

with rounded bowlders of all sizes up to 20 or 30 tons' weight, and so hard as to defy all ordinary methods of excavation. For the purpose of removing this formation, a powerful steam-pump, discharging two streams of water under a steam-pressure of 80 pounds, was employed to cut away the material and loosen the bowlders; the nozzles of the hose-pipes were conducted to the bed of the river by being attached to a spar and lowered by means of steam-tackle.

This process was found to be very successful, and a scow fitted for this particular work has been put in operation on this reef.

The steam-drilling scow was moved to Shell Drake Reef, Hell Gate, June 1, and remained there until the latter part of the month, when it was removed to Fryng Pan Reef.

The following work was done by the steam-drilling scow:

	Diamond Reef.	Shell Drake Reef.	Fryng Pan Reef.
Cubic yards of rock removed .....	519.1		
Number of holes drilled .....	94	54	8
Number of feet drilled .....	649.75	433.75	35
Pounds of giant powder used for drill-hole blasts .....	3,142.5	196.7	220
Pounds of giant powder used for surface blasts .....	737.5		2,677.5

July 1, 1878, amount available..... \$382,960 21  
Amount appropriated by act approved March 3, 1879..... 250,000 00  
\$632,960 21

July 1, 1879, amount expended during fiscal year..... 197,975 38  
July 1, 1879, outstanding liabilities..... 103,995 06  
301,970 44  
July 1, 1879, amount available..... 330,939 77

Amount (estimated) required for completion of existing project..... 2,615,078 55  
Amount that can be profitably expended in fiscal year ending June 30, 1881. 450,000 00

(See Appendix D 3.)

4. *Improvement of Harlem River, New York.*—Detailed examinations have been made of the different routes for cutting a canal across the mainland to connect the Hudson and Harlem Rivers, and detailed maps and descriptions of each piece of property affected by the proposed cut are in progress of preparation, to be submitted to the supreme court for the appointing of a commission to assess benefits and damages and to condemn such land as may be necessary for the proposed cut, a law to that effect having been granted by the State legislature.

July 1, 1878, amount available..... \$300,000  
Amount appropriated by act approved March 3, 1879..... 100,000  
\$400,000  
July 1, 1879, amount available..... 400,000

Amount (estimated) required for completion of existing project..... 1,700 000

(See Appendix D 4.)

5. *Improvement of Flushing Bay, New York.*—At the close of the fiscal year no work had been done under the appropriation of March 3, 1879, the first for this improvement. It will be applied to the construction of a dike about 3,000 feet long.

Amount appropriated by act approved March 3, 1879..... \$20,000 00  
July 1, 1879, amount available..... 20,000 00

Amount (estimated) required for completion of existing project..... 153,500 00  
Amount that can be profitably expended in fiscal year ending June 30, 1881. 40,000 00

(See Appendix D 5.)

6. *Improvement of East Chester Creek, New York.*—Dredging was done by hired labor at the following points: Near Lockwood's channel, near Goose Island, and at Pelham's Bridge. The amount of material removed was 23,195 cubic yards of mud, sand, and bowlders, and 85 stones of one yard and upwards were chained and removed.

The works as far as completed have given the requisite depth.

July 1, 1878, amount available..... \$10,011 75  
Amount appropriated by act approved March 3, 1879..... 3,500 00  
\$13,511 75

July 1, 1879, amount expended during the fiscal year..... 9,353 48

July 1, 1879, amount available..... 4,158 27

Amount (estimated) required for completion of existing project..... 86,000 00  
Amount that can be profitably expended in fiscal year ending June 30, 1881. 35,000 00

(See Appendix D 6.)

7. *Improvement of Echo Harbor, New Rochelle, New York.*—Contract was made November 21, 1878, for the removal of the rock known as "Start Rock," to a depth of 7 feet at mean-low water. Owing to the protracted winter weather the contractor did not commence work until the month of May, 1879.

As the appropriation of March 3, 1879, is not sufficient for the removal of "Sheepshead Rock," further operations will be deferred until another appropriation is made.

July 1, 1878, amount available..... \$10,000 00  
Amount appropriated by act approved March 3, 1879..... 3,000 00  
\$13,000 00

July 1, 1879, amount expended during fiscal year..... 1,810 22  
July 1, 1879, outstanding liabilities..... 6,125 00  
7,935 22

July 1, 1879, amount available..... 5,064 78

Amount (estimated) required for completion of existing project..... 25,955 38  
Amount that can be profitably expended in fiscal year ending June 30, 1881. 25,900 00

(See Appendix D 7.)

