

REPORT OF MR. EMIL MAHLO, ASSISTANT.

PHILADELPHIA, PA., January 22, 1879.

COLONEL: I have the honor to make the following report relating to the survey of the Manasquan River, New Jersey:

The survey was commenced September 20, and finished October 3, 1878. It comprised the hydrography and topography of the river and its shores from the inlet to the "Red Bank," a distance of  $5\frac{1}{4}$  miles; a reconnaissance of the narrow upper portion of the river from Red Bank to the "Old Bridge," an additional distance, as measured along the axis of the stream, of 2 miles, and a transit and level line run from the tide-gauge at the lower bridge of Manasquan River to a tide-gauge at Bennett's Landing, head of Barnegat Bay, to determine the difference of level at both places. Two base-lines were carefully measured twice and connected by triangulation, and a meander-line was run with the transit along the north shore of the river, from the first base-line on the lower bridge to the second base-line on the upper bridge, making connections with both, and from there to "Bass Point," about 4,000 feet above.

Soundings were taken from the steam-launch and positions determined with two sextants. The time occupied in sounding was two days and a half.

The remainder of the shore-line not determined by transit along the meander-line was located by sextant.

For the reduction of soundings three tide-gauges were kept (exclusive of the one at Barnegat Bay); No. I near the inlet, No. II at the lower bridge, and No. III at the second or upper bridge, readings being taken every ten minutes. Their respective distances from each other are:

Gauge II from I.....	6,300 feet.
Gauge III from I.....	18,750 feet.

The following is a summary of the work done during the time occupied in the survey:

Length of lower base-line.....	1,813.0 feet.
Length of upper base-line.....	750.2 feet.
Number of stations occupied with transit.....	42
Number of points determined with transit.....	54
Length of meander-line.....	15,011.7 feet.
Total number of transit angles.....	366
Total number of miles of shore-line.....	16.3
Square miles of hydrography.....	$1\frac{1}{2}$
Total number of sextant angles.....	371
Total number of soundings taken, about one-fourth plotted on the chart.....	4,644
Length of transit and level line run between Manasquan River and Barnegat Bay.....	18,342.4 feet.
Distance between tide-gauge No. II, Manasquan River, and gauge No. IV, at Barnegat Bay, in a direct line, 15,750 feet.....	2.98 miles.
Mean low-water at Barnegat Bay, according to the record of levels, was found to be 0.623 feet below mean low-water of Manasquan River.	

The following table shows the mean rise and fall at the different tide-gauges:

	Feet.
Mean rise and fall at gauge No. I (inlet).....	1.0
Mean rise and fall at gauge No. II (lower bridge).....	0.6
Mean rise and fall at gauge No. III (upper bridge).....	0.6
Mean rise and fall at gauge No. IV (Barnegat Bay).....	0.6

The mean duration of flood-tide at gauge II was 5 hours, 40 minutes. The mean duration of ebb-tide at gauge II was 7 hours, 55 minutes.

Very respectfully, your obedient servant,

EMIL MAHLO,  
Assistant.

Col. WILLIAM LUDLOW,  
Captain Corps of Engineers, U. S. A.

## E 19.

## EXAMINATION OF MISPELLION CREEK, DELAWARE.

UNITED STATES ENGINEER OFFICE,  
Philadelphia, Pa., December 4, 1878.

GENERAL: I have the honor to submit herewith a report and map of reconnaissance of Mispillion Creek, Delaware, executed by Mr. W. S. Edwards, assistant engineer, under my direction and in compliance with the provision therefor contained in the river and harbor act of the current year.

I approve the recommendation and estimate for the removal of the shoals in the creek, the cost of which will be within \$3,000, and will effect a permanent improvement in navigation.

The several canal projects are greatly favored by those interested in the shipping, and regarded as an important feature in any plan of future improvement; but, if constructed, the dimensions assigned are manifestly too small. They should be—

1st. Of sufficient capacity to constitute a portion of the stream without injuriously affecting the flow; and

2d. Wide enough to admit of vessels passing.

The minimum width determined from this consideration would be 50 feet, and the cost of construction thereby increased to double the estimate.

