

garded as absolutely essential to the maintenance of the east channel under project V, the same positive necessity is not believed to exist for the construction of dike A, in project IV.

The disposition of the ebb to pass eastward near the bridge is in great measure due to the interruption of its flow occasioned by the bulkhead or high shoal below Island Beach. Were this obstruction removed and its return prevented, and the areas near the bridge dredged out, it is probable that a considerable portion of the ebb would retain its direction along the west shore, even without the assistance of dike A, although some protection would still be required for the upper portion of the west shore of Island Beach.

The omission of dike A, with an allowance for the protection of Island Beach, would more nearly equalize the cost of projects IV and V.

The dikes recommended at various points are intended to be built to half-tide only, giving A or B an elevation of 2½ feet above mean low-water; those near Rocky Point 2 feet, and those on the south branch 1½ feet.

It is proposed to leave the opening between C₁ and C₂ until the completion of the work near Rocky Point, and to require all the material raised in this vicinity to be deposited behind the dikes, after which the two should be connected and the shoal area excluded from the river.

In the case of all dredgings, it is recommended that such disposition be made of them as will prevent their again entering the stream.

The condition indispensable to any successful treatment of the river is the maintenance intact of the front beach now occupied by the New Jersey Southern Railroad as a roadway. No estimate is made for the construction of any works for the protection of this beach, with the exception of those connected with project IV, as it is assumed that the interest of the railroad company will suffice to induce it to make the necessary provisions; but during the progress of the improvements, if any are ordered, the beach should be carefully watched, and any disposition on the part of the sea to break through be counteracted by suitable methods. An arrangement could be, no doubt, made by which the company would bear at least half the expense of repairing or preventing a breach. Cedar brush is obtainable in any quantity from the government lands of the cape, and the railroad company has protected its roadbed by the inexpensive application of this brush loaded with sand-bags. In time, a continuance of this work would suffice to materially elevate and strengthen the beach.

The commerce of the Shrewsbury is at present limited to a line of steamboats making four trips daily between New York and Red Bank, and to numerous sloops and schooners, of the lighter class, transporting mixed freights to and fro. The neighboring lands are, however, rapidly increasing in value, and hotels, villas, and cottages multiplying yearly. The extension of the water facilities herein projected will give additional impetus to this growth, and at once result in an immense increase of the commerce of the river.

Presented herewith are tables showing the work of the survey, and the tidal observations; tracing of the survey with the projected improvements indicated thereon, and estimates of their cost.

Very respectfully, your obedient servant,

WILLIAM LUDLOW,

Captain of Engineers, Bvt. Lt. Col., U. S. A.

Col. J. N. MACOMB,

Corps of Engineers, U. S. A.

ESTIMATES OF COST OF PROJECTED IMPROVEMENTS.

I. South Shrewsbury:

Dredging past Jumping Point, 22,222 cubic yards, at 25 cents.....	\$5,555
Dike G, 700 linear feet, at \$5 per running foot.....	3,500
Dredging at bridge, 1,111 cubic yards, at 25 cents.....	277
Dredging below bridge, 62,324 cubic yards, at 25 cents.....	15,581
Dike F, 250 linear feet, at \$3 per running foot.....	750
Dike E, 300 linear feet, at \$3 per running foot.....	900
Dike D, 1,450 linear feet, at \$3 per running foot.....	4,350
Dike D, 125 linear feet, at \$6 per running foot.....	750
Dredging area O, 32,082 cubic yards, at 25 cents.....	8,020
Total.....	39,683

II. Navesink River:

Dredging opposite Barley Point, 23,166 cubic yards, at 25 cents.....	\$5,791
Dredging off Lower Rock Point, area P, 59,548 cubic yards, at 25 cents.....	14,887
Dike C ₂ , 600 feet, at \$6 per foot.....	\$3,600
Dike C ₃ , 1,400 feet, at \$3 per foot.....	4,200
Dike C ₁ , 1,825 feet, at \$5 per foot.....	9,125

Total cost of dike C (C ₁ , C ₂ , C ₃), when completed.....	16,925
Crib at junction of dikes C and D.....	1,500

Total.....	39,103
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Main stem.

