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REPORT

OF

Hon. William J. Magie,

Special Master

ON

COST OF SEWERS, Etc.,

AND ON

Efficiency of Sterilization Plant
at Boonton.

Press-Chronicle Co.

In Chancery of New Jersey.

BETWEEN

THE MAYOR AND ALDERMEN OF
JERSEY CITY,

Complainant

AND

THE JERSEY CITY WATER SUP-
PLY COMPANY,

Defendant.

Master's Report.

(May 9, 1910.)

In pursuance of an order of this Court made on the 4th day of June, 1908, whereby it was ordered, among other things, that it be referred to the undersigned, one of the Special Masters of this Court, to ascertain and report upon the cost of sewers and of sewage disposal works and of intercepting sewers or drains necessary to substantially prevent the contamination of the waters of the Rockaway river from the sewage of Dover, Hibernia and Boonton, and also to investigate and report upon other plans and devices as alternative remedies presented by the Defendant Company for delivering water to the city in a pure and wholesome condition throughout the year, under present conditions, and upon the cost of the works now necessary therefor; and also the cost of obtaining from the riparian owners below the Boonton Dam, rights of diversion of water to the extent of seventy million gallons per day, so far as said rights have not been here-

tofore acquired by said company; and said master was given permission to use in the inquiry directed, the evidence already in the cause and to receive further evidence on the matters therein referred to him; and he was directed to report thereon to the court with all convenient speed;

I, William J. Magie, Special Master as aforesaid, do respectfully report to the Chancellor, that on the 28th day of September, 1908, I was attended by James B. Vredenburg, Esq., of Counsel with Complainant, and William H. Corbin, Esq., and William D. Edwards, Esq., of Counsel with Defendant, and upon the application of the Counsel for Defendant, the taking of testimony in said cause was adjourned by me to the 5th day of January, 1909, for the purpose of permitting the defendant to present such other plans and devices as were permitted by the said decree to be presented by the defendant; and on the said 5th day of January, 1909, in the presence of James B. Vredenburg, Esq., and Warren Dixon, Esq., of Counsel with the Complainant, and of William H. Corbin, Esq., and William D. Edwards, Esq., of Counsel with the Defendant, I commenced the taking of testimony on the matters referred to me and continued to take such testimony with all convenient speed, occupying therein forty days or more, and thereafter heard Counsel upon the report to be made by me pursuant to said order, and after the arguments made and briefs submitted (the last being submitted April 19th, 1910) I have considered the evidence presented before me and such of the evidence taken in the cause as was pointed out to me by Counsel and seemed competent and relevant upon the matters referred to me.

And I do further report that I have duly considered the three matters referred to me and do report thereon in the order in which they stand in the said decree.

I.

THE COST OF SEWERS AND OF SEWAGE DISPOSAL
WORKS AND OF INTERCEPTING SEWERS OR DRAINS
NECESSARY TO SUBSTANTIALLY PREVENT THE CON-
TAMINATION OF THE WATERS OF THE ROCKAWAY
RIVER FROM THE SEWAGE OF DOVER, HIBERNIA AND
BOONTON.

Under the evidence, this matter is necessarily to be considered in two parts; (a) respecting sewers for Dover and Boonton and (b) respecting some device for Hibernia.

a. In respect to Dover and Boonton, the complainant presented several plans and devices for sewers; one for the complete sewerage of the town of Dover with a disposal plant for the treatment of the collected sewage and the discharge thereof after treatment, into the waters of the Rockaway river above the Boonton Dam; one for the like sewerage of Boonton with a similar disposal plant and the discharge of its sewage after treatment, into the waters of the Rockaway river below the Boonton Dam; and one which was a combined plan for a sewer to take the collected sewage both of Dover and Boonton with a disposal plant for its treatment and its discharge into the Rockaway river below the Boonton Dam.

Finally the complainant presented a modified plan which contemplated a trunk sewer from Dover to Boonton, capable of carrying sewage by gravity; a system of intercepting sewers both in Dover and Boonton connecting with the trunk sewer; a disposal works at the Boonton end of the trunk sewer to treat the sewage which might be delivered therefrom, which when treated would be discharged into the waters of the Rockaway river below the Boonton Dam; and requested that my report on this matter should be restricted to the cost of such modified plan.

In order to properly present my conclusions on this matter, I shall take up and report upon the separate

elements which complainant insisted should be admitted to make up the cost to be reported.