The former consideration would materially swell this amount.

The suggested positions are in some cases faulty in sacrificing too much of the advantage of the existing channel to securing greater directness. Nos. VII and VIII, for example, could certainly be profitably replaced by another, one-third their combined lengths, connecting Potter's Upper and Lower Landings. I do not, however, recommend the construction of any of them, on the ground of their excessive cost as compared with the possible resulting benefits.

The improvement of the entrance to the creek, desirable as it is, offers considerable difficulties. Referring to the chart of 1842, the 6-foot curve is  $1\frac{1}{4}$  miles distant from shore, and 4 miles due east of the entrance is a shoal bare at low water. The intervening depths are 8 and 9 feet only. The shoals all have the southeasterly trend due to the direction of the currents and to the weight of the gales from the northwest quarter.

A 6-foot channel entrance could not be maintained in the absence of permanent works of great cost; I therefore recommend as follows:

1st. To dredge the bar to 4 feet at low-water with a minimum width of 100 feet; and,

2d. To repair the existing pile structure, and connect it with the shore, in order to prevent the littoral drift of sand into the channel behind the bar.

The cost of these two improvements will be, respectively, \$5,333 and \$1,000. Total, \$6,333.

My estimate, therefore, for the improvement of Mispillion Creek is as follows, viz:

For removal of shoals.....	\$3,000
For improvement of entrance.....	7,000
Total.....	10,000

Very respectfully, your obedient servant,

J. N. MACOMB,  
Colonel of Engineers.

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

REPORT OF MR. W. S. EDWARDS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,  
Philadelphia, September 20, 1878.

COLONEL: I respectfully submit the following report of the reconnaissance and examination of Mispillion Creek, Del., ordered by you through Captain Ludlow. Also, to accompany it, a general map of the creek, made with approximate correctness, simply to determine the nature and extent of the difficulties of free navigation, for the purpose of devising methods for their removal and estimating the probable cost of the same. In doing this, I have, in addition to my survey and examination, used all the sources of information that were available.

Mispillion Creek empties into Delaware Bay about 17 miles northwest of Cape Henlopen, and is a narrow and tortuous creek, 80 yards wide at the mouth, running up about 18 miles to the town of Milford, the head of navigation, where it is about 30 yards in width.

Efforts were made, some 20 years ago, to improve the navigation through private subscription and a small appropriation from the State; but the means were too limited to accomplish much more than some dredging of a superficial character.

Upon examination, I find that the improvements required will be:

1st Certain shoals deepened by dredging.

2d. Canals cut connecting some of the deeper bends, for the purpose of avoiding sharp turns and shortening distances.

3d. Improvement of the entrance to the creek, in order that vessels may not be detained awaiting high-water to enter.

The following are the shoals examined, with their length and the present depth of water over them; also character of the bottom:

No.	Name of shoal.	Present depth of water.	Character of bottom.	Length of shoal.	Proposed depth.
		Feet.		Feet.	Feet.
1*	Old Gum Shoal.....	4.5	Gravel....	300	6
2	Mushpot Shoal.....	4.5	Mud.....	800	6
3*	Fork Shoal.....	4.0	Mud.....	200	6
4	Reed Shoal.....	5.0	Gravel....	400	6
5*	May's Shoal.....	4.5	do.....	900	6
6	New Wharf Shoal.....	4.0	Soft.....	450	6
7	Willows Shoal.....	5.0	Hard.....	600	6
8	Red House Shoal.....	4.5	Gravel....	600	6
9	Flat Reach Shoal.....	5.0	Soft.....	700	6

\* If cuts are made these shoals will be left out.

## CANALS.

The following table gives the places where canals are asked for, and approximate lengths of same:

No.	Locality.	Length.
		Feet.
1	Ship-yard to Paul Knabb's.....	360
2	Paul Knabb's to High Hill.....	720
3	Across Dorsey's Meadow.....	1,196
4	Potter's High Hill to New Wharf.....	1,440
5	Poplars to Gravel.....	1,224
6	Hickman's to Mrs. Cain's.....	2,664
7	Mrs. Cain's to Head of Mile Reach.....	5,616
8	Crooked Gut to Sister Reach.....	3,240
9	Flat Reach to Cove.....	3,876
	Total.....	20,336

These canals to be 30 feet wide, and to have a depth of 6 feet at low-water, which would require the cutting to be 10 feet in depth.

