MESSAGE

FROM

THE PRESIDENT OF THE UNITED STATES,

SHOWING

The operations of the Topographical Bureau during the year 1839.

JANUARY 9, 1840.

Laid on the table, and ordered to be printed.

To the Senate of the United States:

I transmit, herewith, for your consideration and action, a communication from the Secretary of War, which is accompanied by the documents from the Military and Topographical Engineer Bureaus, referred to in his late annual report, as relating to the system of internal improvement carried on by the General Government, and showing the operations during the past year in that branch of the public service intrusted to the Topographical Bureau.

M. VAN BUREN.

WASHINGTON CITY, *January* 8, 1840.

WAR DEPARTMENT, *January* 8, 1840.

SIR: In my late annual report I informed you that the report of the Chief of the Topographical Engineers, containing a more than usually detailed statement of the history and progress of the works under the superintendence of that officer, would be presented in a few days; together with detailed estimates of the probable cost of each work, and of the sums required from year to year; and that the same course would be pursued with respect to the improvements and civil works under the superintendence of the Chief Engineer, so as to present to Congress, at one view, the whole system of internal improvement. I have now the honor to lay these documents before you for transmission to that body.

Very respectfully, your most obedient servant,

J. R. POINSETT.

To the PRESIDENT *of the United States.*

Blair & Rives, printers.

ENGINEER DEPARTMENT,
Washington, January 7, 1840.

SIR: In compliance with your directions, I transmit an "estimate of the funds required to complete the various civil works under charge of the Engineer Department, together with an estimate of funds required for operations during the year 1840."

From the nature of these operations, the estimates for their completion, although founded, as far as practicable, on preceding expenditures, must be regarded as mere conjectures for most of the works.

In explanation of the estimates for "new works," are transmitted the following papers, viz:

Captain J. K. F. Mansfield's report on the preservation of the site of Fort Johnson, February 1st, 1839.

Supplement to the above, by the same officer, May 28, 1839.

Captain Mansfield's report on the closing of Hog Island channel, July 25, 1838.

Captain A. H. Bowman's report on the preservation of the site of Fort Johnson, October 11, 1839.

The report of Captain Bowman, on the closing of Hog Island channel, is to be found in the printed Senate documents accompanying the message of the President at page 180. The drawings to accompany the above are now being copied, and will be ready for delivery on application of the committees therefor.

I have the honor to be, very respectfully, your obedient servant,

JOS. G. TOTTEN,
Colonel, and Chief Engineer.

Hon. J. R. POINSETT,
Secretary of War.

Estimate of the funds required to complete the various civil works under charge of the Engineer Department, together with an estimate of the funds required for operations during the year 1840.

No.	Designation.	Estimate for completion.	Amount required for 1840.
1	Light-house at Flynn's knoll The amount required above for 1840 was carried by law to the surplus fund December 31st last, in consequence of being unexpended two years after the appropriation was made, and is now required to be re-appropriated.	$200,000 00	$138,909 26
2	Cumberland road in Ohio	638,166 26	100,000 00
3	Cumberland road in Indiana	3,144,250 20	150,000 00
4	Cumberland road in Illinois	1,432,138 49	150,000 00
5	Piers in the harbor of St. Louis, Missouri	108,554 00	108,554 00
6	Improvement of the Hudson river, above and below Albany	589,110 39	100,000 00
7	Improvement of the Ohio river, between Pittsburg and the falls The amount given above for completion will be sufficient for the work at present contemplated. The Ohio river will, however, admit of improvement highly advantageous to its navigation to a much further extent. $3,000,000 will be required to bring it to the highest state of perfection.	312,000 00	100,000 00
8	Improvement of the Ohio river, below the falls at Louisville, to be committed to the charge of a separate superintendent for that part of the river The work intended for this part of the river is of a similar character to the other. It would require $2,000,000 to bring it to its highest state of perfection.	200,000 00	50,000 00
9	Improvement of the Mississippi river, above the mouth of the Missouri These amounts are for the improvement of the Rock river and Des Moines rapids only.	264,280 00	110,000 00
10	Improvement of the Missouri river, viz: For building a snag-boat $30,000 00 Working 25 years, including work on the shores, at $30,000 per year 750,000 00	780,000 00	50,000 00
11	Improvement of the Mississippi river, between the mouth of the Missouri river and New Orleans, for working two boats 20 years, at $50,000 per year	1,000,000 00	50,000 00
12	Improvement of the Arkansas river, viz: for a snag-boat, $30,000; working the same and for work on shore 20 years, at $25,000 per year	530,000 00	60,000 00
13	Improvement of the Red river, for working one boat 20 years, and for work on shore, at $25,000 per year	500,000 00	85,000 00
14	Sea-wall at St. Augustine, Florida	20,000 00	20,000 00
15	Preservation of Deer island, Boston harbor	750 00	750 00
	Total	9,719,249 34	1,273,213 26

ESTIMATE—Continued.

No.	Designation.	Estimate for completion.	Amount required for 1840.
	For new works.		
16	For the preservation of that part of Sullivan's island, abreast Drunken Dick shoal, Charleston harbor, South Carolina	$356,763 00	$30,000 00
17	For closing Hog Island channel, Charleston harbor, South Carolina	133,994 85	30,000 00
18	Preservation of the site of Fort Johnson, Charleston harbor, South Carolina	53,674 00	53,674 00
	Total	544,431 85	113,674 00
	Aggregate	10,263,681 19	1,386,887 26

JOS. G. TOTTEN,
Colonel, and Chief Engineer.

FORT PULASKI, GEORGIA,
February 1, 1839.

SIR: I have the honor to forward to the department, herewith enclosed, my report, made in compliance with the order of the department of the 23d August last, of a plan for the preservation of the site of Fort Johnson, accompanied by a survey, as a preliminary to the same.

I am, sir, very respectfully, your obedient servant,

JOS. K. F. MANSFIELD,
Capt. Corps of Engineers.

Col. JOS. G. TOTTEN, *Chief Engineer.*

FORT PULASKI, GEORGIA,
February 1, 1839.

SIR: Referring to the letter of the department of the 23d of August last, requiring me to "prepare and report a plan and estimate for the preservation of Fort Johnson, South Carolina," and my letter acknowledging the receipt of the same, under date 8th September following, I have now the honor to report, in compliance therewith, as follows:

That having satisfied myself the wasting away of the shore at that site is in consequence of its being the point at which the currents down and up Cooper river receive a material deflection, in addition to its exposure to northeast gales from sea, I have caused a survey and soundings to be made, which is herewith accompanying. It will be seen, on reference to the same, that the waters of Cooper and Ashley rivers, after their junction, impinge against the shore west of Fort Johnson, at an angle of about 45° with the general direction of that shore, and that the greatest encroachment of the waters, judging from the soundings, must be about the positions A and B. It also appears, as I have frequently observed, that the principal encroachment on the shore south of Fort Johnson, is from the sea rolling in with strong northeast gales, and, consequently beating back the sand ridge over the salt marsh immediately to the leeward of it.

To counteract these causes, and with a view to stay their effects, permanently, I have to propose the construction of four jettees, A, B, C, D, from the shore west of Fort Johnson, indicated in length and position by red lines, and the construction of a catchsand and breakwater, extending from Fort Johnson, along the highest water mark southerly, a distance of about one thousand yards, which is also indicated by red lines. The three jettees, A, B and C, for one hundred yards of their length from the highest watermark, to be constructed like an ordinary wharf, twelve feet broad, and of palmetto logs and stone; the remainder of their length to consist of a grillage of palmetto logs, forty feet broad, weighed down by deposites of stone thereon, raised to a ridge six feet high in the middle, throughout the whole length. The jettee D to consist of a grillage of palmetto logs, thirty feet broad, and weighed down by deposites of stone thereon, raised to a ridge six feet high in the middle for the whole length, except at its junction with the highest water-mark. The catchsand and breakwater to consist of spurs from the sand ridge, connected on the top of the ridge, which is a little above ordinary high water of spring tides, and constructed of refuse live oak and palmetto logs, according to circumstances, and weighed down by

deposites of large stone thereon, of not less than one ton each. These spurs and connexion will be constructed of two parallel rows of timber and logs six feet asunder, joined by cross ties of the same material, whereon it will be proper to deposite the stone.

An approximate estimate for completing this preservation according to the foregoing plan, is hereunto appended.

All which is respectfully submitted.

JOS. K. F. MANSFIELD,
Capt. Corps of Engineers.

Col. Jos. G. TOTTEN, *Chief Engineer.*

Estimate of the cost of the preservation of the site of Fort Johnson, as per plan submitted by Capt. Jos. K. F. Mansfield, of the Corps of Engineers.

THREE JETTEES—A, B, AND C.

63,000 running feet palmetto logs laid complete, at 20 cents the running foot - - - - -	$12,600 00
6,000 tons rough stone, placed complete, at five dollars the ton - - - - - - - -	30,000 00

ONE JETTEE—D.

7,200 running feet palmetto logs, laid complete, at 20 cents the running foot - - - - -	1,440 00
700 tons rough stone, placed complete, at five dollars the ton -	3,500 00

CATCHSAND AND BREAKWATER.

10,000 running feet refuse live oak and palmetto logs, at 80 cents the running foot - - - - -	8,000 00
500 tons large size rough stone, placed complete, at six dollars the ton - - - - - -	3,000 00
Unforeseen expenses - - - - -	6,460 00
	$65,000 00

Respectfully submitted.

J. K. F. MANSFIELD,
Capt. Corps of Engineers.

Col. Jos. G. TOTTEN, *Chief Engineer.*

Report supplemental to the report of the 1st February, 1839, relative to the preservation of the site of Fort Johnson, Charleston harbor, South Carolina, made in compliance with the following order of the Engineer Department, under date 25th February, 1839:

"In reference to the plan and estimate for the preservation of Fort Johnson, I have to inform you, that, as expressed in general terms, it meets the approbation of this department; but, in order that it may be fully under-

stood, it is necessary that there should be further information. You will, therefore, as soon as practicable, transmit plans, exhibiting in detail every feature of the design; making, at the same time, estimates equally in detail. The department wishes it to be understood that, in all cases where works are required to be of lasting effect, no means must be employed but such as are of undoubted durability; and this principle you will observe in devising those portions of the present project that are expected to be of permanent utility."

Accordingly, accompanying herewith is a drawing and plan, dated Fort Pulaski, 28th May, 1839, showing the details of the jettees A, B, and C. The jettee D, as indicated under the head of remarks, and a plan of a unit part of the breakwater and catchsand. Also, an estimate in detail of the same date.

All which is respectfully submitted.

JOS. K. F. MANSFIELD,
Captain Corps of Engineers.

Col. Jos. G. TOTTEN, *Chief Engineer.*

Estimate in detail accompanying report supplemental to the report of the 1st February, 1839, relative to the preservation of the site of Fort Johnson, Charleston harbor, South Carolina.

JETTEES A, B, C, AND D.

39,600 running feet palmetto logs, at 10 cents the foot -	$3,960 00
27,500 lbs. iron bolts, at 8 cents the pound - - -	2,200 00
6,700 tons large rough stone, at $3 75 the ton - -	25,125 00
Receiving and depositing 6,700 tons stone, at $1 50 the ton -	10,050 00
Workmanship of carpenters, and laborers, at grillage, &c. -	3,960 00

BREAKWATER AND CATCHSAND.

16,000 running feet live oak logs, at 30 cents the foot -	4,800 00
800 tons large rough stone, not less than one ton each, at $4	3,200 00
Receiving and placing 800 tons stone, at $2 the ton - -	1,600 00
Workmanship of carpenters and laborers at logs - -	4,800 00
Unforeseen expenses - - - - -	5,305 00
	65,000 00

Respectfully submitted.

JOS. K. F. MANSFIELD,
Captain Corps of Engineers.

Col. Jos. G. TOTTEN, *Chief Engineer.*

FORT PULASKI, GA., *July* 25, 1838.

SIR: Referring to the letter of the department of the 16th instant, requiring me to examine and report my opinion "at as early a period as possible" if the stopping of Hog Island channel will prevent entirely or in part the abrading influence on Sullivan's island; also, to report my opinion relative to a jettee to produce the same result without danger to Shull's Folly, I have now the honor to submit the following:

Will the closing of Hog Island channel lessen the quantity of water that passes between Fort Sumter or the light-house and Sullivan's island? If it will not, will the same body of water pass between those points with less injury to Sullivan's island if Hog Island channel were closed? On the answer to these queries depends, of course, the value of closing Hog Island channel entirely, thereby turning the waters of it into the ship channel, or in part accomplishing the same object by a jettee.

In reply to the first position, it is evident that the closing of Hog Island channel cannot ultimately lessen the quantity of water that passes between Fort Sumter or the light-house and Sullivan's island, or, in other words, over the bar; as the effect will be to increase the velocity of the water between Shult's Folly and the city of Charleston, thereby increasing the depth of Cooper river, and encroaching on Shult's Folly till the present egress and ingress of water be restored.

In reply to the second position, it has been shown by my survey and report for the protection of Sullivan's island, dated 7th June, 1837, that the waters that pass down the ship channel would impinge against the shore of Sullivan's island, generally at an angle of forty three degrees with the general direction of that shore; whereas the course of the waters down Hog Island channel is in a parallel direction to the same shore, thereby producing a combined action of the waters that pass between Fort Sumter and Sullivan's island on the said shore, under an angle less than that of the ship channel above. Now, on the supposition as in the premises, would the same body of water, acting in one direction, to wit, that of the present ship channel, under the firstmentioned angle, by the closing of Hog Island channel, produce more or less effect on the said shore than the combined action above stated? The answer is mathematically clear; it would produce more effect, inasmuch as by the resolution of forces, the greater the angle under which the water impinges against the shore, the velocity after deflection being the same, (and it surely in this case could not be argued as materially different,) the greater the force acting perpendicularly against the shore; and, consequently, the stronger the current will press against it, and of course the greater the abrasion. But admitting, from various causes, there be no difference as to the abrasion of the shore by closing Hog Island channel, it still appears that no relief will result therefrom.

My opinion, therefore, on this subject is clearly against stopping Hog Island channel entirely or in part by jettees as the means of protecting Sullivan's island, as I can see no reason in favor of its accomplishing that object.

It may be necessary at some future day to obstruct Hog Island channel, with a view to deepen the water at the wharfs of the south end of the city, but, long before that will be necessary, it is hoped that the position of Fort Johnson, which deflects the currents, will be thoroughly protected, or but a very little of that point, which is now wasting away, will be left to the great disadvantage of the harbor and to the loss of an excellent site for an hospital.

I have made no sounding, &c., with a view to compare Hog Island channel with the ship channel, as the relative value of them as to quantity of water, &c., is not essential to the making up of the opinion here expressed.

I am, sir, very respectfully, your most obedient servant,

JOS. K. F. MANSFIELD,
Capt. Corps of Engineers.

Gen. CHAS. GRATIOT, *Chief Engineer.*

ENGINEER OFFICE, SULLIVAN'S ISLAND,
October 11, 1839.

SIR: In obedience to your orders, I have visited the site of Fort Johnson, and have carefully examined the effects there produced by the waves and currents.

Referring to the reports and drawings of Captain Mansfield, forwarded from the department, I find no material change since they were made, except in the point at which the united currents of Cooper and Ashley rivers impinge against the shore of the island. The point of impact appears at present farther east than that indicated in Captain Mansfield's drawing, and not far from the base of grillage B. If it should be found, after a series of observations and experiments, that this point is changed since his survey, grillage A will not be necessary. I fully concur in the views and plans of Captain Mansfield, and deem the preservation of the site of Fort Johnson so important, not only as a military position of strength, but as one of the principal protections of the harbor against the sea, that I would respectfully recommend early measures for carrying the proposed improvements into execution.

The estimate will be subject to a corresponding reduction, should it be found advisable to dispense with one of the proposed grillages. Supposing my observations in this point to be correct, I subjoin an estimate. All of which is respectfully submitted.

I am, sir, very respectfully, your obedient servant,

A. H. BOWMAN.
Captain of Engineers.

Estimate.

Palmetto logs, 27,600 running feet, at 10 cts.	$2,760 00
Bolts, 18,500 lbs., at 6 cts.	1,110 00
Stone, 4,700 tons, at $3 75	17,625 00
Receiving and placing 4,700 tons of stone, 9,400 days, at $1	9,400 00
Carpentry of grillage, 3,560 days, at $1 25	4,450 00
800 tons of stone, 1 ton each at $4	3,200 00
Receiving and placing 800 tons of stone	1,600 00
Live oak, 16,000 feet, at 40 cts.	6,400 00
Carpentry, in construction of catchsand, 1,800 days, at $1 25	2,250 00
Contingencies	4,879 00
	53,674 00

A. H. BOWMAN,
Captain of Engineers.

Col. J. G. TOTTEN, *Chief Engineer.*

ANNUAL REPORT.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
December 30, 1839.

SIR: In submitting the customary annual report, as an important accession of duties has been made by your orders to those formerly exercised by the corps, at the head of which I have the honor to be, it has occurred to me that some slight notice of past events might not be uninteresting or out of place.

The origin of the topographical engineers was in 1813, when such officers were first authorized by law, and were then by law attached to the army as part of the general staff. In the law of March, 1821, they may be considered as being for the first time formed into a corps, although it was doubtful in the minds of many whether this law changed their original condition of an integral part of the general staff; but the Executive acted upon the supposition that the law did make this change, and, in accordance with that impression, separated the topographical engineers from their former duties in the staff of general officers, placing the one highest in rank in the corps at the head of a bureau, and recognising rights of regular promotion on the occurrence of vacancies. Under this organization the corps consisted of ten officers, and the highest rank which it possessed was that of major, and its bureau, although separate, was considered subordinate to that corps of engineers in especial charge of the fortifications and defences of the country. The chief of this corps had the rank of colonel, and the corps of topographical engineers was considered a part of his command.

