough to fill aqueduct, million gallons daily	.....	.....	.....
4. The same with dams, full height proposed, millions of gallons	32,000	.....	.....
5. Total cost including no provision for storage	† $12,000,000	‡ $13,093,414	‡ $13,719,529
6. Total cost including provision for 32,000,000,000 storage	14,000,000	§ 19,493,414	§ 20,119,529
7. Cost of providing 32,000,000,000 gallons storage in Croton basin	2,000,000	6,400,000	6,400,000
8. Area of new lake including present Croton lake, acres	3,635	1,200	1,200

* From profiles.
† Estimate for aqueduct to High Bridge $10,000,000, for dam without storage, $2,000,000 (see page 41) =$12,000,000.
‡ Estimate in Appendix "A" added to Mr. G. W. Birdsall's estimate (Appendix "B") for conveying the water to Central Park reservoir, by the plans contemplated in 1875.
§ The same as No. 5, with $6,400,000 for storage added.

Table of Comparison of the Plans which have been proposed for an Aqueduct from Croton Basin, terminating at High Bridge.

	Quaker Bridge Plan, 1881.	Sawmill River Plan, 1875.	Bronx River Plan, 1875.
1. Total length from the Croton to High Bridge, miles	26.51	36.52	36.08
2. Capacity, U. S. gallons in 24 hours, millions	250	150	150
3. Total cost with no additional storage	$10,000,000	* $9,191,989	* $9,818,104
4. Total cost with 32,000,000,000 additional storage in Croton basin	† 12,000,000	‡ 15,591,989	‡ 16,218,104
5. Cost per million of gallons of supply obtained, including 32,000,000,000 additional storage in Croton basin	48,000	103,946	108,121

* See estimate in Appendix "A."
† Estimating increase in height of dam for storage to be $2,000,000, see page 13.
‡ Adding cost of 32,000,000,000 storage at $200 per million.

A large amount of field and office work has been accomplished during the season, among other things, the flow-line of Quaker bridge reservoir, 78 miles, and 21¾ miles of cross section lines have been run; over 100 miles have been run in Westchester Chounty. A great deal of detail survey has been done to determine the proposed dam site, besides other surveys of a simimilar character; 78 borings to rock have been made in Harlem river above High Bridge. The data obtained from the U. S. Geodetic and Coast Survey has been a valuable aid in topographical work along the line of proposed aqueduct. We have had the advantage of the trigonometrical points and the detail surveys made under the late Professor Bache by the officers of the Coast Survey. Over 100 test pits have been put down on the proposed dam site, and two diamond drills are accomplishing good results in the bed of the Croton.

I have studied the entire subject with the aid of E. S. Chesbrough, Consulting Engineer. B. S. Church, Resident Engineer, from his long experience with the existing works has rendered valuable aid. The topographical work has been under the immediate charge of John Mechan, formerly of U. S. Coast Survey.

I am indebted to J. W. Adams for assistance in making up the estimates, as well as details of plans of aqueduct on which they were based.

Very respectfully submitted,
ISAAC NEWTON, Chief Engineer.

NEW YORK, January 31, 1882.

ISAAC NEWTON, Esq., *Chief Engineer Croton Aqueduct:*

DEAR SIR—I concur with you in the views and recommendations of your report on the proposed additional supply of water for this city.

E. S. CHESBROUGH, Consulting Engineer.

APPENDIX.

OPINION OF JOHN B. JERVIS, ESQ., CONSTRUCTOR OF THE CROTON AQUEDUCT.*

ROME, N. Y., January 13, 1882.

To ISAAC NEWTON, *Esq., Chief Engineer Croton Aqueduct, New York:*

DEAR SIR—I acknowledged your favor of the 10th December, 1881, also that of December 26, 1881. In the mean time I visited your office in New York, and obtained a knowledge of the general features of the plans and estimates of the proposed improvements for the supply of New York City with water. After full consultation with yourself and your Consulting Engineer, I now propose to reply to the questions you have propounded to me.

FIRST QUESTION.—*As to the Necessity of an Additional Supply of Water.*

As to this question, it does not appear necessary to go much into detail. For several years, instead of adding to the supply as population increased, the overstrained capacity of the present aqueduct has been the same, and no addition has been practicable to the supply needed for the largely increased population.

A serious failure in the present aqueduct, which has been a source of anxiety for several years, may arrest its functions.

New York has a very large shipping interest, that needs much water; since the introduction of the Croton, her manufactures have largely increased; she is reported now the largest manufacturing city in the United States.

The present population is too large to depend for its current supply of water on one aqueduct. Without further discussion of this question, I have no doubt that the important interests of the city demand an additional conduit.

SECOND QUESTION.—*Source of Supply.*

I noticed by the reports you gave me that surveys have been made, establishing the practicability of obtaining the supply from the Housatonic river in Massachusetts and Connecticut. Whatever feasibility there may be of drawing from this or any other source, it appears to me better that it should be held in reserve until the supply from the Croton valley is exhausted.

THIRD QUESTION.—*Position of Reservoirs for Storage—Importance of having them Large and well down the Stream.*

No doubt, large reservoirs are to be preferred, and the nearer the lower end of the valley, the more effectual will they be to secure the whole drainage of the basin. The securing of large reservoir sites, instead of several small ones, is decidedly important in securing pure water. The high dam at the lower end of the valley certainly provides for the most efficient method of securing the entire drainage of the Croton valley.

FOURTH QUESTION.—*Practicability of a High Stone Dam—Its Safety—Precautions to be observed; Means of Passing Flood Water during Construction of the Foundation—Height of Main Dam above Flow-line—Length of Waste-weir and Height of Water to be permitted above Flow-line during and after Greatest Storms.*

As to general practicability, I have no doubt; but it will be a high dam, so far as can now be judged, about 230 feet above rock bottom, or 180 feet above surface of ground. You may require to go lower to secure a rock foundation for the highest part; your soundings not being complete, I do not think you will have to go materially lower than now appears probable.

There will be no difficulty in making a wall of hydraulic masonry sufficient to sustain it against the power of the water above from overthrowing it.

The main question will be the power of the material to resist the crushing force of this weight. I think you will have no difficulty in obtaining stone in the vicinity of the location that will sustain the pressure. Good brick will bear near four times the weight without crushing. I have no hesitation in expressing the opinion that the Ulster cement, with clean sand, will make mortar and concrete sufficient for this work. If you can find cement that is stronger, it will be prudent to use it in the lower section of the dam.

Means of Passing Floods during Construction.

The floods of the river will, no doubt, embarrass the work of construction, and as this will be a work of years, the precautions should be very efficient. Such a work cannot be executed without many contingent embarrassments, and you will find occasion for the most vigilant assiduity and your best professional judgment will be demanded.

The Height of Dam above Flow-line—Length of Waste-weir and Height above Flow in Floods.

The old dam has a waste-weir of 270 feet. In about 40 years since its construction, no flood has been reported, except in one instance, of a rise of 8 feet above the crest of the dam.

If I understand the location, and I have no doubt it was well explained to me, the facilities for a waste-weir in the proposed dam are very good. Its position will be in the subsidiary dam that is required north of the main dam, where the waste-weir and the channel from it will be in solid rock.

FIFTH QUESTION.—*Conduit in the Tunnel as much as possible, instead of an Embankment or in slight Excavations.*

There can be no question that a conduit in a tunnel through solid rock will be more safe, and require less repair than one on any kind of filling or in light cuttings.

In some cases the cost of filling in low grounds would be greater than that of tunnel in sound rock.

SIXTH QUESTION.—*Difference in Cost of Conduit, of, say, 150.000,000 daily and one of, say, 200,000,000 to 250,000,000 not Equal to the Value of the Increased Capacity.*

It would require more calculations than I am now able to make, to determine what the difference of value may be. There is, however, no doubt the large conduit will be less expensive, as compared to capacity, than the smaller one.

SEVENTH QUESTION.—*Level of Central Park Reservoir to be Maintained in New Works, but General Head throughout the City to be greatly improved by Additional Supply, probably without New Mains at first.*

The new aqueduct will greatly improve the facility for keeping full head in the city reservoirs, and consequently maintain more efficiency on the pressure in the distribution pipes. Whether an increase of the city mains may be found necessary, will depend on the experience of the effect of a full head in the reservoirs.

EIGHTH QUESTION.—*Danger to a City of the Importance and Magnitude of New York, of depending wholly on one Aqueduct.*

As to the propriety of a second aqueduct there can be no doubt.

Finally, I would say:

1st. The dam you propose is practicable.

2d. That it is the best, and, in fact, the only plan that can secure the whole source of the Croton valley for the supply of its waters to the City of New York.

3d. Furnishing, as it does, a reservoir of large capacity, it provides a supply of water of the purest condition practicable.

4th. Though there will be more or less embarrassment from the floods of the river during construction, there is no reason to doubt they may be successfully overcome by the engineering skill you will be able to exercise on this subject.

5th. As to line and plan of aqueduct you propose, I see nothing to suggest. Your view of this I regard as well taken.

When the dam is carried to the height of the gate chamber, you can occupy the new aqueduct, should it be ready. This you will see.

With sincere wishes for your success in the construction of this rather bold, but eminently important and, as I believe, quite practicable work, I submit this paper.

Very respectfully,

JOHN B. JERVIS, Consulting Engineer.

OPINION OF JAMES B. FRANCIS, ESQ., PRESIDENT OF AMERICAN SOCIETY OF CIVIL ENGINEERS.

ISAAC NEWTON, Esq., *Chief Engineer of Croton Aqueduct:*

DEAR SIR—In reply to your communication of the 10th instant, requesting my opinion of the advisability of obtaining an additional supply of water for the City of New York, by the plan you describe, I have to say that, in addition to the brief description in your communication, I have been informed verbally by yourself and Mr. E. S. Chesbrough more fully on the subject; have read various printed reports and documents relating to the general subject of the water supply of the city; examined the maps, plans, and profiles of proposed plans in your office, and have made a personal examination of the site of some of the proposed works.

From information gathered as above, I beg leave to offer the following remarks on the several parts of the plan described by you:

1st. To go to the Croton water-shed for the additional supply.

Every year there is a waste of water from the water-shed much greater than the quantity now supplied to the city.

This can be made available, to a great extent, by additional storage reservoirs of sufficient capacity.

The alternative is to divert a supply from the Housatonic river by means of a canal and tunnel into the Croton valley, estimated to cost, with the damages to the mill property on the river, about $2,500,000.

The canal provided for in the estimate I consider quite insufficient to provide for the obstruction to the flow from ice. I should recommend it to be made of much greater depth than proposed, with walled sides, instead of earth slopes, for at least part of the depth. As the canal would be about 30 miles long, this would add largely to the cost. I also consider the estimate of damages to the mill property much too low.

The Housatonic river being in another State would be, as you suggest, a very serious objection.

Your estimate of the cost of sufficient storage on the Croton river is $4,000,000. The cost of the Housatonic plan, in my judgment, would not be very much less than this.

There being no great saving in cost, the want of jurisdiction, to my mind, points decidedly to the Croton water-shed as being the proper source of supply.

2d. "To build a masonry dam on the bed rock near Quaker bridge on the Croton, about 4½ miles below the present dam, and thereby raise the water level to 200 feet above tide."

3d. "This reservoir thus made, to contain about 32,000,000,000 gallons of storage above the line which will keep water 11′ 5″ deep in an aqueduct 12 feet diameter."

This dam would be nearly 200 feet high in the highest part, and would be a work of great magnitude, but I think entirely practicable, and as it would include a larger water-shed than reservoirs higher up the river, and create an available storage capacity of 32,000,000,000 of gallons at an estimated cost of $4,000,000, or at the rate of $125* per million gallons, it would appear to be the most economical mode of obtaining storage in the Croton water-shed.

In the report of the Commissioner of Public Works for the quarter ending June 30, 1879, "it is estimated that the average cost per million gallons, of all the reservoirs projected in the Croton basin, will be $200."

A point to be considered in a reservoir of this elevation and magnitude, is the probable loss from percolation, elsewhere than at the dam; the geological formation appears to be very favorable in this respect, but I think there would be some loss. I should expect, however, that the additional water-shed, which would be obtained at the proposed site, over that at the site of the present dam, would fully compensate for this loss.

4th. "To run the aqueduct from the dam to High Bridge as far as possible in tunnel, and to avoid embankments whenever possible."

The experience with the present Croton aqueduct is so clearly and distinctly in favor of avoiding embankments, and constructing either in tunnel or open cutting, that I do not see that anything more need be said on that point.

5th. "To cross the Harlem river by a syphon, either tunnel through rock or pipes laid on river bottom; to cross Manhattan valley by a similar syphon, and to build the rest of the aqueduct between High Bridge and the Central Park reservoir in tunnel wherever possible."

6th. "To raise the gate-house at the present dam to suit the new water level, and to thoroughly strengthen the present aqueduct between this and the new dam.

7th. "When the new aqueduct is completed to rebuild those portions of the present structure on embankment where it has shown signs of weakness."

I am not sufficiently familiar with the localities to express an opinion on all these points.

Crossing the Harlem river by a high bridge I think should be avoided if possible, as being too much exposed to injury. Either of the modes you suggest would be far better in this respect, and I have no doubt much less expensive.

The thorough repair of the present aqueduct as soon as the new one is in successful operation, is no more than ordinary prudence would require.

Comparing the several plans to which you have called my attention:

New aqueduct on the Sawmill river route with a new dam across the Croton river, one-quarter of a mile above the head of Croton lake; length from dam to High Bridge 36.52 miles, 10.06 miles being in tunnel; the supply to be derived from new reservoirs in the Croton basin:

Estimate of cost of conduit and pipe work	$8,700,000 00
Cost of 32,000,000,000 gallons of storage capacity at $200	6,400,000 00
	$15,100,000 00

New aqueduct on the Sawmill river route with new dam as above; the supply to be derived from the Housatonic river:

Conduit and pipe work as above	$8,700,000 00
Estimate of cost of supply from the Housatonic, as per report of the Commissioner of Public Works for the quarter ending June 30, 1879, $2,500,000; as stated above, I consider this too low, for the present purpose say	3,500,000 00
	$12,200,000 00

By the plan you propose, called the Quaker bridge plan, the estimate is as follows, the estimate for the conduit for comparison with the other plans, being for a capacity of 150,000,000 of gallons per day, the same as for the preceding, requiring a conduit of not more than ten feet in diameter:

Dam and land damages for reservoir	$4,000,000 00
27 miles of conduit	8,028,000 00
	$12,028,000 00

In view of the great objection of deriving the supply from a source not within the jurisdiction of the State of New York, I think the choice would lay between the two plans deriving the supply from the Croton water-shed.

By the above estimates the cost would be much less by the plan you propose than by the Sawmill river plan, and I see no advantage that the latter plan would have to compensate for its increased cost; of the three plans considered as above, I have no hesitation in recommending the Quaker bridge plan as being the most advisable one to adopt.

Very respectfully,

JAMES B. FRANCIS.

LOWELL, MASS., December 30, 1881.

*This includes the cost of dam to full height.

OPINION OF ROBERT K. MARTIN, CHIEF ENGINEER (NEW) BALTIMORE WATER SUPPLY.

BALTIMORE WATER DEPARTMENT,
CHIEF ENGINEER'S OFFICE, CITY HALL,
December 30, 1881.

ISAAC NEWTON, *Esq., Chief Engineer, Croton Aqueduct:*

SIR—I had the honor to receive from you a communication, dated December 14, 1881, containing your conclusions upon an additional water supply for New York City.

Having examined the maps, plans, profiles, and reports relating to the matter, and after having made a personal inspection of the site of the proposed dam near Quaker bridge, and a careful study of the subject, I beg leave to present the following report:

By reference to a "table showing waste of water over the Croton dam," it will be seen that a large amount of water annually goes to waste in the Croton water-shed.

This waste, if stored, would be more than enough for your present wants, and will be sufficient in the future, for a largely increased consumption.

Again, the Croton water-shed is the nearest large supply to your point of delivery.

These facts influence me in saying that the most available source from which to obtain an additional water supply is the Croton water-shed.

In order to store the water of the Croton water-shed, you propose building a masonry dam on bed rock near Quaker bridge, 4½ miles below the present Croton dam, and thereby raise the water level in the Croton basin to 200 feet above tide, which will give a storage capacity of about 32,000,000,000 gallons.

In my opinion a dam of such a height as you propose should be of masonry laid in hydraulic mortar, which, in the hands of competent engineers, I believe to be entirely practicable. My own views are fully sustained by the experience of French engineers, with similar dams, of nearly the same height.

You propose to build an aqueduct from the dam at Quaker bridge to High Bridge, as far as possible in tunnel, and to avoid embankments wherever possible.

And aqueduct is the main artery of a water supply, and should be located where it will be safe and give the least trouble in the future.

In my opinion, the best location for an aqueduct is in tunnel, where practicable.

The form of an aqueduct that I would recommend should be circular, the diameter sufficient to preclude the possibility in the future of wishing that it had been larger.

*Condensed by Mr. Jervis from his longer report.

Harlem river and Manhattan valley can be crossed either with a tunnel or by pipes, laid on the river bottom, or beneath the surface.

There can be no difficulty in the raising of the gate-house, at the present Croton dam, to suit the higher water-level, and also strengthen the present aqueduct between the present Croton dam and the proposed new dam.

After your new aqueduct is completed, you can rebuild those portions of the present aqueduct, or embankment, where it has shown signs of weakness.

I consider that no large city should be dependent on a single aqueduct for its water supply.

Your plan of constructing a large storage supply at Quaker bridge is preferable to the building of storage reservoirs in the upper Croton basin.

These storage reservoirs, in the upper Croton basin, can be availed of in the future, when the storage at Quaker bridge becomes inadequate. The Housatonic plan, as a source of supply in place of storage, has objections. It is located in an adjoining State, where it will be difficult to exercise control over pollutions, or enforce regulations.

Furnishing a city with pure water through an open canal, at all seasons of the year, and guarding every avenue of pollution along its line, is a serious problem.

Is it not possible that the Housatonic will be subjected to the same diminution of flow as the Croton during a drought, and may you not, eventually, have to resort to storage, to keep up this supply?

After a careful study of the whole subject, I feel confident that the plan recommended by you is not only advisable, but the proper one for an additional supply of water for New York City.

Respectfully submitted,

ROBERT K. MARTIN, *Chief Engineer*.

"A"

REPORT ON SAWMILL RIVER AND BRONX RIVER PLANS.

DEPARTMENT OF PUBLIC WORKS,
ENGINEER'S OFFICE, CITY HALL,
NEW YORK CITY, January 3, 1876.

Hon. FITZ JOHN PORTER, *Commissioner of Public Works:*

SIR—In compliance with your instructions, two surveying parties were organized under Mr. Charles J. McAlpine and Mr. Horace Loomis, to ascertain the best route for another aqueduct between the Croton river and the Harlem river, at High Bridge.

These parties were placed under the charge of Mr. Thomas A. Emmett, who for the last four years has had chargeof the reservoirs in the Croton valley, and whose report of the surveys and the estimated cost of the new aqueduct is hereto annexed. A careful examination of the Croton river was made, showing the most favorable place for another dam was about a quarter of a mile above the head of the Croton lake, and just below the mouth of the Muscoot river. It is at this point proposed to raise a dam thirty feet above the lip of the present dam, which will form a reservoir and settling basin covering about 800 acres, and will be about seven miles in length and hold about 1,180,000,000 gallons.