The material to be removed would be stiff marsh mud, ordinary meadow material,

and probably 10 inches of sand and gravel at the bottom of the cuts. It could all be deposited on the banks.

Judging from the cuts made some years ago, there probably would be a permanency in the depth.

## THE ENTRANCE TO THE CREEK.

Here, some twenty years ago, an attempt was made to deepen and protect the channel by running out a row of close piling from the northern point in a southeastern direction. What effect it had at the time I was unable to learn; but at present there is a distance of 200 feet between the shore end of the piling and the high-water mark on the beach, which allows the sand to wash into the channel of the creek opposite the light-house, whence the strong ebb-current of the creek spreads it over the bar. The length of piling that remains is 560 feet, and it is now in a dilapidated condition. The present entrance to the creek is from the southeast, and has but about 18 inches at low-water for a distance of 900 feet. Under the present action of the waters of the bay the shore-line is steadily moving back and the water gaining on the land. The bar is a thin layer of sand overlying marsh mud and white clay, and a channel dredged through it would probably remain for many years without much change.

For its improvement the following plan is proposed: To cut a canal from the lower end of the Flat Reach a distance of 3,876 feet across the marsh, as shown on the map by line "A B," and from there across the shoal water of the bay to the 6-foot curve. This canal would terminate at a point on the shore-line where there is no sand, but stiff marsh mud. The dredging through the shoal water to the 6-foot curve in the bay would be about 6,600 feet in distance, with an average depth of 3 feet. The material, a thin layer of sand, about 10 inches, then marsh mud and white clay. This would be in fact making a new entrance to the creek, and at a point where there is no sand to close it, as has occurred at Cedar Creek a few miles below.

The amount of material to be removed to make a channel of 50 feet wide and 6 feet in depth would be 36,666 cubic yards.

## TIDES.

The ordinary rise of tide at the entrance to the creek is about 4.5 feet, but is always strongly influenced by the winds. At Milford the tide rises 2.3 feet, and is 2<sup>h</sup> 30<sup>m</sup> later than at the entrance. The surface current for about a mile above the mouth of the creek runs down about 1 hour after the flood-tide has made.

I herewith attach recapitulation of improvements suggested and estimates on same, based on the measurements as far as I was able to make them. Also statistics of trade of town of Milford passing up and down the creek.

Very respectfully,

W. S. EDWARDS,  
Civil Engineer.

Col. J. N. MACOMB,  
Corps of Engineers, U. S. A.

## COMMERCIAL STATISTICS OF MILFORD.

Milford, at the head of navigation on the Mispillion Creek, Delaware, is a town of about 3,000 inhabitants, whose principal employment and source of revenue is ship-building, in which it ranks next to Wilmington in the State. They also export large quantities of white-oak planking, knees, and railroad-ties; also, cord-wood and agricultural products. They have built within the past year 5 vessels, of which 2 were over 1,000 tons, and they would build much larger ones if they could get them out of the creek. There are 10 mills within a radius of a few miles, engaged in sawing white-oak planking, knees, &c.

The statistics of the commerce of the creek are as follows:

*Exports.*—Corn, wheat, oats, rye, &c., 75,000 bushels; timber to the value of \$20,000; cord-wood, 10,000 cords per annum; 5 factories, box, hat, phosphate; 30,000 railroad-ties.

*Imports.*—Coal, 6,000 tons per annum; lime, 40,000 bushels per annum; merchandise to the value of \$75,000.

Milford has railroad communication with Philadelphia and Baltimore; also with Lewes, whence large quantities of white-oak timber are shipped.

The shipping of Milford consists of 7 schooners, running during 10 months of the year; these are from 75 to 150 tons burden. There are also about 5 transient vessels, making each 4 or 5 trips a year. The naval stations at Philadelphia and New York are largely supplied with ship-timber from this point.