III. Improvement of Flood Channel:

Dike A, 3,400 feet, at \$7.50 per running foot.....	\$25,500
Dredging above Island Beach, 63,870 cubic yards, at 25 cents.....	15,968
Dredging between Island Beach and bar, 171,347 cubic yards, at 25 cents.....	42,837

Total.....	84,305
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IV. Improvement of Ebb Channel:

Construction of new draw, Highlands Bridge.....	\$8,000
Dredging above Island Beach, 14,888 cubic yards, at 25 cents.....	3,722
Dredging between Island Beach and bar, 75,112 cubic yards, at 25 cents.....	18,778
Dike B, 1,200 feet, at \$5 per foot.....	\$6,000
Dike B, 2,600 feet, at \$7 per foot.....	18,200

Shore revetment, 600 feet, at \$2 per running foot.....	1,200
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Total, including draw.....	55,900
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RECAPITULATION.

I. South Shrewsbury.....	\$39,683
II. Navesink.....	39,103
III. Main stem—improvement of Flood Channel.....	84,305

Total project III.....	163,091
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IV. Improvement of Ebb Channel.....	55,900
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Total, project IV.....	134,686
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REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., February 7, 1879.

GENERAL: The Board of Engineers convened by Special Orders No. 9, Headquarters Corps of Engineers, dated Washington, D. C., January 30, 1879, has the honor to report as follows:

1. The dike H should be constructed approximately in the position and with the development shown upon the accompanying tracing.

2. The Board is not positive as to the necessity for the construction of dike G, and leaves the determination of this question to the local engineer.

3. The Board also leaves to the decision of the local engineer the exact position for the crib opposite Lower Rocky Point which shall best develop the beneficial effect of dikes C and D.

4. While the Board believes that the best results would in the end be attained by the improvement of the flood channel below the bridge, it is of opinion that, having in view the relative estimated cost, it will on the whole be most judicious to adopt the ebb channel project, and that the probabilities are strong that with the aid of the projected modifications of this channel a depth favorable to navigation will be secured.

5. That the change in position of the draw is involved in the improvement of this channel.

6. That the report and project as modified are recommended for approval.

CORRECTED ESTIMATE OF PROJECT TO ACCOMPANY REPORT OF THE BOARD.

1. South Shrewsbury:	
Estimate as per Captain Ludlow's project.....	\$39,683 00
To which add cost of dike H	8,400 00
	48,083 00
Deduct decreased cost of dredging	1,000 00
	47,083 00
2. North Shrewsbury	39,103 00
3. Improvement of ebb channel	55,900 00
	142,086 00

Respectfully submitted.

J. N. MACOMB,
Colonel of Engineers.

Z. B. TOWER,
Colonel of Engineers.

JOHN NEWTON,
Lieutenant-Colonel of Engineers.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

E 2.

IMPROVEMENT OF SALEM RIVER, NEW JERSEY.

This stream discharges into Salem Cove and thence into the deep water of the Delaware through a channel about 2 miles long and 6 feet or 7 feet deep at mean low-water, following the south shore under Elsingborough Point.

The creek itself is of ample depth and offers no difficulties to the vessels navigating it, beyond its bends and occasional insufficient width, with the exception of a bar of small extent near the town of Salem, 3 miles above the mouth.

The principal obstruction is found in the channel through the cove. When first examined in 1870 this shoal was supposed to consist of heavy boulders or fast rock, but an attempt to remove it in 1871 with

an appropriation of \$4,000, made in March, 1871, showed that the material was gravel and small bowlders imbedded in a tenacious clay.

The act of June 18, 1878, having appropriated \$3,000 for the continuance of the work, the shoal was resurveyed in July and August last, and contract made to dredge an 8-foot channel through it to as great a width as the funds would admit. Owing to the dilatoriness of the contractor in commencing operations and the unsuitable character of his plant, but little progress was made, and the storm of October 23, by disabling the dredge, put a stop to further work after the removal of 1,400 cubic yards.

The contract was annulled in November, and advertisement again made in March with the result of receiving but one bid, which was considered too high to warrant acceptance.

It is proposed so soon as the appropriation for Cohansey Creek, made in river and harbor act of March 3, 1879, shall become available, to unite the two works and include both in a new contract, for which it is expected more favorable bids will be received.