8. *Improvement of Port Chester Harbor, New York.*—There being no appropriation for this work, no operations were conducted during the year.

July 1, 1878, amount available..... \$1,950 00  
July 1, 1879, amount available..... 1,950 00

Amount (estimated) required for completion of existing project..... 84,632 00

(See Appendix D 8.)

9. *Improvement of Passaic River, New Jersey.*—The small dredging scow removed a quantity of railroad iron, ties, and stones from near the draw of the Montclair railroad bridge; drilled, blasted, and removed a number of bowlders from channel near Passaic.

The cuts through the bars between Rutherford Park and the Erie Railroad Bridge have been widened to 60 feet on the bottom, and the channel at Belleville was cleared of a quantity of clay and sand; this work was done by hired labor.

The Passaic River from the Midland Railroad Bridge to Passaic is now in good condition for navigation, and vessels drawing 6 feet can now go from Newark to Passaic without being compelled to lay over for a change of tide.



July 1, 1878, amount available.....	\$10,608 92
Amount appropriated by act approved March 3, 1879.....	2,000 00
	<u>\$12,608 92</u>
July 1, 1879, amount expended during fiscal year.....	8,046 23
July 1, 1879, amount available.....	4,562 69
	<u>11,924 00</u>
Amount (estimated) required for completion of existing project.....	11,924 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	12,000 00

(See Appendix D 9.)

10. *Improvement of channel between Staten Island and New Jersey.*—No work has been done during the year. It has been judged expedient to delay the commencement of operations until the increase in draught of the vessels should demand additional depth in the channel.

July 1, 1878, amount available.....	\$25,224 74
July 1, 1879, amount expended during fiscal year.....	4,154 43
July 1, 1879, amount available.....	21,070 31
	<u>15,480 00</u>
Amount (estimated) required for completion of existing project.....	15,480 00

(See Appendix D 10.)

11. *Improvement of Raritan River, New Jersey.*—Contract has been made for the construction of about 12,800 feet of pile dikes at the "Middle Ground" and "Stakes." As the timber and piles had to be treated with "dead oil" or carbolized, the contractor was not able to commence driving piles until the month of May, 1879, and at the close of the year the following work had been done:

*Dike No. 2, "Middle Ground."*

Linear feet of rows of piling driven.....	2,715
Linear feet of dike filled with stone.....	1,140

*Dike No. 3, at the "Stakes."*

Linear feet of rows of piling driven.....	1,500
Linear feet of dike filled with stone.....	146

The contract for dikes has been extended to October 1, 1879.

Dredges were put to work upon the shoals at the "Middle Ground" and "Stakes," and at the close of the year had removed 142,244 cubic yards of material, composed of sand, gravel, shells, &c. In the month of June a dredge was put to work near Whitehead's Sand Dock, and removed 5,170 cubic yards of material, composed of blue and red shale, small boulders, and a compact blue clay.

Between Whitehead's Sand Dock and Martin's Dock the bed of the river has been examined by borings made by means of a stream of water from a steam-pump on the small drilling-scow, the water being conducted through rubber hose to the bed of the river. By this process holes were bored in some cases to a depth of 14 feet, and the presence of rock readily determined.

July 1, 1878, amount available.....	\$200,000 00
Amount appropriated by act approved March 3, 1879.....	60,000 00
	<u>\$260,000 00</u>
July 1, 1879, amount expended during fiscal year.....	37,427 05
July 1, 1879, outstanding liabilities.....	107,799 06
July 1, 1879, amount available.....	145,226 11
	<u>114,773 89</u>
Amount (estimated) required for completion of existing project.....	1,833,632 05
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	100,000 00

(See Appendix D 11.)

12. *Improvement of harbor of Plattsburg, New York.*—There being no appropriation, no work was done during the year.

Under the appropriation of March 3, 1879, it is proposed to remove as far as possible the shoals lying nearest the breakwater, and to improve the navigation between the North and South wharves.

July 1, 1878, amount available.....	\$980 49
Amount appropriated by act approved March 3, 1879.....	2,000 00
	<u>\$2,980 49</u>
July 1, 1879, amount expended during fiscal year.....	21 28
July 1, 1879, amount available.....	2,959 21
	<u>3,000 00</u>
Amount (estimated) required for completion of dredging.....	3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	3,000 00

(See Appendix D 12.)