It continued in this position until 1831, when, by a regulation of that date, it was declared that "the topographical bureau will hereafter constitute a distinct bureau of the War Department, and the officer in charge thereof will communicate directly with the Secretary of War, from whom he will receive all his orders, and to whom he will make all his reports."

At the time of this regulation the highest rank in the corps of topographical engineers was that of lieutenant colonel by brevet, and its duties had so much increased that a body of civil engineers, authorized by the law of April 30, 1824, was attached to it. It had also under its control about thirty officers of the line, (artillery and infantry,) detached temporarily from the line for topographical duties.

This regulation made no specification of the duties of the corps; but I was assured by Mr. Secretary Eaton, who left the department but a few days before the date of the regulation, and by Mr. Acting Secretary Randolph, by whom, under the supervision of the Executive, the regulation was issued, that it was in contemplation at the time also to specify the duties of the corps, assigning to it the entire charge of all civil works, of harbor and river improvements, and of roads, in addition to the other duties upon which it had already been engaged; and that the silence of the regulation in this respect was in delicacy to his position as Acting Secretary, and to him who might be appointed to fill the place.

The successor to General Eaton was Governor Cass. He universally expressed himself in favor of the specification of duties as contemplated by his predecessor; but considered the imperfect organization of the corps, and the smallness of its numbers, as obstacles which had first to be removed.

My own views on this question were always decided, and were considered by me as involving not merely the prosperity of the two corps, but that of the public service. It was therefore frequently brought by me to the consideration of the department. It will be found referred to in the annual report from this bureau of November, 1835, in the following words:

"There is no corps in the country to which the duties of a corps of ponts et chaussées so properly belong, as to the corps of topographical engineers. It is so intimated in the report of the military committee (of Congress) of the last year, and it seems to me an unequivocal dictate of common sense to say, that the corps which is employed in making the survey, digesting the plan, and forming the estimate of a work, is, from the nature of the case, more fully imbued than any other can be, with the considerations and unity of view which the constructions involve, and therefore better qualified to superintend them." To which one may add, that it is also the corps whose personal and scientific reputation is involved in the success of the works, and has therefore every incentive to the most vigilant and skilful superintendence.

It was always a source of no small degree of gratification with me that my notions of a proper division of the duties of the two corps, were in harmony with those of several of the distinguished officers of the corps of engineers, one of whom is now at its head. They always viewed the superintendence of these civil works as an embarrassment to the proper functions of their own corps, and foreign to them; and, with a just and enlightened consistency, always befriended those propositions before Congress, the tendency of which was to remove the obstacles before referred to, in the way of a proper arrangement of duties.

Such was the condition of things when you were called upon to preside over the War Department, with the exception, that from the necessities of the case, and in despite of all obstacles, the construction of many works of a civil character, authorized by the United States laws, were under the direction of this bureau. The confusion from this want of system was soon apparent to your judgment. A remedy was absolutely necessary, the well-being and the duties of your department called for it. Your opinion of a proper division of the duties of the two corps was soon formed, and as soon verbally communicated to the chiefs of each, and would have been immediately carried into effect, but for the embarrassing obstacles arising from the imperfect organization and the small number of the topographical engineers. Your efforts were immediately given to relieve the matter from these obstacles, and were crowned with success by the law of July, 1838.

This law may be considered, therefore, as a new creation of the corps, giving to it the requisite rank and form, and numbers. The obstacles to a proper arrangement of duties being now removed, that arrangement soon followed. In less than a month after the passage of this law, a regulation was issued by the War Department, of which the following is an extract:

"All new works of improvement, not of a military character, nor connected with the fortifications, are assigned to the direction of the Topographical Bureau; and also, all such old works of a similar character as can be

transferred without prejudice to the public service, and according to an understanding to be had with the Chief Engineer and the officer in charge of the Topographical Bureau."

This regulation at once drew the line of distinction between the duties of the two corps, leaving to the one its proper and important functions, the defences of the country, and adding to the former duties of the other the superintendence of all United States improvements of a civil character.

In conformity with the spirit and intention of this regulation, all the plans and drawings connected with the fortifications of the country, and heretofore in the charge of this bureau, have been surrendered on his application to the chief of the corps of engineers, who, since the regulation above quoted, has issued the necessary orders in the cases of the transfer of sixty-six distinct works of civil improvement—breakwaters, harbors, rivers, roads. A few yet remain to be transferred. Considerations connected with the public service occasioned a delay in these cases, which, it is presumed, need not last much longer, and that the system contemplated and authorized by the regulation, will be in full operation by the ensuing season.

This sudden accession of so many new works, gave an intense activity to the duties of the corps. It has attended to all, has executed various surveys, and has, at the same time, maintained a large detachment of its officers as field and topographical engineers with the army in Florida.

A system of rigid inspection has been established in the persons of the older officers of the corps, the result of which is highly gratifying in the information obtained, and the means thus procured of enabling the bureau to direct intelligibly the operations of its subordinates, and to produce the best results with the means at its disposal. The information received will now be submitted, condensed from various reports and from personal inspection.

The War Department is aware that the greater part of the harbor improvements are upon our western waters. The lakes alone embrace a coast within our own territory of more than three thousand two hundred miles, excluding the coast of connecting straits and rivers, and are exposed to a coast in the possession of a foreign power of about two thousand miles. Among the physical features which characterize these lakes, are their great extent, their uninterrupted connexion with each other, except at Niagara, their great depth, the extreme fertility of their shores, and their singular destitution of natural harbors.

Taking Lake Champlain into the number, parts of the shores of no less than seven populous flourishing and powerful States, and one extensive Territory, are washed by their waters; and already the route across them is found to be the most convenient, the most economical, the most expeditious, and the most certain, between the cities on the Atlantic and the Upper Mississippi. In fact, it may be said that the vast trade of the great valley between the Alleganies and the Rocky mountains, and its intercourse with the cities of the Atlantic, are more or less facilitated and protected by the path which these lakes afford, and by the harbors which are found upon them.

Possessing such advantages, and with a people so enterprising, the commerce of the lakes has increased beyond all anticipation, and has really left it doubtful if any notions of prosperity may, in this country, be called visionary. The harbors of the lakes are seaports, crowded with vessels of all sizes and of all kinds, and their beautiful waters are whitened with many a sail, and teeming with prolific steam. One universal aspect of enterprise,

of wealth, and of activity, presents itself; and one single reflection possesses the mind, that to the prosperity of such a people there can be no stay.

The chief embarrassment to this extensive and increasing prosperity, is in the deficiency of harbors and of ports of refuge. Much has already been done by Government to remedy this defect, but more still remains to be done, as well in commencing new works, as in completing those which have been begun. The questions involved are, in my judgment, no longer those of choice, but those of necessity. They are, whether the vast amount of property, and the number of lives connected with the commerce of these lakes, are to be abandoned to the mercy of every storm; and whether the large sums already expended in efforts to form harbors and ports of refuge, are to be completely lost for want of the additional means required to finish and to preserve them.

The simple relation of this commerce with these harbors, is but a small portion of its advantages. It should be viewed in connexion with the manufactures, to which it gives birth, and which it facilitates; the agriculture which it generates and supports; the increased value which it gives to both public and private lands, and the consequent rapid and extensive sale of the former; and with the population which it is continually collecting and concentrating on a long and exposed line of frontier. With a commerce producing all these happy effects, and so intimately allied to the agricultural and mineral wealth of the great west, and which will, probably in a few years, rival that of the Atlantic coast, the shores of these lakes, unlike those of the Atlantic, are destitute of harbors. Nature has denied to the one, that which it has so bountifully supplied to the other. The remedy must be furnished by art, or this prolific source of national and individual wealth be for ever crippled and embarrassed by its risks and losses. And when, in addition to these reflections, we take into consideration the fact that the lake shores are also frontier shores, the remedy which art is called upon to supply becomes then of vital interest, as an important part of national defence from its effects in concentrating population. But I will endeavor to illustrate these remarks by more detailed references.

The whole eastern and southern shore of Lake Ontario, from Cape Vincent to Niagara, embracing within these limits about two hundred and thirty miles, has but one natural harbor, that of Sackett's Harbor, towards its eastern extremity. There is the harbor of Niagara at the western end, but this is so directly within the command of the opposite shore, which is held by a foreign government, that it cannot be considered as a secure American harbor, nor does it afford any shelter for the winter. In times of peace, however, it is a good summer harbor, and therefore, in times of peace, the commerce of this lake may be considered as having two harbors or ports of refuge, one at each extremity of the lake, and about two hundred miles from each other.

These are all that nature has supplied of adequate size in this extent of coast. Now, as this as well as all the other lakes is liable to frequent and very violent storms, it is easy to deduce how dreadful and how frequent must be their results in an active commerce, if art does not interpose a remedy. But although nature has made no good harbors between these points, she has yet furnished the means of which art can avail itself, and which are now the basis of several artifical harbors, partially completed, namely, at Salmon river, Oswego, Sodus bay, Genesee, and Oak-Orchard creek. At all these improvements have been made, which will be more particularly noticed

presently. The entire American shore of this lake is within the limits of the State of New York.

The next lake, proceeding westwardly, is Erie. The American shore of this lake is about three hundred and thirty miles long, embracing parts of the States of New York, Pennsylvania, Ohio, and Michigan. It may be considered without any harbors of even moderate facilities of entrance, and of protection from storms, as nature has made them, except at Erie, the protection from the islands on the western extremity of the lake, and the straits at Detroit; the latter, however, under the command of the opposite and a foreign shore. Upon this lake improvements are making at the following places: Buffalo, Cattaraugus, Dunkirk, Portland, Erie, Conneaut, Ashtabula, Grand river, Cleveland, Black river, Cunningham's creek, Vermillion, Huron, La Plaisance bay, and River Raisin. Of this lake it may be said, as of Lake Ontario, and, in fact, of all of them, that they are subject to violent storms and to consequent shipwrecks, if harbors are not at hand; for, although inland seas, there is yet not searoom for a twenty-four hours' storm. In that time, generally speaking, if the storm does not abate nor the vessel find a point of shelter, she must go ashore; and, indeed, it must be a singular and most favorable position, that will enable her to endure it so long.

On Lake St. Clair there is about forty miles of American coast. No harbor improvements are making there. The lake being small, it may be considered as not so much in need of them.

The American coast of Lake Huron is nearly 400 miles. There are several bays on this coast forming good harbors, and also river outlets, highly capable of improvement, but no works are being constructed there.

Lake Michigan.—The whole of this lake is within the limits of the United States. It is subject to violent storms and an extremely heavy surf, as its position gives it the full benefit of the prevailing northwestwardly winds. Its entire length of coast is about 980 miles. On the eastern coast, and towards its upper end, there are some good natural harbors, but, upon the western coast, and south of Green Bay, in a space of about 300 miles, it cannot be said that there is one, and yet there are many points capable of being rendered such. The only works now in construction upon this lake, by the Government, are two on the eastern coast, St. Joseph and Michigan city, and one on the western, Chicago.

The American coast of Lake Superior is about 940 miles. There are several fine natural harbors on this lake, but as yet its trade and intercourse have not called for artificial constructions, nor have its shores been sufficiently explored to justify opinions in relation to their necessity and number.

Lake Champlain may be considered as being entirely within the limits of the United States, having about 220 miles of American coast, and but about 10 of foreign. Upon this lake four works of improvement are now in progress—the deepening of the harbor of Whitehall, the deepening of the passage between the two Hero islands, the breakwater at Plattsburg, and the breakwater at Burlington.

The harbor improvements on the Atlantic are so directly connected with a well-known and extensive commerce, that their necessity comes too immediately within the range of existing and well-established facts, to need any effort to demonstrate their advantages.

After this brief general exposition, I will now refer to each improvement in detail, as well as to several road and river improvements, and to various surveys.

SU VEYS.

1. Six of the officers of the corps have been employed in Florida, the greater part of them under the commanding general there, in reconnoitering and making surveys of parts of that Territory, the result of which will be found in the improved map of that Territory, transmitted by General Taylor, and now being published.

2. *Military and geographical survey of the country west of the Mississippi and north of the Missouri, being the continuation of the operations of the previous season.*—By these previous operations, above 140 positions have been astronomically determined, and a vast fund of topographical knowledge has also been collected; which, with the additional information now being obtained, but of which the result has not yet been received,* will furnish the department with the means of constructing an extremely accurate map of that region. The expenses of this survey have been defrayed from the appropriation for surveys of previous years, but for the operations of the present season there was no appropriation; and there will consequently be an accumulation of debt to the amount of the expenses of the present season. As this will have the appearance of authorizing an expedition without the sanction of law, I beg leave to submit the following explanations: To have the party in the field in time to avail itself of the season, and to produce results which, in value and number, would be equivalent to the expenditure it would occasion, it was necessary to make early arrangements. But it being customary not to make appropriations until the latter part of a session, and as the steamboat for the Upper Missouri was to leave St. Louis in the forepart of March, and the expedition had to avail itself of this boat, it became necessary either to abandon the expedition, or to anticipate the appropriation. Reference was made, under these circumstances, to the committees having these appropriations under their care, and assurances being received that they would certainly be made, the expedition was authorized, and directions given to procure the requisite outfit. But after the adjournment of Congress, and on examining the various laws, it was found that the appropriation for surveys had escaped attention, and, in consequence, a debt amounting to the expenses of the expedition has been created. It is hoped that not only this debt, but that additional means for further similar surveys will be provided. Our operations have been heretofore limited to the region north of the Missouri and west of the Mississippi, but not extending westwardly to the Rocky mountains. It is extremely desirable that means to fill up the hiatus south of the Missouri, and to extend the observations to the Rocky mountains should now be granted. It would really be questioning the known intelligence of the country, were one to reason upon the advantages of correct geographical knowledge, or of the national benefit in obtaining, now in time of peace, a knowledge of so vast a region, bordering upon so extensive a line of our settlements, inhabited by a numerous, warlike, and well-armed race, bound to us by no ties of common feeling or interest, and

*Since this report was written, information has been received from the party on this duty, giving the most flattering accounts of the success of the operations of the last season.

with whom peace can be counted upon no longer than their fears or their whim may induce them to keep it.

3. *The survey of Yellow river, Florida.*—This survey was authorized by a law of the last session of Congress, and an amount of $500 was appropriated to meet the expenses. It is generally called Yellow-Water river, has its origin in Covington county, Alabama, and empties into a small bay at the head of Pensacola bay. Its navigation is completely obstructed by an extensive deposite of timber, usually denominated a raft; and the object of the survey was to determine the extent of the raft, and the probable expense of removing it. The amount appropriated for the survey was only $500, which was entirely inadequate to the expenses of a complete and thorough investigation, and to the consequent adoption of any specific plan or estimate of the probable cost of removing the obstruction. The best examination, however, under the circumstances was made, the results of which are, that the impediments extend throughout a distance of several miles, and that if removed, a depth of not less than three feet of water could be maintained to the Alabama line. To complete the investigation as it should be made, and to attack the impediment efficiently, would require about $20,000, which amount would probably, in the judgment of the officer who made the survey, be sufficient to remove the rafts entirely.

4. *The survey of the mouth of the Suwance, with a view to its improvement.*—Both the survey and operations for the improvement are authorized by law, and an appropriation of $15,000 was made for the expenses. This amount might possibly pay all expenses of the survey, and procure a dredge-boat, which would have to be used in the operations; but it would not furnish means for keeping the dredge-boat in activity, in which are included not merely the hands and fuel necessary for the boat, but attending scows. The dredge-boat itself would probably absorb the whole of the appropriation, if one of sufficient power could even be obtained for that amount. The attention of the bureau was therefore directed to the survey alone. This river has its origin in Dooley county, Georgia, and after passing through Irvin county, of the same State, it continues its course through Florida, receiving a fine tributary, the Santa Fe, to the gulf of Mexico, into which it empties a short distance above the Cedar keys. It early attracted the attention of the United States engineers, and the board of which General Bernard was the head, spoke in flattering terms of its adaptation, throughout a great extent, to steamboat navigation. Its most serious impediment is in the small bay into which it first enters, and the primary objects of the surveys were to determine the true extent and character of the impediments, and then to adopt some plan for their removal. These preliminary surveys are of the greatest importance; without them we know not what points to attack, nor what plan to adopt, and may waste both time and money in abortive attempts. Hence the necessity that they should precede all expenditures directly connected with the removal of the impediments, or with the accomplishment of the improvement. From these considerations, therefore, as before remarked, the first attention of the bureau was directed to the preliminary surveys. A party was organized, and the necessary orders given; but the troubled state of the country, from Indian hostilities, rendered it impossible to execute the duty. The necessary protecting force could not be obtained. The lives of the officers and men on the survey might have been sacrificed, but the duty would not have been performed. Under such circumstances, it appeared to me worse than use-

less to persevere in a work, the only probable result of which was a wanton waste of life. The survey has, therefore, been postponed until the condition of that country will render its successful execution a reasonable probability.

5. *The "surveying and marking the boundaries between the Indian tribes west of the Mississippi."*—These boundaries had been already surveyed under the Bureau of Indian Affairs, and the corner posts, metes, and bounds of the surveys were made known to the Indian tribes to whom the tracts were severally assigned, and whose ideas of the extent of their different assigned tracts had, therefore, become fixed in their own minds. From the known looseness with which these surveys are generally made, some apprehensions were entertained that more exact measurements would expose errors, unsettle present and acknowledged boundaries, and create dissatisfaction among the various tribes. But, as the "surveying and marking" were both directed by the law, the attention of the officer assigned to the duty was directed to both. His first effort was to affix the northeast corner of the Shawnee lands, where he placed a mound of rocks, and an iron-shod post bearing the inscription: N. E. Cor. S. L. This position, Captain Hood remarks, "is not exactly that which I would have given to it, had these lines been run originally by myself; but I was forced to it by the situation in which I found the northern boundary-line of the Shawnees as marked by Langham. This was the position which he assigned for the northeastern angle, and, as I found his northern boundary line running directly westward from this point, I had, of course, either to assume the position as correct or change the northern boundary.