Surveys for the aqueduct were made across the divide to the head waters of the Bronx, and down that valley, and also further to the west to the Pocantico and Sawmill rivers.

The length of the aqueduct from the reservoir to the High Bridge, on the Bronx river route, will be 36.08 miles, and by the Sawmill river route 36.52 miles.

The aqueduct will start from the Croton river with an elevation of thirty (30) feet above the present aqueduct, and descend on a grade 12.67 inches per mile to the vicinity of Jerome Park, at which point the high grounds fall away so far as to render the continuance of the aqueduct of masonry expensive and objectionable.

It is here proposed to construct a reservoir, and from this point carry the water in cast-iron pipes. The water in the reservoir will stand forty-two (42) feet above that of the waters in the reservoirs in the Central Park.

The estimate is based on an aqueduct of sufficient capacity to carry 150,000,000 gallons per day, which, with the present aqueduct carrying 100,000,000, will give a daily supply of 250,000,000 gallons.

The drainage area of the Croton basin, above the Croton dam, is 338 square miles.

In the report of the Croton Aqueduct Board, made to the Common Council in 1863, they estimate the daily flow of the Croton river at 338,832,128 gallons.

Mr. Tracy, late Chief Engineer of the Croton Aqueduct, in his report in May, 1873, says: "For many years past the Department has kept a gauge of the daily quantity of water flowing over the Croton dam, in addition to that which is conveyed to the city by the aqueduct, and during the past ten years an average daily quantity of 340,000,000 gallons has run to waste over the dam, in addition to the quantity that was brought to the city."

Professor Chandler, President of the Board of Health, who has made the Croton a special study, says of it: "We have an available supply of 387,000,000 gallons." Of the purity of the Croton water he says: "The character of the Croton water-shed is of a nature to guarantee water of the best quality. Mountains and hills of Laurentian gneiss receive the rain-fall, which is quickly absorbed and filtered by the pure siliceous sands and gravels, to gush out in numberless springs, feeding the brooks which bear the sparkling waters to the ponds and reservoirs. From these flow the large streams which, by uniting, form the Croton river. This is finally expanded by the dam at the head of the aqueduct, into a broad, deep lake, the fountain reservoir, or Croton lake, in which the quiet waters deposit the finer sediments and thus undergo a final purification before they are admitted to the aqueduct. Nowhere along the streams can anything be found which can render the waters impure. Rugged rocks or bright green pastures generally border them. At certain seasons of the year, as when the snows melt in the spring, and the waters scour the still frozen earth, the water is often discolored when it reaches the city, and alarmists begin to discuss the danger to be apprehended from the poisons and miasmata which are derived from the bogs and morasses of Westchester County and Putnam County. But we have never been able to trace any sickness whatever to such sources, and do not believe that any unwholesome impurities ever occur in our water. The purity of the Croton water is remarkable."*

The present aqueduct is now bringing into the city daily all the water that it can carry with safety, and it is necessary that steps be taken at once to bring in an additional supply.

The importance of a full supply is too great to be dependent upon one aqueduct, and another should be built entirely away from and independent of the present, that in case of accident to one the other may not be affected by it. It is now impossible to keep the water out of the present aqueduct sufficient time to make the thorough repairs to it that it requires. Had we another aqueduct, the water could be drawn from it for such time as may be necessary to thoroughly repair it, when it could be made fully as good as when the Croton water was first brought through it in 1842.

In order to keep the supply necessary for the city until another aqueduct is built, meters will be required on all places where extra water is used to stop the waste, and every effort made to stop the waste in private houses. By such exertions the demand may be kept down to the present supply until such a time as another aqueduct can be built. Work on the present aqueduct was commenced in the fall of 1837, and the water brought through it and let into the reservoirs at Eighty-sixth street, in July, 1842.

The present facilities for excavating rock with steam drills will expedite work, but it will not be safe to expect the completion of the work and passage of water through it in less than three years after the work shall be placed under contract.

The quantities of work in the estimate for the new aqueduct are full and the prices such as the work can be done for.

Very respectfully, your obedient servant,

JOHN C. CAMPBELL, Chief Engineer.

DEPARTMENT OF PUBLIC WORKS,
ENGINEER'S OFFICE, CARMEL, PUTNAM COUNTY,
NEW YORK, December 20, 1875.

JOHN C. CAMPBELL, Esq., *Chief Engineer:*

SIR—I herewith submit a report of operations in the field (together with profile and estimates) of the engineering parties who have been engaged in making surveys for a new aqueduct from the Croton to the Harlem river. The map is not quite completed, but will be sent to you in a few days.

The first party, under the charge of Mr. Charles L. McAlpine, began work on the 20th of August, locating the site for a dam across the Croton river one-quarter of a mile above the head of Croton lake, and establishing a flow-line for a new lake or settling basin 30 feet higher than the lip of the present Croton dam. From the point where the dam was located a line was run down the east bank of the Croton lake on a descending grade of 0.020 per 100 feet, or 1 56-100 feet per mile, which grade was continued to the end of the line. Leaving Croton lake at the mouth of the Kisco river, the line follows up that stream to the summit between it and the Bronx river, and down the Bronx to the end of the route. The length of this route to High Bridge is 36 8-100 miles, of which 13 98-100 miles is tunnel, 19 9-100 miles in open cuts and embankments, and 3 1-100 miles in cast-iron pipes to the High Bridge over the Harlem river.

The second party under the charge of Mr. Horace Loomis, began on the 6th of September, at a point on Mr. McAlpine's line on the north bank of Kisco river, near its mouth, and crossing that river continued down Croton lake to a small stream called Trout or Van Cortland brook, and followed it to the summit or head waters of the Pocantico river; following down that stream four and a half miles, and thence across to Sawmill river valley, which was followed for twelve and a quarter miles, thence crossing the ridge to the valley of Tibbet's brook. In the valley of Tibbet's brook the line runs about three miles alongside of the present aqueduct, varying in distance from fifty to one hundred feet to the east of it, and on ground from thirty to forty feet higher. From where it leaves the aqueduct the line runs west of Woodlawn Cemetery and thence on high ground to its junction with Mr. McAlpine's line. The length of this route from the dam at High Bridge is 36 52-100 miles, of which 10 6-100 miles is tunnel, 23 45-100 miles is open cuts and embankments, and 3 1-100 miles in pipes.

For the lake above the dam two flow-lines were run, one of them thirty feet and the other twenty-five feet above the lip of Croton dam. The area of land covered by the upper flow-line will be 860 acres, and the capacity is estimated at 1,180,000,000 of gallons. The lower flow-line will cover an area of 614 acres, and will contain about 765,000,000 of gallons. The upper flow-line covers the track of the Lake Mahopac branch of the Harlem Railroad, from one to six feet in depth, for a distance of 1,300 feet, and the lower flow-line for a distance of 400 feet nearly touches the track, the deepest place being one foot. The water by the upper flow-line will also cover about four feet above the lower chord of the railroad bridge across the Croton river, the track being laid on the upper one.

Two points were examined for receiving reservoirs in the vicinity of Jerome Park, one containing 65 acres, with a capacity of about 600,000,000 of gallons, the other containing about 60 acres, with a capacity of about 550,000,000 of gallons.

In making these surveys the country has been carefully examined, and lines run through every gap or opening that was found between the Bronx river and Pocantico river, and the Bronx river line, which runs from the summit along the head waters of Sawmill river to Unionville, is connected with the Sawmill river line a short distance below that place. In crossing Sprain Brook, on the Bronx river route, the estimate is for carrying the water across that valley in cast-iron pipes. The inside area of the proposed aqueduct is 75 32-100 feet.

Estimates are made on the Bronx river and Sawmill river routes as being the most direct and presenting the fewest obstacles to the construction of an aqueduct, and I think the estimates annexed to this report will fully cover the cost.

I am indebted to Messrs. McAlpine and Loomis, and the young men under them, for their careful and skillful prosecution of the surveys, and their promptness and dispatch in making up the estimates and profiles.

Respectfully submitted,

THOMAS A. EMMETT, Assistant Engineer in Charge.

ESTIMATES ON SAW MILL AND BRONX RIVER PLANS ACCOMPANYING ABOVE REPORT.

Estimate for Lake and Dam at head of New Aqueduct.

860	acres of land, including buildings	$300,000 00
	Clearing and grubbing	5,000 00
8,500	cubic yards of earth excavation, at 25c	2,125 00
24,000	" rock excavation, at $1.25	30,000 00
2,000	" tunnel cutting in rock, at $6	12,000 00
90,000	" embankment, at 50c	45,000 00
500	" concrete masonry, at $6	3,000 00
4,500	" rubble masonry, at $5	22,500 00
200	" brick masonry, at $12	2,400 00
2,000	" cut-stone masonry, at $25	50,000 00
Gate-houses, gates, screens, etc		30,000 00
Making new road, raising railroad bank, and bridge		30,000 00
		$532,025 00

Estimate for New Aqueduct on Saw Mill River route, from Dam to High Bridge 36 52-100 *miles, of which* 10 06-100 *miles is in Tunnel,* 23 45-100 *miles in Open Cut, etc., and* 3 01-100 *miles by Pipes.*

300	acres of land for right of way, at $500		$150,000 00
	Clearing and grubbing		5,000 00
660,000	cubic yards of earth excavation, at 30c		198,000 00
130,000	" rock excavation, at $1.50		195,000 00
254,000	" tunnel cutting in rock, at $6		1,524,000 00
200,000	" embankment, at 30c		60,000 00
75,000	" foundation wall, at $2.25		168,750 00
65,000	" protection wall, at $2.25		146,250 00
41,000	" concrete masonry, at $6		246,000 00
253,400	" rubble masonry, at $6		1,520,400 00
130,300	" brick masonry, at $10		1,303,000 00
6,750	" hammer-dressed masonry, at $15		101,250 00
	3 miles of new roads		30,000 00
			$5,645,650 00
	3 01-100 miles of 48-inch pipes (six lines), at $132 per foot		2,097,850 00
	Gate-house		30,000 00
	Estimate of dam		532,025 00
	60 acres of land, at $2,000 per acre	$120,000 00	
350,000	cubic yards of earth excavation, at 25c	87,500 00	
105,000	" rock excavation, at $1.25	131,250 00	
120,000	" embankment, at 30c	36,000 00	
12,000	" puddle, at $1	12,000 00	
6,000	" slope wall, at $2	12,000 00	
Gate-houses, gates, etc		50,000 00	
			$448,750 00
			$8,754,275 00
Add for superintendence and contingencies			437,714 00
			$9,191,989 00

Estimate for New Aqueduct on Bronx River Route, from Dam to High Bridge, 36 08-100 *miles, of which* 13 98-100 *miles is in Tunnel,* 19 09-100 *miles in Open Cuts, etc., and* 3 01-100 *miles by Pipes.*

300	acres of land for right of way, at $500		$150,000 00
	Clearing and grubbing		5,000 00
350,000	cubic yards of earth excavation, at 30c		105,000 00
230,000	" rock excavation, $1.50		345,000 00
360,000	" tunnel cutting in rock, at $6		2,160,000 00
100,000	" embankment, at 30c		30,000 00
55,000	" foundation wall, at $2.25		123,750 00
50,000	" protection wall, at $2.25		112,500 00
28,000	" concrete masonry, at $6		168,000 00
203,400	" rubble masonry, at $6		1,220,400 00
113,300	" brick masonry, at $11		1,246,300 00
8,000	" hammer-dressed masonry, at $15		120,000 00
	2 gate-houses, etc., at Sprain brook		40,000 00
18,000	lineal feet of 48-inch pipe, at $22		396,000 00
			$6,241,950 00
	3 01-100 miles of 48-inch pipes (6 lines), at $132 per foot		2,097,850 00
	Gate-house		30,000 00
	Estimate of dam		532,025 00

Reservoir near Jerome Park.

	60 acres of land, at $2,000 per acre	$120,000 00	
350,000	cubic yards of earth excavation, at 25c	87,500 00	
105,000	" rock excavation, at $1.25	131,250 00	
120,000	" embankment, at 30c	36,000 00	
12,000	" puddle, at $1	12,000 00	
6,000	" slope wall, at $2	12,000 00	
Gate-houses, gates, etc		500,0000	
			448,750 00
			$9,350,575 00
Add for superintendence and contingencies			467,529 00
			$9,818,104 00

* From report of Croton Aqueduct Board, 1863.

EXTRACT FROM REPORT OF THE CROTON AQUEDUCT BOARD, MADE JANUARY 5, 1863, TO THE COMMON COUNCIL.

With an aggregate annual precipitation of rain and snow of 42 inches vertical height, which is about the average for many years past, the quantity falling upon the Croton basin, tributary to our works, it is equal to an average of 667,674,257 gallons per day.

Judging from experiments made in other localities, the physical and geological features of which, while resembling the Croton basin to some degree, are less favorable as a whole, the loss from evaporation, vegetation, and such absorption as does not subsequently reappear in springs, may be put down as equal to 14 inches vertical height of the total annual rain-fall. Make a further deduction equivalent to one-sixth of the entire annual rain-fall, to cover loss by evaporation and filtration from storage reservoirs, and we find that a quantity equal to an average of 338,832,128 gallons per yad would find its way to Croton dam and the inlet of our aqueduct.

Were it necessary to use the entire yield of the Croton basin, a great portion, if not the whole of this quantity, could, by a proper system of storage reservoirs, be saved and made available.

"B."

ESTIMATE OF MR. G. W. BIRDSALL, FIRST ASSISTANT ENGINEER, FOR CONVEYING WATER FROM TERMINATION OF SURVEYS OF SAW-MILL AND BRONX RIVER ROUTES, NORTH SIDE OF HIGH BRIDGE, TO CENTRAL PARK RESERVOIRS.

Estimated Cost of Laying 10-48″ *Pipe from North End of High Bridge to Connections with Central Park Reservoirs.*

	Lineal Feet.		
From north end High Bridge, by Sedgwick and Ogden avenues, to McComb's Dam, 4,800 feet.	48,000	.....	.....
Across Harlem river to One Hundred and Fifty-third street, 1,500 feet	15,000	.....	.....
McComb's Dam road and One Hundred and Fifty-third street, and Eighth avenue to North Gate-house, Central Park, 5 pipe, 16,000 feet	80,000	.....	.....
Seventh avenue and One Hundred and Fifty-third street to Fifth avenue and One Hundredth street and North Gate-house Central Park, 5 pipe, 18,000 feet	90,000	.....	.....
Total lineal feet	233,000	.....	.....
82,000 tons 48″ pipe delivered at dock, at $30	.....	$2,460,000 00	
350 tons specials and branches, at $75	.....	26,250 00	
Stop-cocks, hydrants, etc	.....	71,000 00	
Hauling and laying 235,000 ft. 48″ pipe, at $2	.....	470,000 00	
60,000 cubic yards rock excavation, at $2.50	.....	150,000 00	
235,000 " earth excavation, at 30 c	.....	70,500 00	
290,000 " filling, at 10 c	.....	29,000 00	
80,000 square yards pavement to relay, at 25 c	.....	20,000 00	
Extra expense crossing Harlem river—			
6,000 cubic yards concrete, at $10	.....	60,000 00	
30,000 " excavation, at $5	.....	150,000 00	
Contingencies	.....	40,000 00	
			$3,546,750 00
Add 10 per cent. for engineering and contingencies	.....	.....	354,675 00
	.....	.....	$3,901,425 00

TABLE 1.—*Showing Waste of Water over Croton Dam.*

MONTHS.	1863. Depth on Crest of Dam. Inches.	1863. Average Daily Waste Per Month. Gallons.	1864. Depth on Crest of Dam. Inches.	1864. Average Daily Waste Per Month. Gallons.	1865. Depth on Crest of Dam. Inches.	1865. Average Daily Waste Per Month Gallons.	1866. Depth on Crest of Dam. Inches.	1866. Average Daily Waste Per Month. Gallons.
January	10.45	492,889,805	9.36	401,909,383	10.20	444,492,829	5.50	180,493,695
February	12.18	577,015,622	4.47	148,840,523	5.75	218,319,680	16.80	1,119,330,543
March	11.79	593,521,536	7.10	260,810,911	14.81	790,830,624	9.77	406,809,297
April	11.50	522,240,315	7.70	293,170,821	8.97	358,022,600	10.03	420,795,777
May	9.16	397,367,737	8.84	354,266,997	11.65	562,581,688	9.97	390,692,555
June	1.29	23,549,244	2.92	84,015,412	7.60	278,039,658	9.70	402,344,929
July	3.66	130,131,046	....	.....	2.74	80,784,000	2.96	90,730,852
August	5.65	195,376,905	1.60	50,596,702	7.13	279,516,724	3.97	139,504,212
September	1.80	38,813,937	2.00	50,574,082	0.12	1,348,158	3.13	169,831,484
October	3.27	124,938,305	4.71	144,042,562	0.15	2,998,362	2.59	144,919,622
November	8.03	322,179,348	8.87	359,551,272	5.62	189,968,266	12.20	591,115,654
December	9.90	427,651,960	8.06	316,223,620	8.35	355,310,165	10.96	499,294,183
Average daily waste in U. S. gallons per year		320,472,980	....	205,333,524	.....	296,850,229	.....	379,655,150

MONTHS.	1867. Depth on Crest of Dam. Inches.	1867. Average Daily Waste Per Month. Gallons.	1868. Depth on Crest of Dam. Inches.	1868. Average Daily Waste Per Month. Gallons.	1869. Depth on Crest of Dam. Inches.	1869. Average Daily Waste Per Month. Gallons.	1870. Depth on Crest of Dam. Inches.	1870. Average Daily Waste Per Month. Gallons.
January	4.39	129,086,655	7.96	299,813,000	8.67	343,350,000	13.51	657,000,000
February	14.73	773,323,600	3.65	87,636,000	.....	.....	14.31	712,950,000
March	12.00	551,322,898	13.70	675,234,000	16.48	847,972,500	12.19	557,550,000
April	9.93	417,567,753	16.33	867,997,000	12.26	568,492,500	14.64	739,050,000
May	13.48	670,816,408	17.87	995,175,000	10.51	461,325,000	7.14	255,000,000
June	14.60	785,413,290	12.26	567,487,000	5.41	170,250,000	2.83	60,600,000
July	6.94	256,829,196	4.24	116,122,000	1.48	24,337,500	0.82	9,000,000
August	13.40	700,459,214	7.30	261,112,000	.....	.....	0.80	9,000,000
September	9.33	417,856,399	16.73	908,317,000	.....	.....	.....	.....
October	7.55	290,193,855	10.90	476,797,000	9.45	387,750,000	0.108	750,000
November	9.27	359,947,474	13.96	693,150,000	8.10	300,000,000	2.04	37,500,000
December	7.71	298,024,947	3.85	104,250,000	11.19	496,875,000	2.04	37,500,000
Average daily waste in U. S. gallons per year		470,903,474	.....	504,424,000	.....	327,300,000	.....	256,325,000

TABLE 1.—*Showing Waste of Water over Croton Dam*—(Continued).