The vessels built here rate very high with the insurance companies. While I was engaged in surveying the creek, a vessel was launched of 1,100 tons burden, 145 feet on the keel, and that in a creek about 90 feet wide.

It is the center of a large agricultural district, as will be seen by the amount of grain exported.

There is a light-house at the mouth of the creek; the nearest fort is Fort Delaware, and it is the collection-district of Wilmington, Del.

## RECAPITULATION.

Shoals—Channel to be cut 40 feet wide.

No.	Name.	Present depth.	Bottom.	Length.	Proposed depth.	Amount to be excavated.	Cost at 30 cents.
		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Cub. yds.</i>	
1*	Old Gum Shoal.....	4.5	Gravel..	300	6	645	\$193 50
2	Mushpot Shoal.....	4.5	Mud....	800	6	1,715	514 50
3*	Fork Shoal.....	4.0	do.....	200	6	570	171 00
4	Reed's Shoal.....	5.0	Gravel..	400	6	570	171 00
5*	May's Shoal.....	4.5	do.....	900	6	1,920	576 00
6	New Wharf Shoal.....	4.0	Soft....	450	6	1,285	385 50
7	Willows Shoal.....	5.0	Hard...	600	6	855	256 50
8	Red House Shoal.....	4.5	Gravel..	600	6	1,285	385 50
9	Flat Reach Shoal.....	5.0	Soft....	700	6	1,000	300 00
	Total.....					9,845	2,953 50

\*If canals are cut, these shoals will be avoided, and the cost (\$940.50) of their improvement omitted.

Canals—To be cut 30 feet wide, 10 feet deep.

No.	Locality.	Length.	Amount excavated.	Price.	Cost.
		<i>Feet.</i>	<i>Cub. yds.</i>		
1	Ship-yard to Paul Knabb's.....	360	4,000	\$0 15	\$600 00
2	Paul Knabb's to High Hill.....	720	8,000	15	1,200 00
3	Across Dorsey's Meadow.....	1,196	13,300	15	1,995 00
4	Potter's High Hill to New Wharf.....	1,440	16,000	15	2,400 00
5	Poplars to Gravel.....	1,224	13,600	15	2,040 00
6	Hickman's to Mrs. Cain's.....	2,664	29,600	15	4,440 00
7	Mrs. Cain's to head of Mile Reach.....	5,616	62,400	15	9,360 00
8	Crooked Gut to Sister Reach.....	3,240	36,000	15	5,400 00
9	Flat Reach to Cove.....	3,876	43,050	15	6,457 50
	Total.....	20,336	225,950	15	33,892 50

Whole amount to be removed, 225,950 cubic yards, at a cost of \$33,892.50.

## ENTRANCE.

Dredging from mouth of proposed canal to 6-foot curve in bay, 50 feet in width, 6,600 feet in distance, and an average depth of 3 feet.

Amount of material to be removed, 36,666 cubic yards, at 20 cents, \$7,333.

## E 20.

## EXAMINATION OF DUCK CREEK, DELAWARE.

UNITED STATES ENGINEER OFFICE,  
Philadelphia, Pa., December 3, 1878.

GENERAL: I have the honor to submit herewith a report and map of the reconnaissance of Duck Creek, Delaware, provided for in the river and harbor act for the current year, and executed under my direction by Mr. W. S. Edwards, assistant engineer.

The tables in the original report have been amplified by the addition

of a column of amounts, calculated for each locality, with the corresponding cost of the improvement at each.

The recommendations with reference to the removal of the shoals in the creek and to the improvement of the entrance (with an important modification) are approved of by me.

The material of these shoals being principally gravel, it is probable that the improvement once made would be permanent and greatly facilitate navigation.

The depths to be attained, with the corresponding amounts to be removed, are reasonable, and the estimated cost moderate.

The greater price per yard is due to the necessity for removing the dredged material entirely from the bed of the creek and depositing it upon the banks above high-water.