"After fixing this point, the line was prolonged. It was deemed proper to reblaze the timber in the woods, and rebuild the mounds on the prairies of the Missouri State line as fixed in 1823. The mounds erected by Langham were merely noted as to their positions and distances on the line, but were not, except in two instances, re-erected. After running the first two miles of the eastern line of the Shawnees, I found a difference in the measurement of 1823 and my own of about 72 feet; not being satisfied, the line was remeasured, but, finding no difference of moment existing between the second and first measurements, concluded the error was not in our line. From this point to the termination of the survey of the Shawnees, differences were continually occurring, when, having arrived at the southeastern corner, I found the large mound erected by Langham as the terminating point just 1,204 feet in advance of ours. Reasons of a similar nature to those which governed in the locating of the northeastern angle induced me to adopt this mound, as the southeastern corner of the Shawnees, and the northeastern of the Piankeshaws and Weas.

"Assuming the point usually known as the twenty-eighth mile of the western boundary of Missouri, as the zero point of the Piankeshaws and Weas, the line was continued southward for fifteen miles, (with a continuation of the differences of measurement,) as far as the termination of this boundary, upon our arrival at which, I found our position of the southeast corner was just 572.88 feet north of that assigned by the former survey. These differences in measurement appear strange; but I know that our chain was daily remeasured and rectified, and in use always levelled in passing hills, crossing ravines, &c. From the deductions made during the survey of these two lines, I am placed in a position in which I know not how to act. My desire was to establish a base for future operations, in running out the northern and southern boundaries of the Indian tribes.

"If the point of termination of the eastern Shawnee line be taken 1,204 feet north of the old terminus, (which is the correct one, as I feel well assured,) and the southern boundary be run west from said point, then it will strike off, from that which the Shawnees were given to understand by the agents of Government, and which they recognise, as their own property, about 17,000 acres of land. Again, I would, without hesitation, make this the starting point of the line west, if, in doing so, it affected this tribe alone. This is not the case, however, for it acts immediately upon the Piankeshaws and Weas, the Peorias and Kaskaskias, the Pottawatomies, and the two tribes of Ottowas, all of which tribes have their boundaries dependant upon the southern line of the Shawnees.

"Here, then, appears to me to be a difficulty of a serious nature, and one which can only be gotten over by letting the matter alone. In the one case, as I verily believe, the United States would be a loser of about 17,000 acres, (to them of minor importance); on the other hand, the several tribes would scarcely understand the propriety, to say the least of it, of disarranging arrangements adopted in full faith of the correctness of the surveys made by order of Government. Again, the difference between our survey and that originally made for the Piankeshaws and Weas, if arranged according to the corner indicated by our measurement would take from this band alone about 1,068 acres, which, together with their removal further north, in the event of a change being made in the southern line of the Shawnees, would alter their country as regards the timbered portion of it, which to them is of great value, and would cause without doubt great dissatisfaction.

"These surveys are the most ancient of any having claim to the denomination of Indian surveys, west of the Mississippi. They were made about the year 1828, and their corner marks were distinctly visible. Those of a later date have their marks without doubt equally distinct. I know not how the matter stands to the southward; but I cannot help entertaining the opinion, that some differences will be found, if the same examination be made in that quarter, as I am induced to believe that the same system of measurement was adopted there.

"The result of our surveys carried out would, in my opinion, cause a clashing among all the tribes bordering upon the frontiers of Arkansas and Missouri; would create the greatest mass of confusion and discontent—therefore the uncertainty which rests upon my mind as to how I should proceed.

"As it is, the surveys which have already been made being taken as correct, we have on hand sufficient data to enable the Government to give 'land patents' to all or nearly all of the following tribes, with which they would doubtless be satisfied: The Iowas, Sauks, Kickapoos, Shawnees, Piankeshaws and Weas, Peorias and Kaskaskias, the distinct tribes of the Ottowas, the Pottawatomies, Osages, Quapaws, Creeks, Choctaws, and Kansas."

From these remarks of Captain Hood, it is very evident that corrections of the old surveys cannot be made short of an entire resurvey of the boundaries of all the several tribes, and that far more would be lost by the disaffection which would be created in the minds of the Indians, than would be gained to the United States by the correction of the errors in the boundaries. These errors are principally the result of different methods of using the chain. With the United States engineers, the chain is first

made with great care, of a strong and stiff wire, and graduated by a standard measure. In its use, great care is taken to keep in its proper direction, and to account for vertical deviations from the plane of the horizon. It is also frequently verified in its length, that account may be taken of its wearing, and of the opening of joints, or the bending of a link. Surveyors generally use the common Gunter chain, bought in any shop, without trial of its correct length, and without much care in its use in reference to direction, or irregularities of the surface over which they measure, and without notice of its wearing, the bending of a link, or the opening of its joints. It is not possible for surveyors to agree with such differences of instruments and manner of using them; and when lengths measured by each method embrace a number of miles, the resulting differences cannot fail to be great.

The chief object of the operations under Captain Hood being, however, to my understanding of the case, to determine such metes and bounds as will enable the Executive to issue land patents to the several tribes, as directed by treaty stipulations, it appears to me that, under all circumstances, it would be advisable to limit the investigations of Captain Hood to this single point, and to the erection of durable corner marks.

The Indians may probably gain a few thousand acres of land by such a course, but the United States would gain a much greater return, in the satisfaction and confiding impression with the Indians, that boundaries regularly surveyed by the United States agents, and assigned to them in due form, were not to be disturbed.

6. *The survey of the Des Moines and Iowa rivers, with views to the improvement of their navigation.*—The appropriation in this case was considered entirely inadequate to the object. These improvements occasion serious expenditures, and if undertaken without a careful investigation of all involved elements, are too apt to result to the injury (unjustly) of the character of the engineer, and in much useless expenditure of money. The appropriation in the present case would have done but little more than obtain the proper outfit for the party, leaving it without means to prosecute the work. It was considered better, under such circumstances, to await an additional appropriation, which is now asked for.

7. *The survey of Red Cedar river, Territory of Iowa.*—A party was early organized and placed on this duty, but the report of its operations has not yet been received. The object of the survey is to determine upon a plan for the improvement of the river above the town of Moscow, and to form a connexion, by a canal, with the Mississippi, near Bloomington. It is doubtful if the appropriation in this case will prove adequate to a sufficient examination of both objects, but the officer in charge will, without doubt, do the best that can be done under the circumstances.

8. *The survey of Oswego harbor and its vicinity, on Lake Ontario.*—The object in this case referred to the defences at that place, for which an appropriation had been made. The survey has been completed, and the returns delivered to the bureau in special charge of the defences and fortifications of the country.

9. *The survey of Sackett's harbor and its vicinity.*—This highly important position, on Lake Ontario, has hitherto remained unsurveyed. It attracted your early attention, and the barrenness of the records of the bureau in reference to it, together with its great importance as a naval as well as a military position, induced the order for the survey. The party which

had been employed at Oswego, was accordingly sent there. The returns have not yet been received, and, from the lateness of the period when the duty was commenced, it is probable it may not be completed this season.

10. *Survey of a route for a railroad from Milwaukie, on Lake Michigan, to the Mississippi, by act of Congress.*—Captain Cram reports, that "this survey was carried on last fall, from Milwaukie westward, for a distance of about ten miles, by the officer to whom it had been intrusted. The report of that officer in May last was such as to induce the belief of its being inexpedient to reorganize the party with the remaining funds, (amounting only to about four hundred dollars,) and send it into the field for a few days at most, when other duties, of paramount importance, were pressing; accordingly, no further work upon the railroad survey was commenced. Since receiving the order from the Topographical Bureau, directing an attention to the subject of this survey, an examination of the profile and plat of the survey of the ten miles above alluded to has been made. This examination has resulted in showing the difference of level of the surface of the lake near Milwaukie and the summit between the lake and Rock river, to be about 300 feet. This difference of level would give an average grade sufficiently low for a railroad; but, unfortunately, the route is such that the average grade could not be maintained with that approximate degree of uniformity which would be necessary, without too great an expense of cutting and filling, and without curves of too great a degree of curvature. For example: within the first six miles a cutting of about two miles in extent, with an average depth of forty feet, would be necessary in order to bring the grade down to thirty feet per mile, and the track, besides, would have several curves of from 300 to 400 feet radii. These circumstances are sufficiently unfavorable to cause a rejection of this line. It is presumed, however, that a more favorable line for an equivalent short distance may be found either a few miles north or south of the one surveyed. But before commencing the survey with instruments, the necessary preliminary reconnoissances for a railroad from Lake Michigan to the Mississippi would occupy one season, at least of the time of an experienced engineer in careful examinations in the field; and should the result of the reconnoissances justify the commencement of the surveys, it would be necessary to run several experimental lines, to enable the engineer to decide upon the most eligible points for crossing the summits. Thus another season for field operations would be consumed.

"By glancing at the map, it will be perceived that the directions of the Pashtic, the Rock, the Sugar, the Peckatonokee, the Fever, and Platt rivers, have a southerly course. One who has made the surface of the ground his study, between Lake Michigan and the Mississippi, must be convinced that the undulating and rolling character of the country, and the elevated summits which are encountered in passing from one of these streams to the next, hold out no favorable prospect for the construction of a railroad with easy grades. Such roads may, however, be constructed along some of the valleys of these streams, but not transversely thereto, for such an extent as the whole distance between Lake Michigan and the Mississippi river. The additional appropriation necessary to a complete survey of the route for the railroad in question, would be $11,250."

From these remarks, the propriety of a further prosecution of this survey is rather doubtful; but as the same has been directed by a law of Congress, I feel bound to submit the estimate necessary to accomplish the object.

11. *Road from Detroit to Fort Gratiot.*—This road passes through Wayne, Macomb, and St. Clair counties, terminating near the northern end of the strait between Lake St. Clair and Lake Huron. It passes principally through a flat and heavily timbered country, is much out of repair, and in some places nearly impassable. Its chief importance is as a military road to maintain a communication between the town of Detroit and the fort during periods when the navigation is suspended by ice. About half a mile, at its northern end, passing round the enclosure at Fort Gratiot, has never been completed. For this short distance an appropriation of $500 will be sufficient. For its repairs about $5,000 more will be required. The road is not considered as affording any great commercial or agricultural facilities to the State, but is principally of value as a military road, which character it will possess so long as it may be considered necessary to maintain the post of Fort Gratiot.

12. *The road from Detroit to Saginaw.*—This road passes through Wayne, Oakland, Genesee, and Saginaw counties, terminating on Saginaw river, about twenty miles, by the windings of the river, above Saginaw bay. The object of the road was to furnish a communication between Detroit and Saginaw, which could be depended upon at all seasons for military and other purposes. The deep indentation of Saginaw bay into the eastern coast of the State offers a route by which an enemy could easily transport a large force into the interior of the State, and the principal mass of population being concentrated at Detroit, a road establishing a communication between that city and the bay acquires, from these circumstances, an important military character, sufficient to justify its completion. Moreover, all the land immediately adjacent to the route has been purchased from the United States on the expectation and faith that the road, as designated before these purchases were made, would be completed, and for which purchasers are now anxiously waiting. The opening of the road is also considered by the inspecting officer "as well calculated to have a great influence upon the value of unsold Government lands in the section above its terminating point."

The road has been completed to a point five miles north of the Flint river, and sixty-five from Detroit, and was found in this distance to be generally in good order. A distance of thirty-one miles yet remains to be completed. About eight miles of this distance have been opened, leaving twenty-three untouched, except at Cass river, where a bridge was erected; which, however, was afterward overthrown by a freshet. For the opening and clearing of these twenty-three miles, and for the reconstruction of the bridge over Cass river, the sum of $16,250 will be required.

13. *Road from Detroit to the mouth of Grand river.*—The entire length of the surveyed route, is 177 miles, crossing the State, and passing through the counties of Wayne, Oatland, Livingston, Ingham, Clinton, Ionia, Kent, and Ottowa, in which last it terminates, at the mouth of Grand river. This road has been completed for about ten miles from Detroit; partially opened to about the 34th mile, and bridges have been constructed on the principal streams to about the 52d mile, beyond which the road has received no labor.

The object of the road appears to have been to open a communication with one of the best agricultural districts of the State—to afford a direct route for the transportation of the mail—to induce the sale of the public lands,

and to facilitate emigration to the Grand river country. The road was commenced when the lands through which it is located belonged to the Government, and purchases of these, were made under the expectation that the road would be completed by the same authority under which it was commenced. There is also, yet unsold, a large tract of Government land north of Grand river, which would receive value, and be brought in demand, if the road were completed. Slight variations from the original survey, would, as reported by the inspecting officer, tend much to economy in the construction of the road, and will be carefully attended to, should the further construction be authorized.

For clearing, ditching, grubbing, causeways, for 167 miles, -	$58,450 00
For bridges - - - -	38,135 00
Total - - - -	$96,585 00

14. *Road between Sheldons and the mouth of St. Joseph, Michigan.*—The road is properly a road from Detroit to the mouth of the St. Joseph, but as it occupies 22 miles of the road from Detroit to Chicago, before it turns off, it takes its name from the point of its separation at Sheldons in Wayne county. From this point, it passes through Washtenaw, Jackson, Calhoun, Kalamazoo, Van Buren, and Berrien counties, in which last it terminates, at the mouth of the St. Joseph.

The object of this road, is to afford a central communication across the State, and to open to the settler a very rich agricultural district. Its advantages are chiefly of an agricultural and commercial character, and it has, even in its present unfinished condition, greatly facilitated the selling of the public lands, and the settling of the country, and it is, perhaps, the best route for the transportation of the mail to the west.

The whole distance from Sheldons, to the mouth of the St. Joseph, is about 167 miles.

At St. Joseph, a harbor improvement is being made by the United States.

I should suppose that about 20,000 dollars would be sufficient to place the road in such a condition as would fulfil any obligations in which the Government may be considered as involved.

15. *Road from Clinton to the rapids of Grand river, Michigan.*—This is a cross road. Clinton is on the great Chicago road, in Lenawee county. The road from thence, passes through the southwest corner of Washtenaw county; thence, crossing Jackson, Easton, and Ionia counties, terminates on the rapids of Grand river, in Kent county.

The object of this road appears to have been to open a valuable agricultural district, to facilitate the sale of Government lands, and to facilitate the transportation of the mail.

The entire length of this route is 117 miles. From Clinton to Jackson, a distance of 29 miles, the road has been finished, and is in excellent condition, but from Jackson, scarcely any labor appears to have been bestowed upon it.

For clearing, grubbing, ditching, and making causeways, where necessary in the 87 miles from Jackson, $26,100 will be required; and for bridges, an additional sum of $4,000, making in all, $30,100.

16. *Road from Niles to the mouth of the St. Joseph.*—This road is about 25 miles long, and rather local in its character. The claim upon

Government for its completion, rests chiefly upon the consideration that lands were purchased from the Government with this expectation.

For properly opening those parts of the road that have not yet been opened, about $5,000 will be required, and for a bridge across the St. Joseph at Berrien, about $4,800 more, in all, $9,800.

17. *The road from Detroit to Chicago, in Illinois.*—This road is a great thoroughfare. The object is to establish a communication at all seasons of the year, between Detroit and the States south and west of lake Michigan, by which emigration into those regions would be facilitated. "Its advantages," says the superintending engineer, "have been, and are immense, and it has contributed more to the sale of public lands, and the settlement of the country, than any other road in the State."

Leaving Detroit, it passes through the counties of Wayne, Washtenaw, Lenawee, Hilsdale, Branch, St. Joseph, Cass, and Berrien, where it crosses the Michigan State line, and entering the State of Indiana, continues along the southern margin of Lake Michigan until it enters the State of Illinois, when turning toward the north, it terminates at Chicago.

The length of this road within the State of Michigan, is about 185 miles; 161 of which, (from Detroit,) have been completed, except the ditching of about 20 miles; and the remaining 24 miles cannot be said to have had any labor bestowed upon them. This will leave, for as much of the road as lies within the State of Michigan, 20 miles, which require ditching; and about 24 miles which require to be opened and made. There is, also, a bridge wanted over the St. Joseph, at Bertrand, about 300 feet long. These several items will require about $14,500. There will then remain about 100 miles of this road from the point where it crosses the Michigan State line to Chicago, but as the examination of this part of the road has not yet been made, I forbear submitting an estimate of the cost of properly opening the same, but it probably would not exceed $250 the mile.

18. *Road from La Plaisance bay to the Chicago road, Michigan.*—The object of this road is to furnish an additional termination on Lake Erie to the Chicago road, and thereby to extend the facilities and the great object of that road.

Its entire length is 47 miles, about 20 of which are but imperfectly opened, and in many places require the usual structure of log causeways.

Both the local agent and the inspecting officer represent this road as having mainly influenced the sale of every acre of public land lying near it, all of which, to the amount of some millions of acres, has been sold; and hence the inhabitants consider the General Government under obligations to complete it on its original trail.

For this purpose the sum of $6,000 will be required, to which should be added an amount of $1,797, due as arrearages to contractors and others, making a total of $7,797.

In all of the foregoing roads, the superintending engineer has in his estimate included items for "turnpiking," that is, for making an artificial bed to the road of gravel or stone. These items have been universally excluded by me. I have not considered the obligation of the Government in reference to these roads to involve more than what is understood by the "opening of a road," or the construction of one on the most simple principles; that is, that the timber should be cut down and removed, the undergrowth grubbed up and removed, ditches dug on the sides of the road where required, swamps made passable by the customary log structures

and bridges thrown over streams that are not conveniently fordable, leaving all artificial structures of a road bed to the future efforts of the local authorities, or to positive legal enactments by the General Government. And even where it is contemplated to make an artificial road bed, on the part of the General Government, the preliminary steps should be those which have been indicated, that the road-way may be properly dried before the artificial bed is applied.

