

Report, Estimates and Specifications of Spielmann & Brush,
Engineers, for the building of the sewers necessary to drain
the district described in the petition presented to the
Board of Health and Vital Statistics, May 4, 1881.

ENGINEERS' OFFICE,
13 Newark Street,
HOBOKEN, N. J., June 27th 1881.

TO THE HONORABLE THE MAYOR AND COUNCIL OF
THE CITY OF HOBOKEN:

Gentlemen:—In accordance with your resolution of May 23rd, 1881 we herewith submit our report accompanied by plans, estimates and specifications for the building of a sewer or sewers and such other works as may be necessary to drain the district described in the petition presented to the Board of Health and Vital Statistics, May 4th, 1881.

Hoboken contains in all about 720 acres of which 270 acres are upland and 450 acres are marsh lands: About 90 acres of uplands and 140 acres of marsh lands are built upon.

The drainage of our uplands is a comparatively simple problem because it can be easily effected by tidal sewers, that is, by sewers built on such a grade and at such elevations above mean low water that they will freely discharge their contents directly into the Hudson river. At some future time, no doubt a large intercepting sewer will have to be built along our water front collecting the sewerage at their present outlets and carrying the same to the southerly end of the county and depositing it by a tunnel far out into the waters of the Bay. This will probably not be necessary for some time to come and therefore need not be considered at present, although it is well to remember that Boston has already been obliged to resort to such procedure and New York is even now building these intercepting sewers with a similar view.

The drainage of the marsh lands of Hoboken being principally on what is known as the Coster estate, is a much more intricate problem. These marsh lands are a formation of blue clay or silt, the depth in places being over 100 feet with a crust of matted stems and roots about five feet thick still in the process of accumulation; they lie east of the Palisade Ridge and are separated for the most part by a knoll comprising the uplands of Hoboken; they extend north and south about one mile and one-half and are about one-half of a mile in width.

The original tidal flow over these marsh lands has been obstructed by the filling in for railroads and streets, until now there are only two natural outlets to the river, one on the south, a basin constructed by the Delaware, Lackawanna and Western Railroad Co., 100 feet wide and 2,300 feet long, and the other on the north, a sluice way at 15th street.

The average difference between mean high and mean low water in the Hudson river at Hoboken, is 4 feet and 6 inches. The average level of the meadow lands is 1 foot and 6 inches below mean high water or 3 feet above mean low water. The established grade of the streets on the Coster estate is 2 feet above mean high water. During long easterly or northerly storms, especially at times of high spring tides, the level of the water in the Hudson river at low tide is several feet higher than mean low water, the greatest difference that has been noted, being 3 feet 9½ inches; that is to say, there have been times when even at low tide the water in the river was 9½ inches higher than the surface of meadows. On several occasions the water in the river has risen

more than 3 feet higher than mean high water and of course, at such times the water in the river was 4½ feet higher than the level of the meadows and 1 foot higher than the established grade of the streets.

We will now glance at the attempts made to accomplish the drainage of these low lands, and since much has been learned the review will be of great service to us in the present discussion.

It has been claimed by many that these meadow lands could be drained by tidal sewers without altering the present grades of the streets, and during the last fifteen years many attempts have been made and \$100,000 have been spent in the endeavor to carry out this system.

The first drainage map of these marsh lands was made by Bacot & Post on Feb. 1st, 1866; they proposed to have main sewers running east and west in Ferry, First, Third, Tenth and Fifteenth streets, and discharging at low tide into the Hudson river.

By an act of the Legislature of the State of New Jersey, approved April 4th, 1866, pamphlet laws, page 941, a commission of three gentlemen from Hoboken and two from Weehawken were appointed to take charge of the drainage of these low lands. Supplements to this act were passed in 1867, 1868 and 1869.

In April, 1869, Wm. Hexamer, as Secretary of this Commission, reported that about three miles of ditches had been dug, about one mile of box sewers built, principally in Ferry and First streets, two main sluices, one gate on Ferry street, various sewer connections and repairs, and 4,369 cubic yards of filling on the old line ditch; the expenses incurred were \$45,729.

The next important map in relation to the drainage of these low lands was made by William Hexamer in 1869. Mr. Hexamer proposed to divide the whole city into three districts, with main sewers in Ferry, Third and Thirteenth streets, running from the westerly boundary of the city to the Hudson River. Except that he reduced the number of mains from five to three, Mr. Hexamer's plan in 1869 was practically the same as Bacot & Post's plan in 1866.