MONTHS.	1871. Depth on Crest of Dam. Inches.	1871. Average Daily Waste Per Month. Gallons.	1872. Depth on Crest of Dam. Inches.	1872. Average Daily Waste Per Month. Gallons.	1873. Depth on Crest of Dam. Inches.	1873. Average Daily Waste Per Month. Gallons.	1874. Depth on Crest of Dam. Inches.	1874. Average Daily Waste Per Month. Gallons.
January	1.16	22,125,000	7.75	285,300,000	13.34	639,322,500	13.78	675,600,000
February	7.47	271,875,000	4.76	137,370,000	7.56	272,250,000	10.68	465,000,000
March	12.40	585,000,000	5.50	170 872,500	12.09	550,950,000	10.76	472,500,000
April	8.20	307,500,000	11.36	517,500,000	20.50	1,229,820,000	12.45	585,000,000
May	7.85	292,500,000	4.96	147,750,000	20.88	1,375,000,000	10.84	478,500,000
June	5.57	172,500,000	4.94	147,375,000	0.72	8,550,000	3.41	82,500,000
July	2.42	51,750,000	1.16	20,775,000	.....	.....	3.08	69,000,000
August	2.49	52,350,000	5.25	159,375,000	1.36	21,000,000	1.99	37,425,000
September	1.76	30,825,000	4.86	142,500,000	0.35	3,150,000	0.55	4,725,000
October	7.31	234,000,000	4.40	126,000,000	4.44	120,000,000	1.99	37,425,000
November	13.53	657,750,000	9.92	417,750,000	5.78	206,250,000	1.23	20,250,000
December	8.58	330,000,000	5.93	187,500,000	11.53	516,750,000	3.05	68,850,000
Average daily waste in U. S. gallons per year		250,680,000	.....	205,005,000	....	403,582,000	.....	249,750,000

MONTHS.	1875. Depth on Crest of Dam. Inches.	1875. Average Daily Waste Per Month. Gallons.	1876. Depth on Crest of Dam. Inches.	1876. Average Daily Waste Per Month. Gallons.	1877. Depth on Crest of Dam. Inches.	1877. Average Daily Waste Per Month. Gallons.	1878. Depth on Crest ot Dam. Inches.	1878. Average Daily Waste Per Month. Gallons.
January	0.88	11,077,500	5.74	179,100,000	2.40	51,750,000	9.50	387,967,500
February	11.83	533,925,000	12.62	593,250,000	6.11	199,200,000	13.11	628,500,000
March	10.10	419,250,000	18.34	1,035,000,000	19.65	1,155,900,000	13.08	620,925,000
April	16.45	888,000,000	17.56	975,000,000	10.71	472,500,000	6.70	232,320,000
May	6.80	231,525,000	7.50	272,175,000	2.77	61,350,000	5.99	194,700,000
June	0.70	8,550,000	1.63	25,500,000	1.00	13,245,000	5.53	171,000,000
July	0.40	4,125,000	0.17	900,000	.....	.....	1.37	22,650,000
August	15.07	771,750,000	.....	.....	.....	.....	1.39	22,875,000
September	2.93	67,500,000	.....	.....	.....	.....	6.81	245,250,000
October	0.23	1,650,000	.....	.....	2.50	52,372,500	2.47	52,350,000
November	8.05	300,000,000	1.80	30,825,000	13.68	672,225,000	6.87	246,000,000
December	6.90	240,000,000	0.03	187,500	7.05	245,400,000	20.03	1,185,135,000
Average daily waste in U. S. gallons per year		289,777,000	.....	259,327,000	.....	243,661,000	....	334,140,000

MONTHS.	1879. Depth on Crest of Dam. Inches.	1879. Average Daily Waste Per Month. Gallons.	1880. Depth on Crest of Dam. Inches.	1880. Average Daily Waste Per Month. Gallons.	1881. Depth on Crest of Dam. Inches.	1881. Average Daily Waste Per Month. Gallons.
January	5.54	171,000,000	9.90	418,500,000	1.80	30,850,000
February	9.40	382,500,000	11.04	483,750,000	11.97	547,500,000
March	13.74	675,000,000	10.79	472,500,000	17.58	973,175,000
April	16.16	862,500,000	8.10	300,750,000	7.03	245,320,000
May	7.40	268,500,000	2.89	67,500,000	5.14	149,000,000
June	2.80	60,000,000	0.21	1,650,000	6.16	199,400,000
July	1.40	22,500,000	0.30	2,400,000	0.48	4,925,000
August	4.00	105,975,000	.....	.....	.....	.....
September	3.93	105,000,000	.....	.....	.....	.....
October	1.51	24,375,000	.....	.....	.....	.....
November	2.60	54,000,000	0.63	6,000,000	0.13	918,000
December	7.54	272,250,000	0.23	1,687,500	5.97	194,500,000
Average daily waste in U. S. gallons per year		250,300,000	.....	146,233,000	.....	195,465,600

NOTE.—As the flow over a dam does not vary directly as the depth of water on it, and the averages being made from single daily measurements, the above table is not *absolutely* accurate, but as close an approximation as is required.

TABLE 2.—*Average Depth in Aqueduct and Average Delivery in Gallons per Day.*

MONTHS.	1868. Depth in Aqueduct at Sing Sing.	1868. Delivery of Aqueduct.	1869. Depth in Aqueduct at Sing Sing.	1869. Delivery of Aqueduct.	1870. Depth in Aqueduct at Sing Sing.	1870. Delivery of Aqueduct.	1871. Depth in Aqueduct at Sing Sing.	1871. Delivery of Aqueduct.	1872. Depth in Aqueduct at Sing Sing.	1872. Delivery of Aqueduct.
	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.
January	....	.....	....	.....	6.28	87,000,000	5.84	79,382,000	6.32	87,540,000
February	....	.....	....	.....	6.21	85,500,000	6.00	82,189,000	6.45	89,000,000
March	....	.....	....	.....	6.08	83,565,000	5.90	80,797,000	6.39	88,500,000
April	....	.....	....	.....	5.62	75,775,000	5.95	81,300,000	6.60	91,290,000
May	....	.....	6.02	82,500,000	5.96	81,300,000	6.01	82,189,000	6.52	90,079,000
June	....	.....	6.02	82,500,000	6.01	82,190,000	6.02	82,200,000	6.20	86,220,000
July	5.76	77,960,000	6.00	82,189,000	6.00	82,189,000	6.15	84,917,000	6.36	88,000,000
August	6.00	82,189,000	4.96	64,700,000	5.62	76,000,000	6.05	83,000,000	6.19	85,500,000
September	....	.....	3.50	47,937,000	5.03	65,000,000	6.00	82,189,000	6.38	88,500,000
October	....	.....	6.13	84,900,000	5.83	79,382,000	6.03	83,000,000	6.19	86,220,000
November	....	.....	6.00	82,189,000	5.75	77,960,000	5.88	80,000,000	6.17	84,917,000
December	....	.....	6.37	88,100,000	5.77	78,000,000	6.13	84,917,000	6.17	84,917,000

TABLE 2.—*Average Depth in Aqueduct and Average Delivery in Gallons per Day*—(Continued).

MONTHS.	1873.		1874.		1875.		1876.		1877.	
	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.
	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.
January	7.09	97,777,000	6.81	94,448,000	7.38	100,780,000	7.52	101,866,000	7.09	97,877,000
February	7.25	99,551,000	7.09	97,777,000	7.45	101,350,000	7.53	101,926,000	7.35	100,541,000
March	7.23	99,545,000	7.12	98,177,000	7.51	101,890,000	7.61	102,518,000	7.35	100,541,000
April	7.25	99,551,000	7.01	96,954,000	7.49	101,600,000	7.62	102,578,000	7.43	101,280,000
May	7.02	96,834,000	6.85	95,000,000	7.48	101,500,000	7.60	102,458,000	7.45	101,480,000
June	6.75	93,622,000	7.01	96,954,000	7.50	101,746,000	7.58	102,338,000	7.32	100,241,000
July	6.82	94,713,000	7.17	98,695,000	7.48	101,500,000	7.49	101,686,000	7.12	98,177,000
August	6.09	83,580,000	7.15	98,395,000	7.57	102,320,000	6.98	96,784,000	6.81	94,528,000
September	6.80	93,682,000	7.28	100,000,000	7.58	102,338,000	5.50	73,617,000	5.01	64,810,000
October	7.04	97,000,000	7.41	101,080,000	7.60	102,458,000	5.44	72,743,000	6.26	87,646,000
November	7.36	100,741,000	7.37	100,941,000	7.56	102,200,000	6.55	90,679,000	7.30	100,041,000
December	7.66	102,838,000	7.33	100,341,000	7.58	102,338,000	6.50	90,079,000	7.26	99,651,000

MONTHS.	1878.		1879.		1880.		1881.	
	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.	Depth in Aqueduct at Sing Sing.	Delivery of Aqueduct.
	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.	Feet.	Gallons.
January	7.28	99,851,000	7.33	100,341,000	7.34	100,441,000	7.10	97,977,000
February	7.26	99,651,000	7.32	100,241,000	7.33	100,341,000	7.28	99,851,000
March	7.27	99,751,000	7.36	100,641,000	7.35	100,541,000	7.34	100,441,000
April	7.27	99,751,000	7.35	100,541,000	7.35	100,541,000	7.33	100,341,000
May	7.21	99,150,000	7.31	100,141,000	7.32	100,241,000	7.32	100,241,000
June	7.30	100,041,000	7.31	100,141,000	7.25	99,551,000	7.32	100,241,000
July	7.29	99,941,000	7.32	100,241,000	7.07	97,677,000	7.31	100,141,000
August	7.27	99,751,000	7.28	99,851,000	7.17	98,695,000	7.29	99,951,000
September	7.30	100,041,000	7.02	97,004,000	7.19	98,895,000	7.29	99,951,000
October	7.32	100,241,000	7.36	100,641,000	7.12	98,177,000	7.29	99,951,000
November	7.33	100,341,000	7.36	100,641,000	7.23	100,141,000	7.35	100,541,000
December	7.34	100,440,000	7.34	100,441,000	7.09	97,677,000	7.29	99,951,000

TABLE 3.—*Rain-fall in Croton Basin.*

MONTHS.	1866.			1867.			1868.			1869.		
	Croton Dam	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.
January	1.04	3.33	....	1.26	2.11	....	3.23	2.90	....	5.40	3.79	....
February	5.58	3.60	....	4.90	3.00	....	1.52	1.38	....	5.75	3.64	....
March	2.15	3.33	....	2.46	1.49	....	3.91	2.55	....	9.51	5.48	....
April	2.69	3.79	....	3.13	3.74	....	5.47	3.87	....	3.38	2.11	....
May	5.06	5.62	....	7.26	6.86	....	13.78	8.79	....	6.72	4.52	....
June	4.41	4.45	....	7.19	5.28	....	7.11	4.53	....	1.19	3.59	....
July	4.27	4.01	....	5.22	5.25	....	3.65	2.13	....	2.06	2.26	....
August	5.50	6.56	....	8.79	10.04	....	13.05	6.98	....	1.97	1.92	....
September	6.16	4.92	....	3.66	3.62	....	20.47	9.33	....	2.64	3.20	....
October	4.44	5.09	....	4.74	3.66	....	0.63	0.87	....	8.93	9.46	....
November	3.87	3.80	....	3.42	3.10	....	7.14	4.65	....	7.23	2.43	....
December	3.59	3.27	....	1.98	2.62	....	2.50	2.35	....	5.74	5.96	....
Totals	48.78	51.77	....	54.03	50.77	....	82.46	50.33	....	60.52	48.36	....

MONTHS.	1870.			1871.			1872.			1873.		
	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.
January	9.51	4.51	....	1.18	3.80	....	.76	1.44	....	2.96	5.66	....
February	6.37	6.40	....	.12	3.81	....	1.29	1.22	....	1.40	3.09	....
March	7.23	3.80	....	5.62	4.27	....	3.57	2.59	....	1.90	3.08	....
April	4.95	5.45	....	4.92	3.01	....	.70	3.04	....	3.17	3.77	....
May	2.71	2.30	....	5.74	3.45	....	3.93	3.69	....	3.02	2.91	....
June	....	2.06	....	8.62	5.73	....	3.65	4.00	....	.14	.71	....
July	2.75	3.43	....	5.33	5.07	....	5.11	4.34	....	4.41	2.21	....
August	7.71	5.10	....	9.48	5.24	....	7.83	5.99	....	9.91	5.73	....
September	2.36	2.85	....	1.47	1.44	....	3.17	3.69	....	5.36	3.73	....
October	7.62	4.73	....	7.89	6.18	....	1.80	2.15	....	4.85	5.13	....
November	3.74	2.51	....	7.71	4.35	....	4.51	4.91	....	2.16	3.72	....
December	1.20	1.49	....	.42	2.59	....	1.80	3.68	....	2.37	4.13	....
Totals	56.15	44.63	....	72.81	48.94	....	43.48	40.74	....	46.08	43.87	....

TABLE 3.—*Rain-fall in Croton Basin.*—(Continued).

MONTHS.	1874.			1875.			1876.			1877.		
	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.
January	5.98	6.96	....	2.01	2.74	....	1.03	1.42	....	3.23	2.68	....
February	.17	2.78	....	3.83	3.47	....	6.98	4.91	....	1.21	0.80	....
March	.54	1.57	....	5.87	4.99	....	14.61	6.33	....	8.89	7.66	....
April	3.49	6.31	....	3.78	3.04	....	3.78	4.43	....	2.73	2.35	....
May	1.59	1.99	....	1.36	1.08	....	3.42	3.99	....	.50	.85	....
June	2.26	3.57	....	2.78	3.02	....	4.35	2.52	....	5.58	4.95	....
July	5.96	5.98	....	7.34	3.10	....	5.13	3.42	....	6.26	4.65	....
August	4.22	2.75	....	12.98	10.33	....	2.51	1.20	....	3.18	2.54	....
September	4.32	3.56	....	1.76	2.11	....	4.41	5.21	....	1.09	1.49	....
October	1.90	2.40	....	4.27	3.61	....	2.13	1.50	....	10.03	8.38	....
November	2.68	2.72	....	4.17	4.61	....	3.33	3.40	....	8.06	8.16	....
December	.99	1.78	....	1.76	1.56	....	6.51	2.35	....	1.35	1.52	....
Totals	36.93	42.37	....	53.52	43.66	....	58.14	40.68	....	52.11	46.03	....

MONTHS.	1878.			1879.			1880.			1881.		
	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.	Croton Dam.	Boyd's Corners.	South East.
January	4.30	4.49	....	4.56	2.52	2.20	3.71	4.00	3.69	5.32	4.19	5.06
February	4.61	3.65	....	4.53	2.85	2.47	2.85	2.92	3.13	6.70	5.28	4.65
March	2.69	3.10	....	5.76	4.96	3.85	3.30	4.51	4.21	9.76	6.14	6.16
April	4.00	2.85	....	4.17	5.10	4.80	3.28	3.99	3.44	.86	1.67	1.20
May	2.69	4.97	1.72	2.19	2.45	2.02	1.10	1.17	1.00	2.74	3.74	3.89
June	4.52	4.65	6.13	5.23	5.29	5.36	1.47	1.28	1.43	5.27	5.27	4.62
July	3.86	4.28	3.02	5.28	5.95	6.12	6.56	5.65	5 49	1.60	2.45	2.17
August	2.63	2.66	4.49	9.39	5.83	6.69	5.25	3.60	4.05	2.97	1.71	3.30
September	11.26	6.61	8.58	2.88	3.43	3.40	2.64	2.69	2.16	0.41	0.75	0.94
October	6.79	3.78	3.51	0.39	0.95	.57	2.43	3.25	2.56	1.98	3.65	2.75
November	5.27	4.36	4.43	2.59	2.49	2.54	2.54	2.97	1.85	5.60	4.50	5.53
December	13.28	8.74	7.08	4.80	4.26	3.17	2.38	2.49	2.44	7.56	6.37	8.12
Totals	65.90	54.14	....	51.77	46.08	43.19	37.51	38.52	35.45	50.77	46.17	48.39

TABLE 4.—*Showing Rain-fall and Melted Snow, in Inches, for each Month in the Years* 1862 *to* 1870, *inclusive, at Receiving Reservoir, High Bridge, Fordham, Tarrytown, Sing Sing, Croton Dam, and Boyd's Corners.*

MONTHS.	1862.							1863.						1864.						
	Receiving Reservoir.		High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.	Receiving Reservoir.		High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.	Receiving Reservoir.		High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.
January	3.77	..	4.45	4.88	....	4.75	..	3.23	..	4.41	....	....	5.25	..	1.83	..	2.06	1.59	3.01	1.84	..
February	2.33	..	3.25	2.91	....	2.88	..	3.61	..	5.74	....	....	0.10	..	0.95	..	1.00	1.26	1.95	1.49	..
March	4.46	..	4.60	3.25	....	2.17	..	4.46	..	5.77	....	....	3.16	..	2.03	..	2.65	2.35	4.50	5.49	..
April	1.59	..	3.28	1.82	....	0.55	..	4.72	..	3.91	....	....	4.31	..	2.24	..	3.89	3.16	7.49	3.04	..
May	2.85	..	3.36	2.28	....	....	..	4.58	..	5.32	....	....	3.99	..	4.52	..	5.17	4.54	10.59	4.95	..
June	5.75	..	3.19	5.65	....	....	..	1.68	..	3.29	....	....	0.52	..	4.59	..	3.08	2.14	5.07	1.76	..
July	4.32	..	5.83	6.13	....	5.42	..	6.18	..	6.25	....	....	10.27	..	1.85	..	2.20	2.61	4.61	2.42	..
August	2.45	..	2.59	1.76	....	2.18	..	4.91	..	2.40	....	....	4.78	..	2.42	..	5.98	7.88	11.81	7.45	..
September	3.75	..	1.91	1.73	2.33	2.17	..	1.03	..	0.82	....	....	1.39	..	5.09	..	5.19	4.49	6.86	3.66	..
October	4.23	..	5.24	3.42	3.04	3.37	..	3.12	..	3.48	....	....	4.99	..	2.47	..	2.70	2.69	5.72	2.97	..
November	4.75	..	4.55	4.69	4.94	5.98	..	1.76	..	3.55	....	....	4.37	..	3.86	..	4.82	4.00	8.95	3.48	..
December	1.28	..	1.57	0.57	....	0.98	..	3.58	..	4.89	5.29	6.65	4.10	..	2.83	..	3.05	3.09	2.90	2.73	..
Total	41.53	..	43.82	39.09	....	30.45	..	42.86	..	49.83	....	....	47.23	..	34.70	..	41.79	39.80	73.46	41.28	..
Mean	3.46	..	3.65	3.26	....	2.54	..	3.57	..	4.15	....	....	3.94	..	2.89	..	3.48	3.32	6.12	3.44	..

MONTHS.	1865.							1866.						
	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.
January	2.66	....	3.60	3.19	4.47	3.43	....	1.01	....	1.48	1.33	0.85	1.04	3.33
February	3.79	....	4.54	3.24	3.81	2.86	....	5.38	....	5.78	4.48	7.22	5.58	3.60
March	4.85	....	5.83	4.03	8.03	5.03	....	2.44	....	2.47	2.10	2.60	2.15	3.33
April	3.77	....	3.81	2.94	4.25	2.95	....	2.66	....	3.25	2.68	2.48	2.69	3.79
May	4.91	....	5.51	6.37	13.88	7.38	....	4.33	....	4.09	4.57	9.12	5.06	5.62
June	3.72	....	4.88	6.60	6.05	3.41	....	2.68	....	3.21	3.39	7.78	4.41	4.45
July	5.73	....	5.80	8.64	16.18	3.05	....	4.13	....	4.36	3.63	7.87	4.27	4.01
August	3.16	....	2.55	3.30	5.31	8.12	....	5.48	....	6.03	6.72	8.42	5.50	6.56
September	1.77	....	1.85	2.71	3.34	2.23	....	3.69	....	4.59	6.23	9.22	6.18	4.92
October	3.93	....	4.85	3.63	8.35	4.56	....	5.41	....	5.16	5.71	5.60	4.44	5.09
November	2.69	....	4.14	3.48	6.30	3.15	....	3.16	....	2.87	3.08	6.75	3.87	3.80
December	4.16	....	4.95	3.76	5.20	3.87	....	3.04	....	4.04	3.38	7.79	3.59	3.27
Total	45.14	....	52.31	51.29	84.07	50.04	....	43.41	....	47.31	47.30	75.70	48.78	51.77
Mean	3.76	....	4.36	4.32	7.06	4.17	....	3.62	....	3.94	3.93	6.31	4.07	4.31

TABLE 4.—*Showing Rain-fall and Melted Snow, in Inches, for each Month in the Years* 1862 *to* 1870, *inclusive, at Receiving Reservoir, High Bridge, Fordham, Tarrytown, Sing Sing, Croton Dam, and Boyd's Corners.*—(Continued).