These elements are (1) the cost of constructing the trunk sewer, (2) the cost of constructing the intercepting sewers, (3) the cost of land to be acquired to carry out the plan, (4) the cost of the disposal works, (5) the cost of operating the sewers and the disposal works, it being claimed by complainant that a capitalization of said cost of operation should enter into the cost to be reported, (6) a capitalized sum sufficient to cover depreciation of the plant and to provide for its replacement when worn out. Upon these elements much evidence has been taken by both parties, and I deem it wise to report my finding on each of them, including my finding of cost upon those I reject, so that upon a review of my findings if the finding in that respect is found to be erroneous, the total cost may be ascertained without further reference.

Taking up the various items claimed to enter into the cost of sewers and sewage disposal works which I am directed to ascertain and report, I find as follows.

(1) By a concurrence of evidence I find that the cost of constructing a trunk sewer from Dover to below the Boonton Dam will be \$148,984.11.

(2) In respect to the connecting sewers contemplated by complainant's final plan for Dover and Boonton, I find that such sewers are essential to the operation of the plan (if the same is capable of being operated) and fall under the description of intercepting sewers described in the order of reference.

In respect to the cost of these collecting sewers in Dover, the evidence is conflicting. Upon the weight of evidence I find that the cost will be \$165,000.

In respect to the cost of collecting sewers in Boonton, it is contended by the defendant, that none are necessary and that the sewage from Boonton is satisfactorily disposed of by an open drain and connecting pipes constructed by it. That construction is in part upon land

occupied by the plane and the canal of the Morris Canal and Banking Company.

There was put in evidence before me a written contract made between the Morris Canal and Banking Company and the Lehigh Valley R. R. Company, lessee, of one part and the Jersey City Water Supply Company of the other part, which contract was dated October the 14th, 1909, and has been marked Exhibit Reference D-65. Notwithstanding the license thereby given to construct and maintain the drain and pipes put in by it, I am constrained by the terms of the order of reference, to report the cost of intercepting sewers for Boonton, because that contract by its provisions will cease to be binding in case navigation shall be abandoned from legislative action or from any other cause.

A great variance occurs in the evidence respecting the cost of constructing the connecting sewers in Boonton, but upon the whole evidence I find that the cost thereof will be \$58,300.

(3) In respect to the cost of procuring the right of way over private property across which it is conceded that the trunk sewer should be constructed, it is obvious that the cost of procuring such right of way must be considered.

The evidence as to the cost of procuring such right of way, is by no means satisfactory. What is to be obtained over private property, is an easement to lay beneath the surface the sewer pipes, and thereafter to enter upon the line for the purpose of maintenance and repair. Evidence that in some cases the cost of procuring such easement equals or exceeds the value of the property crossed thereby, has little value. There is the additional complication that a resort to the power of condemnation may be necessary, the costs of which are practically impossible to compute. Making allowance for estimates made on erroneous principles and giving fair consideration to the probable costs of condemnation, I estimate and find that the cost of right of way will be \$25,000.

(4) In respect to the cost of constructing sewage disposal works, it is contended by defendant, that the works contemplated in the final plan presented by complainant and which provides for the discharge of the water therefrom into the Rockaway river below the Boonton Reservoir, are not within the terms of the order of reference. The plan first presented by complainant contemplated a sewage disposal works which would discharge the water therefrom so that it would reach the Boonton Reservoir. Such disposal works were obviously within the terms of the order of reference. The amended and final plan is obviously better calculated to preserve the purity of the water in the Boonton Reservoir, but although the final plan contemplates the discharge from the sewer below the Boonton Dam, a sewage disposal works to treat the sewage before discharge, is essential to the plan. Without such treatment the sewage could not be discharged into the Rockaway river to the detriment of owners of land thereon and to the pollution of water which eventually comes into the Passaic river, from which a water supply for various municipalities is shown to be now taken. I have therefore concluded that the cost of such disposal works should be included in the estimate of the cost which I am directed to report.

It appears from the evidence that such disposal works are of two kinds, (1) in which the sewage is brought into contact with prepared beds and which is called the contact bed system and another which employs sprinkling and is called the sprinkling filter system. It is conceded by counsel for complainant that the latter system gives satisfactory results at a less cost of construction and operation and the evidence supports this concession. The evidence on the cost of such works is variant, but practical contractors who testified before me, fixed the cost at \$40,905 and declared a willingness to contract for the construction at that rate. I find that sum to be the cost of such disposal works.