Only one of the three main sewers proposed by Mr. Hexamer has been built, namely, that in Third street, which extends from the Hudson River to Adam street and receives the drainage of the sewers in Garden street, Park avenue, Willow street, Clinton street and some box drains in Grand and Adam streets. The present condition of this Third street sewer is not satisfactory. The bottom of the sewer at Clinton street is 2 feet lower than the bottom of the sewer at Willow street and the general fall of the sewer west of Willow street is towards the Meadows, instead of being towards the river. If the three main sewers were actually built as proposed by Mr. Hexamer, to the westerly boundary of the city the top of the sewers at that point would be 2 feet above the level of the meadows and one and one-half feet below the established grade of the streets.

On November 22, 1870, the Council directed Arthur Spielmann to prepare a plan for a sewer in Ferry street from the Hudson river to the westerly bound-

dary of the city and to submit a report and estimates in regard to the same. On February 14, 1871, this plan and report were submitted. The estimated cost of the sewer was \$130,000. Mr. Spielmann, in his report most emphatically advised the Council not to build the sewer because it would fail to answer the purpose for which it would be constructed. He called the attention of the Council to the utter inefficiency of these tidal sewers and claimed that there were only two ways of properly draining these low lands.

First. By raising the grade sufficient to give good drainage.

Second. By making reservoirs and forcing the drainage matter out into the river by means of steam pumps.

The first method he found impracticable on account of the expense that would be incurred from the amount of filling required and also of the cost of raising most of the houses already built. The second method he recommended as being much cheaper and entirely practicable.

In accordance with this report the Ferry street sewer was not built, but from that time until now, a period of ten years the two propositions that were advanced by him have been most earnestly discussed.

The following engineers have been engaged on the investigation of this question from time to time during this period and have made reports thereon which although they differ in detail, agree on the general principle that the only practical means of draining these meadows is by pumping, to wit: Arthur Spielmann, William W. Shippen, Levi W. Post, James P. Kirkwood, L. B. Ward, Edlow W. Harrison, Charles B. Brush.

Seven acts have been passed by the New Jersey Legislature since 1870 in relation to the drainage of these lands:

First. Section 19 of an amendment to the charter of the City of Hoboken, Laws, page 1422, approved April 6, 1871, gave the Mayor and Council power to provide for the removal of the surface water south of Eighth street and 10½ feet west of Willow street.

Second. An act approved April 4, 1873, Laws, page 799, appointed a commission for the purpose of building a sewer through Jefferson street from 2d to 15th or 16th streets and thence to the Hudson river.

Third. A supplement to said act of 1873, approved March 27, 1874, Laws, page 559, extended the original act so as to embrace two drainage districts and provided for the construction of main and 1st lateral sewers. This act dispensed with the sewer in Jefferson street and divided the low lands of Hoboken into two districts, one north and the other south of 8th street, and authorized the building of a sewer in 1st street with branches. It further provided for the appointment of two extra commissioners by the Hoboken Council.

These acts of 1873 and 1874 were declared unconstitutional at the February Term of the Supreme Court in 1875 on the ground that the acts did not provide for assessments according to benefits and no power was granted to compel the payment of the assessment.

Fourth. An act approved April 24, 1876, pamphlet Laws, page 375, authorized the corporate authorities of cities and towns to drain meadow and swamp lands lying within their corporate limits.

Fifth. An act approved March 9, 1877, pamphlet Laws, page 369, authorizing the settlement and adjustment of claims arising under the act of 1873.

Sixth. An act approved March 14, 1879, pamphlet Laws, page 276, entitled an act for the improvement of the sanitary condition of cities. This act was pronounced defective by Thomas N. McCarter, Esq.,

July 16, 1879, to whom it was referred by the Hoboken Council.

Seventh. An act approved March 25, 1881, entitled a supplement to an act for the improvement of the sanitary condition of cities, approved March 14, 1879.

Under the authority of these various acts, a large amount of valuable information has been obtained, though an expense has been incurred of nearly \$20,000. The report in 1874 of Mr. James P. Kirkwood, a hydraulic engineer of high reputation (the engineer of the Brooklyn Water and Sewerage Works and a consulting engineer in nearly all similar works that have been projected in this country), is one of the most valuable records in many respects, in the possession of the city. He decided that the drainage of these lands must be done by pumping, and after giving his reasons, (which though concisely stated, are too voluminous to be included in this report,) he arrived at the conclusion that when the low lands are all graded and built upon it will be necessary to provide the following pumping capacity:—For the heaviest storms, which it is true, occur only a few times in the year, but which nevertheless must be provided for, 78,856,000 gallons in twenty-four hours for the district south of 8th street, and 54,634,000 gallons in twenty-four hours north of 8th street, a total of 134,500,000 gallons per day—and for the maximum flow of sewerage proper, exclusive of storm waters in each twenty-four hours, he estimated 4,000,000 gallons per day in the district south of 8th street and 2,650,000 gallons per day in the district north of 8th street, a total of 6,650,000 gallons per day.