Assistant John J. Lee had the immediate supervision of this work.

In order to free the navigation of the creek, it is essential that the curved channel through the obstruction be made sufficiently wide and deep to prevent any danger of vessels at any stage of tide striking it, either with the hull or the screw, and since the removal of the gravel and boulder bar has been attended with unexpected difficulties and delays, it is recommended that an additional amount of \$3,000 be appropriated for the fiscal year ending June 30, 1881.

Salem Creek is in the collection-district of Bridgeton, N. J., which is the nearest port of entry.

The amount of revenue collected at that port during the past fiscal year was \$2,985.21.

Fort Delaware is the nearest fort, and the Finn's Point Range Lights the nearest light-house.

Original estimate of cost.....	\$10,000 00
Total amount appropriated to June 30, 1879.....	7,000 00
Total amount expended to June 30, 1879.....	4,685 34

Money statement.

July 1, 1878, amount available.....	\$3,000 00
July 1, 1879, amount expended during fiscal year.....	685 34
	2,314 66
July 1, 1879, amount available.....	2,314 66
Amount (estimated) required for completion of existing project.....	3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.	3,000 00

COMMERCIAL STATISTICS.

There are 50 vessels of all classes that belong to Salem and trade in and out of Salem Creek; the tonnage aggregating about 4,000. The larger part of merchandise received and shipped at Salem is in vessels belonging to other ports.

Two large side-wheel steamers ply between Salem and Philadelphia carrying annually 50,000 passengers, and their freight receipts each year amount to \$25,000. There is also a propeller of 250 tons, carrying freight exclusively, which makes 2 trips a week between Salem and Philadelphia.

The receipts at Salem during the past year were as follows:

Coal	25,000 tons.
Oyster-shells	100,000 bushels.
Fertilizers.....	500 tons.
Soda ash	2,000 tons.
Wood	500 cords.

Sand for glass.....	3,000 tons.
Lumber.....	5,000,000 feet.
Lime.....	100,000 bushels.
Salt hay.....	500 tons.
Miscellaneous merchandise.....	5,000 tons.

The shipments from Salem during the past year were:

Glassware.....	3,500 tons.
Oil-cloth.....	1,000 tons.
Grain.....	150,000 bushels.
Grass-seed.....	50,000 bushels.
Garden produce.....	1,000 tons.
Canned goods.....	500 tons.
Hay and straw.....	500 tons.
Flour.....	1,000 barrels.
Potatoes.....	100,000 bushels.
Miscellaneous merchandise.....	1,000 tons.

Abstract of bids received by Col. J. N. Macomb, Corps of Engineers, U. S. A., at Philadelphia, at 12 m., October 3, 1878, for the improvement of channel of Salem River, New Jersey.

No. of bid.	Name of bidder.	Residence.	Dredging in Salem River.	Remarks.
1	M. F. Brainard, agent.....	Albany, N. Y.....	Per cubic yard. \$0 22	Contract awarded.
2	Franklin B. Colton.....	Philadelphia, Pa.....	28	
3	American Dredging Company.....	do.....	27½	

Abstract of contract entered into by Col. J. N. Macomb, Corps of Engineers, during the fiscal year ending June 30, 1879, for the improvement of Salem River, New Jersey.

Name of contractor.	Residence.	Dredging.	Date.	Remarks.
1 M. F. Brainard, agent..	Albany, N. Y.....	Per cubic yard. \$0 22	Oct. 14, 1878	Contract annulled Nov. 13, 1878.

Abstract of bid received by Col. J. N. Macomb, Corps of Engineers, U. S. A., at Philadelphia at 12 m., April 3, 1879, for the improvement of Salem River, New Jersey.

No. of bid.	Name of bidder.	Residence.	Dredging in Salem River.	Remarks.
1	American Dredging Company ..	Philadelphia, Pa....	63 cents per cubic yard, in accordance with specifications.	No contract awarded. The bid was considered exorbitant.

E 3.

IMPROVEMENT OF COHANSEY CREEK, NEW JERSEY.

The act of June 10, 1872, ordered a survey of this stream, which was made the following August.