MONTHS.	1867.							1868.						
	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.
January	3.34	0.61	1.32	0.89	0.20	1.26	2.11	4.53	5.57	4.03	5.20	5.72	3.23	2.90
February	5.15	4.79	5.87	4.12	8.34	4.92	3.00	2.32	0.36	2.91	1.10	2.65	1.52	1.38
March	5.24	2.53	3.63	2.20	2.40	2.46	1.49	0.35	0.75	4.34	2.09	1.67	3.91	2.55
April	2.50	2.15	2.96	2.91	6.68	3.13	3.74	6.09	5.29	6.92	4.06	8.24	5.47	3.87
May	5.78	3.55	6.34	6.15	9.85	7.26	6.86	6.14	10.41	3.30	7.99	12.26	13.78	8.79
June	9.45	9.21	9.24	6.09	20.15	7.19	5.28	4.80	4.95	6.60	5.06	8.86	7.11	4.53
July	4.50	4.90	4.34	4.48	5.14	5.22	5.25	5.58	7.22	6.39	5.94	4.95	3.65	2.13
August	8.54	9.14	11.04	8.81	15.18	8.79	10.04	8.65	4.86	4.51	5.86	14.70	13.05	6.98
September	0.77	0.65	0.66	0.24	1.59	3.66	3.62	9.30	9.09	9.76	10.19	21.97	20.47	9.33
October	3.73	4.77	5.87	4.84	8.64	4.74	3.96	1.32	1.37	2.38	0.72	0.16	0.63	0.87
November	1.98	2.45	2.59	2.74	6.53	3.42	3.10	4.28	4.90	5.32	4.30	7.60	7.14	4.65
December	2.34	2.27	2.43	2.26	3.32	1.98	1.62	2.77	2.56	3.26	2.68	4.64	2.50	2.35
Total	53.32	47.08	56.29	45.73	88.02	54.03	50.07	56.13	57.33	59.72	55.19	93.42	82.46	50.33
Mean	4.44	3.92	4.69	3.81	7.35	4.50	4.17	4.68	4.78	4.98	4.59	7.79	6.88	4.19

MONTHS.	1869.							1870.						
	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.	Receiving Reservoir.	High Bridge.	Fordham.	Tarrytown.	Sing Sing.	Croton Dam.	Boyd's Corners.
January	2.99	3.47	3.68	4.74	3.95	5.40	3.79	4.83	5.85	6.06	4.70	14.18	9.51	4.51
February	5.84	5.75	7.50	4.83	3.80	5.75	3.64	5.15	2.90	3.75	5.11	6.24	6.37	6.40
March	4.38	4.01	6.33	5.06	10.64	9.51	5.48	4.34	5.18	5.22	2.64	8.90	7.23	3.80
April	1.87	1.39	1.85	1.96	2.72	3.38	2.11	4.40	4.56	4.77	4.80	6.40	4.95	5.45
May	4.39	4.14	4.14	4.38	7.64	6.72	4.52	2.06	2.11	2.05	3.19	6.00	2.71	2.30
June	4.38	6.37	6.37	2.74	4.62	1.19	3.59	2.66	2.50	2.07	2.77	7.05	....	2.06
July	3.83	3.82	3.28	2.66	3.82	2.06	2.26	3.53	....	3.33	2.98	4.16	2.75	3.43
August	2.49	5.31	3.13	3.02	4.55	1.97	1.92	3.24	4.24	4.46	6.83	7.69	7.71	5.10
September	2.46	3.57	3.00	2.70	5.61	2.64	3.20	2.02	2.43	3.04	1.16	2.76	2.36	2.85
October	7.03	7.65	8.45	7.84	16.98	8.93	9.46	4.90	4.83	5.19	6.18	6.95	7.62	4.73
November	3.28	3.55	3.53	2.70	10.03	7.23	2.43	2.71	2.96	2.84	2.55	4.04	3.74	2.51
December	5.47	5.47	5.10	7.77	8.62	5.74	5.96	2.49	2.31	2.11	1.96	1.33	1.20	1.49
Total	48.41	54.50	56.36	50.40	82.98	60.52	48.36	42.33	39.87	44.89	44.87	75.70	56.15	44.63
Mean	4.04	4.54	4.69	4.20	6.92	5.04	4.03	3.53	3.32	3.74	3.74	6.31	4.68	3.72

TABLE 5.—*Comparison of Rain-fall at Different Places.*

	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.
Croton Dam	48.78	54.03	82.46	52	56.15	72.81	43.48	46.08
Boyd's Corners	51.77	50.77	50.33	48.36	44.63	48.94	40.74	43.87
Southeast	.....	.....	.....	.....	.....	.....	.....	.....
Sing Sing	75.70	88.02	93.42	82.98	76.54	91.35	55.60	66.94
Tarrytown	47.30	45.73	55.19	50.40	47.50	60.39	42.75	50.44
Kingsbridge	47.31	56.29	59.72	56.36	45.09	57.90	48.43	52.36
West Point	47.51	57.83	52.11	47.64	42.33	52.41	56.38	44.83
Central Park Observatory	52.23	54.66	64.03	45.47	39.25	51.26	42.49	47.99
Central Park Receiving Reservoir	43.40	53.32	56.13	48.41	42.45	53.07	47.02	49.71

	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
Croton Dam	36.93	53.52	58.14	52.11	65.90	51.77	37.51	50.77
Boyd's Corners	42.37	43.66	40.68	46.03	54.14	46.08	38.52	46.17
Southeast	.....	.....	.....	.....	.....	43.19	35.45	48.39
Sing Sing	71.87	75.90	66.24	.....	.....	.....	.....	.....
Tarrytown	49.38	59.58	47.74	.....	.....	.....	.....	.....
Kingsbridge	51.12	52.44	43.32	.....	.....	.....	.....	....
West Point	47.60	54.09	48.11	47.76	48.78	42.59	33.53	46.30
Central Park Observatory	45.83	40.90	41.77	40.18	48.66	39.03	36.64	36.26
Central Park Receiving Reservoir	52.86	45.31	38.91	42.97	49.86	38.66	36.14	36.86

TABLE 6.—*Showing Rain-fall and Melted Snow at North Salem Croton Basin, N. Y.; Latitude,* 41° 20'; *Longitude,* 73° 38'; *Elevation,* 361 *feet.*

YEAR.	January. Inches.	February. Inches.	March. Inches.	April. Inches.	May. Inches.	June. Inches.	July. Inches.	August. Inches.	September. Inches.	October. Inches.	November. Inches.	December. Inches.	Total Fall of Rain and Melted Snow. Inches.	Average per Month. Inches.	DRIEST MONTH IN THE YEAR.	WETTEST MONTH IN THE YEAR.
1830	2.18	1.82	5.05	1.76	3.29	5.97	5.50	0.41	2.25	4.81	3.41	6.92	43.37	3.61		
1831	2.09	2.54	2.38	5.79	3.41	3.31	4.39	3.22	4.50	6.51	3.02	0.60	41.76	3.48	August	December.
1832	3.18	1.61	3.40	2.97	3.58	1.25	3.65	7.99	2.25	3.78	3.60	3.67	40.93	3.41	December	October.
1833	3.17	1.13	3.34	1.57	5.11	3.89	3.01	2.69	3.06	9.90	1.97	4.21	43.05	3.58	June	August.
1834	1.52	0.82	1.28	4.38	4.44	7.02	4.45	0.31	4.75	2.15	0.83	1.57	33.50	2.60	February	October.
1835	6.12	0.82	1.77	6.25	1.46	1.96	5.52	2.07	1.44	3.42	1.88	2.78	35.49	2.96	August	June.
1838	2.45	0.96	1.52	2.04	3.48	3.48	1.79	1.73	5.14	3.42	3.91	0.95	30.87	2.57	February	April.
1840	1.46	1.92	2.45	4.18	3.63	3.52	2.95	3.19	2.70	5.82	2.81	3.91	38.54	3.21	December	September.
1841	6.20	1.70	2.51	4.38	2.54	2.93	1.87	1.78	2.06	4.08	4.17	5.56	39.78	3.31	January	October.
1842	1.55	4.78	1.50	4.95	4.99	2.77	5.56	6.05	3.80	4.57	2.53	2.67	45.72	3.81	February	January.
1843	2.51	3.27	5.53	4.03	2.06	2.58	3.99	8.74	5.00	5.80	3.90	1.50	48.91	4.08	March	August.
1844	2.77	0.88	4.44	1.73	5.49	2.67	6.63	1.59	1.96	4.33	1.23	3.57	37.49	3.12	May	August.
1845	4.94	2.87	2.37	1.62	2.60	2.05	2.36	3.40	3.84	4.17	5.48	3.80	39.50	3.30	February	July.
1846	4.07	2.65	3.71	1.95	6.90	3.43	7.20	5.11	0.35	2.59	4.78	2.93	45.67	3.80	April	November.
1847	3.61	5.41	3.76	1.28	2.05	3.00	5.00	3.25	5.33	3.61	3.02	4.88	44.80	3.73	September	July.
1848	1.46	1.60	2.05	1.23	7.02	4.41	4.27	1.27	2.06	2.56	2.81	3.88	34.62	2.88	April	February.
1849	1.55	2.09	5.19	1.35	5.85	1.09	1.32	7.24	1.43	7.88	4.42	3.24	42.65	3.55	April	May.
1850	4.46	4.67	3.68	2.73	7.60	5.41	6.81	4.97	6.63	1.64	3.03	3.39	55.02	4.58	June	October.
Mean.	3.07	2.27	3.11	3.01	4.19	3.46	4.23	3.61	3.08	4.50	2.29	3.30	42.41	....	October	May.
															February	October.

August, 1834, Driest Month of this Period ..... 0.31 inches.
October, 1833, Wettest Month of this Period ..... 9.90 "
Average Annual Rain-fall ..... 42.41 "
Average Driest Month, February, Mean ..... 2.27 "
Next Driest Month, November, Mean ..... 2.29 "
Average Wettest Month, October ..... 4.50 "
Next Wettest Month, July ..... 4.23 "

The above is taken from page 330 of "N. Y. Meteorology," by F. B. Hough, from Reports of Regents of University.

FROM REPORT OF DR. DANIEL DRAPER, 1876.

THE DROUGHT OF 1876.

The most important meteorological phenomenon for the past year was the drought that caused great scarcity of Croton water in this city. It began with an nuusually small fall of rain, the total amount for January being .94 inch, while the average for forty-one years is 3.30 inches. There are only two other years on record in which the rain-fall for that month was less; they are 1839, when it was .69 inch, and 1849, when it was .61 inch. The following two months were above their averages, February having 4.81 inches, its average for forty-one years being 3.40 inches, while in March it was 8.79 inches, the average being 3.76. After this all the other months were below their averages, except September, which was 1.60 above, as is shown in Table 7.

TABLE 7.—*Table showing Monthly and Annual Fall of Water for* 46 *years, in the Vicinity of New York City (at Fort Columbus, Deaf and Dumb Asylum, and New York Observatory, Central Park).*

INCHES.

	YEAR.	JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL AMOUNT.
Army Records.	1836	1.09	2.01	1.31	2.66	0.63	6.46	1.44	2.37	3.40	2.00	1.90	2.30	27.57
	1837	2.70	3.70	8.20	7.50	9.50	8.50	5.90	6.30	2.10	2.11	2.90	6.10	65.51
	1838	3.93	3.70	4.10	2.50	3.99	3.12	1.83	4.79	4.96	3.64	3.10	2.24	41.90
	1839	0.69	2.05	2.46	3.35	8.37	4.94	1.35	4.92	3.59	1.45	2.19	7.61	42.97
	1840	1.84	1.84	2.92	2.03	2.39	2.40	1.80	4.25	1.84	4.59	2.90	1.00	29.80
	1841	5.30	0.80	2.35	3.93	3.95	4.65	4.90	2.50	2.90	4.40	3.70	2.70	42.08
	1842	1.07	2.85	1.25	3.60	3.60	3.30	3.80	2.81	2.10	4.30	1.80	3.50	33.98
	1843	1.00	2.31	2.13	2.14	1.00	0.76	1.64	15.26	3.06	5.91	2.82	3.34	41.37
	1844	2.66	1.03	4.50	0.55	3.41	2.37	6.00	2.73	4.50	4.08	1.73	2.82	36.38
	1845	4.87	3.22	3.33	1.22	1.75	3.70	1.75	3.21	2.62	2.50	3.40	2.51	34.08
	1846	3.92	3.01	3.82	4.01	9.70	1.39	6.01	3.88	0.48	1.34	8.36	2.99	48.91
	1847	4.62	5.74	8.48	1.53	2.18	6.78	1.62	6.93	12.20	2.13	6.29	6.35	64.85
	1848	1.75	1.68	2.23	1.16	7.28	4.56	2.64	1.41	1.87	6.61	1.59	4.02	36.80
	1849	0.61	2.26	4.87	0.62	3.47	0.78	1.43	4.63	1.55	5.63	1.88	4.01	31.74
	1850	5.57	2.64	4.64	2.72	9.20	3.07	3.92	7.21	4.71	3.16	2.33	5.36	54.53
	1851	1.46	4.50	1.70	6.94	4.73	0.90	4.72	3.47	1.26	2.95	4.53	3.72	40.88
	1852	2.92	3.08	4.43	4.74	2.24	2.11	3.25	6.20	2.29	2.06	6.07	4.45	43.84
	1853	4.14	4.98	2.03	3.32	5.80	4.80	4.40	5.50	5.49	3.90	6.80	1.04	52.20
	1854	2.60	4.00	0.70	8.80	7.70	2.20	1.90	1.03	1.90	1.80	3.95	8.60	45.18
Deaf and Dumb.	1855	4.77	5.12	2.83	2.86	4.90	5.83	5.06	2.90	1.51	7.37	3.00	6.86	53.01
	1856	3.98	0.66	2.08	2.72	4.78	3.58	2.79	6.73	5.05	1.18	2.50	4.45	40.50
	1857	4.99	1.69	2.32	9.05	6.72	5.43	6.13	3.90	4.26	1.67	1.30	6.42	53.88
	1858	3.80	3.30	1.47	4.83	6.00	6.42	4.32	3.15	3.50	4.19	5.99	4.90	51.87
	1859	5.78	5.59	8.21	5.10	1.57	4.60	4.76	4.12	6.45	1.75	3.37	4.42	55.72
	1860	2.52	3.28	1.60	3.21	4.54	1.43	3.33	3.85	6.24	3.55	7.57	4.05	45.17
	1861	4.81	2.45	5.78	5.62	6.03	4.24	2.89	5.52	4.03	3.46	8.09	1.73	54.65
	1862	5.60	4.17	4.54	2.14	3.84	9.03	5.85	2.15	2.25	6.86	5.63	1.91	53.97
	1863	5.45	7.04	5.77	5.69	4.58	1.43	8.60	4.59	1.05	4.09	3.88	4.86	57.03
	1864	2.92	2.04	2.15	3.28	5.23	4.41	3.20	5.19	5.45	2.68	5.16	5.90	47.61
	1865	3.40	4.06	8.32	4.14	5.56	10.42	5.21	2.23	4.21	4.94	4.19	6.30	62.98
	1866	2.56	10.09	2.28	4.09	4.46	4.38	1.67	4.81	4.85	5.28	3.84	3.92	52.23
	1867	2.54	5.53	4.09	2.47	5.70	10.18	5.76	7.68	0.78	5.12	2.25	2.56	54.66
	1868	4.00	2.31	3.69	6.42	7.19	4.66	6.44	8.31	9.60	2.01	5.13	4.27	64.03
Central Park.	1869	2.53	6.87	4.61	1.39	4.15	4.40	3.15	1.76	2.81	6.48	2.30	5.02	45.47
	1870	4.41	2.83	3.33	5.11	1.83	2.82	3.76	3.07	2.52	4.97	2.42	2.18	39.25
	1871	2.07	2.72	5.54	3.03	4.04	7.05	5.57	5.60	2.34	7.50	3.56	2.24	51.26
	1872	1.88	1.29	3.74	2.29	2.68	2.93	7.83	6.29	2.95	3.35	4.08	3.18	42.49
	1873	5.34	3.80	2.09	4.16	3.69	1.28	4.61	9.56	3.14	2.73	4.63	2.96	47.99
	1874	5.33	2.04	2.12	8.77	2.24	2.78	5.06	2.43	8.24	1.70	2.30	2.82	45.83
	1875	3.17	2.62	3.48	3.08	1.33	2.72	4.89	8.97	1.89	2.85	3.78	2.12	40.90
	1876	0.94	4.81	8.79	3.06	3.03	2.66	3.65	2.28	5.28	1.42	3.31	2.54	41.77
	1877	2.62	1.24	5.56	2.73	0.95	2.80	5.73	2.77	1.33	8.14	5.63	0.68	40.18
	1878	4.46	3.75	3.27	1.97	3.19	3.08	4.62	7.97	4.05	2.43	4.73	5.14	48.66
	1879	2.63	2.02	3.41	4.33	2.02	3.15	3.58	7.95	2.37	.43	2.20	4.94	39.03
	1880	2.02	2.12	4.66	2.90	.62	1.14	8.53	5.26	1.85	2.81	2.46	2.27	36.64
	1881	4.80	4.93	5.81	0.95	3.20	5.35	1.25	.86	.97	1.60	2.36	4.18	36.26

This drought has led me to examine the following question:

Has there been in late years any change in the rain-fall of New York City or its vicinity to affect seriously its water supply?

In a former report I discussed a question nearly related to this, viz.: "Does the clearing of land increase or diminish the fall of rain." We found that the wide-spread impression that the clearing of land diminishes the volume of rain is not based on fact. We shall have to study the present question in a similar manner, relying on the observations then used, and others that have since been collected.

As the water supply of New York comes from the Croton river, we shall have to examine the table of the rain-fall on the shed of that river, but as the observations for it extend back only a few years, it becomes necessary to compare them with those of New York City.

The annual observations at Boyd's Corners, which is within the Croton water-shed, are from 1870 to 1877, and those of this Observatory are for the same period. By the table it appears that the rain-fall of these stations varies from year to year, but in the means for the series there is a variation of only 1.8 inch. This might be expected from topographical and other considerations.

YEARS.	1871.	1872.	1873.	1874.	1875.	1876.	MEAN.
Boyd's Corners	48.94	40.74	43.87	42.37	43.66	40.68	43.37
Central Park	51.26	42.49	47.99	45.83	40.90	41.77	45.17

The fall at Boyd's Corners resembles that of the city. We may therefore use our city observations for the missing ones there.