ROADS IN WISCONSIN.

These roads have been under the superintendence of Captain Th. J. Cram, of the corps, and the information concerning them is taken from his report.

19. *Road from Fort Howard, at Green bay, by Milwaukie and Racine to the northern boundary line of the State of Illinois.*—This road has been located nearly all the way through; the construction has been commenced and is expected to be completed in the course of the next year.

The whole cost of the road is estimated at $48,381, of which $15,000 having been already appropriated, it will require a further appropriation of $33,381.

The superintending engineer, Captain Cram, in remarking upon this road, says: "The road, if constructed in the manner contemplated in the estimate, would open a good and convenient highway for an extent of about 158 miles, chiefly through an excellent woodland district which stretches along the western shore of Lake Michigan, and which, for size and quantity of timber, the farming qualities of its soil, and its abundance of water, both for irrigation and hydraulic power, is rarely if ever excelled. This belt of timber land is generally settled on the route of the road from the Illinois line, as far north as to Saukville, an extent of 68 miles. Between Milwaukie and Sheboygan river there are several settlers seated along in the vicinity of, and immediately upon the route of the road. At Sheboygan falls there is water power of great force and value, and an active state of business exists in the manufacturing of pine lumber and shingles. The same is also to be remarked at Manitowoc rapids. Between these places, for a distance of about 30 miles, there are no settlements, and the land is chiefly owned by the United States. Neither is it settled between Manitowoc rapids and Green Bay, a distance of 33 miles.

"A large portion of the land in the immediate vicinity of the line of the road still belongs to the United States, and so long as it shall be allowed to remain without the means of convenient access, just so long will it continue to be the property of its present proprietor, unsaleable and unproductive. This woodland, however, would most unquestionably be sought by the hardy settler, had he but a reasonable prospect of the possibility of penetrating the forests with his wagon-load of effects.

"The route which the road follows is the principal mail route from the south and east towards the Green Bay district. The mail is now carried for more than 80 miles of the route, thrice a week, on the backs of men. It is impossible to drive a wheel carriage over the route farther north than Milwaukie, and nowhere south of this town, within the Territory, can a span of horses haul an empty wagon at a greater speed than 25 miles per day. Such is the rate of motion on this route, that five days are consum-

ed in transporting the mail from the southern boundary of the Territory to Green bay, a distance of 158 miles.

"And, finally, though Chicago has ceased to be a military post, still the abandonment of that station by the United States troops has not divested the route in question of that military importance which it was once supposed to possess, and which may have partly induced its original survey; for in the event, which is by no means beyond the limits of probability, of the necessity of rapidly concentrating the militia of Wisconsin and Illinois at Fort Howard, for the purposes of defence against threatened danger from Indians in the neighborhood of Lake Superior, a well-constructed road leading directly from the south towards the theatre of operations, might in a single campaign save more than its original cost of construction. Such a road would afford facilities for marching troops to a point not to be reached except by an overland route during the winter, and at the seasons of opening and closing of the lake navigation."

20. *Road from Sauk harbor, on Lake Michigan, to Dekorree, on the Wisconsin river.*—"The portion of this road," Captain Cram reports, "west of Rock river, was located early in the season, and its construction put under contract. The precise time of its completion, however, could not be fixed in the contract, owing to a necessary dependance upon a sufficiency of water to raft the timber for the bridges down the upper part of Wisconsin river. The masonry of the bridges is nearly completed, and little doubt exists of all the work west of Rock river being completed before the cold weather sets in. The eastern part of the road (from Sauk harbor to Rock river) is located; and the contract for cutting and clearing this portion has been made, with the stipulation of having it opened to Rock river this fall.

"The amount of the appropriation for the survey and construction of this road was $5,000. With this sum the road will have been surveyed, and cut, and cleared out for its whole extent, about 86 miles; and the construction of the 46 miles in extent west of Rock river, completed in a durable manner, and left in a condition to require no further aid from the United States. But the construction of the part east of Rock river, an extent of about 40 miles, will require an additional appropriation of $12,700. By means of this sum all the requisite bridging, ditching, and filling may be completed. The whole cost of the construction would then amount to $17,700, averaging about $207 per mile.

"The route of this road from Sauk harbor, upon Lake Michigan, to Rock river, passes over land of a heavy growth of timber. The soil is of the richest quality, and well provided with water and all the requisites for agricultural purposes. There are no settlements, however, upon this part of the route, excepting those at Sauk harbor and at Saukville, and the land is yet the property of the United States; circumstances, owing their existence in some degree to the great difficulty of penetrating this forest, without incurring an expense greater than the limited means of the emigrants would justify. It is believed, however, that the opening of the road will induce purchases of land along the route; and one may reasonably expect that settlers will soon be found scattering along this portion of the road. The road will afford facilities to the inhabitants of Washington and Sheboygan counties for reaching the seat of Government, and for penetrating to the interior of the Territory; and if the road should be constructed in the manner contemplated in the estimate, requiring an additional appropri-

ation of $11,700 it would also afford facilities which are much needed, for supplying settlers in the south part of the Territory, through the channel of Rock river, with a better quality of building timber and fence-rails than it would be possible for them otherwise to obtain ; a circumstance of no small consideration, and one of far more pecuniary weight to the agricultural interest of the Rock river valley than many times the whole cost of the road."

21. *Road from Rock river to Wisconsin river.*—"This road will pass through a succession of prairie and woodland," Captain Cram reports, "most of which is admirably adapted to immediate agricultural purposes, and a large portion of it to the raising of stock to a degree not excelled by an equivalent extent of surface in the Territory. Several settlers have already commenced on and in the vicinity of this part of the route, and the business of farming presents an encouraging aspect, and gives earnest to the settler that his enterprise and industry will be immediately and richly rewarded.

"The western terminus of this road is Dekorree, a small town situated on the south bank of the Wisconsin river. Its position is high, commanding, and healthy, and is well adapted to the business of receiving lumber from the upper Wisconsin 'pineries,' for the supply of a large extent of country back of it, and for receiving in return for shipment the surplus produce that might be raised in the neighborhood."

22. *Road from Fond-du-Lac, on Lake Winnebago, by Fox lake, to Wisconsin river.*—"This road," Captain Cram reports, "was located, and its construction put under contract in May last. With the exception of about seven miles near Fond-du-Lac, the route was found to be highly favorable for the construction of a good road. The bridging with stone abutments and truss-frames, and the ditching and filling, have been contracted for, to be finished before winter. The amount appropriated for its construction was $5,000, with which all may be done in a manner requiring no further aid from the United States.

"The part of the Territory through which this road is located consists of prairie and woodlands, and possesses every natural advantage which could be desired for stock and grain farms. The numerous living, limpid, and rapid streams which drain this district into the Rock, the Neenah, and the Wisconsin rivers, afford bottom lands whose growth of native grass—mowed even as early as the month of June—would yield from 1½ to 2½ tons to the acre, of the very best of hay ; and the table-land, which is generally from 8 to 12 feet more elevated than the bottoms, is strongly impregnated with lime, and, consequently, adapted to the culture of wheat ; and the prairies, studded here and there with a clump of trees or willows, from which a living spring of water of the purest quality usually gushes forth, afford excellent pasturage in great abundance ; and, although the timber is usually light and of second growth, still there is enough for fencing and fuel.

"The route of this road is one of general travel, and the construction of bridges will confer a great benefit upon the traveller as well as upon the settlers, who are greatly dependant upon this road for the means of reaching the markets of Green Bay and Fort Winnebago. A large portion of the land along and in the vicinity of the route is yet the property of the United States ; but it needs only to be seen by the emigrant to be desired ; and a good road through it will afford such facilities, that, in all probability,

a few years only will elapse ere it will be very generally taken up, and much of it under cultivation."

23. *Road from the town of Milwaukie, on Lake Michigan, by way of Madison, the permanent seat of Government, to a point opposite the town of Dubuque, on the Mississippi river.*—"This road," Captain Cram reports, "was located during last autumn and winter as far as to Madison, a distance of 79 miles. The timber has been cut and cleared where requisite as far as located, and log causeways and bridges constructed so that wagons with very light loads may now reach Madison on this route. The whole appropriation, amounting to $10,000, has been expended between Milwaukie and Madison, and to complete the road between these two towns in a manner to meet the wants of the inhabitants along the line, and of Milwaukie and Madison, an additional appropriation of $5,000 would be requisite. This sum, although inadequate to the construction of a durable road, would nevertheless leave it in such a condition that the inhabitants settled along on the line of the road might keep it in repair between Milwaukie and Rock river. Between that river and Madison there are few if any settlers, and the ground is wet and unfavorable for a road, and the land is not so well adapted to farming purposes as to induce the belief that it will be settled for some years to come. Between Madison and the Mississippi, nature has done so much towards providing for a good road that an expenditure of about $10,000, in bridging the streams, ditching, and grading, would be sufficient, making an additional sum of $15,000 necessary to be appropriated to complete the construction of the road all the way through from Lake Michigan to the Mississippi river."

24. *Military road from Fort Crawford, by Winnebago, to Fort Howard at Green Bay.*—"Commencing at Prairie du Chien, and running east as far as the Blue Mounds, this road," Captain Cram reports, "is laid on the ridge dividing the waters flowing towards the north from those flowing towards the south. At the Blue Mounds this dividing ridge deflects towards the northeast to within about four miles of Fort Winnebago, where it is lost in a summit level denominated 'the Portage.' This remarkable summit is one among a few others of similar character in our country, possessing the property of dividing the waters flowing into the gulf of Mexico from those which flow into the gulf of St. Lawrence. The part of the road from Fort Crawford to 'the Portage,' a distance of about 115 miles, will need the sum of $5,700, to be expended chiefly in the repairs and construction of small bridges, and the opening of ditches, which are not only necessary to the immediate use of the road, but also to the preservation of the road itself. The construction of a safe and permanent road across 'the Portage,' for about four miles, will require the sum of $5,955. Owing to the periodical overflowings of this summit level the road across it is rendered utterly impassable, and continues so for several days at a time, amounting to some weeks during each year. At such times the United States mail and travellers to Fort Winnebago are obliged to be taken around on a circuitous route of about 15 miles, crossing a lake on their way, in order to reach the desired point; and it is not unfrequently the case that the unwary traveller is led into the middle of 'the Portage' before he becomes fully apprized of his danger, when, all of a sudden, his horses are mired in the midst of a flood of water, from which he finds it impossible to extricate his team, and it might perish in sight of the fort, but for the assistance of the soldiers who come off in canoes to his rescue.

A thorough and critical examination has been made with a view of constructing a road around 'the Portage;' it is found, however, that the cost of such a construction, besides an increase of distance and the inconvenience of a ferry, would quite equal the cost of making the present road good and safe at all times.

"The sum required to complete the construction of the part of the road between Fort Winnebago and the south end of Lake Winnebago, a distance of about 60 miles, is $6,320. The land in the vicinity of this portion of the road is of good quality, and similar in most respects to that described in the report on the road from Fond-du-lac to Wisconsin river. From the south end of Lake Winnebago to within about six miles of Fort Howard, at Green Bay, the road is exceedingly bad, and the cost of transportation over it is a heavy tax upon the settlers, and tends greatly to retard the settlement of the whole tract of country between Green Bay and the Wisconsin river.

"The tract of land bordering on the east side of Lake Winnebago, and thence along Neenah river to Green Bay, is chiefly covered with excellent timber, consisting of various kinds of oak, white pine, sugar-maple, basswood, black walnut, &c., and, from its proximity to navigable waters on two sides, must become valuable. The soil of this tract is deep, with a substratum of limestone, and, being well watered with numerous small brooks, is well adapted to farming. The military road along here passes directly through the settlements of the Brothertown and Stockbridge Indians. The farms of the Brothertown people are in a promising condition, and the clearings, fences, and snug buildings, show that their proprietors are not behind any of the farmers of Wisconsin in the art of agriculture. Their respectable appearance, civil and quiet demeanor, and exceedingly industrious habits, all combine to render them good and worthy citizens of the United States. It is to be regretted, however, that the general appearances of the Stockbridge settlements are not so favorable, and yet were it not for the contrast of their neighbors, the Stockbridge people might be said to have evinced signs of civilization not often met with in the settlements of the red men.

"The cost of constructing the road from Fond-du-lac to Green Bay, about fifty-six miles, would be $17,292, to be expended in bridging, ditching, and filling the wet places with durable materials, which exist in abundance on the road. Thus the whole sum required to complete the construction of the military road from Fort Crawford, by Fort Winnebago, to Fort Howard, an extent of about two hundred and thirty-five miles, amounts to $35,267. This sum, with strict economy in adopting the most simple kind of construction, would not more than cover the cost of completing this road, which, in a military point of view, is of unquestionable importance, connecting, as it does, a chain of military posts which the safety of the people of Wisconsin, and the north part of Illinois, will require to be maintained for several years to come."

25. *Road from Racine, by Janesville, to Sinipee, on the Mississippi.*—"The general route for the final location of this road," Captain Cram reports, "has been designated, all the way through, after a careful reconnoissance upon all the routes and parts of routes which had any claim worthy of examination. This whole road, in extent one hundred and fifty miles, according to an approximate estimate, would cost $32,620, giving an average cost of about $227 per mile. This sum would cover the cost of a con-

struction suitable for heavy transportation, such as would naturally come upon the road. With the appropriation of this year, $10,000, as much of the road as lies between Lake Michigan and Rock river, an extent of sixty-three miles, would be completed by the first of January next, if the fall should not prove unfavorable for such work. The additional appropriation necessary to complete the remaining eighty-seven miles would amount to the sum of $22,620.

"From Racine to Janesville the route of this road passes through and near by the most thickly settled part of the Territory, and its location is such that the people, for several miles north and south of the line of the road, can very conveniently avail themselves of the general benefit to be derived from its construction. The fertility of the soil of the southern tier of counties, through which the road passes, is very great, a fact sufficiently tested by the immense crops of wheat, oats, Indian corn, peas, beans, potatoes, &c., which burden the ground this season. This tract of land is exceedingly well adapted for grazing and dairy purposes, and it will this year yield a large surplus of wheat, butter, and other provisions, over and above what will be needed for immediate home consumption. From Rock river to a point six miles west of Sugar river there are no settlers, although a large portion of the land has been purchased from the United States. The quality of the soil, the abundance of pure water, and sufficiency of wood for fuel and fences, all conspire to render this tract valuable for agricultural purposes of any description. On leaving the Sugar River valley, the route of the road soon enters the most populous part of Green county, and after leaving New Mexico, the county seat, it very gradually descends to the valley of the Peekatanokee river, a stream susceptible of being improved for slackwater navigation up to the junction of its east and west branches, at a reasonable expense, whenever the uncommonly rich valley through which it passes for many miles, shall become sufficiently populous to require such an improvement.

"The route, on leaving the beautiful and romantic scenery of the valley of the main Peekatanokee, follows the crest of a high ridge along the south side of the west branch of the stream for several miles, and enters the mining lands a few miles west of Wolf creek, and thence passes through the mineral district to its western terminus, the town of Sinipee. This town is situated at the water's edge of the Mississippi, and is intended for the deposite of the lead and copper of Wisconsin. The water of the river in front of the town was found, on examination, of sufficient depth for steamers of the largest size to come immediately alongside of the natural shore, to discharge and receive freight. Sinipee will also become the landing place for large quantities of lumber, from the Wisconsin river country, to supply the wants of the back settlers.

"The active state of business which is now being carried on at Sinipee, in the article of copper ore, which is hauled to this place for shipment to England, and in the articles of pig lead and lumber, conclusively demonstrate that this point is of importance to the southwestern part of Wisconsin. Should the road be constructed in a manner adapted to heavy transportation along through the mineral lands, it would afford greater facilities for transporting the minerals for many miles to the river than are now enjoyed; and if constructed all the way through, it would afford a general thoroughfare from Lake Michigan to the Mississippi, besides rendering essential aid

to the farmers in the southern counties of the Territory, for transporting their surplus produce to the places of shipment.

"The route of this road is one of military importance, for a road constructed upon it according to the plan supposed in the estimate, would afford the means of rapidly approaching, from the south and east parts of Wisconsin, and the northeast part of Illinois, and from Michigan directly towards the west, the quarter from which danger must be apprehended and should be provided against, so long as the region west of the Mississippi shall be occupied by the Indian race. The transportation of provisions and munitions towards the theatre of action in time of war or for the supply of the posts on the Upper Mississippi, would be greatly facilitated by constructing this road all the way through to Sinipee."

ROADS IN IOWA TERRITORY.

The roads ordered in the Territory of Iowa, are:

26. One from Burlington toward the seat of the Indian agency on the river Desmoines;

27. One from Dubuque to a point in the northern boundary of Missouri;

28. One from Burlington to De Hagues.

Directions were given early last spring for the survey of these and for placing them under contract. The report of the officer has not yet been received, but from the number of miles of these roads and the small amounts appropriated, there can be no doubt that additional sums will be required to complete them. The report of the officer being delayed, in the absence of the precise data, which it would no doubt furnish, an estimate of additional means can be based only upon a presumed average of what such roads generally cost, on the supposition of what is usually called a country road.

1. The road from Dubuque to a point of the northern boundary of the State of Missouri, best suited to the future extension of the road to the cities of Jefferson and St. Louis. The entire length of this road will probably be 170 miles, for which $20,000 have been appropriated. Its entire cost will not probably be less than $68,000, from which deducting the $20,000 already appropriated, it will leave an amount of $48,000 yet to be provided.