Although the canals proposed would considerably shorten the distance around the bends by amounts varying from one-half to two-thirds, and for that reason are favored by those interested in navigation of the creek, I do not at the present time recommend the construction of any of them for the following reasons: Unless constructed of sufficient dimensions to enable them to appropriate the greater part of the flow of the creek, it is likely that the division of the stream into two channels would in most cases occasion a certain diminution in practicable draught in both, besides giving rise to bars at their junction from mutual interference; and in order to constitute them a portion of the stream by giving them anything like the same capacity, it would be necessary to make them very much wider than in the estimates, thus not only increasing by several times the amounts to be removed, but adding also to the price per yard, which is based upon the supposition that but one handling of the material would be required. With the canal so wide as to require more, the cost per yard would be about that of deepening the shoals. The expense of constructing these canals would consequently be out of all proportion to the advantages gained.

With regard to the uppermost canal, that numbered 1 in the table, this disproportion would be less than in the others. It is also to be observed that its construction would obviate the necessity for any dredging upon shoals 3, 4, and 5, the cost of which approaches that of the canal. But this cut-off would isolate the two landings and the phosphate works, situated on the fast land in the bend, which contribute materially to the commerce of the creek. It is preferable to improve the shoals, omitting the canal, and to expend an additional amount upon the enlargement of the present cut-off above by increasing its width to about that of the creek above and below, viz, 100 feet. This would require the removal of about 7,000 cubic yards of mud, at a cost of about \$1,500, which should be added to the estimate.

Considering the great utility and manifest desirability of harbors for the use and safety of small vessels navigating the broad reaches of Delaware Bay, particularly in the fall and winter months, when gales are frequent and the ice dangerous, and the small number of such harbors now available, I attribute much importance to the improvement of the entrance of Duck Creek independently of the navigation of the creek itself.

For both purposes I recommend the deepening of the channel at the mouth to 8 feet at low-water, in order to enable these vessels to enter at any stage of the tide. This would increase Mr. Edwards's estimate by 10,000 cubic yards, and the cost by \$2,000.

As the material of the bar is principally soft mud, this improvement would not probably be permanent, although the increased flow of the

tides due to the deepening and to the removal of the shoals above would tend to make it partially so.

This report, however, being preliminary only, it does not seem advisable to increase the estimates by the amount which would be required for the construction of permanent protective works at the mouth until after the other improvements shall have been effected, as without them the permanent works would fail of their full and proper effect.

My recommendations are summarized as follows:

For the removal of the shoals in the creek .....	\$5,500
For widening the old "cut-off" above the phosphate works .....	1,500
For improvement of the entrance .....	5,000
<b>Total .....</b>	<b>12,000</b>

And which could be profitably expended during a single season.

Very respectfully, your obedient servant,

J. N. MACOMB,  
Colonel of Engineers.

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

REPORT OF MR. W. S. EDWARDS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,  
Philadelphia, Pa., September 26, 1878.

COLONEL: I respectfully submit the following report of the reconnaissance and examination of Duck Creek, Delaware, ordered by you, and made in accordance with instructions from Capt. William Ludlow, Corps of Engineers; also to accompany it a general map of the creek, made with approximate correctness from the best available authorities and actual personal examinations and surveys.

Duck Creek is a tortuous, narrow stream, about 15 miles in length, emptying into the Delaware River on its west side, 5 1/4 miles above Bombay Hook Point, and is navigated at high-water for about 8 miles, to Smyrna Landing, by vessels of about 7 feet draught. At Smyrna Landing the creek is bridged, and a short distance above there it is dammed, furnishing water-power for saw-mills.

The width of the creek decreases from 200 yards at the mouth to about 30 yards at Smyrna.

Upon examination, I find that the improvements required will consist of the following, viz:

- 1st. Deepening the water over certain shoals.
- 2d. Cutting canals to shorten distance and avoid sharp turns.
- 3d. Deepening the water over the bar at the entrance from Delaware River.

The shoals and present depths of water at low-water are as follows, descending from Smyrna Landing:

No.	Name.	Depth.	Bottom.	Length.	Proposed depth.	Proposed width of channel.
		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
1	Walraven Shoal .....	2.5	Gravel	730	6	40
2	Beaver House Shoal .....	3.5	do	360	6	40
3	Fishing Landing Shoal .....	3.0	Hard	2,190	6	40
4	Briglang Shoal .....					
5	Back Landing Shoal .....					
6	Deep Hole Shoal .....	3.0	Gravel	280	6	40
7	Cave Landing Shoal .....	3.0	do	200	6	40
8	Gravel Reach Shoal .....	2.5	do	820	6	40
9	Cherry Tree Shoal .....	4.0	do	780	6	40

Canals.