(5) It is contended by the complainant that the cost of operating and maintaining the trunk sewer, the connecting sewers in Dover and Boonton and the sewage disposal works, ought to enter into and make part of the cost I am directed to report, by adding to the cost of construction a sum, the interest of which will perpetually provide for such cost. This contention is based upon the provisions of the 8th Section of the contract between the parties for the enforcement of which the bill in this cause was filed. I have reached the conclusion that the question thus presented does not fall within the terms of the order of reference, but as much evidence was taken thereon, I have concluded to report my findings of the average annual cost of operating and maintaining the sewers and disposal works, so that if I am in error respecting the scope of the order of reference, the material for fixing the amount will be before the court. Upon the evidence I find that the average annual cost of operating and maintaining the trunk sewer will be \$667.80 and of the connecting sewers \$2040 and of the disposal works \$2500. I also find that the customary rate for such capitalization is 5 per cent annually.

(6) The complainant claims that there should be included in the cost which I am to report, a sum which retained and accumulated for the period of fifty years, will be sufficient to meet the natural depreciation of such sewers and sewage disposal works. In my judgment the defendant is not liable for such wear or depreciation, nor bound to perpetually replace or provide for the replacement of the sewers and sewage disposal works. But for convenience's sake I find upon the evidence that the annual depreciation of the trunk sewer will be \$1,267.93 and of the connecting sewers in Dover and Boonton will be \$2,284.18 and of the sewage disposal works will be \$477.03.

I do further report that if the sewers contemplated by the plan and scheme presented and the cost of which I have considered, shall be built, they will not

be capable of substantially preventing the contamination of the Rockaway river above the Boonton Reservoir, from the sewage of Dover and Boonton, without other additional works. They will not intercept the surface water carrying the wash of fields and roads, and possibly at times contamination from neglected and overflowing privies. They will not intercept any seepage from neglected privies, through permeable soil. They can only be made available by the exercise of power, to compel the connection of all the privies within the district, conceived to be threatening to the purity of the Rockaway river, with some means of discharging the sewage into the connecting sewers and so to the trunk sewer. At the time the parties made the contract in question in this cause, there was no power in either to lay sewers within the streets of Dover or Boonton, or to connect houses and lots with the connecting sewers, or to compel the householders or landowners to make use of such connections. By an act entitled "An act to authorize cities having a public water supply derived from sources beyond the city limits, to protect the same from pollution, by providing for any portion of the territory from which such water is derived, or through which it flows, a system of sewers or drains, in order to take up, carry off and dispose of the sewage and other polluting matter, and providing also for the raising and expenditure of the money necessary for this purpose" (Approved April the 4th, 1907, p. 57), it is claimed that there is conferred upon cities such as the complainant, the power to connect the sewage system presented on this reference, in and upon private property at the expense of the complainant and to enforce and to compel the use of sewers by the owners and occupiers of lands in Dover and Boonton.

With respect to the situation at Hibernia, I further report that the complainant has presented two plans which it claims, will substantially prevent contamination of the Rockaway river from that locality. One of

the plans contemplates the construction of a sewer and a sewage disposal works. The other of the plans contemplates the establishment of sanitary privies and of disposal works for the effluent of the Hibernia mines. The evidence of the probable cost of each plant is presented by the complainant. The defendant has presented no evidence as to the cost, but contends that neither plan is necessary, or effective if necessary.

Upon the evidence thus presented, I find that the total cost of the sewer and the sewage disposal works contemplated in this plan will be \$78,152 and the annual cost of operating and maintaining the same will be the sum of \$1,889.90 and that a yearly sum of \$596.29 will be required to redeem in fifty years the \$78,152, the cost of construction.

And I do further report that the works contemplated by this plan will not be capable of preventing contamination of the Rockaway river without the construction of additional works and the exercise of some power to construct connecting sewers, connecting with the privies of houses in that village, and to compel the occupants thereof to effectually make use of such connecting sewers, there being no water supply in that village.

As before stated, no power had been conferred upon the parties in this cause, at the time of the contract in question to make such connections or to compel the use thereof. If such power now exists, it has been acquired under the provisions of the act of 1907 above referred to.

The other plan presented by complainant for this purpose, involves a novel scheme for the construction of sanitary privies upon the lots of land occupied by houses in the village of Hibernia, with a sewer and sewage disposal works for the effluent of the Hibernia mines. The plan contemplates the erection of such privies with removable pails, which are to be removed from time to time and the contents discharged in a latrine to be provided for and protected.

Upon the evidence produced before me, I find that the cost of the sanitary privies with pails, will be the sum of \$4230. and of the sewer and sewage disposal works for the mine effluent will be the sum of \$19,245. I further find that the annual cost of operating and maintaining the same, including the removal of pails from time to time, will be the sum of \$3500 and that an annual sum of \$219.19 will be required to redeem in fifteen years the sum of \$4230, the cost of installing the sanitary pails, and a further annual sum of \$146.80 to redeem in fifty years the sum of \$19,245.00, the cost of construction of the proposed sewer and works.