The fall in New York City bears, in like manner, a general resemblance to that of other adjacent cities, as Washington, Philadelphia, Providence ; and since there exist very old observations made in those places, they may be used in investigating the rain-falls here. Of course it will be understood that I am not here speaking of the absolute rain-falls in those places, but the variations they exhibit, and using those variations as a guide to the determination in New York.

TABLE 8.—*Monthly and Annual Fall of Rain, from January*, 1865, *to December*, 1881, *at Receiving Reservoir, Central Park.*

MONTHS.	1865.		1866.		1867.		1868.		1869.		1870.	
	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.
January	2.71	6½	1.01	8¾	3.34	27¼	4.53	25¾	2.99	7½	4.83	3
February	3.79	8¾	5.23	7¼	5.15	13	2.32	15¼	6.04	11½	5.15	9½
March	4.85	¼	3.34	2	5.24	12¼	3.35	26	4.98	3¾	4.34	11¼
April	4.77	....	2.66	....	2.25	....	6.09	7¾	1.88	....	4.40	....
May	6.17	....	4.30	....	5.78	....	6.14	....	4.34	....	2.06	....
June	3.77	....	2.68	....	9.45	....	4.80	....	4.33	....	2.78	....
July	5.63	....	4.13	....	4.50	....	5.58	....	3.83	....	3.53	....
August	3.16	....	5.48	....	8.54	....	8.65	....	2.49	....	3.24	....
September	2.46	....	3.69	....	0.77	....	9.30	....	2.46	....	2.02	....
October	4.93	....	4.77	....	3.73	....	1.32	....	7.03	....	4.90	....
November	2.69	....	3.16	....	1.98	....	4.28	....	3.28	....	2.71	....
December	4.36	10	2.71	3¼	2.34	12	2.77	8½	5.47	6¾	2.49	5
	49.29	25½	43.21	21¼	53.07	64½	59.13	83¾	49.12	29½	42.45	28¾

MONTHS.	1871.		1872.		1873.		1874.		1875.		1876.	
	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.
January	4.10	21	1.90	2¾	5.91	12	5.81	6¼	2.84	12¾	1.09	....
February	4.03	18¼	1.69	4	3.95	16	3.37	16½	3.44	5¾	4.48	10
March	5.74	....	4.08	4	2.35	1	4.09	2	3.15	17½	8.01	2½
April	3.15	2	2.51	¾	3.87	....	9.47	....	3.37	12½	2.87	....
May	4.06	....	3.12	....	3.96	....	2.62	....	1.85	....	3.34	....
June	8.05	....	2.80	....	1.18	....	4.69	....	3.21	....	3.93	....
July	6.04	....	8.70	....	6.00	....	6.07	....	4.86	....	2.49	....
August	6.30	....	6.61	....	7.84	...	2.63	....	11.10	....	2.40	....
September	2.41	....	3.61	....	4.04	....	7.13	....	1.94	....	3.98	....
October	8.05	....	2.94	....	3.40	....	1.96	....	3.18	....	1.56	....
November	4.60	½	4.51	4¼	4.77	1½	2.13	....	4.12	....	3.18	¾
December	2.10	7	4.57	24¾	2.38	7	2.89	11½	2.25	3½	1.58	11½
	58.63	48¾	47.04	40½	49.65	37½	52.86	36¼	45.31	52	38.91	24¾

MONTHS.	1877.		1878.		1879.		1880.		1881.		ANNUAL AMOUNT.	
	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Rain or Melted Snow. Inches.	Depth of Snow. Inches.	Year.	
January	3.77	18	3.54	¼	3.06	14½	2.16	3½	4.75	12	1865.	49.29
February	1.79	....	4.04	6	2.55	15	3.19	1	4.14	8	1866.	43.21
March	6.43	7¾	3.17	....	3.85	....	4.84	10	4.97	3	1867.	53.07
April	2.63	....	1.88	....	6.41	....	2.74	....	1.02	....	1868.	59.13
May	1.04	....	2.75	....	2.09	....	0.62	....	2.86	....	1869.	49.12
June	2.73	....	4.18	....	3.10	....	1.01	....	5.75	....	1870.	42.45
July	5.96	....	6.18	....	2.22	...	7.26	....	1.53	....	1871.	58.63
August	2.88	....	8.00	....	6.50	....	4.69	....	1.25	...	1872.	47.04
September	1.22	....	3.52	....	2.73	....	1.34	....	1.30	....	1873.	49.65
October	8.02	....	2.66	....	0.35	....	3.04	....	1.83	....	1874.	52.86
November	5.75	....	4.51	....	2.03	2	2.54	2¾	2.85	....	1875.	45.31
December	0.75	....	5.43	2	3.77	6	2.71	12	4.61	2	1876.	38.91
	42.97	25¾	49.86	8¼	38.66	37½	36.14	29¼	36.86	25	1877.	42.97
											1878.	49.86
											1879.	38.66
											1880.	36.14
											1881.	36.86

TABLE 9.—*Rain-fall at West Point, New York, from* 1843 *to* 1881.

	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.
January	2.85	5.25	5.15	3.42	4.01	1.87	1.03	6.06	.82	1.62	3.27	3.62	3.63
February	3.02	3.10	2.88	2.78	6.22	3.98	2.07	3.33	5.09	3.80	4.45	5.04	4.23
March	5.05	4.20	3.40	3.90	3.49	2.71	4.55	4.84	2.56	2.68	3.25	2.81	.83
April	3.40	.50	1.80	3.04	.79	1.90	.96	4.30	7.24	4.66	5.84	10.53	2.52
May	2.28	5.10	4.10	2.93	2.70	7.15	6.10	8.26	4.34	1.65	8.04	5.08	4.16
June	1.95	3.45	1.82	.17	2.27	7.37	1.06	3.97	1.53	2.30	3.79	1.62	4.50
July	3.00	7.96	2.38	2.46	2.52	4.42	3.15	5.33	4.44	4.67	9.48	3.73	6.26
August	11.33	5.28	7.72	10.02	2.20	.49	5.74	5.13	2.58	6.93	7.25	.46	3.10
September	3.62	3.50	2.60	2.80	3.58	3.67	.42	8.14	1.22	2.39	3.89	4.00	.97
October	6.95	4.92	2.93	2.60	1.97	4.33	7.63	2.14	4.02	2.99	2.85	1.98	10.25
November	4.60	1.65	5.36	3.65	1.80	6.76	2.31	2.17	4.31	2.60	5.60	5.65	3.69
December	2.70	4.12	3.24	4.40	3.50	5.04	4.11	5.65	2.45	6.17	2.26	2.64	5.14
Yearly Rain-fall	50.75	49.03	43.38	42.17	35.05	49.69	39.13	59.32	40.60	36.52	59.97	47.16	49.28

	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.
January	1.81	2.25	3.83	4.00	.65	4.25	5.47	5.55	1.10	3.20	1.00	1.15	1.50
February	.63	1.79	.65	2.30	4.72	1.80	2.32	2.84	1.75	1.25	4.50	4.40	1.60
March	1.68	1.88	.92	5.85	.93	3.67	2.90	2.65	3.00	5.25	3.65	1.25	3.86
April	3.76	5.32	4.48	4.00	4.25	3.75	2.60	2.65	6.00	4.55	3.20	3.40	4.80
May	6.59	5.70	6.17	2.89	4.50	3.00	2.70	5.35	4.65	2.25	4.20	10.50	11.66
June	4.81	6.38	4.30	5.49	6.20	2.60	9.60	1.90	2.50	4.88	8.51	6.00	3.45
July	2.42	2.04	3.22	1.65	5.66	4.70	4.02	5.90	2.80	4.35	2.90	6.15	1.15
August	11.56	3.97	3.52	6.70	3.80	3.50	3.00	3.93	5.35	1.65	5.50	11.75	7.20
September	4.52	4.46	2.05	5.20	3.70	4.05	4.30	3.65	2.15	3.05	7.20	6.90	11.22
October	1.35	5.40	3.65	1.55	5.30	2.80	4.70	4.75	1.35	3.60	2.10	2.00	.90
November	2.50	2.75	6.30	2.70	5.35	3.90	4.56	4.90	3.80	2.70	3.45	3.50	3.85
December	5.76	5.55	3.90	1.40	2.73	1.21	2.80	4.85	2.60	3.75	1.30	.83	.92
Yearly Rain-fall	47.39	47.49	42.99	43.73	48.21	39.23	48.97	48.92	37.05	40.48	47.51	57.83	52.11

	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	880.	1881.
January	2.40	4.90	1.48	1.70	6.82	7.03	3.02	1.45	3.37	4.16	2.21	3.30	5.45
February	3.50	6.15	2.87	1.00	4.80	2.06	4.24	6.48	1.42	3.15	2.10	3.25	4.30
March	4.25	4.65	5.24	2.40	2.36	2.08	4.22	9.31	7.40	3.38	4.29	2.25	5.15
April	3.07	5.15	3.43	3.20	3.82	6.49	3.33	4.38	4.00	3.48	6.04	3.25	.20
May	4.75	3.82	3.85	5.41	3.31	2.15	1.13	3.37	1.02	5.37	2.20	1.13	4.40
June	5.33	3.15	7.27	6.16	.76	2.17	3.48	3.49	5.15	3.20	6.25	1.35	5.40
July	2.43	2.53	8.50	2.10	2.46	8.49	4.31	6.40	4.02	3.37	2.25	5.35	2.25
August	1.90	2.95	6.60	10.43	4.41	3.10	8.32	.05	2.46	2.35	5.30	4.05	3.00
September	3.35	2.40	1.03	5.27	3.34	5.36	1.98	4.47	2.16	4.11	3.20	1.45	1.15
October	7.80	3.52	4.96	4.10	5.75	2.33	4.18	2.00	9.34	4.46	.35	2.45	5.30
November	3.82	1.11	4.40	9.23	2.75	3.33	14.06	3.36	6.06	4.28	3.40	3.30	3.50
December	4.99	2.00	2.78	5.38	4.25	3.01	1.82	3.35	1.36	7.47	5.00	2.40	6.20
Yearly Rain-fall	47.64	42.33	52.41	56.38	44.83	47.60	54.09	48.11	47.76	48.78	42.59	33.53	46.30

TABLE 10.—*Storage Drawn in* 1880 *and* 1881, *in Million Gallons.*

	January.	February.	March.	April.	May.	June.	July.		August.		September.		October.		November.	December.
	1881.	1881.				1880.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1880.
1	60	10	..	..	..	..	75	..	20	50	..	90	85	90	..	..
2	50	10	..	..	..	..	75	..	30	50	20	90	85	90	..	..
3	50	10	..	..	..	..	75	..	50	50	60	90	80	90	..	..
4	50	30	..	..	..	..	75	..	60	50	80	90	80	70	..	..
5	50	30	..	..	..	..	45	..	75	50	80	90	80	60	..	..
6	30	30	..	..	..	..	15	..	75	60	80	90	80	70	..	..
7	30	35	..	..	..	..	25	..	75	30	85	90	80	70	..	..
8	30	30	..	..	..	..	35	..	75	30	85	90	80	70	..	..
9	30	30	..	..	..	..	65	..	75	30	85	90	80	70	..	..
10	30	10	..	..	..	..	70	..	75	60	80	90	80	70	..	..
11	30	..	..	..	..	..	85	..	75	60	20	90	75	70	..	..
12	30	..	..	..	..	10	85	..	75	70	25	90	75	90	..	..
13	..	..	..	..	..	10	65	..	60	80	25	90	75	90	..	..
14	..	..	..	..	..	30	35	..	60	80	25	90	75	90	..	..
15	..	..	..	..	..	30	65	..	60	90	25	90	75	90	..	..
16	..	..	..	..	..	40	65	..	45	90	25	90	75	90	..	..
17	..	..	..	..	..	45	45	..	40	90	15	90	70	90	..	..
18	..	..	..	..	..	45	15	..	70	90	35	90	70	90	..	..
19	..	..	..	..	..	45	15	..	75	90	35	90	70	90	..	..
20	..	..	..	..	..	45	25	30	85	90	65	90	70	90	..	15
21	..	..	..	..	..	45	30	40	85	90	60	90	70	90	..	15
22	..	..	..	..	..	80	20	40	85	90	80	90	70	90	..	25

TABLE 10.—*Storage Drawn in* 1880 *and* 1881, *in Million Gallons*—(Continued).

	January.	February.	March.	April.	May.	June.	July.		August.		September.		October.		November.	December.
	1881.	1881.				1880.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1881.	1880.	1880.
23	..	..	..	..	..	80	20	60	85	90	85	90	70	90	..	25
24	..	..	..	..	..	65	20	60	70	90	85	90	70	90	..	25
25	..	..	..	..	..	65	..	50	70	90	80	90	75	90	..	30
26	..	..	..	..	..	65	..	50	70	80	80	90	75	70	..	30
27	..	..	..	..	..	65	..	30	50	80	80	90	70	70	.	30
28	..	..	..	..	..	75	..	30	60	90	85	90	70	70	20	30
29	..	..	..	..	..	75	..	40	75	90	85	90	70	60	20	30
30	..	..	..	..	..	..	..	40	75	90	85	90	70	60	20	40
31	..	..	..	..	..	..	..	50	10	90	..	..	70	20	..	40

Total, 1880 ..... 8,520,000,000 gallons.
Total, 1881 ..... 8,605,000,000 "

TABLE 11.—*Existing Storage—Artificial and Natural.*

(From Report of August 12, 1879.)

The reservoirs and lakes within the Croton basin, and now available for storage purposes, are as follows :

	Gallons.
Boyd's Corners Reservoir	2,727,000,000
Middle Branch Reservoir	4,004,000,000
Lake Mahopac	575,000,000
Lake Kirk	565,000,000
Lake Gleneida	165,000,000
Lake Gilead	380,000,000
Lake Waccabuc	200,000,000
Lake Tonetta	50,000,000
Barrett's Pond	170,000,000
China Pond	105,000,000
White Pond	100,000,000
Pine Pond	75,000,000
Long Pond	60,000,000
Peach Pond	230,000,000
Cross Pond	110,000,000
Haine's Pond	25,000,000
Total Gallons	9,541,000,000

TABLE 12.

(From Report of August 12, 1879.)

The following table, prepared from daily observations for several years by the Engineers of the Croton Bureau, shows the rain-fall and the average daily quantity of water running in the Croton river :

YEAR.	RAIN-FALL AT BOYD'S CORNERS RESERVOIR.	AVERAGE DAILY FLOW OF THE CROTON RIVER AT CROTON DAM.	PERCENTAGE OF RAIN-FALL RUNNING IN THE STREAM.
	Inches.	Gallons.	Per cent.
1866	51.77	440,705,558	51.
1867	50.77	541,318,397	65.
1868	50.33	600,524,194	74.
1869	48.36	456,575,841	58.
1870	44.63	347,935,318	47.
1871	48.94	357,175,341	45.
1872	40.74	307,208,408	49
1873	43.87	444,236,877	67.
1874	42.37	427,638,306	63.
1875	43.66	425,021,738	59.
1876	40.68	367,872,936	56.
1877	46.03	346,503,178	45.
1878	54.14	462,854,308	52.

APPROVED PAPERS.

Resolved, That permission be and the same is hereby given to Bode Brothers to retain the storm-door at the entrance on Thirteenth street, corner of Sixth avenue, of their premises ; such permission to continue only during the pleasure of the Common Council.

Adopted by the Board of Aldermen, February 21, 1882.
Approved by the Mayor, February 27, 1882.

Resolved, That permission be and the same is hereby given to D. Fincke to place and keep a storm-door at each of the two entrances to building No. 620 Grand street, and to be within the stoop-line, the work to be done at his own expense ; such permission to continue only during the pleasure of the Common Council.

Adopted by the Board of Aldermen, February 21, 1882.
Approved by the Mayor, February 27, 1882.

Resolved, That the sidewalk on the northerly side of East One Hundred and Seventy-fourth street, between Third avenue and Washington avenue, be flagged a space four feet wide, and that crosswalks be laid in Washington avenue and in East One Hundred and Seventy-fourth street, at the intersections of said avenue and street ; under the direction of the Commissioners of the Department of Public Parks ; and that the accompanying ordinance therefor be adopted.

Adopted by the Board of Aldermen, February 21, 1882.
Approved by the Mayor, February 28, 1882.

Resolved, That permission be and the same is hereby given to Samuel Emmert to suspend sign from awning in front of his premises, No. 163 Reade street; such permission to continue only during the pleasure of the Common Council.

Resolved, That permission be and the same is hereby given to Ira Perego, of No. 128 Fulton street and No. 87 Nassau street, to retain two signs, each about two and a half feet high by eighteen inches wide, in front of his place of business ; such permission to continue only during the pleasure of the Common Council.

Adopted by the Board of Aldermen, February 7, 1882.
Received from his Honor the Mayor, February 14, 1882, with his objections thereto.
In Board of Aldermen, February 28, 1882, taken up, reconsidered, as provided in section 13, chapter 335, Laws of 1873, and adopted, notwithstanding the objections of his Honor the Mayor, three-fourths of all the members elected voting in favor thereof.

OFFICIAL DIRECTORY

STATEMENT OF THE HOURS DURING WHICH all the Public Offices in the City are open for business, and at which each Court regularly opens and adjourns, as well as of the places where such offices are kept and such Courts are held ; together with the heads of Departments and Courts.

EXECUTIVE DEPARTMENT.

Mayor's Office.

No. 6 City Hall, 10 A. M. to 3 P. M.
WILLIAM R. GRACE, Mayor ; WILLIAM M. IVINS, Secretary and Chief Clerk.

Mayor's Marshal's Office

No. 1 City Hall, 10 A. M. to 3 P. M.
GEORGE A. MCDERMOTT, First Marshal.

Permit Bureau Office.

No. 13½ City Hall, 10 A. M. to 3 P. M
HENRY WOLTMAN, Register.

Sealers and Inspectors of Weights and Measures.

No. 7 City Hall, 10 A. M. to 3 P. M.
WILLIAM EVLERS, Sealer First District ; CHRISTOPHER BARRY, Sealer Second District; JOHN MURRAY, Inspector First District; JOSEPH SHANNON, Inspector Second District.

COMMISSIONERS OF ACCOUNTS.

No. 1 County Court-house, 9 A. M. to 4 P. M.
WM. PITT SHEARMAN, JOHN W. BARROW.

LEGISLATIVE DEPARTMENT.

Office of Clerk of Common Council.

No 8 City Hall, 10 A. M. to 4 P. M.
WILLIAM SAUER, President Board of Aldermen.
FRANCIS J. TWOMEY, Clerk Common Council.

City Library.

No. 12 City Hall, 10 A. M. to 4 P. M.
THOS. J. O'CONNELL, Librarian.

DEPARTMENT OF PUBLIC WORKS.

Commissioner's Office.

No. 31 Chambers street, 9 A. M. to 4 P. M.
HUBERT O. THOMPSON, Commissioner; FREDERICK H. HAMLIN, Deputy Commissioner

Bureau of Water Register.

No. 31 Chambers street, 9 A. M. to 4 P M.
JOHN H. CHAMBERS, Register.

Bureau of Incumbrances.

No. 31 Chambers street, 9 A. M. to 4 P M
JOSEPH BLUMENTHAL, Superintendent.

Bureau of Lamps and Gas.

No. 31 Chambers street, 9 A. M. to 4 P. M.
STEPHEN MCCORMICK, Superintendent.

Bureau of Streets.

No. 31 Chambers street, 9 A. M. to 4 P M.
JAMES J. MOONEY, Superintendent

Engineer in Charge of Sewers.