Mr. Kirkwood considered, however, that it would not be necessary to make provision for this flow at the present time, because of the ungraded condition of the lots and streets; and the fact of their being only partially occupied, would greatly diminish the amount of water and sewerage which would have to be provided for within a given time. He believed that if provision was made south of 8th street for 26,000,000 gallons per day of storm waters and north of 8th street for 18,000,000 gallons per day or a total for storm waters, at present, of 54,000,000 gallons per day, it would be sufficient, while for sewerage, 2,000,000 gallons per day for the district south of 8th street and 1,325,000 gallons per day for the district north of 8th street, or a total of 3,325,000 gallons per day of sewerage flow, would be ample.

All the investigations that have been made on this subject to date corroborate these estimates and after carefully going over the calculations we have no hesitation in presenting them to your Honorable Body as perfectly reliable.

The first practical application of the pumping system on these meadows was under the Acts of 1873-4; a small 9 inch pump was set at work in Meadow street, between Ferry and First streets.—It was found that all the water south of 3rd Street could easily be controlled by the pump except during time of storms. A number of bids were also received for building the sewers and for furnishing the pumps and pumping stations. Again under the law of 1876 the Council received other bids for furnishing pumps and pumping stations. During the last six months the practicability of the pumping system has again been tested, a number of property owners have erected at their own expense a 6 inch pump in the Southwestern portion of the city on one of the worst portions of these marshlands.—By pumping about 20 minutes every two hours all the water from an area of about 25 acres was removed except during storms.

Such in brief is a history of the efforts made up to this time towards the drainage of our marshlands.

It would be folly to ignore the fact that our tidal sewers have been as nearly a complete failure as it is possible for any system to be. These low lands

are to-day, merely a sink hole for all the refuse that is thrown upon them. The sewers and drains already built are almost entirely useless in times of heavy storms, sometimes they are tide-locked for days together and there is no escape for the water except by evaporation. There is seldom any escape for the refuse except by putrefaction. The death rate on these lands is very excessive. The statistics of 1875 show that in the 4th Ward (marsh lands) it was 37 per 1000, whilst in the 2nd Ward (uplands) it was 20 per 1000.

As an instance of the failure of these tidal sewers the 3rd street sewer might be mentioned; the outlet of this sewer at the Hudson river is $1\frac{1}{2}$ feet below low water, the western extremity of the sewer is at low water. While it is true that in times of ordinary low tide, the water will flow through the sewer towards the Hudson river, yet the sewer can never be entirely emptied, and at flood tide a horrible and sickening mass of corruption is thrown upon the meadows.

The fact is, there are only two methods of effectual draining the meadows to wit: those suggested in 1871:

- 1st.—By a proper system of tidal sewers.
- 2nd.—By the pumping system.

Whichever system is adopted it should comprehend the complete drainage of these low lands in their entirety and whatever constructions are hereafter to be made, should be in accordance with the plan selected. Under either system the cost of the construction of the sewers will be about the same.

When all the low lands are built upon and sewered the cost of the sewers will have been, according to our estimate, \$700,000. This outlay however will be gradual and will only be required as the growth of the city increases. Under either system an immediate outlay of \$110,000 would be required in the construction of sewers to provide for the drainage of low lands south of Eighth street, requiring immediate attention.

A proper tidal system of sewers will necessitate the raising of the grade of the streets on these low lands to a height of at least 10 feet, above mean high water.

The extra cost of raising this grade over and above the cost of the filling necessary to bring this property up to the established grade of the Coster Estate would be as follows:

10 000,000 cubic yards of filling at 20 cents.....	\$2,000 000 00
1,300 houses to be raised, including damages at \$500.....	650,000 00
170,000 square yards of Repavement at 20 cents.....	34,000 00
550,000 square feet of Re-flagging at 5 cents.....	27,500 00
50 000 lineal feet Re-curbings at 5 cents.....	2,500 00
100 Basins rebuilt at \$10 00.....	1,000 00
Contingencies.....	285,000 00
Total extra cost of raising grade..	\$3,000,000 00

While the cost of the Pumping Stations and Pumps, including Land, Buildings, Reservoirs and machinery with power and capacity sufficient to remove all the storm water and sewerage, that will eventually accumulate when this whole area is built up, we estimate as follows:

Land.....	\$15,000 00
Engine and Pumps of 425 horse power.....	45 000 00
Cisterns.....	40,000 00
Buildings.....	35,000 00
Contingencies.....	15,000 00

Total final cost of Pump works.... \$150,000 00

The annual running expenses, including interest on \$150,000, will not exceed \$30,000.