2. The road from Burlington, through the counties of Des Moines, Henry and Van Buren, to the Indian agency on the Des Moines. It will probably be about 70 miles long, and will cost about $28,000; $5,000 have been already appropriated on this account, leaving a balance yet to be provided of $23,000.

ROADS IN ARKANSAS.

29. *A road from the Mississippi, opposite Memphis, to the St. Francis river, usually called "the Memphis and St. Francis road."*—The information in reference to this road is taken from a report of Captain A. Bowman, dated October 3, 1838:

"The road is now finished 24½ miles from the Mississippi river to Blackfish lake, except 400 feet upon which the laborers are now engaged, and which will be completed in all this month. Beyond the lake, one mile is so far embanked as to form an excellent road at all seasons, except that of

extreme high water, when a portion of this last mile will be overflowed, not having been raised to the required height. From the 35th mile to the west end of the road, there remains the following work to complete the embankment, viz: 660 feet of the east end of the 36th mile, 345 of the 38th mile, and 943 yards of the same mile not raised to the required height. There are also on this section 940 feet of bridging. That portion which is completed fully meets my expectations; and although in many places the road passes over an almost bottomless quagmire, it has settled and become a solid and permanent embankment, capable of sustaining at all seasons, a large amount of travel, and of resisting the action of the water.

"I have had occasion to remark, in a former report, that this work is important, less on account of the facilities which it affords to the country lying in its immediate vicinity, than as constituting the only land route to the interior of Arkansas. If left in its present unfinished condition, it will be comparatively of little value to the State: like a bridge finished to the middle of a stream, and then terminated, it will serve only to tempt travellers to the interior of the swamp, the passage of which is, at certain seasons, wholly impracticable. The general suspension of the public works in the west and south has rendered labor abundant and comparatively cheap. There probably will never be a more favorable season than the ensuing one for the completion of this work. I would, therefore, respectfully urge the importance of calling for the maximum amount of the accompanying estimate which will finish the work."

The estimate for completing the road is as follows:

For the 1st quarter - - - - - -	$22,450 13
2d quarter - - - - - -	34,412 58
3d quarter - - - - - -	43,764 59
4th quarter - - - - - -	35,325 93
	135,953 23

ROADS IN FLORIDA.

The several roads which Congress has directed in the Territory of Florida, are:

30. The road from Tallahassee to Iola;
31. The road from Tallahassee to Jacksonville;
32. The road from Jacksonville, by Garey's Ferry, to Newmansville;
33. The road from Jacksonville to St. Mary's;
34. The road from St. Augustine to Picolata.

In consequence of the condition of the country from the prevailing Indian hostilities, the officer in charge has been able to make only a slight reconnoissance of the first two; but hopes are entertained that parts of each may be put under contract during the present winter. Directions have been given in reference to the one from Jacksonville, by Garey's Ferry, to Newmansville; bids have been received in reference to the one from Jacksonville to St. Mary's; and the one from St. Augustine to Picolata will probably be completed by the ensuing spring. As the usual detailed reports have not yet been received, in reference to these roads, it is not in my power to say whether any additional sums will be required to complete them.

35. *Kennebunk, Maine.*—The object of the improvement at this place is to confine the channel of the river at its mouth, and thereby obtain more water at the bar.

From Capt. Swift's report, it appears that, "in the years 1820 and 1821, two piers were built under the direction of the Treasury Department. In 1828, the eastern pier was destroyed by a storm, but repaired in 1829, using the same kind of materials, cribs of timber with stone. The western pier has been rebuilt of stone; the eastern pier is now being rebuilt in the most substantial manner, of granite, having a base of 28 feet, and 9 feet wide at the highwater mark of spring tides. From the base to highwater mark is 17 feet, above which two feet courses of stone are laid, narrowing to a width of three feet. The pier head is built in three feet water, and as the entire rise of spring tide is 15 feet, vessels can then enter drawing 17 feet of water.

"The pier head is completed, and about 130 feet of the pier itself, and a quantity of stone, is collected for the continuation of the work. About 350 feet of the pier yet remain to be completed: $15,000 are required to continue the work next season. About 10,000 tons of shipping are owned at Kennebunk and the port, and the population of the town is about 6,000."

36. *Breakwater at Stamford Ledge, Portland, Maine.*—The original survey for the improvement of this harbor was made in 1832. The plan submitted contemplated two distinct works, namely, the breakwater at Stamford ledge, at the southern part of the harbor, and a breakwater extending from Mount Joy, the northern part of the harbor, to the middle ground.

The first of these works was intended to be 842 yards long, to be built of stone; the second to be built of the same material, and to be about 360 yards long.

A sum of $30,000 is estimated as the amount which will be required for the continuation of the work during the next season.

The inspecting officer, Captain H. H. Swift, adds: "The advantages of this important work are so fully set forth in the annual reports of the agents for the last two seasons, that it seems unnecessary in me to do more than to refer to them. The breakwater is of obvious benefit, not only to Portland, but to a numerous class of vessels which are compelled, in stress of weather, to make a harbor for safety."

37. *Improvement of the Cocheco branch of the Piscataqua river, New Hampshire.*—"The entrance of the harbor of Dover," Capt. Swift reports, "is obstructed by rocks and shoals at three different points: 1st. At Alley's point, about one and a half miles above the confluence of the Cocheco with the Piscataqua, where the obstruction consists of rocks. 2d. At Trickey's point. 3d. At the Gulf, so called, about half a mile below the village of Dover, at which place a ledge of rocks extends entirely across the bed of the stream, causing a fall, at low water, of about two feet. 4th. Between this ledge and the wharves of the town, a bar of sand and gravel. The foregoing embrace the principal obstructions, as they existed prior to the improvement of the channel. At Alley's point, and at the Gulf, the difficulties have been chiefly removed. At Trickey's shoal are some loose, detached rocks which require blasting.

"The inhabitants of Dover already derive great advantages from the work which has been done, as vessels can now discharge their cargoes at the wharves, while formerly they were obliged to use lighters. Ten thousand dollars are required to complete the improvements originally contemplated."

38. *Breakwater at Sandy Bay, Massachusetts.*—This work consists of a breakwater thrown off from the western point of the harbor, in an eastern direction, protecting it from the northwest, north, and northeast winds. About 800 feet of the breakwater have been made, and it is proposed, to complete the improvements, that the work should be extended 400 feet farther, to defray the expense of which, with a suitable pier-head and beacon, a further sum of $30,000 is estimated by the inspecting officer. This work is not only of great advantage to the inhabitants of Sandy Bay, but as a harbor of refuge for coasters. It is rather limited in size, and I consider the plan of connecting the breakwater with the eastern point of the harbor as seriously defective, from its tendency, inevitable, in my judgment, to fill up the harbor; an opening should have been left between this point and the breakwater, in order to give a free passage to the littoral current, and thereby prevent the deposites from a still water, and if the breakwater is extended as proposed, I would advise that such an opening be made.

But, in my judgment, the object which would be accomplished by the extension, is not such as would justify the increased cost, and my own views are, that the work should be limited to the original plan, and completed accordingly, with suitable pier-head and beacon, for which the sum of $6,000 will probably be sufficient.

39. *Dike at Newburyport, Massachusetts.*—"This dike," Captain Swift reports, "is composed principally of timber, and having been built for upward of eight years, exhibits symptoms of decay."

The entire length of the structure on the west side of the river, is 7,200 feet. There being no worm in the harbor, all the woodwork in contact with the water is perfectly sound; but other portions, particularly those built over the sandy soil of the islands, exhibit evidences of decay. These works require overlooking and occasional repairs, for which the unexpended balance is considered sufficient for the ensuing year.

40. *Duxbury harbor, Massachusetts.*—In reference to this harbor, the following extracts are taken from the report of Captain W. H. Swift:

"In 1836 an appropriation of $5,000 was made for preserving the point of land leading to the fort and light-house at the Gurnet. The point of land referred to, is a low, narrow peninsula, about six miles in length, extending from the main land, in a southeasterly direction. This neck constitutes the eastern boundary of Duxbury harbor, and upon its preservation depends entirely the usefulness and even safety of the harbor. The portion of it which requires to be protected, is about four miles in length. Throughout this distance, two parallel rows of stakes are driven about 75 feet apart, each row is formed of two sets of stakes placed one and a half feet apart, and about the same distance from each other, in a longitudinal direction. They are from six to eight feet in length, and are two feet below the surface, leaving from four to six feet exposed above ground. Seaweed is placed between the stakes, and thus a barrier is formed to the drifting sand of which the neck is composed. The barrier thus raised forms a nucleus around which the sand is collected, and in the course of a year or two the accumulation is very great. In many places I noticed stakes which had been placed six feet above the ground, with a bank of sand four feet in height, and this the

agent assured me had been raised in two seasons. In other places the sand had been raised quite to the top of the stakes. Where the beach was most exposed to breaches, several rows of stakes had been driven, and the result was most satisfactory, and, doubtless, in time, the sand will be raised as high as is necessary. In the first stages of the work, the timbers of two wrecked vessels were used for the stakes, but, subsequently, refuse boards were procured, and cut into pieces of 6 to 8 feet in length and 6 inches in width; a trench of 2 feet in depth was then dug, and the stakes well secured by packing the sand around them. Outside additional pieces, shorter than the first, were placed to aid in strengthening the work. 3½ miles of two double rows of this description of work, cost $2,500. I have been thus particular in describing the mode in which this work was performed, because I think it answers the object fully, and is both simple and cheap. I do not perceive the advantage of more than one row, unless at particular points, where imminent danger is to be apprehended from a breach.

"As a further proof of the utility of this species of work, the agent stated that, for a distance of 1½ miles, the sea had formerly made an entire breach over it, but, by adopting the plan above described, the beach has been raised four feet. The beach-grass soon makes its appearance after the sand-bank has been raised by the above means, and the roots of this grass prevent, to a great extent, the drifting of the sand.

"The small balance on hand will be disposed of before the close of the year, in placing the seaweed in the hedges. The sum of $1,500 will be required for 1840, to complete the work, that is, to fill the rows of the stakes with seaweed; and it will also be necessary to expend a few dollars annually for occasional renewal of the fence, &c.

"The commercial interest connected with the harbor of Duxbury will best be understood by a statement of the following facts, drawn from official returns: For the year ending the 1st of April, 1837, the number of vessels employed in the cod and mackerel fishery was 46; tonnage, 2,590; value of fish caught, $69,500. For the five years preceding April 1, 1837, the number of vessels built was 71; tonnage of the same, 11,711; value of the same, $845,250. During the same period, the number of vessels built in Boston was 37; tonnage, 8,600; value of the same $622,000.

"It results from this comparison that this important branch of industry (ship-building) is carried on in Duxbury quite extensively. The population of the town is about 2,800."

41. *Plymouth harbor, Massachusetts.*—Captain W. H. Swift, the inspecting officer, says of this harbor: "It is formed in a manner very similar to that of Duxbury, that is to say, by a long, low, and narrow sand beach on its eastern side. The difficulties, too, are nearly similar. The importance of this harbor long since attracted the notice, and received the fostering care, of the State. Between the years 1806 and 1824, there had been expended upward of $40,000 for the preservation of the beach; and even as early as 1702, the settlers inflicted a penalty on any one who should fell trees on, or set fire to the beach.

"In 1824 Congress appropriated $20,000, in 1825 the sum of $5,712, in 1826 $13,184 90, and various other sums from that time to the year 1838, inclusive, amounting to the total sum of $51,766 90.

"Major Chase, of the corps of engineers, made a plan, in 1824, for the preservation of the beach. The plan was adopted, and carried into execution. It consisted of a breakwater composed of triangular frames of wood filled

with stone, and extended about 1,400 feet in length, from the northern extremity of the beach southerly. The frames were of three sizes, each forming an isosceles triangle. The first size had sides of 12 feet, and a base of 14 feet; the second size had sides of 10 feet, and a base of 12 feet; the third had sides of 7 feet, and a base of 10 feet, made of timber one foot square, morticed and tenoned together, and secured to each other by trenails. The frames were laid upon three longitudinal sills, and filled with stone. On the western or bay side, 5 triangular pieces, of the same description as the breakwater, were placed a few feet distant, and connected by means of ties with the body of the work. These were intended to subserve the purposes of counterparts, to resist the effect of the heavy swells occasioned by gales from the east. A portion of the breakwater, of about 400 feet in length, was laid upon an embankment formed of stone, carried to the height of high-water mark. This stone work was placed across a channel which had been formed through the beach. The end of the breakwater is of stone, in rather a rough state, with a beacon erected upon it. That part of the wood work of the breakwater which is exposed to the water has been much injured by worms; and to prevent the entire destruction of the frames, three courses of split granite, 1½ feet square, have been laid upon the outside of the work, and two of the same on the inside. This will prevent the stones on the interior of the frames from pushing out the timbers from the sills, when the worms shall have caused the destruction of the same. In addition to the above, fascines and hurdles have both been used to collect the drifting sand. The effect of all has been a great accumulation of sand. Seaweed has also been scattered over the surface of particular portions of the beach, serving a good purpose in collecting and retaining the sand also.

"The extreme point of the breakwater being now protected by the stone work, it will be an easy matter hereafter to raise the sand by means of the hurdle work or brush fence. Indeed, a large bed of sand has been deposited outside of the breakwater, near the northern extremity, and where last year vessels employed in transporting stone to place at the foot of the frame work laid at anchor.

"The operations at this beach have been confined this season to the placing of 150 tons stone around the pier erected at the northern extremity of the breakwater, to the planting of a small quantity of beach grass, and to the placing of seaweed to collect the drifting sand; all of which have answered a good purpose.

"The sum of $1,500 will be required for the year 1840. I would further recommend that provision be made for a suitable compensation for the agent at this place. The commissions amount to little; and the constant supervision of some trusty individual is absolutely necessary, in order that the occasional breaches which take place in the beach may be arrested in season, and before serious damage is sustained. A few dollars, judiciously expended in the first stages of a breach, may save hundreds, or even thousands, applied at a later period.

"In estimating the commercial interests involved in the preservation of this harbor, it is necessary to consider Kingston, (the adjoining town to Plymouth.) It lies upon the same bay north of Plymouth. Taking the towns of Kingston and Plymouth together, we shall have the following number of vessels employed in the fisheries of whale, cod, and mackerel, for the year ending the 1st of April, 1837: Number of vessels employed, 68; tonnage of the same, 6,248; value of oil and fish caught, $203,076.

For the five years preceding the 1st of April, 1837, the number of vessels built in both towns was 41; the tonnage of the same, 7,222; the value of the same, $386,700. Anchors and cordage manufactured in one year prior to April 1, 1837, amounted in value to $197,225. If we add to this the value of articles manufactured of iron and steel, for the same time, ($230,400,) it exhibits a gross result of upward of $700,000 annually. These facts warrant the conclusion that the preservation of this harbor is an object of great importance in a commercial point of view alone, if in no other."

42. *Hyannis harbor, Massachusetts.*—The survey for the determination of a proper site for the breakwater at this harbor was made in 1826, by Colonel John Anderson, of the Topographical Engineers. "The breakwater," Captain Swift reports, "lies about 800 yards southeast of Hyannis port. About 1,190 feet in length of the breakwater is completed, and if carried as far west as originally intended, 110 feet remain to be finished. The appropriation of 1838 was made at so late a period, that no work was performed in that year. This year about 560 tons of stone have been used in repairing the breaches in the western part of the work, and 700 tons have been laid at the western end of the breakwater, to raise that part of the work above low-water mark. At the eastern or finished end, the breakwater is 22 feet wide at top, and stands in 18 feet at low water. At the western end it is 14 feet wide at top, and stands in 12 feet at low water.

"The amount expended during the present season is about $7,262. The unexpended balance, estimated to be in the agent's hands at the close of the present season, will be nearly $400. The amount estimated and required for continuing and completing the work in 1840, is $11,000.

"The object of the work is to form an anchorage for vessels with the wind at south and southwest, and at the same time to afford shelter during the winter from drifting ice. The following extracts from the instructions to the agent, will exhibit the mode in which it was intended originally that the breakwater should be constructed:

"'The slopes first given to the breakwater should be such as the stones will take of themselves, being thrown overboard, and these slopes should not be increased until the top of the work is put on, because with these steep slopes the scows may be placed in convenient situations for unloading upon the top.

"'In case, however, the boisterous season should come on before the completion of any part of the work, it will be requisite to give that part a more gentle slope on the seaward side, to secure it from the effects of a heavy sea. Stones of any size may be used in forming the body of the work, but in forming the slope on the side next the sea, and also the top from low water upward, only large stones should be used, the largest of them being placed upon the surface of the outside slope, from five feet below low water to the top of the breakwater. The top of the breakwater should be ten feet broad. The northern slope should have a base equal to the altitude, as should the slopes at the end. The southern slope should have a base equal to twice and a half the altitude. The top should be at least as high as the level of the highest spring tides.'

"The present agent has been in charge of the work since 1833. About 600 feet in length (he states) has been built since his superintendence; the balance was built by other persons prior to his appointment.

"Some modification has been made in the plan of the breakwater since the original instructions quoted above were framed, that is to say, the slopes

above low water do not exceed one of base to five in height, on both sides. The eastern end, for some distance, is from 16 to 20 feet in width; widened, as I understood, for the purpose of placing a beacon upon the extremity. The stones generally are of good size, and mostly of good shape; many are from four to six feet in length, and, at the west end, upon the top, even larger. The harbor, at this place, is resorted to principally by vessels in the coasting trade.

"Hyannis is a village in the town of Barnstable, and having no means of ascertaining the information required relative to its trade, I addressed a note to Henry Crocker, Esq., the collector at Barnstable, and have received from him the following answer: 'As to the commercial interests involved, it is difficult to fix upon the amount of those interests, or the extent to which they are involved in the work in question. There is scarcely any commercial trade at that harbor, not a single vessel sailing therefrom in any trade. It is used, almost exclusively, as a stopping place for vessels trading between the eastern, western, and southern ports, occasionally as a harbor for vessels in foreign trade. The amount of tonnage registered at the custom-house here is 3,500 tons, of enrolled, 48,000 tons. But a small part of this, however, is ever benefited, or its interests at all involved in the work at Hyannis, and this is not proper data from which to estimate the utility of that work, or the amount of commercial interests involved in it.