No.	Name.	Depth.	Length.	Width.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
1	Deep Hole Shoal to Cut Channel .....	11	912	40
2	Cave Landing .....	11	720	40
3	Cherry Tree Shoal .....	11	860	40
4	Old Thoroughfare .....	11	1,570	40

ENTRANCE TO THE CREEK.

By reference to the Coast Survey chart of 1841, I find that there was at that time 2 feet at low-water of spring tides; at the time I made the examination I found 3 feet at ordinary low-water, which probably would be 2 feet at spring tides; but the direction of the channel has moved more to the southward and eastward, and the shore line has changed materially; therefore, before making any improvements at this point, a close survey would be advisable. At present I can only recommend the dredging of the channel from 7 feet in the bay to the same depth in the mouth of the creek. The distance is about 1,400 feet, and across the shoalest part about 360 feet. To obtain a channel 100 feet wide and 6 feet deep at low-water would require dredging for a distance of 1,300 feet to an average depth of 3 feet. This would then form an excellent "harbor of refuge" for the small vessels running up and down the bay, and seems to be needed at this point. It is now used to a great extent for that purpose whenever the tide allows them to enter.

The ordinary rise of tide at the mouth of the creek is about 5.5 feet, but is much influenced by the winds. The rise of the tide at Smyrna Landing is about 2.5 feet, and it is 1 1/2 hours later than at the entrance. These data are deduced from three days' observations.

I hereto attach a recapitulation of the improvements asked for and estimates of amounts of materials to be removed; also partial statistics of commerce of town of Smyrna, passing up and down the creek.

Very respectfully,

W. S. EDWARDS,  
Civil Engineer.

Col. J. N. MACOMB,  
Corps of Engineers, U. S. A.

RECAPITULATION.

Shoals.

No.	Name.	Depth.	Bottom.	Length.	Proposed depth.	Proposed width of channel.	Amount of excavation.	Cost at 25 cents per cubic yard.
		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Cub. yds.</i>	
1	Walraven Shoal .....	2.5	Gravel	730	6	40	3,600	\$900 00
2	Beaver House Shoal .....	3.5	do	360	6	40	1,270	317 50
3	Fishing Landing Shoal .....	3.0	Hard	2,190	6	40	9,300	2,325 00
4	Briglang Shoal .....							
5	Back Landing Shoal .....							
6	Deep Hole Shoal .....	3.0	Gravel	280	6	40	1,170	292 50
7	Gravel Reach Shoal .....	2.5	do	820	6	40	4,200	1,050 00
8	Cave Landing Shoal .....	3.0	do	200	6	40	825	206 25
9	Cherry Tree Shoal .....	4.0	do	780	6	40	2,270	567 50

Amount to be removed, 22,635 cubic yards; cost, \$5,658.75.

## Canals.

No.	Name.	Depth.	Length.	Width.	Amount of excavation.	Cost at 15 cents per cubic yard.
		Feet.	Feet.	Feet.	Cub. yds.	
1	Deep Hole Shoal to Cut Channel .....	11	912	40	14,862	\$2,229 30
2	Cave Landing Canal .....	11	720	40	11,733	1,759 95
3	Cherry Tree Shoal Canal .....	11	860	40	14,015	2,102 25
4	Old Thoroughfare Canal .....	11	1,570	40	25,585	3,837 75

Amount to be removed, 66,195 cubic yards; cost, \$9,929.25.

## Entrance.

1,300 feet in length, 100 feet wide, and 6 feet deep.  
 Amount to be removed, 14,444 cubic yards, at 20 cents ..... \$2,888 80  
 Total cost of improvement ..... 18,500 00

The material on the shoals is gravel and sand mixed; of the canals, moderately stiff marsh mud; and on the bar, sand and mud.