The navigable part extends from Bridgeton, N. J., to the Delaware River, a distance of 20 miles, through a tortuous channel of ample depth.

The obstructions to its free navigation are found at Bridgeton and at the mouth where the river discharges across a soft mud-bar without any well-defined channel.

The appropriation of \$10,000, made March 3, 1873, was expended upon the upper part of the river, the project submitted by Colonel Kurtz, printed in Annual Report Chief of Engineers, 1873, contemplating the construction of a channel 130 feet wide and 4 feet deep at mean low-water, at a total cost of \$30,000.

The act of June 18, 1878, having appropriated \$5,000 for the continuance of the work, a re-examination of the creek was made in August, and subsequently a contract entered into to expend the amount in conformity with the above project.

The contractor not having begun his work by the time it should have been completed, his contract was annulled, no work having been done.

The act of March 3, 1879, appropriated an additional \$4,500, and on May 10 I submitted a project for the joint application of the two sums, differing somewhat from the previous one.

Inasmuch as the factor of depth is vastly a more important one than width, it was proposed to reduce the width of the intended channel to 80 feet, and increase the draught to 7 feet at mean low-water, from the lower steamboat-landing to the bridge, and above that point to 5 feet, since the water-pipe crossing the stream near that point limits the depth of the channel.

This project was approved by the Chief of Engineers under date of May 14, 1879. It is therefore proposed, so soon as the appropriation of March 3, 1879, shall become available, to combine the two appropriations and advertise for proposals for dredging.

The obstruction at the mouth will require attention if the improvement of the river is to be continued. Owing to its extent, and the semi-fluid nature of the material, permanent works will be required for its modification. During the ensuing summer an examination and survey will be made to determine the best means for improving it.

An appropriation of \$10,500 is required for the fiscal year ending June 30, 1881, which will be applied to the enlargement of the channel at Bridgeton.

Cohansey Creek is in the collection-district of Bridgeton, N. J., which is the nearest port of entry, the amount of revenue collected there during the fiscal year ending June 30, 1879, being \$2,985.21.

Fort Delaware is the nearest fort, and Cohansey Light the nearest light-house.

The original estimated cost of the work was.....	\$30,000 00
Total amount appropriated.....	19,500 00
Total amount expended.....	10,549 81

Money statement.

July 1, 1878, amount available.....	\$5,000 00
Amount appropriated by act approved March 3, 1879.....	4,500 00
	<u>\$9,500 00</u>
July 1, 1879, amount expended during fiscal year.....	424 81
July 1, 1879, outstanding liabilities.....	125 00
	<u>549 81</u>
July 1, 1879, amount available.....	8,950 19
	<u>8,950 19</u>
Amount (estimated) required for completion of existing project.....	10,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.	10,500 00

BRIDGETON, NEW JERSEY, COMMERCIAL STATISTICS.

Received:	
Coal (not including glass manufacturing company)	tons.. 25,000
Iron	do.. 10,200
Iron ore	do.. 3,000
Fire-bricks	do.. 200
Sand	do.. 100
Stock for woolen mill	do.. 200
Stock for glass-manufacturing company	do.. 9,000
Fertilizers	do.. 600
Oyster-shells	bushels.. 130,000
Lime	do.. 40,000
Gas-lime	do.. 20,000
Lumber	feet.. 1,350,000
Shipped:	
Wood	cords.. 1,200
Hoops	600,000
Grain	bushels.. 40,000
Hay	tons.. 500
Gas-pipe	do.. 1,500
Nails	do.. 6,000
Glassware	do.. 4,000

In addition to this, there is a considerable amount of merchandise shipped and received, which cannot be fixed. One steamer runs to Philadelphia semi-weekly; about 15 vessels of from 100 to 200 tons ply regularly on the creek, and occasionally some of larger size. The business of the Cumberland Nail and Iron Company is done mostly by barges, employing 2 tugs constantly.

Abstract of proposals received by Col. J. N. Macomb, Corps of Engineers, U. S. A., at Philadelphia, Pa., October 3, 1878, for the improvement of Cohansey Creek, New Jersey.