13. *Improvement of harbor of Burlington, Vermont.*—The base of that portion of the breakwater built since 1868, has been ripped with rubble stone.

A contract has been made for an extension of the breakwater in a northwesterly direction of 100 feet, and the crib has been constructed and sunk in position.

July 1, 1878, amount available.....	\$22,759 65
Amount appropriated by act approved March 3, 1879.....	15,000 00
	<u>\$37,759 65</u>
July 1, 1879, amount expended during fiscal year.....	12,633 24
July 1, 1879, outstanding liabilities.....	1,900 00
	<u>14,533 24</u>
July 1, 1879, amount available.....	23,226 41

Amount (estimated) required for completion of existing project.....	260,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	30,000 00

(See Appendix D 13.)

14. *Improvement of harbor of Swanton, Vermont.*—Contract was made for the construction of two cribs with superstructure of 189 feet in length to repair damage done to the breakwater by ice floes in March, 1878, and at the close of the fiscal year the work was nearly completed.

July 1, 1878, amount available.....	\$22,600 50
Amount appropriated by act approved March 3, 1879.....	6,000 00
	<u>\$28,600 50</u>
July 1, 1879, amount expended during fiscal year.....	8,021 14
July 1, 1879, outstanding liabilities.....	14,364 00
	<u>22,385 14</u>
July 1, 1879, amount available.....	6,215 36

Amount (estimated) required for completion of existing project.....	179,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	5,000 00

(See Appendix D 14.)

15. *Improvement of Otter Creek, Vermont.*—Dredging by contract has been done at different points on the creek, the channel being widened and deepened and in some places straightened; the amount of material removed was 15,667 cubic yards of silt, sand, stone, clay, and trees. Some 432 leaning trees upon either bank of the creek which were in danger of falling into the stream and obstructing navigation have been removed by hired labor.

The navigation in the vicinity of the steamboat landing has been



very much improved, and vessels with their cargoes are able to reach the wharves at the foot of the "Falls."

July 1, 1878, amount available.....	\$8,050 84	
Amount appropriated by act approved March 3, 1879 .....	5,000 00	\$13,050 84
July 1, 1879, amount expended during fiscal year .....	6,628 33	
July 1, 1879, amount available.....	6,422 51	
Amount (estimated) required for completion of existing project.....	30,146 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	5,000 00	

(See Appendix D 15.)

#### EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with provisions of the river and harbor act of June 18, 1878, Colonel Newton was charged with and has completed the following examinations and surveys:

1. *The coast of Long Island, New York, between Coney Island Point and Rockaway Inlet, in New York Bay.*
2. *Sheepshead Bay, New York.*
3. *Canarsie Bay, New York.*

The results of the above-named surveys were transmitted to Congress and printed as House Ex. Doc. No. 89, Forty-fifth Congress, third session. (See, also, Appendix D 16.)

4. *Flushing Bay, New York.* (See Appendix D 5.)
5. *East River, New York, at its junction with New Town Creek.*—A preliminary examination of this locality was made and reported upon in the last annual report.

And to comply with provisions of the river and harbor act of March 3, 1879, has been charged with and is now engaged upon the following, the results of which will be duly submitted when received:

1. *New Town Creek, at mouth of East River, New York.*
2. *South River, New Jersey, between Raritan River and Old Bridge.*
3. *Cheesequakes Creek, New Jersey.*
4. *Ship canal across Bergen Neck in Hudson County, New Jersey.*

#### IMPROVEMENT OF THE NAVIGATION OF CERTAIN RIVERS IN NEW JERSEY; OF DELAWARE AND SCHUYLKILL RIVERS AND RIVERS IN DELAWARE—HARBOR IMPROVEMENTS ON DELAWARE RIVER AND BAY—CONSTRUCTION OF PIER AT LEWES—DELAWARE BREAKWATER.

Officer in charge, Col. J. N. Macomb, Corps of Engineers, with Capt. William Ludlow, Corps of Engineers, under his immediate orders.

1. *Improvement of Shrewsbury River, New Jersey.*—During the past year a survey of the river was made from the entrance to above Upper Rocky Point on the Navesink, and to Jumping Point on the South Shrewsbury, and a project adopted for the thorough improvement of both branches within the limits indicated.

During the fiscal year it is proposed, in pursuance of this project, to apply the \$10,000 appropriated March 3, 1879, together with the balance on hand, to the credit of this work, to the construction of training-dikes in the vicinity of Lower Rocky Point, and to dredging the adjacent channels so as to afford 6 feet at low-water.