"'I can form no satisfactory estimate of the number of vessels that harbor there during the year, nor how many of them are *compelled* to do so by the winds or weather. I am satisfied, however, that the latter number is not very large. No more than a dozen vessels from foreign parts have harbored there during the last two years.'"

43. *Breakwater at Bass river, Mass.*—"The survey of this harbor was made by Col. J. Anderson, of the Topographical Engineers in 1829. In 1830, he made a report of the same and furnished a plan for a breakwater; the plan was adopted, and in 1836, Congress appropriated $10,000 for the work—since that time $10,000 more have been appropriated: Of this total, $12,000 have been expended up to the end of last year: since the 15th of May of this year, when the operations at the breakwater were resumed, 2,311 tons of stone have been laid, thereby adding 78 feet to the length of the work, making a total length of 200 feet, and all of good materials and faithful workmanship.

"The amount expended during the present season, is $5,271 85, and the unexpended balance of appropriation is $3,581 41, all of which will be expended before the close of the year. For the service of the year 1840, $10,000 will be required.

"The work projected by Colonel Anderson, is 500 feet in length, and formed of two piers inclined towards each other at an angle of 30°, one being 350 feet in length, and the other 130 feet. It is placed one mile southeast of Bass river, and south of the anchorage ground called "Deep Hole." The following extracts from the instructions will exhibit the manner in which the work has been built: 'In erecting the work, the strictest adherence must be maintained to Lieutenant Colonel Anderson's project, both as to the position and form of the breakwater. Colonel Anderson proposed to place the breakwater in about 9 feet water at low tide, or 14 feet at high tide, and to raise it 3 feet above high water; making it 17 feet high. The whole length was to be 500 feet, viz: 350 feet from the western end to an elbow or bend, and 150 feet from the elbow to the southeastern extremity; the

slope on the outside was to be three times the height, which would give a base of 51 feet; the slope on the inside was to be twice the height, which would give a base of 34 feet, and making the top 6 feet wide, would give a total breadth of bottom of 91 feet.

"'The stones forming the interior of the mass need not be very large, but those forming the inside slope should be all stones of considerable size, say not one less than 800 lbs. in weight, and those forming the outside slopes and the slopes at the two ends, should not be less than one ton. Every stone in the two ends and in the outside slopes that will come above a level 6 feet below low water, should be at least of two tons in weight; and every stone that forms the upper surface or top of the breakwater should weigh at least 4 tons.

"'No stone, large or small, that has been rounded by the action of the sea or from any other cause, or that is not decidedly angular at its corners or edges, should be put into any part of the breakwater.'

"No modification has been made of the above plan. The work itself has been placed about 150 feet farther seaward than was originally contemplated, in order that a larger space for anchoring ground might be secured, for, this being a tide harbor, vessels cannot enter at any stage of water less than half tide, and hence the necessity of preserving a suitable lee outside of the bar for them to lie at anchor in safety.

"About 200 feet in length of the breakwater is completed and a temporary beacon has been erected upon it. The work is of good character and will soon exhibit the valuable result anticipated by those who were instrumental in calling the attention of Government to the importance of erecting it.

"The harbor of Bass river serves equally for South Yarmouth and South Dennis, the river forming the boundary between the two towns. As these towns both extend across the Cape, and have by means of Barnstable a harbor on that side of the Cape, it is not in my power to state what proportion of the commercial or fishing interests involved, belong to the south side, but the following statement will show the total amount of both towns:

"Vessels employed in the cod and mackerel fishery, one year prior to the first April, 1837, 31; tonnage of same 1788, value of fish caught $77,600. Establishments for the manufacture of salt 166; bushels of salt manufactured 417,400; value of same $127,200. Abont one hundred sail of coasting and fishing vessels belong to Bass river. The harbor affords shelter to vessels navigating the vineyard sound also.

44. *Provincetown harbor, Mass.*—The improvement at this place consists in the planting of beach-grass, to prevent the extensive bodies of sand which lie north and west of the village, from blowing about, threatening, as it was supposed, the destruction of the harbor.

The first appropriation made for this work, was in 1826, but it was not till 1830, that any grass was planted. "The grass is pulled up by the roots and planted during the months of April, May, and June," Captain Swift reports, "much in the manner in which corn is planted, that is to say from two to three feet apart, each root being distinct. In the course of one or two seasons, it attains sufficient size to collect around it the drifting sand, and as it increases in height, the sand rises with it. The roots frequently grow to a great length, often from 10 to 20 feet. The seed from the grass is scattered by the winds, and the consequence at Provincetown has been, that large tracts that were before destitute of vegetation, are now covered with a growth of this plant. About one thousand acres of the beach have

been planted. In many places the grass which has been set out looks very promising, while in others it has been covered entirely by the drifting sand; but the agent thinks that in most cases it will push its way through to the surface and continue to grow. This, most likely, will be the case where it has not been buried to any great depth; where it has, it will be necessary to replant. The whole length of the beach upon which it is designed to plant the grass, is upward of four miles, and that part which is to be planted, varies in width from two hundred yards to one mile. The whole amount expended from 1830 to 1837, inclusive, was $23,258. $4,500 was appropriated in 1838, but at too late a period to be of use that year, the season for planting grass having expired before the money was available. About 250 acres of the beach have been planted with beach-grass this season. The amount expended during the present year is $4,459. The sum of $4,500 will be required for the service of the ensuing year, and $12,000 in addition to the above, will be required to complete the work; and as the average rate for planting the grass for the last five years, has amounted to 200 acres annually, it will require two seasons more to complete the whole, say by June, 1841.

"The great importance of this harbor," continues Captain Swift, "is so well known, that I deem it unnecessary to descant upon its merits, more especially as the reports of Major J. D. Graham, and Captain Williams, of the Topographical Engineers, contain ample details upon the subject. I will confine myself to an enumeration of the business connected with the town alone, unimportant as it is when compared with the great maritime interests which are involved, and for the protection of which, the preservation of this harbor forms so important a consideration. Number of vessels employed in the cod, mackerel, and whale fisheries, for one year prior to 1st April, 1837, 100; value of fish and oil taken $312,400. Establishments for the manufacture of salt 78; number of bushels manufactured 49,000; value of same $18,300."

45. *New Bedford harbor, Mass.*—The operations in this harbor were to remove an obstruction, consisting of mud and sand, through which it was necessary to dredge a channel. The work was put under contract; the dredging commenced on the 22d of October, 1838, and continued with but little interruption, until the 28th of June last, when it had to be suspended for the want of funds. The whole quantity excavated was 13,106 cubic yards. There is an arrearage of $125 60 due the contractors; and the amount yet required to complete the channel on the original plan, and to enlarge its width a little on the end adjacent to the wharves, is estimated at $5,500.

46. *Church's Cove harbor, Rhode Island.*—This work was inspected in March last, by Captain W. H. Swift, who made the following report:

"This harbor was surveyed in 1829, by Colonel J. Anderson, of the Topographical Engineers, in conformity with an act of Congress, of March, 1827, appropriating the sum of $2,000 for making a survey and examination, to ascertain the expediency and expense of constructing piers to improve the harbor.

"A plan of this harbor, and of a breakwater for the same, was prepared by Colonel Anderson. These, with a report on the subject, were laid before the Engineer Department, in 1829. The proposed breakwater was to be 414 feet long, 10 feet wide at top, outer slope 3 to 1, inner slope 2 to 1. The contents as computed by him were 30,556 perches, of 25 cubic feet. The

estimated cost of laying the same, at 75 cents per perch, was $22,917, and $1,145 85 for contingencies. Total cost of breakwater $24,062 85.

"In July, 1836, Congress appropriated the sum of $10,000 for the construction of the same. To carry this object into effect, the Engineer Department appointed agents to superintend the construction of the work, under the direction of one of its officers.

"Detailed instructions, plans and sections of the breakwater, were furnished the agents by the officers of Engineers, and contracts were made in conformity thereto. The construction has been carried on since that period, and in September last, (1838,) 120 feet in length of the breakwater were completed. A violent storm during this month, swept about 20 feet off the end of the work, and the gale of January last overthrew about 30 feet more of it, leaving at this time 60 or 70 feet uninjured.

"Your instructions call for an opinion upon the 'plan pursued, and the probability of its success.' The following extract from the instructions given to the agents, under date October 6, 1836, will exhibit the plan of construction pursued:

"'The stones in the interior of the mass, and the eastern slope, need not be very large; but those forming the northern end, and the western slope, must be large stones without exception. Not a stone ought to be permitted to go into the end, or the western slope, of less than one ton in weight, and every stone that forms the upper surface or top of the breakwater should weigh at least four tons. No stone, large or small, that has been rounded by the action of the water, or any other cause, or that is not decidedly angular at its corners and edges, should be put in any part of the breakwater.'

"Further instructions, dated October 4, 1838, state, 1st, 'The inner slope of the breakwater may be reduced, below water, to 1 to 1, and may be even less than that above water; 2d, Small stones may be put in the heart of the breakwater; but they must be angular, and not rounded, and no stone less than 500 lbs. weight should be placed nearer than 6 feet to the surface of the slopes.'

"In the contract made by the agents with Messrs. Sisson & Co., it is stipulated that the work shall be executed in the manner pointed out in the above instructions; the price agreed to be paid is 92 cents per ton of 2,000 lbs. for all stone laid in the breakwater.

"The height of the breakwater, at its northern extremity, is 28 feet. Ten feet from the shore, it is 20.2" feet high; and as it will be placed upon a hard bottom, sloping with great uniformity from the shore to the end, it will average about 24 feet 5' in height. The top of the breakwater is carried up 4 feet above highwater mark. The rise of the tide is 4½ feet.

"The main object to be secured by this breakwater is thus stated by Col. Anderson: 'The bottom of the channel for some distance being hard, and the shores rocky, the space included within the basin would no doubt accommodate as great a number of vessels, drawing from 12 to 18 feet water, as might at any time be under the necessity of seeking this harbor for security in stress of weather; and that it would prove (were these improvements made) of very considerable importance to the coasting vessels passing from the (Vineyard) sound to New York, or any other port to the west of it, and from thence to the eastward, there can be no doubt, as in making the latter trip, it not unfrequently happens that vessels passing

down the sound to any part east of Seconnet point, and meeting a head-wind after passing Point Judith and the Newport channel, are under the necessity of seeking a shelter, by removing into what is called the "Eastern channel," where they are not enabled, now, to find secure anchorage ground, in case of a storm, until they arrive under cover of Frog's point, seven miles above Church's cove: and this shelter is sought generally at some risk; vessels, in gaining it, are obliged to pass near a dangerous reef of rocks, called Church's ledge, and always at the loss of considerable time in making a trip coastwise, both of which would be obviated in a great measure by the proposed improvements of the harbor of Church's cove.'

"The same observation may frequently apply to vessels passing up the sound from the eastward, or coming in from sea, during a south or south-westerly storm. This harbor might be sought many times with greater facility, as a place of security, than that of Newport to the west, or than any of those to the east, in the Vineyard sound, &c.

"I have now stated 'the object of the improvement, and the plan furnished.' The third question, 'The probability of success,' remains to be answered.

"The breakwater is situated about one mile north of Seconnet point, (the east chop of Narragansett bay.) Being so near the line of coast, it must of necessity be exposed occasionally to very heavy storms, such, for instance, as those which have already injured it. Although the top of the breakwater is carried 4 feet above high water, still it was represented to me, by a person living near the harbor, that the sea broke *ten feet* over the top of the breakwater in the gale of January last. The average height of the stone work being 24½ feet, it is obvious that it will require work of more than ordinary strength to withstand the effort of such storms. I noticed stones, weighing from 2 to 5 tons, carried 20 feet from the place in which they were laid; others were turned over merely.

"I doubt not that a breakwater can be constructed at Church's cove, which shall withstand the effect of the gales which occasionally visit the coast; but to accomplish this, I should deem it necessary to increase the outer slope from 1 to 3, to 1 to 5; to increase the width of the parallelogram from 10 feet at top to 13 feet, and to diminish the quantity of small stone in the body of the work.

"I proceed now to show the probable cost of the work, upon the supposition that it be constructed in the manner and of the dimensions recommended by Col. Anderson, taking the present contract price for the stone per ton of 2,000 lbs., as the price which it may be necessary to pay for the whole work, to wit:

"The contents, (in perches, of 25 cubic feet each,) as stated by Col. Anderson, are 30,556. A cubic foot of granite, such as is used in the breakwater, weighs about 160 lbs. This will give, for the whole contract, 61,112 tons of stone; and, at 92 cents per ton, the amount is - $56,223 04
To which add 5 per cent., as estimated by Col. Anderson - 2,811 15

59,034 19

"If the outer slope should be increased from 3 to 1, to 5 to 1, and 3 feet should be added to the width of the parallelogram, the cost will be increased $20,455 36.

"The existing contract will absorb all the available means which remain of the appropriation of 1838; to wit, $15,400.

"Before a stone can be laid, that portion of the breakwater which was overthrown must be restored, and as it will be very difficult to ascertain the expense of restoring these stones to their places, a *contract* could not be made for such a purpose without subjecting the United States to the hazard of paying much more than the work ought to cost. To avoid this, I would recommend that a gang of hands, with a competent overseer, be employed by the agent to remove the stone by day's-work. The only difficulty which this case presents, is the want of means to pay for the work. It may be, however, that a fair arrangement can be made with the contractors for removing the stone, and to relay the same in the breakwater.

"The course which I would recommend in reference to this work is this:

"1st. To allow the uninjured portion of the breakwater (about 60 feet in length) to remain as it now is.

"2d. To authorize the agent to make a contract with the present contractors to relay that portion of the work which has been overthrown by the storms.

"3d. To increase the outer slope from *three* base to *one* perpendicular, to *five* base to *one* perpendicular. The covering stone to be of the same size as now specified in the existing contract. To increase the width at the top to thirteen feet, to be extended gradually from the portion now completed (ten feet in width).

"4th. To require that in future contracts, the stones, in addition to their being angular in shape, should be increased in size.

"In conclusion, I would remark that the contracts thus far appear to have been executed agreeably to the stipulations specified; but more small stones have been admitted than I would recommend for the remaining portions of the work."

Captain Swift's annual report of September, states:

"During the present year, the injured portions of the breakwater have been repaired, and 90 feet, which have been built this season, are ready for the covering stone; this, it is expected, will be completed in all this month; the entire length will then be 210 feet. Suitable provision has been made to preserve the unfinished end through the winter.

"There are three rocks of considerable size within the purposed harbor, two of which it may be necessary to remove.

"The sum of $13,880 has been expended during the present season, and the balance of the appropriation unexpended is $1,520. For the service of the year 1840, the sum of $12,000 will be required, in addition to the above balance of $1,520."

47. *Thames river, Conn.*—The description of this work will be found in Senate Document, No. 1, of the last session, from page 400 to 401.

No appropriation having been made for this work for the year 1839, the small balance of $833 07, which remained in the hands of the agent on the 31st December, 1838, is all the public funds which have been expended during the present year.

Two of the piers nearest the village (No. 1, east side, and No. 2, west side,) have been extended, and others have been repaired.

The sum of $10,000 is the estimate of the superintending officer for the year 1840.

48. *Mouth of the Connecticut river.*—"The operation of dredging a channel through the bar at the mouth of this river, was resumed in June," Capt. Swift reports, "and has been continued since that time, whenever the state of the wind would admit of it. The situation is a very exposed one, and much time is unavoidably lost. The contractors have at this time two dredging machines in operation; one, driven by horse-power, placed on the inner side of the bar, and the other, an excellent steam-dredge, placed on the outer side of the bar. The former has one bucket—the latter, two.

"From an examination of the steam-dredge, I feel satisfied that it will answer a good purpose. Since it has been in operation, it has excavated, at an average, 220 cubic yards per day.

"The contractors were disappointed by the engine-builder, and the machine which, by contract, was to have been completed in June, did not reach the bar until the middle of August. But the inventor and proprietor is using every exertion possible to make an entire cut through the bar before the close of the present season, and I feel encouraged to believe that he will effect the object.

"The substantial dolphins, to mark the channel, have been erected. They are placed 20 feet east of the cut; one at each extremity, and one midway.

"The amount expended during the present season (to 1st September) is $3,586 34, and the balance of appropriation remaining unexpended, is $12,136. A great portion of this, and most probably all, will be absorbed before the close of the year."

For the service of the year 1840, the sum of $10,000 will be required.

49. *Bridgeport harbor, Conn.*—No appropriation having been made for this work at the last session of Congress, nothing of course has been done. The highly beneficial results heretofore stated in reference to it, are confirmed by the additional experience of another year. The channel continues to admit the passage of vessels drawing ten feet water at low tide; that is, the water is twelve feet deep, and has so continued. It is used daily by the steamboats which enter the harbor; but in consequence of the limited width of the channel (60 feet) it cannot be advantageously used by ordinary vessels, without a free wind. A beating channel is very desirable; say one of 200 feet.

To effect their object, as well as to open a channel through the inner bar, will require about $40,000.

50. *Blackrock harbor and Fairweather island.*—The work of the present season has been confined to the building of the lower portion of the breakwater proper. This extends across the breach which the sea has made between two parts of Fairweather island. A reference to the report of last year, (p. 383, Doc. No. 2, H. R., 25th Congress, 3d session,) will show the necessity of securing this part of the island point, and the course pursued has proved judicious. To complete the breakwater by carrying up the stone work to the proper height, one foot above the highest tides, or three and a quarter feet higher than it is now, and for building 320 feet of wall between the sea-wall constructed under the superintendence of the Treasury Department, for the preservation of the dwelling-house of the light-keeper, and the wall built under the direction of the engineer department, a sum of $11,727 00 will be required.