In a word, a proper tidal system of drainage for the marsh lands when all built upon (exclusive of the cost of the sewers, which we estimate at \$700,000) will require a preliminary expenditure of at least \$3,000,000 or \$180,000 per annum: while a complete pumping system will require a preliminary expenditure of \$150,000 or \$30,000 per annum.

When we consider that in addition to the enormous increase of cost it will require several years to regrade the streets and adjoining lots in order to prepare for the construction of the tidal systems, and that when completed the flat grades and low levels will cause the sewers to be often tide locked, we reiterate our opinion and advice to the Council as expressed in 1871, and declare any tidal system of Sewers for our low lands entirely impracticable.

Having now shown that the pumping system alone is practicable it only remains to submit a general plan of the sewers to be eventually built, what sewers are at present needed and estimate of the cost necessary to inaugurate the system.

On the accompanying plan we have shown in heavy black lines the sewers that should be built, their sizes and grades, the location of the pumping stations—we have also shown in red the location of the existing sewers.

The area colored green is that condemned by the Board of Health—the area colored red is the balance of Hoboken, partly upland and partly marsh lands.

We have made provisions for the drainage of all the marsh lands in Hoboken, west, south and north of the uplands, whether included in the condemned district or not.

We have located our main sewer in Jefferson street, with two outlets, one through First and Park Avenue to the basin of the Delaware, Lackawanna and Western Railroad Co., and one through 15th street to the Hudson river.

We have located the southern outlet through First streets and Park Avenue instead of through the present outlet opposite Jefferson street because by so doing we save at least \$15 000 on the cost of the construction of one outlet or tail sewer, and because by so doing many of the box drains recently built may be utilized and the streets newly paved may not have to be disturbed for years.

Our estimate of the cost necessary to be incurred in order to inaugurate the new system and to effectually drain the lands south of 8th street, is as follows:

COST OF PUMP WORKS.

Land.....	\$10,000 00
Cisterns.....	15,000 00
Pumps and engines of 92 horse power.....	18,000 00
Buildings.....	10,000 00
Contingencies.....	7,000 00
Total for pump works.....	60,000 00

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BOX NO.

COST OF SEWERS.

2,150 feet of 5-foot circular sewer in Park avenue and 1st streets @ \$15	\$32,250 00
1,750 feet of 5 feet egg shape sewer in Jefferson street @ \$13.....	22,750 00
1,767 feet of 4 feet 6 inches egg shape sewer in 1st street, west of Jefferson street @ \$12, say.....	21,200 00
800 feet of 3 feet 9 inches egg shape sewer in 5th street, between Jefferson and Clinton, @ \$10.....	8,000 00
1,400 feet 2 feet 3 inches egg shape sewer in Clinton, between 5th and 6th streets, and in Adams street, between 1st and 3rd streets, @ \$8....	11,200 00
675 feet of 2 feet 3 inches egg shape sewer in Jackson street, between Newark Avenue and 1st street, connecting with present Newark Avenue sewer @ \$8.....	5,400 00
Contingencies.....	10,200 00

Cost of Sewers..... \$121,000 00

This outlay of \$121,000 for sewers will be made necessary under either system.

Annual expenses of the pump works:

Interest on \$60,000 @ 6 percent	\$3,600 00
Depreciation.....	800 00
Attendance.....	4,000 00
Fuel.....	2,000 00
Labor and repairs.....	1,500 00
Contingencies.....	1,100 00

Total annual expenses..... \$13,000 00

We have no doubt that the work can be done at lower prices than we have estimated, but we have purposely taken these figures in order to cover all emergencies.

In conclusion we would call your attention to the fact that the idea of a city relying upon Pumps for removing water is just as practicable as the idea of a city relying on pumps for furnishing water, also that the silt beneath our marsh lands being impermeable to water makes the pumping system the more feasible. After giving due consideration to all the facts in the matter we advise the immediate erection of the pumping works for the district, south of Eighth street, the cost of which we estimate at \$60,000 and the construction of the sewers in First, Jefferson and other streets referred to in our estimate of \$111,000 making a total of \$171,000. This whole system can be put in complete operation within one year.

Respectfully submitted,

SPIELMANN & BRUSH.

*Mr. A. Report of
5 grad main & pump
engineers in charge
of the Madison
Drainage
June 28/81 - Brecken
and referred to the
Council in December,
report of the entire
at large on the
minutes.*

Attest

Wm. B. Kelly clerk

Dec 11. 1882