The officer in charge submits an estimate of \$116,000 to complete the

improvement of the river in accordance with the project recommended by a Board of Engineer Officers.

July 1, 1878, amount available.....	\$18,000 00	
Amount appropriated by act approved March 3, 1879.....	10,000 00	\$28,000 00
July 1, 1879, amount expended during fiscal year .....		2,315 58
July 1, 1879, amount available.....		25,684 42

Amount (estimated) required for completion of existing project.....	116,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	40,000 00

(See Appendix E 1.)

2. *Improvement of Rahway River, New Jersey.*—The river and harbor act of June 18, 1878, provided for a survey of this river with estimates of the cost of improvement. The appropriation of March 3, 1879, will be applied towards carrying out a plan of improvement resulting from this, and is deemed only sufficient for dredging a channel 75 feet wide and 7 feet deep, at mean high-water, from Edgar's Dock to the stone bridge at the head of navigation, a distance of about 1,400 yards.

To increase this width to 125 and 100 feet, and the depth to 8 feet, which will meet the present wants of commerce, and for the removal of some boulders in the upper part of the stream, will require, as estimated by the officer in charge, an additional appropriation of \$27,000.

Amount appropriated by act approved March 3, 1879.....	\$10,000 00
July 1, 1879, amount available.....	10,000 00

Amount (estimated) required for completion of existing project.....	27,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	15,000 00

3. *Improvement of Elizabeth River, New Jersey.*—An examination of this river, with estimates of cost of improvement, was made in compliance with requirements of the river and harbor act of June 18, 1878. The river and harbor act of March 3, 1879, appropriated \$7,500 for the improvement, "to secure a 7-foot channel." It is estimated that this sum will only suffice to prolong to a width of 60 feet the depth of 7 feet, at mean high water, up stream for about 1,370 yards from the point where the depth becomes less.

It is estimated by the officer in charge that to continue this depth and width as far up stream as the first permanent bridge (at Broad street, in Elizabeth) will require an additional appropriation of \$18,000; and increasing the depth to 8 feet, retaining the same width, \$25,000.

Amount appropriated by act approved March 3, 1879.....	\$7,500 00
July 1, 1879, amount available.....	7,500 00

Amount (estimated) required for completion of existing project.....	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	15,000 00

4. *Improvement of Woodbridge Creek, New Jersey.*—The appropriation of March 3, 1879, will be applied to widening the stream near the Salamander Dock; to dredging through the shoal near Valentine's Dock, and to constructing a pile revetment for the purpose of straightening and strengthening the banks in that vicinity.

The estimate for the improvement of the navigation of this stream, made in compliance with provisions of the river and harbor act of June 18, 1878, was as follows: For providing a uniform depth of 12 feet at



mean high-water in a channel 80 feet wide from the mouth of the creek as far up as the Salamander Dock, \$13,800.

Amount appropriated by act approved March 3, 1879.....	\$4,000 00
July 1, 1879, amount available.....	4,000 00

Amount (estimated) required for completion of existing project.....	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.	10,000 00

5. *Improvement of Manasquan River, New Jersey.*—The inlet at the mouth of this river is about midway between Sandy Hook and Barnegat Inlet. Owing to the instability of its channel, and small depth, it can now be but little used.

A report of the results of an examination made in compliance with provisions of the river and harbor act of June 18, 1878, has been transmitted to Congress, and was printed in Executive Document No. 53, third session Forty-fifth Congress.

As the securing of a safe entrance to the river is at present the main object, the appropriation of March 3, 1879, will be applied to making a survey for the purpose of determining the proper location for jetties for controlling the inlet and concentrating the scouring action of the ebb-tide through it, and towards their construction.

The officer in charge estimates the whole cost of this improvement at \$52,120, as follows: For the jetties, \$22,550; for dredging, \$28,370; and for removing wrecks and snags in the stream, \$1,200.

Amount appropriated by act approved March 3, 1879.....	\$12,000 00
July 1, 1879, amount available.....	12,000 00

Amount (estimated) required for completion of existing project.....	41,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	20,000 00

6. *Improvement of Salem River, New Jersey.*—The principal obstruction to the navigation of this stream is a bar of gravel and small bowlders imbedded in clay which is found in the channel through Salem Cove into the Delaware. It was partly dredged in 1871, and a contract was made during the fiscal year for the dredging of an 8-foot channel, under the appropriation of \$3,000 made in river and harbor act of June 18, 1878.