No. of bid.	Name of bidder.	Residence.	Dredging in Cohansey Creek.	Remarks.
1	M. F. Brainard, agent	Albany, N. Y.	Per cubic yard.	Contract awarded.
2	Franklin B. Colton	Philadelphia, Pa.	\$0 24½	
3	American Dredging Company ..	do	25 28½	

Abstract of contract entered into by Col. J. N. Macomb, Corps of Engineers, U. S. A., for improving Cohansey Creek, New Jersey, during fiscal year ending June 30, 1879.

Name of contractor.	Residence.	Rate for dredging channel of Cohansey Creek.	Date.	Remarks.
M. F. Brainard, agent.	Albany, N. Y.	24½ cents per cubic yard ..	Oct. 14, 1878	Contract annulled Nov. 13, 1878.

E 4.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

In 1870, when this work was begun, the channel entrance from the Delaware had a mean low-water depth of but 15 feet. With the appropriations made annually thereafter, this depth was successively increased to 18 feet and 20 feet; but the commerce of the river developed in an extraordinary degree, and the shipment of freights increased so enormously as to require for their transportation vessels of the largest size and heaviest draught.

The original projects were therefore modified so as to contemplate securing a 24-foot channel of sufficient width to Girard Point, and a 20-foot channel thence to Gibson's wharf. Above Gibson's, to the Chestnut Street Bridge, a depth of 18 feet was considered sufficient.

Down to July 1, 1879, over 660,000 yards of material have been removed from the channel at the following-named localities:

From between the mouth and Girard Point, 300,000 yards sand and mud.
Between Penrose and Yankee Point, 221,000 yards gravel, sand, and mud.
Between Point Breeze and Gibson's, 138,000 yards gravel and boulders.
Between Gibson's and Locust street, 1,000 yards rock.

During the fiscal year, with the \$30,000 appropriated June 18, 1878, operations have progressed under this modified project. From the 24-foot channel, near the mouth, 137,000 yards were dredged; between Penrose and Yankee Point, 8,000 yards; and between Point Breeze and Gibson's, 33,000 yards. In the vicinity of Gibson's, 100 yards of rock were taken out.

A survey was made in April, 1879, from Gibson's to the Delaware. The chart shows a 24-foot channel, 200 feet wide, to Girard Point; and thence to Gibson's, substantially a 20-foot channel, about 150 feet wide.

With the \$25,000 appropriated March 3, 1879, it is proposed to continue work at the same points, and in substantial accordance with the present project, widening and deepening the channel where necessary.

It has become evident, however, that even the increased depths attained, with the width of the channel enlarged to the proposed dimensions, will be insufficient to accommodate the rapidly-increasing traffic of the Schuylkill. Since the vessels landing at Girard Point are the largest that enter the capes, the depth at the entrance should conform to that needed for the Delaware, viz, 25 or 26 feet at mean low-water.

Furthermore, since sailing-vessels of 1,000 tons and upwards crowd the wharves at Point Breeze and Gibson's, the channel depth to these points should be sufficient to afford free egress at any ordinary stage of tide. It should, therefore, be not less than 22 feet at mean low-water. No special difficulties exist in securing these depths, as the materials to be removed are such only as a powerful dredge will in all cases excavate. The "rock" removed near Gibson's is not a reef, but a compacted mass of clay, gravel, and boulders. Some of these last are of such size as to require blasting or grappling, but all could come under the same class of contracts.

During the year ending June 30, 1881, it is proposed, with the approval of the department, to continue the improvement of the river with these depths in view, and upon a general project to be submitted after the close of this year's operations.

The cost of the project cannot be calculated until the completion of a hydrographic chart in the fall shall supply the necessary information, but from present data the amount that can be profitably expended during the fiscal year ending June 30, 1881, will be \$50,000.

Operations were under the immediate supervision of Assistant Thomas Valentine.

* Original increased estimated cost of improvement	\$374,700 00
Total amount appropriated	220,000 00
Total amount expended	194,851 53

This work is in the collection-district of Philadelphia, which is a port of entry.

The nearest light-house is Mifflin Bar light, and the nearest fort is Fort Mifflin.

The amount of revenue collected at Philadelphia during the fiscal year ending June 30, 1879, was \$9,008,611.09.

* Owing to the increasing demands of commerce, this estimate requires modification.