For a portion of the wall south of the work erected by the direction of the Treasury Department, the sum of $4,000 will hereafter be required, but

that part of the island not being in immediate danger, an appropriation for this object might, if considered necessary, be deferred to another season.

The amount expended during the year 1839, is (to 1st of September) $6,580.

51. *Southport harbor, Connecticut.*—In reference to the works at this place, Capt. Swift says in his annual report: "In the report which I made on this harbor in 1838, (see p. 382, Doc. No. 2, H. R., 25th Congress, 3d session,) and to which I beg leave to refer you, I stated the necessity of making certain repairs to the dike opposite the village. At the same time I made an estimate of the cost of these repairs, amounting to $2,581 60."

52. *Westport harbor, Connecticut.*—On this head, Capt. Swift, in his annual report, expresses himself thus: "Since the date of my last report upon this harbor, the excavation of the canal through Great Marsh, has been continued, and by the 20th of November it is probable that this part of the work will be completed, thus furnishing a canal from the harbor of Westport at the mouth of Saugatuck river to the sound, of 450 yards in length, 68 feet in width, and a depth of four feet below low water mark.

"Some stone work at the northern extremity remains to be done, and two rocks which obstruct the channel of the river above the canal, remain to be removed.

"In addition to the above, it will be proper to erect a beacon on the sea-wall, at the northeastern point of the canal. This is highly necessary, and the work would be incomplete without it. The balance of the appropriation unexpended will, in the opinion of the agent, be sufficient to erect this beacon and remove the rocks from the river channel before referred to.

"The amount expended during the present season is $2,453, (to 1st September,) the unexpended balance is $3,781, all which will be required to meet existing contracts and to complete the work. No further appropriation for this harbor will be required."

53. *Improvement of the harbor of New Brunswick, New Jersey.*—The work in this harbor consists in the use of a dredge-boat upon certain shoals which have been fully described in former printed reports. For the service of 1840, $3,000 is required.

54. *Improvement of Little Egg Harbor, New Jersey.*—A full account of the operations in this harbor will be found in a report from Capt. Smith, printed in Senate document No. 1 of last session, pages 220–222. To the information of this report, I will add the following extract from the report of Lieut. Allen, of the present year:

"A light-house on Tucker's island, or some point near the inlet, is much needed. The inlet has three fathoms of water at ordinary tides, and the harbor to which it leads is the best that is found between Cape May and Sandy Hook. This fact, taken in connexion with the extensive trade which passes this coast, would seem to render the measure one of undoubted utility."

For the preservation of the harbor, a sum of $5,800 is required.

55. *Harbor of Wilmington, Delaware.*—The balance on hand will be sufficient for the operations at this place during the next year.

56. *Harbor of New Castle, Delaware.*—The extract which follows, in reference to the work at this place, is taken from the report of Lieut. Emory, of the corps:

"The artificial harbor of New Castle is located at a point where the paths of the ebb and flood tides make a small angle; the natural tendency

is perhaps to form a deposite. By a view of the accompanying map, elucidated by what is here said, it will be seen that this tendency has been accelerated by the works constructed. I will mention the works in the order they were built, together with the agency each has had in bringing about the present condition of the harbor.

"The first were the two piers 'd d,' and the wharves with which they were connected by sluiceways, built prior to 1817. The effects of these were to cause deposites of mud from the shore to the inner sides of the sluiceways. An act passed by the General Assembly of Delaware in 1803, and a further act in 1827, ceding this harbor to the United States, for the purpose of making it secure from the effects of floating ice. With this in view, the engineer in charge filled up the sluiceways, run out the pier 'd' thirty feet longer, and built the two elbows diagonally across the stream and converging toward each other. The basin so formed was secure from the effects of running ice, but the water thus penned in being reduced to a state of rest, the matter held in suspense was deposited, and in the course of two years this basin, which before, as is said, could, on a medium tide, float a vessel drawing fifteen feet of water, was left bare at low-water. The square piers, 'e e' were also built about this time.

"In 1835, the work was resumed by partially cutting away the elbows 'f f,' finishing the square piers with masonry from low-water mark, and sinking the foundation of the two hexagonal piers 'h h.' In 1838, these last named were loaded with stone, and the one up the river (h) is now being completed as far as the balance of funds on hand will admit. It was designed that these piers should be no more than six inches above high-water mark, but experience has shown that vessels coming alongside at high tide, have not sufficient hold to interpose their fenders; it is therefore intended to carry them up eighteen inches. Another objection to the formation of these piers is the large batter (1 3) to the face. When the sea is running high, a vessel getting athwart the angle is raised up and dropped upon the edge of the masonry with violence. In this manner a store-vessel was sunk last winter, and a large ship much endangered. The utility of the square piers cannot be perceived while the upper one 'e' prevents the free passage of the ebb tide. The object intended to be effected by the two hexagonal piers is partially gained. The distance between the lower one and the wharf is however too great, and it was found necessary last winter to moor a temporary wooden structure to prevent the ice from rushing into the harbor with the flood tide. The last work which I have to notice, is the wharf 'g g,' built by the Frenchtown and New Castle railroad company in 1835. This deflects the flood tide from the harbor, and, by diminishing the velocity with which the tide would otherwise sweep it, causes a deposite. This effect is mitigated by the sluiceway; so long as the pier 'd' stands, this wharf, however, cannot materially add to the injury, for the pier projects beyond it, and whatever water escapes the wharf is deflected by it. To make useful the effect of removing one, the necessity of removing both is apparent.

"The effect of all these artificial projections has been to protrude the formation at this point by increasing the angle made by the paths of the ebb and flood tides, and until we reach such a distance that the reaction from the opposite shore shall be felt, the farther the formation is pushed, the greater will be its disposition to increase. This remark, though applicable more particularly to the works connected with the shore, is in some degree appli-

cable to those detached. It would, in some measure, be obviated with regard to these last, if they were reduced in their tranverse section; which, being unnecessarily large, diminishes the section of water that sweeps the harbor, and lessens its momentum. This section bears so small a proportion to the whole section of the river, which is here one mile and a quarter wide, that it does not gain in velocity what it loses in volume. There must be added to this cause of diminution in the momentum, the retardation from friction, caused by the great extent of surface presented. This has been found by using M. Buat's formula, $\frac{v^2}{243\ (v\ d^{\frac{1}{2}}-0.1)^2}$ v, the velocity being assumed as equal before and after the piers were placed, and d representing the hydraulic mean depth, which is ascertained by dividing the border by the section, the section in one case being the natural bed of the river for such portion as sweeps the harbor, and the other, the section supposing all the piers in position. In the first place d will be 31 feet, and the other 16 feet, which substituted in the place of *d*, will make the friction nearly one-half greater after the piers are put down."

Of a revised plan for the harbor: "It is easier in all cases to point out wherein a work has failed, than to project a plan which will be successful. This is particularly the case in the present work, where, in addition to the uncertainty attending works in tidal ways, the work proposed must conform to that already done. The principles which should guide in the project of any new work, I will briefly state, and, in submitting a plan, will conform to them as nearly as circumstances will admit:

"1st. It has been found by experiments of M. Vention, that 'the expenditure of water will be greatly retarded if the channel have enlarged parts or swellings.'

"2d. M. Buat found, that 'in two channels which had the same slope and same propelling force, the velocity was greatest in the channel which had the greatest section relative to its border.'

"3d. To present such a section, which will as nearly as possible conform to the natural bed of the river, so that no dead angles be made, and the water be allowed to flow through the harbor with undiminished volume and velocity.

"4th. At the same time that the third condition is fulfilled, to present such obstacles at different distances as will prevent the passage of ice.

"A plan for an artificial harbor, based on the above principles, would suggest a straight line of wharfing on the thread of the stream; and, if they would stand, iron piles placed at proper intervals, and on lines projecting from the ends, and perpendicular to the line of the wharf. The line of wharf could be built; but at some cost in consequence of the difficulty of removing the old piers, which are formed by bolting together, in the strongest manner, large logs, with the intervals filled with rubble stone, the whole sunk in mud. To determine the practicability of establishing iron posts, at a reasonable cost, to resist the shock from the ice, it is necessary for me to have data, which can only be acquired by a residence at New Castle during the winter season. At that time it is proposed to make observations to determine the mean angle, the velocity and the average size of the fields of ice it will be necessary to resist. With these difficulties in the way, I submit the following plan of operations for the future, as conforming nearest to one which would be preferred, were those difficulties removed; and in asking an appropriation, I beg it may be with the under-

standing, that should subsequent observations justify the hope that the objections can be surmounted, the plan of a uniform line of wharfing and iron piles be carried out.

"It is proposed to open the old sluiceways, cut away all that portion of the old piers included between the red lines and the small projection from the steamboat wharf, (marked O,) and to fill up the intervals on the shore side with common wharfing, and to complete the removal of the elbow 'f f.'

"It is also proposed to sink two narrow piers at the points n, n, marked in red, according to the plan and elevation, a drawing of which is herewith sent. The effects of the first operation will be, to deepen the harbor by restoring, in some measure, the water to its original channel. In its efforts to resume its old course, it may be necessary, in the first instance, to assist the water in removing the mud by the use of the dredge. The position of the pier O has been determined by taking a point that will deflect from the harbor the field of ice brought down by the ebb tides, at the same time it is placed sufficiently near its neighbor to prevent the passage of a mass of any magnitude between them. The position of the pier O has been selected upon the belief that the ice brought up by the flood tide will choke between it and the shore, and form a continuous barrier for miles along the flat reaching down the river, that will deflect the passing fields from the harbor. Subsequent observations may induce a change in the position of this pier. It may deflect the flood tides from the harbor, and at times it may happen that there will not be room in the river for the two fields coming up, which pass on either side of Peapatch island, in which case the weaker must give way, and masses be forced in between the piers O and h.

"The importance to the commercial interests of Philadelphia, and the navigation of the Delaware, of making this harbor one of safe refuge to vessels during the ice season, is well attested by the several acts of the General Assembly of Delaware, and the efforts of some of the leading merchants in Philadelphia. The General Assembly of Delaware passed three acts in relation to this harbor, one in January, 1803, another in 1827, and a third in 1835. The first ceding to the United States the sites of the piers then built, and those to be built; the second making a further cession; and all containing instructions to their Senators and Representatives in Congress to use their exertions to secure the aid of the General Government. In 1838 an act passed the same Legislature, granting a charter for a railroad from New Castle to Wilmington, to establish the connexion in winter between the former place and Philadelphia.

"Taking the average of the past winters, there are two months that the river above New Castle is blocked up with ice, and all navigation stopped. At this point the river suddenly widens; below its navigation is much less obstructed. So far, the efficiency of the ice-breakers propelled by steam above New Castle, is questionable: be this as it may, the utility of establishing this harbor still exists; vessels must seek protection in it while awaiting their turn to be towed up. From a statement of the collector of this port, (appended,) it will be seen that, with the partial protection already afforded, it is computed that no less than two hundred vessels annually, the aggregate tonnage of which is estimated to be thirty or forty thousand tons, sought refuge here from the effects of the running ice. The number will no doubt be greatly increased when the capacity of the harbor is increased, and the protection it affords, made more perfect. The estimate for

completing this work in accordance with the above suggestions, is $42,350, and the amount required for 1840, $18,000."

57. *Delaware breakwater.*—This work is so well known, and has been so frequently described, that I will limit myself to the statement of the amount which the engineer considers necessary for the ensuing year, viz: $280,742; but, in conformity with considerations which have governed in other cases, this item in the submitted estimate is reduced to $150,000.

58. *Building the light-house on the Brandywine shoal, mouth of Delaware bay.*—Nothing further has been done on this work since the last report; because without an ability to expend about $100,000 in one season, there is great danger that all would be lost, for the want of being adequately secured.

The law, also, in the case, obliges the department to pursue the "plan and estimate" made by Major H. Bache, of the corps of topographical engineers. This plan (and probably no other) cannot be carried into effect without the deposite of a great mass of stone, in order to protect the light-house structure; and the small appropriation heretofore made, had it been expended, would, in all probability, have been wasted, from its entire inadequacy to meet the views of the "plan and estimate" recognised as governing in the execution of the law.

It is a misfortune that such expressions should be incorporated in a law, as, however judicious may be the plan proposed, they preclude its investigation and any modification from the knowledge of additional circumstances, and from the light of additional experience.

The able engineer who digested the "plan and estimate," has more than once regretted these embarrassing conditions of the law, and has desired that his plan in a matter of so great importance, might be submitted to the discussion and varied intelligence of a board, but the request could not be complied with, as the law itself adopted a specific plan.

The light-house is to be placed upon a sand-bar exposed to the burst of the Atlantic at the mouth of the bay. Since the passage of the law an application of Mitchell's patent screw moorings to sustain a light-house in such a locality has opened a new field to such objects. An experiment is now making on this plan in England, which, if it should succeed, and of which I have but little doubt, will vastly reduce the cost of establishing light-houses in such localities, and it may possibly enable the Government to establish some similar structure upon the dangerous shoals of Cape Look-out, Cape Hatteras, and Cape Romaine. The objections to it in the locality of the Brandywine shoal, arise from the floating ice of the bay. But were it ever so applicable, it could not be adopted under the existing law. Major Bache has himself suggested modifications to his original plan which will be found in his report, hereunto annexed, (see Appendix A,) but which if approved could not be followed in consequence of the language of the law.

59. *Harbor of Baltimore.*—The work at this harbor is entirely limited to the use of the dredge, for which a sum of $20,000 is required.

60. *Potomac aqueduct, District of Columbia.*—This work is still under the direction of Major W. Turnbull, an officer of this corps.

The amount of interest held by the United States in the Potomac canal, and the large and distinct appropriations which have been made for the aqueduct, place it among Government public works, entitled to the superintendence of its own engineers.

But one pier and a part of the northern abutment now remain to be completed, when the work will be ready to receive the requisite superstructure or aqueduct trunk.

The present contemplation is to make this last of timber, but the piers and abutments, standing upon the solid rock, and being made of the most solid materials, are capable of sustaining a superstructure as durable as themselves.

For boldness in design, success in execution, and economy of conduct, this work is, in my judgment, without a rival in our country, and need not fear a comparison with the works of any other.

61. *Debouches of the Dismal Swamp canal, Virginia.*—The following information on this improvement is taken from the report of the local agent:

"Congress made an appropriation in 1836 and 1837, to improve the navigation of the northern and southern outfalls of the Dismal Swamp canal, in which the General Government holds $150,000 of stock. Deep creek, the northern debouche, when the canal was first constructed, was sufficiently deep and navigable for vessels which at that time navigated the canal, but since the canal has been opened on a larger scale, and vessels drawing six feet water pass through it (the shores of the creek being sandy, and the farms on it being improved by cutting ditches leading into the creek) it has become very shoal, and when southerly winds prevail, vessels are detained at the lock until the wind changes, because the southerly wind causes low tides and the vessels cannot get out until there is a change. Dredging was not attended with success, and the following plan was adopted, viz: to build a dam across Deep creek and hold the water to the point necessary for good navigation at all times, and to cut a canal above the dam across a peninsula two miles and a quarter, and build a lock near Elizabeth river. This debouche will be in 25 feet water, and within less than four miles of the navy yard, and will shorten the distance two and a half miles, making a straight course. Many other advantages in this improvement could be named, but I do not think it necessary to mention them in this report. The canal company agreed to cut the canal from the creek to the lock, which canal is now half done, and is 60 feet wide, and has eight feet water, and the Government agreed to build the dam and lock. For the amount required to complete the work commenced by the Government, I beg leave to refer you to my report of 23d October, 1838, ($28,946 13.) The same is now required as there is no alteration. In that report the two former appropriations were anticipated, ($25,000.)

"The southern debouche of the Dismal Swamp canal is into Joyce's creek, which empties into Pasquotank river. The shoals in these two streams have been dredged out, and the creek has been otherwise improved by cutting off the prominent points of land.

"2. *The progress made the present year.*—The lockpit has been excavated as deep as was prudent, until we have the means to put down the lock. The necessary cofferdams are built, also a railway to receive stone, of which 13 cargoes have been landed and dressed; timber for the foundation of piling, floors, &c., has been received, piledriver built, and derricks made for setting stone.

"The dredge and lighters are kept in good order."

62. *Improvement of New river, North Carolina.*—The sum appropriated for this work and a large portion of the appropriation for Core sound

were expended in procuring the dredge-boats, lighters, &c. The work in New river has not been commenced. The appropriation heretofore made was united with that for Core sound, upon which last the expenditures have been made. Captain McClellan gives it as his opinion that the utility of operations on New river is extremely doubtful. For should the navigation of the river be improved as proposed, there is a bar over which vessels going to and from the river must pass, which is continually changing position, and which is at times nearly dry at low water. Captain A. J. Swift in a report of 1838 also says in reference to this river that he doubts if the objects to be obtained by the improvements are of sufficient importance to warrant the expenditure of the amount which the improvement would require. The estimate of the cost is about $70,000, but in consequence of the opinions just given, no item in reference to this work has been introduced in the submitted estimate.

63. *Improvement of Core sound, North Carolina.*—This is considered as a work of great importance. The efforts of the superintending engineer have been given to the cutting of a passage through the shoal at Piney Point. The dredge-boats were put in activity in February last, and have removed about 14,896 cubic yards of the shoal, when the balance left of the former appropriation was exhausted. About $30,000 are required to complete the work.