## COMMERCIAL STATISTICS.

Smyrna, Del., is a town of about 3,000 inhabitants, mostly engaged in agriculture and some manufacturing. It is the center of a large peach-growing district, and considerable lumber and ship-timber are exported. It has railroad communication with Philadelphia, Baltimore, and New York. It is in the Wilmington collection-district, and there is a light-house at the entrance to the creek.

*Factories.*—Agricultural implements; tannery; organ factory; two canning establishments. There are two banks in Smyrna; two phosphate factories.

*Exports.*—Grain, 200,000 bushels; lumber, 500,000 feet; ship-timber, 200,000 feet; phosphate, 2,000 tons.

*Imports.*—Coal, 3,000 tons; merchandise, \$300,000 worth per annum; phosphate materials, 8,000 tons.

*Shipping.*—There is one steamboat plying from Smyrna Landing to Philadelphia, and about 7 freighting schooners, from 80 to 120 tons, during 10 months of the year.

The mouth of the creek is used extensively by the deep-water oyster-vessels to fatten their oysters, which is done by laying them on platforms, and allowing one or two tides to flow over them. There are often 6 and 8 vessels lying in the mouth of the creek.

W. S. E.

## E 21.

## SURVEY OF SALEM RIVER, NEW JERSEY, BETWEEN SHARPTOWN AND THE DELAWARE CANAL.

UNITED STATES ENGINEER OFFICE,  
 Philadelphia, Pa., December 16, 1878.

GENERAL: I have the honor to forward the accompanying report and chart of the survey of upper Salem Creek, New Jersey, executed under my direction, in accordance with the provisions of the river and harbor act, approved June 18, 1878.

If the canal through which the creek now discharges was originally designed for the better drainage of the low lands bordering upon it, it is manifest that the intention has failed of accomplishment by reason of:

First. The insufficient capacity of the canal, and the absence of any protection to its banks;

Second. The inadequacy of the restricted movements of the water to maintain a deep channel at its mouth in conflict with the tides and waves of the river; and

Third. The faulty position of the line of the canal, which should have been that of a tangent to the curve of the creek above their junction, in order to secure an easy and unobstructed interchange of contents.

Assuming the motives of those urging the improvement of the creek to be the same now as formerly, it would therefore seem that the first step should be a backward one, contemplating the closing of the canal, and the restoration of the creek to its former course by the removal of the dam.

It appears, however, that the objects now sought by those interested are the improvement of the navigation of the creek, and the resulting increase of the commercial facilities of Sharptown and the neighboring country, and for these direct communication with the Delaware River, via the canal, is extremely favorable. To effect these purposes thoroughly would involve:

First. Deepening and protecting the entrance by a curved jetty extending from the north shore and gradually bending to the southward until the terminal tangent should have about a southwest direction;

Second. Increasing the capacity of the canal; and

Third. Straightening and deepening the creek above to such point as should be considered desirable.

The cost of the first two items would be large.

The jetty would need to be between 400 and 500 feet in length, and would cost not less than \$20 per running foot, constructed in the simplest manner consistent with giving it sufficient stability to withstand ice.

The second item would be provided for adequately only by doubling the width of the canal and deepening it, or, alternatively, by deepening it and supporting the banks with sheet-piling, the expense in either case being about the same to obtain 10 feet at mean low-water, viz, between \$50,000 and \$60,000.

The present commerce of the creek does not seem, however, to demand these large expenditures, and according to the estimate the cost of improving the creek to afford 5 feet at low-water to Course's Landing, the present head of navigation, is \$1,280, and to continue this draught to Kiger's Landing, \$3,900.

If these improvements only are to be made, however, the estimate must be increased at least 50 per cent., in which case the total would be \$7,800. This would in effect remove the head of navigation to Kiger's Landing, and place it at a distance of a little over a mile from Sharptown.

To continue the work further would be a simple matter, to be determined by considerations other than questions of engineering.

The cost from Kiger's to Sharptown, including a terminal basin in the estimate, is \$15,700.

Very respectfully, your obedient servant,

J. N. MACOMB,  
 Colonel of Engineers.

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