This contract was annulled in November, owing to the failure of the contractor to fulfill his obligations.

Readvertisement brought but one bid, which was considered too high to warrant acceptance.

It is proposed to combine this work with that of improvement of Cohansey Creek, with the expectation that a more favorable bid will be received.

July 1, 1878, amount available.....	\$3,000 00
July 1, 1879, amount expended during fiscal year.....	685 34

July 1, 1879, amount available.....	2,314 66
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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

(See Appendix E 2.)

7. *Improvement of Cohansey Creek, New Jersey.*—The improvement of this stream was begun in 1873, the obstructions to its navigation being a bar of soft mud at the mouth and a great shoaling of the channel through Bridgeton, the head of navigation, at which point the appropriation of \$10,000 of March 3, 1873, was applied, with the effect of securing a channel 4 feet deep and 75 or 80 feet wide.

A contract was made during the fiscal year with the appropriation of

\$5,000 of June 18, 1878, for continuing the work, but the contractor having failed to begin his work in time, the contract was annulled.

It is proposed during the present fiscal year to unite the above-mentioned appropriation with that of \$4,500 of March 3, 1879, and to advertise for the construction of a channel 80 feet wide and 7 feet deep at mean low-water, from the lower landing at Bridgeton to Broad Street Bridge, and above that point to dredge to 5 feet.

July 1, 1878, amount available.....	\$5,000 00
Amount appropriated by act approved March 3, 1879.....	4,500 00
	\$9,500 00

July 1, 1879, amount expended during fiscal year.....	424 81
July 1, 1879, outstanding liabilities.....	125 00
	549 81

July 1, 1879, amount available.....	8,950 19
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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

(See Appendix E 3.)

8. *Improvement of Schuylkill River, Pennsylvania.*—This work was begun in 1870. The channel entrance from the Delaware River has been gradually deepened from 15 feet to 24 feet, and a 20-foot channel has been made to Gibson's Point. The commerce of the river has developed in a marked degree and now demands accommodation for the heaviest vessels.

During the past year the \$30,000 appropriated in act of June 18, 1878, were expended in removing 137,000 yards of mud from the channel near the mouth, 8,000 yards of gravel and mud from above Penrose Ferry Bridge, 33,000 yards of clay, gravel, mud, and bowlders from near Gibson's, and 100 yards of rock in the same vicinity.

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

It is proposed with the appropriation of \$25,000 made March 3, 1879, to continue the work of widening and improving the channel with the above depths. It has become evident, however, that these depths should be increased to 25 or 26 feet at the entrance, and to not less than 22 feet to Gibson's.

Surveys to be made after the close of operations in the fall will determine the amount of work necessary to accomplish this and serve as the basis for an estimate of its cost.

July 1, 1878, amount available.....	\$30,323 78
Amount appropriated by act approved March 3, 1879.....	25,000 00
	\$55,323 78

July 1, 1879, amount expended during fiscal year.....	25,449 12
July 1, 1879, outstanding liabilities.....	4,726 19
	30,175 31

July 1, 1879, amount available.....	25,148 47
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Amount that can be profitably expended in fiscal year ending June 30, 1881.	50,000 00
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(See Appendix E 4.)

9. *Improvement of Delaware River, between Trenton and White Hill, New Jersey.*—The operations of the fiscal year have been directed to opening the channel from the terminus of the Delaware and Raritan Canal, at Bordentown, towards the deep water near White Hill, and a channel 200 feet in width and 7 feet deep at mean low-water has been nearly completed.



For the first time in many years the numerous vessels engaged in the canal and river traffic, drawing 7 feet loaded, were able to enter and leave without detention.

In August, 1878, a survey of the river was made from White Hill to one mile above Bordentown, and an examination made of the Periwig Island obstruction, which showed that the channel at this point had again deteriorated notwithstanding the dredging of previous years.

During the winter two ice-gorges formed in the vicinity of Bordentown, one of which had the effect of forcing the current through the slough back of Duck Island, and depositing a considerable amount of sand in the river above the canal.

A survey is in progress and nearly completed, covering both the Bordentown Channel and that at Periwig, near which is the upper end of Duck Island Slough.

During the ensuing season it is proposed to continue the improvement of the Bordentown Channel by cutting through the shoals above, for the purpose of securing a greater flow of water, and to submit projects for the construction of permanent works necessary for the maintenance of free navigation in this vicinity and at Periwig.