I do further report that if any power exists to compel the land owners to permit the erection upon their land, of the sanitary privies thus contemplated and the periodic entrance upon their land for the removal of the pails therefrom, it must be found in the act of 1907 above referred to. The power to build the sewer and sewage disposal works for the effluent of the mine, must be found if it exists, in the same act.

I also deem it proper to report that the situation in Hibernia has materially changed since the decree was made. At that time it appeared that the population of the village was about one thousand or twelve hundred. It has appeared before me that the population has been reduced to a trifle over four hundred, and that of the one hundred and twenty-nine houses in the village, only one hundred were inhabited at the time the evidence on that subject was taken. The reason of this change is the cessation of work in all but one shaft of the mines. The mines have not been abandoned and work may be resumed therein if their working may be considered to be profitable to the owners.

II.

DEFENDANT'S ALTERNATE PLANS AND DEVICES
FOR DELIVERING THE WATER TO JERSEY CITY IN A
PURE AND WHOLESOME CONDITION.

The defendant, pursuant to the permission granted in the decree in this cause, presented as an alternative remedy, a plan and device for delivering the water from the reservoir to Jersey City in a pure and wholesome condition throughout the year. The device was first put in operation on the 26th day of September, 1908. The adjournment of the hearing before me from September the 29th of that year, to January of the following year, was granted for the purpose of permitting constant observation of the operation of the device, which might test its effectiveness. The device has been continued in operation practically for the whole time since it was installed and during that whole period constant observations have been made respecting the quality of the water and particularly by comparison bacteriologically, of the water as it leaves the reservoir, with the water as it passes into the pipe or conduit conveying it to Jersey City, at the distance of about three quarters of a mile below the intake, and with the water when delivered at Jersey City.

The theory upon which this plan or device is supported in this: the water in the reservoir had been found to have become, by reason of sedimentation in the large reservoir, exposure to sunlight, etc., to be reasonably pure and free from contamination for a large part of the year. It had however been determined that at certain periods there was risk that the water delivered from the reservoir might be so contaminated as not to be pure and wholesome as required by the contract. The contamination had been determined to be indicated by the presence of germs, particularly of that called *Bacillus Coli*, which itself is indicative of the possibility of the presence of the typhoid germ. The purpose of the device is to re-

move by chemical action, organic matter from the water, including the germs deemed to be contaminating and possibly pathogenic. It is designed to supplement the purifying action upon the water of the large reservoir.

The plan contemplates the addition to the water as it is discharged from the reservoir into the pipe leading to Jersey City, of a minute quantity of bleach or chloride of lime. Without attempting to describe the chemical changes, it is sufficient to say that it is established by the proofs, that hypochlorous acid is produced almost immediately and that the oxygen contained therein seizes upon and destroys organic matter in the water. The device includes tanks in which the solution of the bleach is made by stirring, the power being obtained by the water in the reservoir. The solution when pumped into another tank is discharged through an aperture which may be increased or diminished in size, into the water flowing in the pipe. The operation requires the attention of skilled workmen to determine the chemical value of the bleach employed, the amount to be applied and the continuous operation of the plant. Much of the operation is automatic, but some of it, and that the most important part, must depend upon the action of the men in charge. In this respect it is similar to the operation of filtering plants when used for the purification of water.

From the proofs taken before me, of the constant observations of the effect of this device, I am of opinion and find that it is an effective process which destroys in the water the germs, the presence of which is deemed to indicate danger, including the pathogenic germs, so that the water after this treatment, attains a purity much beyond that attained in water supplies of other municipalities. The reduction and practical elimination of such germs from the water was shown to be substantially continuous.

It is contended on behalf of complainant that the

evidence discloses that the action of the plan cannot be relied upon. This contention is based upon continuous observations made by experts employed by complainant, upon water supplied to complainant, which observations tended to show that upon three occasions there was a sudden rise in the bacterial count reported by complainant's experts. The water that was examined was taken from taps in the city after it had flower through the surface pipes leading from the reservoir. On two of the occasions the examination of the water supplied, as it entered the reservoir, showed no such rise in the bacterial count from which I am led to the conclusion that the count of bacteria in the water taken from the taps was due to some other cause.