No. 31 Chambers street, 9 A. M. to 4 P. M.
STEVENSON TOWLE, Engineer-in-Charge

Bureau of Street Improvements

No. 31 Chambers street, 9 A. M. to 4 P. M.
GEORGE A. JEREMIAH, Superintendent.

Bureau of Repairs and Supplies.

No. 31 Chambers street, 9 A. M. to 4 P. M.
THOMAS H. MCAVOY, Superintendent.

Bureau of Water Purveyor

No. 31 Chambers street, 9 A. M. to 4 P. M.
DANIEL O'REILLY, Water Purveyor.

Keeper of Buildings in City Hall Park.

MARTIN J. KEESE, City Hall.

Bureau of Chief Engineer.

No. 31 Chambers street, 9 A. M. to 4 P. M.
ISAAC NEWTON, Chief Engineer.

FINANCE DEPARTMENT.

Comptroller's Office.

Nos. 19 and 20 New County Court-house, 9 A. M. to 4 P. M.
ALLAN CAMPBELL, Comptroller ; RICHARD A. STORRS, Deputy Comptroller.

Auditing Bureau.

No. 19 New County Court-house, 9 A. M. to 4 P. M.
DANIEL JACKSON, Auditor of Accounts.

Bureau for the Collection of Assessments and of Arrears of Taxes and Assessments and of Water Rents.

No. 5 New County Court-house, 9 A. M. to 4 P. M.
ARTEMAS CADY, Collector of Assessments and Clerk of Arrears

Bureau for the Collection of City Revenues and of Markets

No. 6 New County Court-house, 9 A. M. to 4 P. M.
THOMAS F. DEVOE, Collector of City Revenue and Superintendent of Markets.

Bureau for the Collection of Taxes.

First floor Brown-stone Building, City Hall Park.
MARTIN T. MCMAHON, Receiver of Taxes; ALFRED VREDENBURG, Deputy Receiver of Taxes.

Bureau of the City Chamberlain.

No. 18 New County Court-house, 9 A. M. to 4 P. M
J. NELSON TAPPAN, City Chamberlain.

Office of the City Paymaster.

Room 1, New County Court-house, 9 A. M. to 4 P. M.
MOOR FALLS, City Paymaster.

LAW DEPARTMENT

Office of the Counsel to the Corporation.

Staats Zeitung Building, third floor, 9 A. M. to 5 P. M Saturday, 9 A. M. to 4 P. M.
WILLIAM C. WHITNEY, Counsel to the Corporation
ANDREW T CAMPBELL, Chief Clerk.

Office of the Public Administrator.

No. 49 Beekman street, 9 A. M. to 4 P. M.
ALGERNON S. SULLIVAN, Public Administrator

Office of the Corporation Attorney.

No. 49 Beekman street, 9 A. M. to 4 P. M.
WILLIAM A. BOYD Corporation Attorney.

POLICE DEPARTMENT.

Central Office.

No. 300 Mulberry street, 9 A. M. to 4 P. M.
STEPHEN B. FRENCH, President ; SETH C. HAWLEY, Chief Clerk.

DEPARTMENT OF CHARITIES AND CORRECTION.

Central Office.

No. 66 Third avenue, corner Eleventh street, 8:30 A. M. to 5:30 P. M.
THOMAS S. BRENNAN, President ; GEORGE F. BRITTON, Secretary.

FIRE DEPARTMENT.

Headquarters.

Nos. 155 and 157 Mercer street.
JOHN J. GORMAN, President ; CARL JUSSEN, Secretary.

Bureau of Chief of Department.

ELI BATES, Chief of Department.

Bureau of Inspector of Combustibles.

PETER SEERY, Inspector of Combustibles.

Bureau of Fire Marshal.

GEORGE H. SHELDON, Fire Marshal.

Bureau of Inspection of Buildings.

WM. P. ESTERBROOK, Inspector of Buildings.
Office hours, Headquarters and Bureaus, from 9 A. M. to 4 P. M. (Saturdays to 3 P. M.)

Attorney to Department.

WM. L. FINDLEY, Nos. 155 and 157 Mercer street and No. 120 Broadway.

Fire Alarm Telegraph.

J. ELLIOT SMITH, Superintendent of Telegraph
Nos. 155 and 157 Mercer street.

Repair Shops.

Nos. 128 and 130 West Third street.
JOHN MCCABE, Chief of Battalion-in-Charge, 8 A. M. to 5 P. M.

Hospital Stables.

No. 109 Christie street.
DEDERICK G. GALE, Superintendent of Horses.

HEALTH DEPARTMENT

No. 301 Mott street, 9 A. M to 4 P. M.
CHARLES F. CHANDLER, President; EMMONS CLARK Secretary.

DEPARTMENT OF PUBLIC PARKS.

No. 36 Union square, 9 A. M. to 4 P. M.
EDWARD P. BARKER, Secretary.

Civil and Topographical Office.

Arsenal, 64th street and 5th avenue, 9 A. M. to 5 P. M.

Office of Superintendent of 23d and 24th Wards.

146th street and 3d avenue, 9 A. M. to 5 P. M.

DEPARTMENT OF DOCKS.

Nos. 11 and 119 Duane street, 9 A. M. to 4 P. M.
JOHN R. VOORHIS, President; JOHN T. CUMING Secretary.

DEPARTMENT OF TAXES AND ASSESSMENTS

Brown-stone Building, City Hall Park, 9 A. M. to 4 P. M.
THOMAS B. ASTEN, President; ALBERT STORER Secretary.

DEPARTMENT OF STREET CLEANING.

51 Chambers Street, Rooms 10, 11 & 12, 9 A. M. to 4 P. M.
JAMES S. COLEMAN, Commissioner ; M. J. MORRISSON, Chief Clerk.

BOARD OF ASSESSORS.

Office, City Hall, Room No. 11½, 9 A. M. to 4 P. M.
JOHN R. LYDECKER, Chairman ; WM. H. JASPER, Secretary.

BOARD OF EXCISE.

Corner Bond street and Bowery, 9 A. M. to 4 P. M.
WILLIAM P. MITCHELL, President; ANTHONY HARTMAN Chief Clerk.

SHERIFF'S OFFICE.

Nos. 3 and 4 New County Court-house 9 A. M. to 4 P. M
PETER BOWE, Sheriff; JOEL O. STEVENS, Under Sheriff

REGISTER'S OFFICE.

East side City Hall Park, 9 A. M. to 4 P. M.
AUGUSTUS T. DOCHARTY, Register ; J. FAIRFAX MCLAUGHLIN, Deputy Register.

COMMISSIONER OF JURORS.

No. 17 New County Court-house, 9 A. M. to 4 P. M.
GEORGE CAULFIELD, Commissioner ; ALFRED J. KEEGAN, Deputy Commissioner

COUNTY CLERK'S OFFICE

Nos. 7 and 8 New County Court-house, 9 A. M. to 4 P M.
WILLIAM A. BUTLER, County Clerk ; CHAS. S. BEARDSLEY, Deputy County Clerk.

DISTRICT ATTORNEY'S OFFICE.

Second floor, Brown-stone Building, City Hall Park. 9 A. M. to 4 P. M.
JOHN MCKEON, District Attorney ; ——— ——— Chief Clerk.

THE CITY RECORD OFFICE,

And Bureau of Printing, Stationery, and Blank Books.

No. 2 City Hall, 8 A. M. to 5 P. M.
THOMAS COSTIGAN, Supervisor ; R. P. H ABELL, Bookkeeper.

CORONERS' OFFICE.

Nos. 13 and 15 Chatham street.
PHILIP MERKLE, THOMAS C. KNOX, GERSON N. HERRMAN, JOHN H. BRADY, Coroners ; JOHN D. COUGHLIN, Clerk of the Board of Coroners.

SUPREME COURT.

econd floor, New County Court-house, 10½ A. M. to 3 P. M,
General Term, Room No. 9
Special Term, Room No. 10.
Chambers, Room No. 11.
Circuit, Part I., Room No. 12.
Circuit, Part II., Room No. 13.
Circuit, Part III., Room No. 14.
Judges' Private Chambers, Room No. 15
NOAH DAVIS, Chief Justice; WILLIAM A. BUTLER, Clerk.

SUPERIOR COURT.

Third floor, New County Court-house, 11 A. M.
General Term, Room No. 29.
Special Term, Room No. 33
Chambers, Room No. 33.
Part I., Room No. 34.
Part II., Room No. 35.
Part III., Room No. 36.
Judges' Private Chambers, Room No. 30.
Naturalization Bureau, Room No. 32.
Clerk's Office, 9 A. M. to 4 P M., Room No. 31.
JOHN SEDGWICK, Chief Judge. THOMAS BOESE, Chief Clerk.

COURT OF COMMON PLEAS.

Third floor, New County Court-house, 11 A. M.
Clerk's Office, 9 A. M. to 4 P. M., Room No. 22.
General Term, Room No. 24.
Special Term, Room No. 21.
Chambers, Room No. 21.
Part I., Room No. 25.
Part II., Room No. 26
Part III., Room No. 27.
Naturalization Bureau, Room No. 23.
CHARLES P. DALY, Chief Justice; NATHANIEL JARVIS, Jr., Chief Clerk.

COURT OF GENERAL SESSIONS.

32 Chambers street. Parts I and II.

FREDERICK SMYTH, Recorder, Presiding Judge of the General Sessions; HENRY A. GILDERSLEEVE and RUFUS B. COWING, Judges.
Terms first Monday each month.
JOHN SPARKS, Clerk.

MARINE COURT.

General Term, Room 15, City Hall.
Trial Term, Parts I., II., and III., second floor, City Hall
Special Term, Chambers, Room 21, City Hall, 10 A. M to 4 P. M.
Clerk's Office, Room 10, City Hall.
GEORGE SHEA, Chief Justice: JOHN SAVAGE, Clerk

OYER AND TERMINER COURT.

General Term, New County Court-house, second floor southeast corner, Room 13, 10:30 A. M.
Clerk's Office, Brown-stone Building City Hall Park, second floor, northwest corner

COURT OF SPECIAL SESSIONS

At Tombs, corner Franklin and Centre streets, Tuesdays, Thursdays, and Saturdays, 10 A. M.
Clerk's Office, Tombs

DEPARTMENT OF PUBLIC WORKS.

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE,
ROOM 6, No. 31 CHAMBERS STREET,
NEW YORK, March 7, 1882.

TO CONTRACTORS.

BIDS OR ESTIMATES, INCLOSED IN A SEALED envelope, with the title of the work and the name of the bidder indorsed thereon, also the number of the work as in the advertisement, will be received at this office until Tuesday, March 21, 1882, at 12 o'clock M., at which hour they will be publicly opened by the head of the Department and read, for the following:

No. 1. SEWER in Cherry street, between Corlears and Jackson streets.
No. 2. SEWERS in Mangin street, between Broome and Delancey streets, and between Rivington and Stanton streets.
No. 3. SEWER in Seventy-second street, between Avenue A and First avenue, from end of present sewer.
No. 4. SEWER in One Hundred and Nineteenth street, between Sixth avenue and summit east of Sixth avenue.
No. 5. SEWER in Fourth avenue, east side, between Eighty-second and Eighty third streets.
No. 6. RECEIVING BASINS on the west side of Fifth avenue, opposite One Hundred and Second street.
No. 7. REGULATING AND GRADING One Hundred and Sixth street, from the west curb of Madison avenue to the east curb of Fifth avenue, and setting curb-stones and flagging sidewalks therein.
No. 8. REGULATING AND GRADING One Hundred and Eighteenth street, from the west curb of Sixth avenue to the east curb of Seventh avenue, and setting curb-stones and flagging sidewalks therein.
No. 9. REGULATING AND GRADING One Hundred and Fifty-third street, from a line sixty feet east of and parallel with the east line of Seventh avenue to the east line of the first new avenue west of Eighth avenue, and setting curb-stones and flagging sidewalks therein.
No. 10. FLAGGING SIDEWALKS four feet wide on Eighty-third street, from the west curb of Eighth avenue to the east curb of the Boulevard.

Each estimate must contain the name and place of residence of the person making the same, the names of all persons interested with him therein, and if no other person be so interested, it shall distinctly state that fact, that it is made without any connection with any other person making an estimate for the same work, and is in all respects fair and without collusion or fraud. That no member of the Common Council, head of a department, chief of a bureau, deputy thereof, or clerk therein, or other officer of the Corporation is directly or indirectly interested in the estimate or in the work to which it relates or in the profits thereof.

Each estimate must be verified by the oath, in writing, of the party making the same, that the several matters therein stated are true, and must be accompanied by the consent, in writing, of two householders or freeholders in the City of New York, to the effect that if the contract is awarded to the person making the estimate, they will, upon its being so awarded, become bound as his sureties for its faithful performance; and that if he shall refuse or neglect to execute the same, they will pay to the Corporation any difference between the sum to which he would be entitled upon its completion, and that which the Corporation may be obliged to pay to the person to whom the contract shall be awarded at any subsequent letting; the amount to be calculated upon the estimated amount of the work by which the bids are tested.

The consent last above mentioned must be accompanied by the oath or affirmation, in writing, of each of the persons signing the same, that he is a householder or freeholder in the City of New York, and is worth the amount of the security required for the completion of the contract, over and above all his debts of every nature, and over and above his liabilities as bail, surety, or otherwise, and that he has offered himself as surety in good faith, with the intention to execute the bond required by law.

No estimate will be considered unless accompanied by either a certified check upon one of the national banks of the City of New York, drawn to the order of the Comptroller, or money, to the amount of five per centum of the amount of the security required for the faithful performance of the contract. Such check or money must not be inclosed in the sealed envelope containing the estimates, but must be handed to the officer or clerk of the Department who has charge of the estimate box, and no estimate can be deposited in said box until such check or money has been examined by said officer or clerk and found to be correct. All such deposits, except that of the successful bidder, will be returned to the persons making the same within three days after the contract is awarded. If the successful bidder shall neglect or refuse, within five days after notice that the contract has been awarded to him, to execute the same, the amount of the deposit made by him shall be forfeited to and retained by the City of New York, as liquidated damages for such neglect or refusal; but if he shall execute the contract within the time aforesaid, the amount of his deposit will be returned to him.

Blank forms of bid or estimate, the proper envelopes in which to inclose the same, the specifications and agreements, and further information desired can be obtained for each class of work at the following offices: For sewers, Room 8, and regulating and grading, Room 5, No. 31 Chambers street.

HUBERT O. THOMPSON,
Commissioner of Public Works.

DEPARTMENT OF PUBLIC CHARITIES AND CORRECTION.

DEPARTMENT OF PUBLIC CHARITIES AND CORRECTION,
No. 66 THIRD AVENUE.

TO CONTRACTORS.

PROPOSALS FOR GROCERIES, DRY GOODS, HARDWARE, ETC.

SEALED BIDS OR ESTIMATES FOR FURNISHing

GROCERIES.

50,000 pounds Brown Sugar.
50,000 " Hard Soap.
6,000 " Dairy Butter (sample on exhibition Thursday, March 16, 1882).
25,000 Fresh Eggs (all to be candled).
50 bbls. Wheaten Grits (160 lbs. net per bbl.)

DRY GOODS.

5,000 yards Sheep's Gray Cassimere.
500 Toilet Quilts.
500 dozen Men's Hats.
24 " Hair Brushes.

HARDWARE.

12 dozen Rakes.
12 " Hoes.
12 " Spades.
12 " Shovels.
25 kegs Horseshoes { 10 x 3. 10 x 4. 5 x 5.
5 tons pure White Lead, equal to "Atlantic."

STRAW.

500 bales long, bright Rye Straw.

—or any part thereof, will be received at the office of the Department of Public Charities and Correction, in the City of New York, until 9:30 o'clock A. M., of Friday, the 17th day of March, 1882. The person or persons making any bid or estimate shall furnish the same in a sealed envelope, indorsed "Bid or Estimate for Groceries, Dry Goods, Hardware, etc.," and with his or their name or names, and the date of presentation, to the head of said Department, at the said office, on or before the day and hour above named, at which time and place the bids or estimates received will be publicly opened by the head of said Department and read.

The Department of Public Charities and Correction reserves the right to decline any and all bids or estimates if deemed to be for the public interest, and to accept any bid or estimate as a whole, or for any one or more articles included therein. No bid or estimate will be accepted from, or a contract awarded to, any person who is in arrears to the Corporation upon debt or contract, or who is a defaulter, as surety or otherwise, upon any obligation to the Corporation.

The award of the contract will be made as soon as practicable after the opening of the bids.

Delivery will be required to be made from time to time, at such time and in such quantities as may be directed by the said Department; but the entire quantity will be required to be delivered on or before thirty (30) days after the date of the contract.

Any bidder for this contract must be known to be engaged in and well prepared for the business, and must have satisfactory testimonials to that effect; and the person or persons to whom the contract may be awarded will be required to give security for the performance of the contract by his or their bond, with two sufficient sureties, in the penal amount of fifty (50) per cent. of the estimated amount of the contract.

Each bid or estimate shall contain and state the name and place of residence of each of the persons making the same; the names of all persons interested with him or them therein; and if no other person be so interested, it shall distinctly state that fact; that it is made without any connection with any other person making an estimate for the same purpose, and is in all respects fair and without collusion or fraud; and that no member of the Common Council, head of a Department, Chief of a Bureau, Deputy thereof or Clerk therein, or other officer of the Corporation, is directly or indirectly interested therein, or in the supplies or work to which it relates, or in any portion of the profits thereof. The bid or estimate must be verified by the oath in writing, of the party or parties making the estimate, that the several matters stated therein are in all respects true. Where more than one person is interested, it is requisite that the verification be made and subscribed by all the parties interested.

Each bid or estimate shall be accompanied by the consent, in writing, of two householders or freeholders in the City of New York, with their respective places of business or residence, to the effect, that if the contract be awarded to the person making the estimate, they will, on its being so awarded, become bound as his sureties for its faithful performance; and that if he shall omit or refuse to execute the same, they shall pay to the Corporation any difference between the sum to which he would be entitled on its completion, and that which the Corporation may be obliged to pay to the person or persons to whom the contract may be awarded at any subsequent letting; the amount in each case to be calculated upon the estimated amount of the work by which the bids are tested. The consent above mentioned shall be accompanied by the oath or affirmation, in writing, of each of the persons signing the same, that he is a householder or freeholder in the City of New York, and is worth the amount of the security required for the completion of this contract over and above all his debts of every nature, and over and above his liabilities, as bail, surety, or otherwise; and that he has offered himself as a surety in good faith and with the intention to execute the bond required by section 27 of chapter 8 of the Revised Ordinances of the City of New York, if the contract shall be awarded to the person or persons for whom he consents to become surety. The adequacy and sufficiency of the security offered to be approved by the Comptroller of the City of New York.

No bid or estimate will be considered unless accompanied by either a certified check upon one of the national banks of the City of New York, drawn to the order of the Comptroller, or money to the amount of five per centum of the amount of the security required for the faithful performance of the contract. Such check or money must not be inclosed in the sealed envelope containing the estimate, but must be handed to the officer or clerk of the Department who has charge of the Estimate-box, and no estimate can be deposited in said box until such check or money has been examined by said officer or clerk and found to be correct. All such deposits, except that of the successful bidder, will be returned to the persons making the same within three days after the contract is awarded. If the successful bidder shall refuse or neglect, within five days after notice that the contract has been awarded to him to execute the same, the amount of the deposit made by him shall be forfeited to and retained by the City of New York as liquidated damages for such neglect or refusal; but, if he shall execute the contract within the time aforesaid, the amount of his deposit will be returned to him.