The appropriation is, by title, now restricted to that portion of the river lying between Trenton and White Hill. Other points farther down require attention, and it is recommended that the appropriation be made to read, "*between Trenton, New Jersey, and Bridesburg, Pennsylvania,*" for the purpose of covering these points.

An appropriation of \$20,000 is recommended for the fiscal year ending June 30, 1881.

July 1, 1878, amount available.....	\$10,000 00	
Amount appropriated by act approved March 3, 1879.....	6,000 00	\$16,000 00
July 1, 1879, amount expended during fiscal year.....	4,023 95	
July 1, 1879, outstanding liabilities.....	1,410 79	5,434 74
July 1, 1879, amount available.....	10,565 26	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	20,000 00	

(See Appendix E 5.)

10. *Improvement of Delaware River below Bridesburg, Pennsylvania.*—Operations under this appropriation were mainly confined to the improvement of Mifflin Bar, from which by the end of the fiscal year 98,000 yards had been dredged. The axis of this channel was somewhat changed so as to correspond more nearly in direction with the currents of the river, and the depth dredged was increased to 26 feet at mean low-water.

The result of the year's work appears favorable. The scouring action had manifested itself in a marked degree, and had deepened the cut to 28, 29, and in some places 30 feet, making the available depth nearly equal to that in the two channels connected by it. The scoured material was principally pushed down stream into the deep water off Billingsport.

A full survey of the locality was made previous to beginning operations, and another in May, 1879, which showed that at that time a 26-foot channel 150 feet wide existed.

Examination was made of the Bulkhead Shoals, and a project adopted for deepening the channel to 24 feet by the removal of a ridge lying parallel and adjacent to the Deep Water Point Ranges.

A small gravel shoal with 16 feet upon it off the Christian Street

Wharf, Philadelphia, which much interfered with the movements of the large vessels in the vicinity, was removed to 25 feet.

Tidal stations were established at Lewes, Del., Fort Delaware, Marcus Hook, and Fort Mifflin, and current-observations were made at several points.

During the ensuing year the Mifflin Bar work will be continued in order to widen it to 500 feet. The proposed dredging at Bulkhead Shoals will be completed, and the improvement of the river along the city front will be begun. The tidal observations will be continued, and the gauges connected by a line of levels.

For the prosecution of this work during the fiscal year ending June 30, 1881, \$150,000 is recommended.

July 1, 1878, amount available.....	\$106,140 85	
Amount appropriated by act approved March 3, 1879.....	45,000 00	\$151,140 85
July 1, 1879, amount expended during fiscal year.....	23,943 29	
July 1, 1879, outstanding liabilities.....	5,824 19	29,767 48
July 1, 1879, amount available.....	121,373 37	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	150,000 00	

(See Appendix E 6.)

11. *Improvement of Delaware River at Schooner Ledge.*—This reef, the only one known at present to exist in the main channel of the Delaware, has between 18 and 19 feet upon it at mean low-water, and is a dangerous obstruction to deep-water navigation.

The act of March 3, 1879, appropriated \$50,000 for commencing its removal, which will be begun as soon as the necessary preparations can be made.

Amount appropriated by act approved March 3, 1879.....	\$50,000 00	
July 1, 1879, amount available.....	50,000 00	
Amount (estimated) required for completion of existing project.....	177,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881, as revised in this office.....	60,000 00	

(See Appendix E, 7.)

12. *Improvement of Delaware River at Cherry Island Flats.*—This is an extensive mud flat in the Delaware, with but 18 and 19 feet at low-water.

The act of March 3, 1879, having appropriated \$100,000 for this improvement, the construction of a 24-foot channel to the westward of Cherry Island Flats will be begun as soon as possible, with a view of having an opening through made this autumn.

Amount appropriated by act approved March 3, 1879.....	\$100,000 00	
July 1, 1879, amount available.....	100,000 00	
Amount (estimated) required for completion of existing project.....	204,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	100,000 00	

(See Appendix E 8.)

13. *Ice-harbor at New Castle, Delaware.*—The necessity for protecting vessels against the heavy ice of the Delaware was early seen, and the construction of this harbor was begun in colonial times. Its extension by the United States was undertaken in 1803, and continued at irregular intervals to the present. The sheltered area, which is every winter crowded with vessels of all sizes, is about 900 feet by 300 feet.

The outer pier of stone, with crib foundation, was completed during the fiscal year; and it is proposed to expend the available balance, including the appropriation of \$5,500 in act of March 3, 1879, in dredging the inner