On one occasion the observations of the experts on both sides indicated a simultaneous increase in the count of bacteria. The evidence discloses that at that time the quantity of bleach applied to the water at Boonton had been materially decreased. Since that time it has been again increased and is now maintained at a uniform rate. I am therefore led to conclude that the increase in the bacterial count on the occasion just mentioned, was due either to the reduction of the applied bleach or to some neglect in the conduct of the operation. The risk of failure on the part of those employed to operate the device is common to all schemes for the purification of water by filtration or otherwise. It is true that this device does not remove from the water impurities contained in suspension or solution, other than bacteria. The operation to remove such impurities is in the large reservoir and the sedimentation thereby produced. The purpose of this reference in my judgment, is to pass upon the effectiveness of any device presented to remove the dangerous germs from the water.

Upon the proofs before me, I also find that the solution described leaves no deleterious substance in the water. It does produce a slight increase of hardness,

but the increase is so slight as in my judgment to be negligible.

I do therefore find and report that this device is capable of rendering the water delivered to Jersey City, pure and wholesome, for the purposes for which it is intended, and is effective in removing from the water those dangerous germs which were deemed by the decree to possibly exist therein at certain times.

I further report that the cost of the installation of this device, amounting to \$20,545.64, has been paid by the defendant and that the device is now installed upon the property which is the subject of the contract in this cause, and will be conveyed by a deed under that contract.

And I do further report that the annual cost of operating and maintaining this device will be \$2100.

And I do further report that upon the evidence before me, another plan presented by the defendant would be equally effective in maintaining the purity of the water with that above stated. That plan contemplates the use of a solution of common salt, after the solution has been electrolyzed. The solution is delivered in the same way as the solution of chloride of lime and produces the same chemical effect. The plant now installed could be used for that purpose, but it would require the addition of power sufficient to develop the necessary electricity.

III.

COST OF UNACQUIRED RIPARIAN RIGHTS.

The remaining matter upon which I am directed to report is the cost of obtaining from riparian owners below the Boonton Dam, rights of diversion of water to the extent of seventy million gallons per day, so far as said rights have not been heretofore acquired by said defendant.

It has appeared by the proofs before me, that since the date of said decree and order of reference, the defendant has acquired some rights of diversion, other

than those which had been acquired by it before that date, and it was conceded by counsel that my report upon this matter might be limited to the cost of procuring the rights not hitherto procured.

A stipulation between the parties for the giving of a protecting bond to the complainant, with respect to any assertion of such rights upon the Passaic river, below the mouth of the Rockaway river, having been entered into by the parties, it was also conceded by counsel that my report should be limited to the cost of such unprocured rights along the Rockaway river between the Boonton Dam and the place where it empties into the Passaic.

Upon the evidence before me, I find that there are eleven thousand nine hundred and five lineal feet of frontage on the east bank of the Rockaway river, and thirteen thousand three hundred and twenty-five lineal feet on the west bank of said river belonging to owners who have not released or conveyed such rights. The total amount of lineal feet is twenty-five thousand one hundred and twenty-two feet, the rights in which have not been procured.

No part of this inquiry has been more difficult than the determination of the cost of such unprocured rights. None of the lands seem to be so situated as to be capable of developing power thereon by the flow of the river. The values of the land along the Rockaway river, appear by the evidence to be extremely variant. In a few cases to which the evidence has been specifically directed, the injury to be done by such abstraction of water, and the value of the rights to a continuous flow of the water as it has been accustomed to flow, is very unsatisfactory. It also appears that in several instances the probabilities are that resort to condemnation proceedings to acquire the rights, must be made with all the attendant cost and expenses, which it is impossible to accurately ascertain.

Upon the evidence before me, including proofs of prices paid per lineal foot for the rights heretofore ac-

quired, I find that a fair estimate of the cost of procuring the unprocured rights will be \$7000 in which sum I have included \$6000 as the fair value of the rights and have added \$1000 as the estimated cost of such condemnation proceedings as may be required.

Upon the difficulty of determining with any satisfactory accuracy the cost in question, being presented to the counsel of the parties, it was suggested that a more satisfactory disposition of this matter would be to require the defendant to give bond with sufficient security conditioned to procure the unprocured rights within a reasonable time and save harmless the complainant from any damages to which they might be put in the case of unprocured rights, and counsel agreed that I should make this suggestion in my report, and find a satisfactory amount to which the defendant should be bound by such bond.

If this disposition of the matter should be resorted to, I have considered the amount of bond that should be required, and I find that a bond for \$12,000 would be satisfactory and sufficient to protect the complainant.

All of which is respectfully submitted this 9th day of May, 1910.

W. J. MAGIE.

*This Report was confirmed
by the Court of Chancery
and the Court of Errors
and appeals of New
Jersey -*