Should the person or persons to whom the contract may be awarded neglect or refuse to accept the contract within five days after written notice that the same has been awarded to his or their bid or proposal, or if he or they accept but do not execute the contract and give the proper security, he or they shall be considered as having abandoned it and as in default to the Corporation, and the contract will be readvertised and relet as provided by law.

The quality of the articles, supplies, goods, wares, and merchandise must conform in every respect to the samples of the same respectively at the office of the said Department. Bidders are cautioned to examine the specifications for particulars of the articles, etc., required, before making their estimates.

Bidders will state the prices for each article, by which the bids will be tested.

Bidders will write out the amount of their estimate, in addition to inserting the same in figures

Payment will be made by a requisition on the Comptroller, issued on the completion of the contract, or from time to time, as the Commissioners may determine.

Bidders are informed that no deviation from the specifications will be allowed, unless under the written instruction of the Commissioners of Public Charities and Correction.

The Department of Public Charities and Correction reserves the right to decline any and all bids or estimates if deemed to be for the public interest, and to accept any bid or estimate as a whole, or for any one or more articles included therein. No bid or estimate will be accepted from, or contract awarded to, any person who is in arrears to the Corporation upon debt or contract, or who is a defaulter, as surety or otherwise, upon any obligation to the Corporation.

The form of the agreement, including specifications, and showing the manner of payment, can be obtained at the office of the Department.

Dated New York, March 4, 1882.

THOMAS S. BRENNAN,
JACOB HESS,
HENRY H. PORTER,
Commissioners of the Department of Public Charities and Correction

DEPARTMENT OF PUBLIC CHARITIES AND CORRECTION,
No. 66 THIRD AVENUE,
NEW YORK, February 28, 1882.

IN ACCORDANCE WITH AN ORDINANCE OF the Common Council, "In relation to the burial of strangers or unknown persons who may die in any of the public institutions of the City of New York," the Commissioners of Public Charities and Correction report as follows:

At Charity Hospital, Blackwell's Island—Catherine Hyland; age 38 years.

At Alms-house, Blackwell's Island—Mary Flaherty; age 60 years.

At Work-house, Blackwell's Island—William Stewart; age 39 years; committed January 26, 1882.

At Lunatic Asylum, Blackwell's Island—Rosanna Griffin; age 27 years; 5 feet 1½ inches high; brown hair; blue eyes. Had on when admitted black sack, gray suit, straw hat, calico dress.

At Homœopathic Hospital, Ward's Island—John Murray; age 60 years; 5 feet 7 inches high; hazel eyes; gray hair. Had on when admitted dark suit of clothes, gaiters.

Harry Conlon; age 75 years; 5 feet 2 inches high; black eyes; gray hair. Had on when admitted black overcoat, brown pants, gray vest, gaiters, black derby hat.

James Ford; age 58 years; 5 feet 7 inches high; blue eyes; gray hair. Had on when admitted brown overcoat, black suit of clothes, gaiters.

Ellen O'Leary; age 59 years; 5 feet high; gray eyes; brown hair. Had on when admitted dark skirt, brown cardigan jacket, black shawl, black hood, gaiters.

Henry Lenz; age 52 years; 5 feet 6 inches high; brown eyes and hair. Had on when admitted blue coat and vest, black pants, check shirt, gaiters.

Margaret McCabe; age 71 years; 4 feet 10 inches high; gray eyes and hair. Had on when admitted brown skirt, black shawl, black straw hat.

Jane Hanneman; age 38 years; 5 feet 4 inches high; brown eyes; dark hair. Had on when admitted black dress, red plaid shawl.

Ann Brady; age 44 years; 4 feet 10 inches high; blue eyes; gray hair.

At N. Y. City Asylum for Insane, Ward's Island—Thomas Thompson; 5 feet 4½ inches high; gray hair; blue eyes.

Nothing known of their friends or relatives.

By order.

G. F. BRITTON,
Secretary.

FIRE DEPARTMENT.

HEADQUARTERS
FIRE DEPARTMENT, CITY OF NEW YORK,
155 AND 157 MERCER STREET,
NEW YORK, March 1, 1882.

TO CONTRACTORS.

SEALED PROPOSALS FOR FURNISHING THIS Department with two (2) new boilers to Steam Fire Engines Nos. 9 and 18, and making repairs to said engines, will be received by the Board of Commissioners at the head of the Fire Department, at the office of said Department, Nos. 155 and 157 Mercer street, in the City of New York, until 10 o'clock A. M., Wednesday, 15th instant, at which time and place they will be publicly opened by the head of said Department and read.

The award of the contract will be made as soon as practicable after the opening of the bids.

Any person making an estimate for the work shall present the same in a sealed envelope, to said Board, at said office, on or before the day and hour above named, which envelope shall be indorsed with the name or names of the person or persons presenting the same, the date of its presentation, and a statement of the work to which it relates.

The boilers to be in all respects as to form and construction exactly similar to that now on Engine No. 21 of this Department, being M. R. Clapp's Circulating Tubular Boiler, patent of 1878.

The engines are to be delivered at the Repair Shops of the Fire Department within 90 days after the execution of the contract, in complete working order, with a guarantee that the material and workmanship are of the best character, and to replace, at the expense of the contractor, such parts, if any, as may fail, if such failure is properly attributable to defective material or inferior workmanship. Said engines shall have a full and complete trial of their working powers at New York, under the superintendence of a competent engineer.

For information as to the amount and kind of work to be done, bidders are referred to the specifications which form part of these proposals.

The damages to be paid by the contractor for each day that the contract may be unfulfilled after the time specified for the completion thereof shall have expired, are, by a clause in the contract, fixed and liquidated at twenty-five ($25) dollars per day.

The Fire Department reserves the right to decline any and all bids or estimates if deemed to be for the public interest. No bid or estimate will be accepted from, or contract awarded to, any person who is in arrears to the Corporation upon debt or contract, or who is a defaulter, as surety or otherwise, upon any obligation to the Corporation.

Each bid or estimate shall contain and state the name and place of residence of each of the persons making the same; the names of all persons interested with him or them therein; and if no other person be so interested, it shall distinctly state that fact; that it is made without any connection with any other person making an estimate for the same purpose, and is in all respects fair and without collusion or fraud; and that no member of the Common Council, head of a Department, Chief of a Bureau, Deputy thereof, or Clerk therein, or other officer of the Corporation, is directly or indirectly interested therein, or in the supplies or work to which it relates, or in any portion of the profits thereof. The bid or estimate must be verified by the oath, in writing, of the party or parties making the estimate, that the several matters stated therein are in all respects true. Where more than one person is interested, it is requisite that the verification be made and subscribed by all the parties interested.

Each bid or estimate shall be accompanied by the consent, in writing, of two householders or freeholders of the City of New York, with their respective places of business or residence, to the effect that if the contract be awarded to the person making the estimate, they will, on its being so awarded, become bound as his sureties for its faithful performance in a sum not less than one-half the amount of the estimate; and that if he shall omit or refuse to execute the same, they will pay to the Corporation any difference between the sum to which he would be entitled on its completion and that which the Corporation may be obliged to pay to the person or persons to whom the contract may be awarded at any subsequent letting; the amount in each case to be calculated upon the estimated amount of the work by which the bids are tested. The consent above mentioned shall be accompanied by the oath or affirmation, in writing, of each of the persons signing the same, that he is a householder or freeholder in the City of New York, and is worth the amount of the security required for the completion of this contract, over and above all his debts of every nature, and over and above his liabilities as bail, surety, or otherwise; and that he has offered himself as a surety in good faith and with the intention to execute the bond required by law. The adequacy and sufficiency of the security offered is to be approved by the Comptroller of the City of New York before the award is made, and prior to the signing of the contract.

No estimate will be received or considered after the hour named.

No estimate will be considered unless accompanied by either a certified check upon one of the National Banks of the City of New York, drawn to the order of the Comptroller, or money, to the amount of five per centum of the amount of the security required for the faithful performance of the contract. Such check or money must not be inclosed in the sealed envelope containing the estimate, but must be handed to the officer or clerk of the Department who has charge of the Estimate Box, and no estimate can be deposited in said box until such check or money has been examined by said officer or clerk, and found to be correct. All such deposits, except that of the successful bidder, will be returned to the persons making the same, within three days after the contract is awarded. If the successful bidder shall refuse or neglect within five days after notice that the contract has been awarded to him, to execute the same, the amount of the deposit made by him shall be forfeited to and retained by the City of New York as liquidated damages for such neglect or refusal; but if he shall execute the contract within the time aforesaid, the amount of his deposit will be returned to him.

Should the person or persons to whom the contract may be awarded neglect or refuse to accept the contract within five days after written notice that the same has been awarded to his or their bid or proposal, or if he or they accept but do not execute the contract and give the proper security, he or they shall be considered as having abandoned it and as in default to the Corporation, and the contract will be readvertised and relet as provided by law.

Bidders will write out the amount of their estimate, in addition to inserting the same in figures.

The form of the agreement and specifications, and showing the manner of payment for the work, may be seen and forms of proposals may be obtained at the office of the Department.

JOHN J. GORMAN,
CORNELIUS VAN COTT,
HENRY D. PURROY,
Commissioners.

HEADQUARTERS
FIRE DEPARTMENT, CITY OF NEW YORK,
155 AND 157 MERCER STREET,
NEW YORK, September 23, 1881.

NOTICE IS HEREBY GIVEN THAT THE Board of Commissioners of this Department will meet daily, at 10 o'clock A. M., for the transaction of business.

By order of

JOHN J. GORMAN, President.
CORNELIUS VAN COTT,
HENRY D. PURROY,
Commissioners.

CARL JUSSEN,
Secretary.

SUPREME COURT.

In the matter of the application of the Mayor, Aldermen, and Commonalty of the City of New York, relative to the opening of Sixty-fourth street, from Third avenue to the East river, in the City of New York.

WE, THE UNDERSIGNED COMMISSIONERS of Estimate and Assessment in the above-entitled matter, hereby give notice to the owner or owners, occupant or occupants, of all houses and lots and improved or unimproved lands affected thereby, and to all others whom it may concern, to wit:

First.—That we have completed our estimate and assessment, and that all persons interested in these proceedings, or in any of the lands affected thereby, and who may be opposed to the same, do present their objections in writing, duly verified, to Joseph W. Meeks, Esq., our Chairman, at the office of the Commissioners, No. 82 Nassau street (Room No. 22), in the said city, on or before the 4th day of April, 1882, and that we, the said Commissioners, will hear parties so objecting within the ten week-days next after the said 4th day of April, 1882, and for that purpose will be in attendance at our said office on each of said ten days, at two o'clock P. M.

Second.—That the abstract of the said estimate and assessment, together with our maps, and also all the affidavits, estimates, and other documents which were used by us in making our report, have been deposited in the office of the Department of Public Works in the City of New York, there to remain until the 12th day of April, 1882.

Third.—That the limits embraced by the assessment aforesaid are as follows, to wit: All those lots, pieces, or parcels of land, lying and being within the following described area:

Beginning at a point on the easterly line or side of Fourth avenue, distant one hundred feet and five inches northerly from the point formed by the intersection of the northerly line or side of Sixty-fourth street with the easterly line or side of Fourth avenue, and running thence easterly and parallel with Sixty-fourth street to the Harbor Commissioner's bulkhead line on the East river; thence southerly along said Harbor Commissioner's line to the centre line of the block between Sixty-fourth and Sixty-third streets; and running thence westerly along said centre line to the easterly line of the Fourth avenue, and thence northerly along the easterly line of Fourth avenue to the point or place of beginning.

Fourth.—That our report herein will be presented to the Supreme Court of the State of New York, at a Special Term thereof, to be held at the Chambers of said court, in the County Court-house at the City Hall, in the City of New York, on the 19th day of April, 1882, at the opening of the Court on that day, and that then and there, or as soon thereafter as counsel can be heard thereon, a motion will be made that the said report be confirmed.

Dated New York, February 25, 1882.

JOSEPH W. MEEKS,
EDMOND CONNOLLY,
LUKE F. COZANS,
Commissioners.

In the matter of the application of the Department of Public Works, for and on behalf of the Mayor, Aldermen, and Commonalty of the City of New York, relative to the opening of One Hundred and Fourteenth street, from Fourth avenue to Eighth avenue, in the City of New York.

PURSUANT TO THE STATUTES IN SUCH cases made and provided, notice is hereby given that an application will be made to the Supreme Court of the State of New York, at a Special Term of said Court, to be held at the Chambers thereof in the County Court-house, in the City of New York, on Tuesday, the twenty-eighth day of March, 1882, at the opening of the Court on that day or soon thereafter as counsel can be heard thereon, for the appointment of Commissioners of Estimate and Assessment in the above entitled matter. The extent and nature of the improvement hereby intended is the acquisition of title in the name and on behalf of the Mayor, Aldermen, and Commonalty of the City of New York, to all the lands and premises, with the buildings thereon and the appurtenances thereto belonging, required for the opening of One Hundred and Fourteenth street, from Fourth avenue to Eighth avenue, being the following described pieces or parcels of land, bounded and described as follows, viz.:

Beginning at a point in the easterly line of Eighth avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly side of One Hundred and Fifteenth street; thence easterly and parallel with said street, seven hundred and seventy-five feet (775′ 0″) to the westerly line of Seventh avenue; thence southerly along said line sixty feet (60′ 0″); thence westerly seven hundred and seventy-five feet (775′ 0″) to the easterly line of Eighth avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning.

Also, beginning at a point in the easterly line of Seventh avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly line of One Hundred and Fifteenth street; thence easterly and parallel with said street, one hundred and thirty-nine feet eight inches (139′ 8″) to the westerly line of Avenue St. Nicholas; thence southerly along said line seventy feet five inches (70′ 5″); thence westerly one hundred and seventy-six feet six inches (176′ 6″) to the easterly line of Seventh avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning.

Also, beginning at a point in the westerly line of Sixth avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly line of One Hundred and Fifteenth street; thence westerly and parallel with said street four hundred and ninety-three feet (493′ 0″) to the easterly line of Avenue St. Nicholas; thence southerly and along said line seventy feet five inches (70′ 5″; thence easterly four hundred and fifty-six feet two inches (456′ 2″) to the westerly line of Sixth avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning.

Also, beginning at a point in the easterly line of Sixth avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly line of One Hundred and Fifteenth street; thence easterly and parallel with said street eight hundred and ninety-five feet (895′ 0″) to the westerly line of Fifth avenue; thence southerly along said line sixty feet (60′ 0″); thence westerly eight hundred and ninety-five (895′ 0″) feet to the easterly line of Sixth avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning.

Also, beginning at a point in the easterly line of Fifth avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly line of One Hundred and Fifteenth street; thence easterly and parallel with said street four hundred and twenty (420′ 0″) feet to the westerly line of Madison avenue; thence southerly and along said line sixty feet (60′ 0″); thence westerly four hundred and twenty feet (420′ 0″) to the easterly line of Fifth avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning. Also, beginning at a point in the easterly line of Madison avenue, distant two hundred and one feet ten inches (201′ 10″) southerly from the southerly line of One Hundred and Fifteenth street; thence easterly and parallel with said street four hundred feet (400′ 0″); to the westerly line of Fourth avenue; thence southerly and along said line sixty feet (60′ 0″); thence westerly four hundred feet (400′ 0″) to the easterly line of Madison avenue; thence northerly along said line sixty feet (60′ 0″) to the point or place of beginning.

Said street to be sixty feet (60′ 0″) wide between the lines of Fourth and Eighth avenues.

Dated New York, Feb. 25, 1882.

WILLIAM C. WHITNEY,
Counsel to the Corporation,
Tryon Row, N. Y. City.

In the matter of the application of the Commissioners of Central Park for and in behalf of the Mayor, Aldermen and Commonalty of the City of New York, relative to the opening of Seventy-fourth street, from Eighth avenue to the Hudson river, in the City of New York.

WE, THE UNDERSIGNED, COMMISSIONERS of Estimate and Assessment in the above entitled matter, hereby give notice to the owner or owners, occupant or occupants, of all houses and lots and improved or unimproved lands affected thereby, and to all others whom it may concern, to wit:

That our report herein will be presented to the Supreme Court of the State of New York, at a Special Term of said Court, to be held at the Chambers thereof in the County Court-house in the City of New York, on the 28th day of March, 1882, at the opening of the Court on that day, and that then and there or as soon thereafter as Counsel can be heard thereon, a motion will be made that the said report be confirmed.

Dated New York, February 18, 1882.

FREDERICK SMYTH,
JACOB F. OAKLEY,
WILLIAM M. TWEED, JR.,
Commissioners.

In the matter of the application of the Commissioners of the Department of Public Parks, for and on behalf of the Mayor, Aldermen, and Commonalty of the City of New York, relative to acquiring right and title to certain land required for a certain public park or parks, square or squares, or place or places, at or near the intersections of Sedgwick avenue with Mott and Walton avenues, in the Twenty-third Ward of the City of New York (Cedar Park).

PURSUANT TO THE STATUTES IN SUCH cases made and provided, notice is hereby given that an application will be made to the Supreme Court of the State of New York, at a Special Term of said Court, to be held at the Chambers thereof, in the County Court-house, in the City of New York, on Tuesday, the 14th day of March, 1882, at the opening of the court on that day, or as soon thereafter as counsel can be heard thereon, for the appointment of Commissioners of Estimates and Assessment in the above-entitled matter—the nature and extent of the improvement hereby intended is the acquisition of title, in the name and on behalf of the Mayor, Aldermen, and Commonalty of the City of New York, to all the lands and premises, with the buildings thereon and the appurtenances thereto belonging, required for the purposes of a public park or parks, square or squares, or place or places, at or near the intersections of Sedgwick avenue with Mott and Walton avenues, in the Twenty-third Ward of the City of New York, being the following described lots, pieces or parcels of land, viz.:

Beginning at a point (the intersection of the western line of Mott avenue with the southern line of Juliet or One Hundred and Fifty-eighth street) distant 5,725 9-10 feet easterly from the eastern line of Tenth avenue, measured at right angles to the same from a point 680 72-100 feet northerly from the southeastern corner of One Hundred and Fifty-fifth street and Tenth avenue. 1. Thence southerly along a line whose direction is 4° 40′ 48″ southeast of that of the eastern line of Tenth avenue for 447 84-100 feet. 2. Thence to the left on the arc of a circle, tangent to the preceding course, and whose radius is 535 feet for 257 9-10 feet. 3. Thence reversing to the right on the arc of a circle, tangent to the preceding course, and whose radius is 465 feet for 224 15-100 feet. 4. Thence southerly and tangent to the preceding course for 210 4-100 feet. 5. Thence deflecting to the left 4° 22′ 58.8″ southerly for 419 87-100 feet. 6. Thence to the right on the arc of a circle, tangent to the preceding course, and whose radius is 265 feet for 149 21-100 feet. 7. Thence southwesterly and tangent to the preceding course for 51 23-100 feet. 8. Thence to the right on the arc of a circle, tangent to the preceding course, and whose radius is 17 7-10 feet for 40 62-100 feet. 9. Thence reversing to the left on the arc of a circle, tangent to the preceding course, and whose radius is 360 feet for 207 34-100 feet. 10. Thence northwesterly and tangent to the preceding course for 355 21-100 feet. 11. Thence deflecting 52° 09′ 29.7″ to the right northeasterly for 1,122 39-100 feet. 12. Thence deflecting 1° 47′ 36.6″ to the right northeasterly for 248 87-100 feet. 13. Thence deflecting 92° 16′ 12″ to the right easterly for 376 91-100 feet to the point of beginning.

The above described parcel being the block included between Mott, Walton, and Sedgwick avenues, and Juliet street.

Also beginning at a point (the intersection of the southwestern line of Sedgwick avenue with the eastern line of Walton avenue) distant 5,494 58-100 feet easterly from the eastern line of Tenth avenue, measured at right angles to the same from a point 771 57-100 southerly from the southeastern corner of One Hundred and Fifty-fifth street and Tenth avenue. 1. Thence southeasterly along a line whose direction is 58° 17′ 41.3″ southeast of that of the eastern line of Tenth avenue for 310 49-100 feet. 2. Thence to the right on the arc of a circle, tangent to the preceding course, and whose radius is 300 feet for 279 31-100 feet. 3. Thence southerly, on a tangent to the preceding course for 17 74-100 feet. 4. Thence, deflecting 126° 39′ 42″ 1 to the right, northwesterly for 435 63-100 feet. 5. Thence deflecting 46° 57′ 33″ to the right northerly for 184 82-100 feet to the point of beginning.

The above described parcel being the block included between Sedgwick, Mott, and Walton avenues and the Spuyten Duyvil and Port Morris Railroad.

And also beginning at a point (the intersection of the southwestern line of Sedgwick avenue with the eastern line of Girard avenue) distance 5,218 83-100 feet easterly from the eastern line of Tenth avenue, measured at right angles to the same from a point 601 26-100 feet southerly from the southeastern corner of One Hundred and Fifty-fifth street and Tenth avenue. 1. Thence southeasterly on a line whose direction is 58° 17′ 56.2″ southeast of that of the eastern line of Tenth avenue for 242 3-100 feet. 2. Thence deflecting 46° 58′ 10″ to the right southerly for 184 79-100 feet. 3. Thence deflecting 133° 02′ 27″ to the right northwesterly for 267 36-100 feet. 4. Thence deflecting 53° 20′ 17.7″ to the right northerly for 168 31-100 feet to the point of beginning.

The above described parcel being the block included between Sedgwick, Walton, and Girard avenues, and the Spuyten Duyvil and Port Morris Railroad.

Being all of those pieces or parcels of land shown on a map or maps, dated August 1, 1881, and filed by the Commissioners of the Department of Public Parks, in the office of the Department of Public Parks, the office of the Register of the City and County of New York, and in the office of the Secretary of State of the State of New York.

Dated New York, February 11, 1882.

WILLIAM C. WHITNEY,
Counsel to the Corporation,
Tryon Row, N. Y. City.

In the matter of the application of the Department of Public Works for and in behalf of the Mayor, Aldermen and Commonalty of the City of New York, relative to the opening of One Hundred and Twenty-second street, between Fourth and Madison avenues, in the City of New York.

WE, THE UNDERSIGNED, COMMISSIONERS of Estimate and Assessment in the above-entitled matter, hereby give notice to the owner or owners, occupant or occupants, of all houses and lots, improved or unimproved lands affected thereby, and to all others whom it may concern, to wit:

That we have completed our estimate and assessment, and that all persons interested in these proceedings, or in any of the lands affected thereby, and who may be opposed to the same, do present their objections in writing, duly verified, to Nevin W. Butler, Esq., our Chairman, at the office of the Commissioners, No. 291 Broadway (Room No. 27), in the said city, on or before the twentieth day of March, 1882, and that we, the said Commissioners, will hear parties so objecting within the ten week days next after the said 20th day of March, 1882, and for that purpose will be in attendance at our said office on each of said ten days, at 3 o'clock P. M.

That the abstract of the said estimate and assesssment, together with our maps, and also all the affidavits, estimates, and other documents which were used by us in making our report, have been deposited in the office of the Department of Public Works in the City of New York, there to remain until the twenty-seventh day of March, 1882.

That the limits embraced by the assessment aforesaid are as follows, to wit: All those lots, pieces or parcels of land, lying and being within the following described area: Beginning at a point on the easterly line or side of Madison avenue, distant one hundred feet and eleven inches southerly from a point formed by the intersection of the southerly line or side of One Hundred and Twenty-second street with the easterly line or side of Madison avenue, running thence easterly and parallel with One Hundred and Twenty-second street four hundred and five feet to the westerly line or side of Fourth avenue; thence northerly along said westerly line or side of Fourth avenue to the centre of the block, between One Hundred and Twenty-second and One Hundred and Twenty-third streets; thence westerly and parallel with One Hundred and Twenty-second street four hundred and five feet to the easterly line or side of Madison avenue, thence southerly and parallel with Madison avenue to the point or place of beginning, excepting therefrom the land in One Hundred and Twenty-second street, between Madison and Fourth avenues.

That our report herein will be presented to the Supreme Court of the State of New York, at a Special Term thereof, to be held at Chambers in the County Court-house, at the City Hall, in the City of New York, on the thirtieth day of March, 1882, at the opening of the Court on that day, and that then and there, or as soon thereafter as counsel can be heard thereon, a motion will be made that the said report be confirmed.

Dated NEW YORK, February 9, 1882.

NEVIN W. BUTLER,
ISAAC T. SMITH,
AUGUSTUS J. REQUIER,
Commissioners.

ARTHUR BERRY,
Clerk.

DEPARTMENT OF TAXES AND ASSESSMENTS.

DEPARTMENT OF TAXES AND ASSESSMENTS,
No. 32 CHAMBERS STREET,
NEW YORK, January 9, 1882.

NOTICE IS HEREBY GIVEN THAT THE books of Annual Record of the assessed valuation of Real and Personal Estate of the City and County of New York for the year 1882, will be opened for inspection and revision, on and after Monday, January 9, 1882, and will remain open until the 30th day of April, 1882, inclusive, for the correction of errors and the equalization of the assessments of the aforesaid real and personal estate.

All persons believing themselves aggrieved must make application to the Commissioners during the period above mentioned, in order to obtain the relief provided by law.

By order of the Board.

ALBERT STORER
Secretary.

THE CITY RECORD.

COPIES OF THE CITY RECORD CAN BE obtained at No. 2 City Hall (northwest corner basement). Price three cents each.

JURORS.

NOTICE

IN RELATION TO JURORS FOR STATE COURTS.

OFFICE OF THE COMMISSIONER OF JURORS,
NEW COUNTY COURT-HOUSE,
NEW YORK, Sept. 15, 1881.

APPLICATIONS FOR EXEMPTIONS WILL BE heard here, from 10 to 3 daily, from all persons hitherto liable or recently serving who have become exempt, and all needed information will be given.

Those who have not answered as to their liability, or proved permanent exemption, will receive a "jury enrollment notice," requiring them to appear before me this year. Whether liable or not, such notices must be answered (in person, if possible, and at this office only) under severe penalties. If exempt, the party must bring proof of exemption; if liable, he must also answer in person, giving full and correct name, residence, etc., etc. No attention paid to letters.

Persons "enrolled" as liable must serve when called or pay their fines. No mere excuse will be allowed or interference permitted. The fines if unpaid will be entered as judgments upon the property of the delinquents.

All good citizens will aid the course of justice, and secure reliable and respectable juries, and equalize their duty by serving promptly when summoned, allowing their clerks or subordinates to serve, reporting to me any attempt at bribery or evasion, and suggesting names for enrollment. Persons between sixty and seventy years of age, summer absentees, persons temporarily ill, and United States and District Court jurors are not exempt.

Every man must attend to his own notice. It is a misdemeanor to give any jury paper to another to answer. It is also punishable by fine or imprisonment to give or receive any present or bribe, directly or indirectly, in relation to a jury service, or to withhold any paper or make any false statement, and every case will be fully prosecuted.

GEORGE CAULFIELD,
Commissioner of Jurors,
Room 17, New County Court-house

FINANCE DEPARTMENT.

WILLIAM KENNELLY, AUCTIONEER.

SALE OF FERRY FRANCHISE.

THE FRANCHISE TO RUN THE FERRY ESTABLISHED by a resolution of the Common Council, passed February 14, 1882, from a point at or near the foot of Liberty street, North river, in the City of New York, to and from Communipaw, or to some street or avenue contiguous or adjacent thereto, as the purchaser of the franchise may elect, in Hudson County, State of New Jersey, along with a lease of certain wharf property belonging to the city required for the use of the said ferry at the foot of Liberty street, will be sold at public auction to the highest bidder, at the office of the Comptroller of the City of New York, on Thursday, March 16, 1882, at 12 o'clock noon, for the term of nine years from May 1, 1882.

TERMS AND CONDITIONS OF SALE.

The lease of the above named ferry, along with the wharf property, will be offered for sale to the highest bidder for the term, and at the time and place mentioned, at the upset or minimum price of $5,000 per annum for the franchise thereof, and $500 per annum for certain wharf property belonging to the city, used and required therefor (being north half of Pier 14, N. R., at end, 98 feet in length), payable quarterly and upon conditions contained in a blank form of lease prepared and approved by the Counsel to the Corporation, on file at the office of the Comptroller, in conformity with the provisions of law and ordinances of the Common Council relating to Ferries.

The purchaser will be required to pay at the time of the sale, the auctioneer's fee, and in addition the sum of $1,000 as security for the execution of the lease, to be applied to the rent first becoming due, but if the purchaser refuses or fails to execute the lease, or give sureties satisfactory to the Comptroller as security for the faithful performance of the covenants of the lease, when duly notified, the amount so paid shall be forfeited to the city.

The right to reject any bid, if deemed to be for the interest of the City of New York so to do, is reserved by the Commissioners of the Sinking Fund.

ALLAN CAMPBELL,
Comptroller.

FINANCE DEPARTMENT,
COMPTROLLER'S OFFICE,
March 1, 1882.

CORPORATION SALE OF REAL ESTATE.

PUBLIC NOTICE IS HEREBY GIVEN THAT the Commissioners of the Sinking Fund of the City of New York will offer for sale at public auction, on Tuesday, March 14, 1882, at noon, at the Exchange Sales Room, No. 111 Broadway, in the said city, the following Real Estate belonging to the Corporation of the said City of New York, to wit:

Beginning at a point on the northerly side of Sixty-first street, distant two hundred feet easterly from the easterly side of Ninth avenue, thence northerly and parallel with Ninth avenue 100 feet 5 inches to the centre line of the block, thence easterly along said centre line and parallel with Sixty-first street 100 feet, thence southerly parallel with the Ninth avenue 100 feet 5 inches to the northerly side of Sixty-first street aforesaid, and thence westerly along Sixty-first street 100 feet to the place of beginning; being the same four lots described in a resolution of the Board of Education, adopted December 21 1881, and in a resolution of the Commissioners of the Sinking Fund, adopted February 2, 1882, as "situated on the north side of West Sixty-first street, commencing at a point 95 feet 7 inches west from Broadway, said lots being of the dimensions (together) 100 feet front and rear, by 100 feet 5 inches deep," designated by Ward numbers 9, 10, 11, and 12, on the map of the Twenty-second Ward, in Block No. 108, now on file in the office of the Commissioners of Taxes and Assessments of the City of New York.

TERMS OF SALE.

The property will be sold for cash, ten per cent. of the amount bid to be paid to the Comptroller at the time of sale, and the balance within thirty days after the sale on the execution and delivery of the deed or deeds.

Full warrantee deed or deeds will be given to the purchasers.

Bills with maps of the above real estate may be obtained at the Comptroller's office on and after February 20, 1882.

ALLAN CAMPBELL,
Comptroller.

FINANCE DEPARTMENT—COMPTROLLER'S OFFICE,
NEW YORK, February 8, 1882.

CORPORATION SALE AT PUBLIC AUCTION.

ALL THE RIGHT, TITLE, AND INTEREST OF the Mayor, Aldermen, and Commonalty of the City of New York, in and to certain lots, pieces, or parcels of land, situate in the Twelfth Ward of said city, will be sold at public auction, to the highest bidder, at the office of the Comptroller, on Friday, March 10, 1882, at 11 o'clock A. M., as follows, to wit:

Twenty-four lots of land in block No. 302 of the map of the Twelfth Ward, now on file in the office of the Commissioners of Taxes and Assessments of the said City of New York, bounded by the Second and Third avenues and Ninety-eighth and Ninety-ninth streets, designated by the Ward numbers respectively, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, and 42, the said land being situated in what was formerly known or called marsh or lowland, through some portion of which the tide had once ebbed and flowed.

TERMS OF SALE.

The amount bid, and the auctioneer's fees, to be paid at the time of the sale, and the expense attending the preparation of the deeds, etc., to be paid also by the purchaser

ALLAN CAMPBELL,
Comptroller.

FINANCE DEPARTMENT—COMPTROLLER'S OFFICE,
NEW YORK, February 7, 1882.

CITY OF NEW YORK,
FINANCE DEPARTMENT,
COMPTROLLER'S OFFICE,
January 18, 1882.

NOTICE TO PROPERTY-OWNERS.

IN PURSUANCE OF SECTION 4 OF CHAPTER 33 of the Laws of 1881, the Comptroller of the City of New York hereby gives public notice to property-owners that the following lists of assessments for local improvements in said city were confirmed by the "Board of Revision and Correction of Assessments" on the 7th day of January, 1882, and, on the same date, were entered in the Record of Titles of Assessments kept in the "Bureau for the Collection of Assessments and of Arrears of Taxes and Assessments and of Water Rents," viz.:

122d street, regulating, grading, etc., from 10th avenue to Riverside Drive.

13th avenue, regulating, grading, etc, from 11th to 16th street.

153d street, regulating, grading, etc., between 10th avenue and St. Nicholas.

4th avenue, regulating, grading, etc., between 94th and 96th streets.

31st street, regulating, grading, etc., sidewalks, between 1st avenue and East river.

Water street, curb, gutter, and flagging, between Corlears and East streets.

81st street, flagging both sides, between 8th and 9th avenues.

9th avenue, flagging, between 71st and 72d streets.

45th street, fencing vacant lots, north side, between 9th and 10th avenues.

47th street, fencing vacant lots, southeast corner 9th avenue.

58th street, fencing vacant lots, north side, between 6th and 7th avenues.

59th street, fencing vacant lots, south side, between 6th and 7th avenues.

78th street, fencing vacant lots, north side, between 4th and Madison avenues, and 4th avenue, between 78th and 79th streets.

81st and 82d streets and Madison and 5th avenues, fencing block.

85th and 86th streets and Madison and 5th avenues, fencing block.

56th street, paving, between 10th and 11th avenues

63d street, paving, between 8th and 10th avenues.

69th street, paving, between 1st and 3d avenues.

80th street, paving, between 2d avenue and Avenue A.

81st street, paving, between 1st and 2d avenues.

111th street, paving, between 2d and 3d avenues.

126th street, paving, between 7th and St. Nicholas avenues.

127th street, paving, between 2d and 3d avenues.

Lexington avenue, paving, between 94th and 95th streets.

Houston street, sewer extension, etc.

43d street, sewer, between 2d and 3d avenues.

134th street, sewer, from 410 feet east of Willis avenue, etc.

Lexington avenue, sewer, from 69th to 70th street.

Water street, sewer, between Dover and Roosevelt streets.

Front street, sewer, between Beekman and Fulton streets.

80th street, sewer, between 10th avenue and Boulevard.

81st street, sewer, between 10th avenue and summit east of 10th avenue.

82d street sewer, between 1st avenue and Avenue B, etc.

82d street, sewer, between branch curve Avenue A.

102d street, sewer, between 3d and Lexington avenues.

113th street sewer, between 7th and 8th avenues.

118th street sewer, between 6th and 7th avenues.

119th street sewer, between 6th and 7th avenues.

123d street sewer, between 4th and Madison avenues.

Lexington avenue sewer, between 38th and 39th streets.

Lexington avenue sewer, between 77th and 78th streets.

Lexington avenue sewer, between 106th and 108th streets.

Lexington avenue sewer, between 110th and 115th streets.

Lexington avenue sewer, between 126th and 127th streets.

Avenue B sewer, between 16th and 17th streets.

2d avenue, east side, sewer, between 61st and 62d streets, and west side, between 61st and 62d streets.

Section 5 of the said act provides that, "If any such assessment shall remain unpaid for the period of sixty days after the date of entry thereof in the said record of titles of assessments, it shall be the duty of the officer authorized to collect and receive the amount of such assessment, to charge, collect, and receive legal interest thereon, at the rate of seven per centum per annum, to be calculated from the date of such entry to the date of payment."

The above assessments are payable to the Collector of Assessments and Clerk of Arrears, at the "Bureau for the Collection of Assessments, and of Arrears of Taxes and Assessments and of Water Rents," from 9 A. M. until 2 P. M., and all payments made thereon, on or before March 20, 1882, will be exempt from interest as above provided, and after that date will be subject to a charge of interest at the rate of seven per cent per annum from the date of entry in the record of titles of assessments in said Bureau.

ALLAN CAMPBELL,
Comptroller.

REAL ESTATE RECORDS.

THE ATTENTION OF LAWYERS, REAL Estate Owners, Monetary Institutions engaged in making loans upon real estate, and all who are interested in providing themselves with facilities for reducing the cost of examinations and searches, is invited to these Official Indices of Records, containing all recorded transfers of real estate in the City of New York from 1653 to 1857, prepared under the direction of the Commissioners of Records.

Grantors, grantees, suits in equity, insolvents' and Sheriffs' sales, in 61 volumes, full bound, price.	$100 00
The same, in 25 volumes, half bound.....	50 00
Complete sets, folded, ready for binding.....	15 00
Records of Judgments, 25 volumes, bound.....	10 00

Orders should be addressed to "Mr. Stephen Angell, Comptroller's Office, New County Court-house."

ALLAN CAMPBELL,
Comptroller.

POLICE DEPARTMENT.

POLICE DEPARTMENT OF THE CITY OF NEW YORK,
PROPERTY CLERK'S OFFICE (ROOM NO. 39),
No. 300 MULBERRY STREET,
NEW YORK, February 14, 1882.

OWNERS WANTED BY THE PROPERTY Clerk of the Police Department of the City of New York, 300 Mulberry street, Room No. 39, for the following property now in his custody without claimants:

Boats, rope, lead, blankets, iron, oil, male and female clothing, revolvers, coffee, trunks and contents, gold and silver watches, seal skin caps, diamond stud, dolman, etc.; also, several amounts of cash found and taken from prisoners by Patrolmen of this Department.

C. A. ST. JOHN,
Property Clerk.

ASSESSMENT COMMISSION.

THE COMMISSIONERS APPOINTED BY CHAPter 550 of the Laws of 1880, to revise, vacate, or modify assessments for local improvements in the City of New York, give notice to all persons affected thereby that the notices required by the said act must be filed with the Comptroller of said city and a duplicate thereof with the Counsel to the Corporation, as follows:

As to all assessments confirmed subsequent to June 9, 1880, for local improvements theretofore completed, and as to any assessment for local improvements known as Morningside avenues, notices must be filed within two months after the dates upon which such assessments may be respectively confirmed.

The notice must specify the particular assessment complained of, the date of the confirmation of the same, the property affected thereby, and in a brief and concise manner the objections thereto, showing, or tending to show, that the assessment was unfair or unjust in respect to said real estate.

Dated, No. 27 CHAMBERS STREET, May 18, 1881.

EDWARD COOPER,
JOHN KELLY,
ALLAN CAMPBELL,
GEORGE H. ANDREWS,
DANIEL LORD, JR.,
Commissioners under the Act

JAMES J. MARTIN,
Clerk.