The advantages that would result from it are, (Captain McClellan reports,) that "it would afford a safe passage to vessels of a much larger class than can now navigate the sound, and should Ocrocoke inlet close (it is apprehended it will do so) this improvement will make Beaufort harbor the outlet for vessels passing from the rivers emptying into Albemarle, Croatan, Pamlico, and Core sounds. Another advantage, perhaps not less important, would be derived from this improvement; it would provide a safe and easy passage to steamboats drawing five feet water, and enable them to pass from Elizabeth city, N. C., through Pasquotank river, Albemarle, Croatan, Pamlico, and Core sounds, and thus avoid the danger of passing around Capes Hatteras and Lookout. And should the contemplated connexion by a canal for steamboats be made, between the eastern branch of Elizabeth river, Virginia, and North river, North Carolina, a secure passage will be provided to steamboats between Norfolk, Virginia, and Beaufort, North Carolina."

64. *Pamlico river, North Carolina.*—"The improvement in this river," Captain McClellan reports, "was nearly completed before I relieved Captain Swift. All that remains to be done is to draw from the bed of the river the logs which sometimes interfere with vessels navigating. About $2,000 in addition to the balance in hand of $545, it is supposed will be sufficient for this purpose."

65. *Improvement of Cape Fear river, North Carolina.*—"The improvement of the navigation of this river below Wilmington," says Captain McClellan, in his report, "was commenced by the General Government in 1829, and since that time there have been constructed five jettees, and another now in progress will be completed in August next, in all 10,730 feet. A dike has been nearly completed, closing the channel between the western shore and Campbell's island; this dike is 960 feet in length. Before any of the jettees were built on the shoals intended to be removed by them, there was scant ten feet water at high water, and for the passage of the freight of vessels drawing more than this lighters were used. In the course of the

last year, doubts having arisen as to the effect of the jettees, an examination was made by the superintending engineer, accompanied by a committee of the most intelligent gentlemen of Wilmington, and it was found, that, at high-water on these shoals, there was a depth of 13 feet, being an improvement of three feet. This, of course, cannot be said of the water on the lower shoal, which is too low down the river to be affected by the jettees then completed; and already, although three of the system of jettees have not been constructed, vessels drawing nearly as great a depth of water as can be carried over the bars at the inlet, to the river, can pass without difficulty over the bars, the removal of which was the object of constructing the jettees.

"To carry out the original design of this improvement, there remain to be constructed three jettees, in all 3,590 feet; to complete the dike from the western shore to Campbell's island, and to rebuild 1,760 feet of jettees; the expense will be about $40,000.

"Before the jettees were constructed, considerable expenses were had for lighterage over the shoals immediately below Wilmington, and now a lighter is seldom, if ever, used.

"The estimate of the expense of completing the improvement in Cape Fear river is based on the supposition that the jettees are to be *rebuilt* of piles, and to have stone placed against their faces, in the same manner as the one now under construction, and that the same method is to be observed in constructing the jettees yet to be commenced. These plans of construction will continue to be observed, unless experience should prove them to be defective, in which event they will be changed, although at the hazard of an increase of cost; as I consider it would be worse than useless to persevere in errors which experience should expose."

66. *Improvement of Savannah river, Georgia.*—An excellent knowledge of the character of this improvement, and of the work which has been already done there, is to be found in a report from Captain J. K. F. Mansfield, an extract from which is herewith submitted, together with a copy of his estimate for the year 1840:

"The year ending September 30, 1833, arrangements were made preparatory to a plan for the improvement of the river, as follows:

"An officer received his instructions from the undersigned to make an accurate survey and soundings of the river, from above Hutchinson's island to Fourmile point, and commenced his operations. The old dredge-boat sunk in the channel at Savannah was raised, the machinery torn out, and the hull removed; the dredge-boat at Nantucket, Massachusetts, dismantled, and the machinery removed to Savannah river, to be used if necessary, and the hull sold; and preparations were made for constructing a dredge-boat, tow-boat, and mud-flats.

"The year ending 30th September, 1834, the survey and soundings were completed, a plan for the improvement made and submitted, and the dredge-boat, tow-boat, and mud-flats about three-fourths finished, and the machinery therefor in Baltimore subject to order.

"The year ending 30th September, 1835, the obstruction contemplated to be erected between Hutchinson's and Argyle islands was commenced, and some material collected for its prosecution, when it was ordered by the department to be suspended, in consequence of the second article of the treaty of Beaufort, concluded in 1787, between the States of South Carolina and Georgia. For particulars on this subject, a reference is respect-

fully made to the annual report of 1835. The dredge-boat, tow-boat, and mud-flats were finished, and 2,800 cubic yards of sand and mud were removed from the bottom of the channel over the wrecks.

"The year ending 30th September, 1836, application was made to the States of South Carolina and Georgia for authority to proceed with the contemplated obstruction between Hutchinson's and Argyle islands, which resulted in a full grant of authority on the part of Georgia, and a contingent grant on the part of South Carolina, the latter referring the matter to three commissioners, who did not succeed at the times appointed to meet together. 480 cubic yards of sand and mud were removed by dredging from the bottom of the channel, over the wrecks. The steamer Essayons was ordered into Florida by Major General Scott, thereby depriving the operations of the means of towing loaded flats, which, together with other obstacles to the improvement, will be found in detail on reference to the annual report of 1836.

"The year ending 30th September, 1837, 11,232 cubic yards of sand and mud were removed from the channel over the wrecks, resulting in a material improvement to the navigation. This year, the commissioners appointed by the State of South Carolina, relative to the contemplated obstruction between Hutchinson's and Argyle islands, did not meet.

"The year ending 30th September, 1838, the steamer Andrew Talcott was procured to tow the loaded mud flats. 12,200 cubic yards of sand and mud were removed from the channel over the wrecks, resulting in such an improvement of the channel indicated on the map of soundings made this year, as to show a greater depth of water over the wrecks by nine inches than for a distance of about 400 yards just above the wrecks. The commissioners on the part of South Carolina, this year, decided against granting authority to make the obstruction between Hutchinson's and Argyle islands, and thereby frustrated, for the present, the plan for any permanent improvement in this river from the city of Savannah to its mouth. For particulars on this subject, a reference is respectfully made to former annual reports and the plan for improvement.

"During the year ending the 30th September, 1839, the operations of dredging for the working season were conducted under the particular superintendence of Lieutenant H. W. Benham, from the 1st December to the 1st January, and under the particular superintendence of Lieutenant J. H. Trapier, from the 16th January to the close of the season. The disbursements were made by these officers for the same periods. While under the orders of Lieutenant Benham, the Andrew Talcott was snagged and sunk, by accident, on the 16th December, and was not got into working condition till the 16th January. The mud-flats, this year, began to fail rapidly from decay, having been in constant use for four years, exposed to sun and rain, without any material repairs. The dredge-boat leaked more than usual, having never been repaired materially for the four years it had been in use, and such is the condition of both boat and flats at present, as to require repair to much extent before fit for service. Under such circumstances the expenditures for repairs have been great, and the occasional interruption from that cause more frequent. 9,700 cubic yards of sand and mud have been removed from the channel just above the wrecks where the dredge was kept at work, resulting in an undoubted improvement at that place. It is apparent, therefore, if the operation of dredging is to be continued, as it undoubtedly should be, until the obstruction for the perma-

nent improvement can be effected, an entire new dredging-boat and flats should be constructed in addition to the repairs of the present dredging-boat, as the steamer, Andrew Talcott, can as well tend two dredging-boats as one, and the navigation to Savannah will require the full power of both to be kept in a manner commensurate with the commerce of that city. An estimate for the year 1840 is hereunto appended.

"During the year the operations have been conducted with a view to system, efficiency, and economy, and on a reference to the returns and records there will be found no appropriation for the year 1839.

"Available for the 4th quarter of 1838, and the year 1839 -	$16,145 06
Expended during the year ending 30th September, 1839, inclusive of average - - - - -	9,956 75
In Treasury undrawn, 30th September, 1839 - -	6,465 00
Due agent, 30th September, 1839 - - - -	224 24
Available for the 4th quarter of 1839 and the year 1840 -	6,244 76

"Thus showing a deficiency of funds to make the necessary repairs, and continue the operations to the 30th September, 1840, without an additional appropriation.

"*Estimate for new dredge-boat and four new flats.*

Hull of dredge - - - - - -	$2,500 00
Engine for dredge - - - - - -	2,500 00
Machinery for dredge - - - - -	3,000 00
Putting up of engine and machinery - - -	2,000 00
Four decked flats with hoppers - - - -	2,000 00
Total -	12,000 00

"*Estimate for repairs of old dredge-boat and four new flats.*

Repairs of dredge and machinery - - -	$2,000 00	
Four new flats - - - - -	2,000 00	
		4,000 00

"*Estimate of the cost of keeping one dredge-boat and steam tow-boat in operation for one season of nine months.*

Pay and subsistence of two captains, two mates, and two engineers, and twelve hands for nine months -	$6,500 00	
Wood for engines - - - -	3,000 00	
Unforeseen expenses - - - -	500 00	
		10,000 00
"Required by appropriation, 1840 -		26,000 00

67. *Improvement of the inland navigation between the St. Mary's and the St. John's, Florida.*—As a very clear exposition of the work, in this case, is given in the report from Captain Mansfield, an extract from the same is hereunto appended:

"The year ending September 30, 1835, the undersigned was instructed in March to examine this pass, in person, and to prepare a project of opera-

tions for the approval of the department. An examination, in person, accordingly took place in June, and a partial project was submitted and approved by the department, and arrangements entered into for the construction of a dredge-boat and mud-flats and the necessary machinery.

"The year ending September 30, 1836, a dredge-boat, two mud flats, and one wood-flat were completed, and placed at work at Amelia dividings, at the south end of Kingsley's cut: 1,300 cubic yards of sand, shells, and mud, were removed from the bottom of the channel-way at this place, resulting in a material improvement of the navigation. A fruitless effort was made to obtain a complete survey of this pass.

"The year ending September 30, 1837, a channel was cut through the oyster bed between the 'Sisters,' near the St. John's river, for a breadth of seventy feet, and a depth of three feet below ordinary low water, over a distance of 680 feet, removing therefrom 2,990 cubic yards, and affording a free passage at half-tide for steamers and vessels drawing six feet water. This year the operations were interrupted by the removal of the dredge-boat, flats, &c., up the St. John's river, by order of Major General Jesup, commanding in Florida, and a heavy gale that drove the same ashore, high and dry, after their return from the St. John's river. An unsuccessful effort was this year made to obtain a complete survey of this inland pass.

"The year ending September 30, 1838, very little was done to the further improvement of this navigation for reasons hereafter following. On the 1st October preparations were making for the removal of the dredge-boat, &c., to the St. John's river, to remove the bar at the outlet of Lake George, and under the commanding general in Florida, agreeably to the orders received from the department, and in a few days after, they were towed up the St. John's river accordingly. The 2d April the dredge-boat, &c., were returned to the command of the undersigned, after having accomplished the object, but with flats, boats, and all the machinery in a bad condition, requiring repair; the smoke-stack rusted and burnt out, and the boilers so weak as to render them unsafe, and accordingly they were condemned. The boats, flats, &c., when repaired were removed from the 'Sisters,' where they were left, to Talbot dividings, and the hands set at work removing obstructions of sand and shells till new boilers could be procured. The additional dredge-boat, for which appropriation was made this year, was not constructed in consequence of the late day in which the appropriation was made.

"During the year ending September 30, 1839, the operations have been confined to the deepening of the channel-way at Talbot dividings, and have progressed as follows: On a reference to the last annual report it will be seen that new boilers, smoke stack, &c., were required for the dredge-boat; they were ordered, and arrived in St. Mary's on the 9th November, and were put in the boat, complete, in working condition by the 30th November, from which time, to the 14th September, the dredging met with no material interruption. 6,600 cubic yards of mud and shells were excavated and removed from the channel way, resulting in deepening the same for a distance of about 800 feet in such a manner as to admit vessels at half-tide which previously required high water. On the 14th September the machinery of the dredge-boat was stopped, as the buckets on the inclined plane were worn out, as well as the rollers, bottom, drum, links, &c. This condition of the machinery was foreseen, and, as early as the 16th April, orders

were sent to Baltimore for duplicates, most of which have arrived, and are being substituted for the wornout parts. It is expected that the residue will arrive soon. In the intervals, while waiting for the arrival of boilers at the commencement of the year, and for machinery at the close of the year, the hands were employed at low water, removing oyster beds, &c., from the channel-way, that could be advantageously done, and in staking out the channel-way through the extensive marsh in which it is located.

"It must be here observed, that no expenditures have this year been made on account of the additional dredge-boat, &c., recommended in the report of 1837, and appropriated for in the year 1838; inasmuch as the engineer department having transferred this improvement to the topographical engineer department, directed it should be suspended till that department was prepared to act on that subject.

"The following is a summary of the expenditures of 1839:

No appropriation in 1839.

Available for the 4th quarter, 1838, and the year 1839,	$29,369 96
Expended during the year ending 30th September, 1839,	8,444 90
Available for the 4th quarter, 1839 and for 1840,	20,928 66
Of this available fund in treasury,	20,260 07
In hands of Captain J. Mackay, as agent, 30th September, 1839,	668 59

"Thus showing funds insufficient for the construction of the additional dredge-boat, &c., and the service of the present dredge during the year ending 30th September, 1840.

"The operations have been conducted as heretofore, with a view to efficiency, system, and economy; and the records of all transactions relative thereto have been kept at Fort Pulaski.

"Orders were received from the department, under date 22d August, 1839, requiring these operations to be turned over to the command of Captain John Mackay; but owing to the absence of the undersigned at the north on duty, it could not be effected till after the close of the fiscal year. Funds, however, were remitted to Captain Mackay, a part of which he turned over to the undersigned to pay up the balances due at the close of said year."

As the balance in the treasury will probably be sufficient for the operations of the next season, no additional estimate is submitted.

68. *Improvement of Mobile harbor, Alabama.*—The following extracts taken from the report of Captain C. Graham, together with a copy of his estimate for the year 1840, will present a summary of operations up to the present time, and an estimate of the funds required for the continuation of the work:

"The channel, leading to Mobile, has been obstructed by two bars, both of soft mud and sand; the upper one across Choctaw pass, about one mile and a half below the city of Mobile, originally having, at low water, not more than 7 or 8 feet; the other, Dog river bar, about five miles below the city.

"*Choctaw pass.*—When I took charge of the improvement of this harbor, on the 1st of March last, a channel had been dredged across this bar 11 feet in depth and 120 feet wide. It has since been completed to the depth of 12 feet, with the exception of a few lumps usually remaining after the operation of dredging, and which will soon be entirely taken away. Buoys have been set down, distinctly marking the channel. The distance cut out, across the bar, is 2,836 feet.

"*Dog river bar.*—Although about 8½ feet of water can be carried across this bar, yet it presents a more serious obstacle to large vessels destined for

the port of Mobile, than the upper bar, measuring, in the most advantageous direction across it for opening a channel, 8,508 feet, from 12 feet water on one side to the same depth on the other. At the time that these works were turned over to me, the direction of the channel to be cut had been marked out by the officer previously in charge of them. Subsequent observation has convinced me that the most suitable position had been chosen by that officer, Captain Barnard, of the corps of engineers. I have accordingly driven piles along each side of the channel to be dredged, at intervals of 300 feet, marking it out distinctly for the direction of the contractors, who commenced dredging in May last with one machine, and intend adding the dredge-boat now employed on Choctaw pass, as soon as that channel is completed. The width to be given to this channel is 220 feet, and the depth the same as the upper one, 12 feet. The whole quantity to be excavated will not fall short of 200,000 cubic yards. It will be perceived, by reference to the accompanying statement of unexpended balances and estimates for the current year, that another appropriation will be required for carrying on the work."

Estimate of funds required for the improvement of Mobile harbor for the year, commencing September 1, 1839,

Amount retained in paying for Choctaw pass, - -	$2,213 68
20 per cent. retained in paying for Dog river bar, - -	2,320 00
Excavation, 9,000 cub. yds. per mo., 108,000, 80 at cts. -	104,400 00
Clerk and superintendent, 365 days at $5 per day, -	1,825 00
Surveyor, 365 days at $3 per day, - - -	1,095 00
2 assistants, 365 days, at $2 per day each, - -	1,460 00
Office rent, $30 per month, - - - -	360 00
6 boatmen, at $45 per month each, - - -	3,240 00
Contingencies, - - - - - -	3,000 00
	119,913 68
Balance in hands of treasurer, - - - -	64,463 00
Sum to be appropriated, - - - - -	55,450 68

69. *Mouths of the Mississippi.*—The report of Captain H. Talcott, of the 15th February, 1838, to be found at page 224 of Senate Document No. 1, of the last session of Congress, contains a history of the proceedings in reference to this work up to that date; and in February last the reports of the survey, together with the maps, were deposited in this bureau.

The work of dredging was discontinued in the month of April last, the small balance of the former appropriation being exhausted. The dredge-boat and its tenders were then withdrawn, all hands discharged, and the boats were laid up in the vicinity of Mobile, to await the future action of Congress. Should additional appropriations be granted they are ready for use; but if not, it would, I think, be advisable to sell them, as they are subject to rapid deterioration in their present condition.

The only plan which has been put in practice in order to deepen the mouths of the Mississippi, has been in the use of the dredge. What would have been its effects, if it had been persevered in, is now difficult to say, as it had to be discontinued for want of funds, before its utility was sufficiently tested.

The problem of deepening the mouths, or any one mouth of the Mississippi, is not only of great importance, but of great difficulty, involving also a vast expenditure. It is one, also, which has attracted no small degree of attention, and upon which engineers of great ability have given opinions, all, however, conflicting with each other. Any plan proposed will be expensive. A work of this kind cannot be accomplished without an expenditure commensurate with its character and difficulties; nor can the expenditure be divided into small annual amounts. The work, to be successful on any plan, must be prosecuted with energy; otherwise there is great danger that the river would gradually modify itself in accordance with slow operations, without any beneficial modifications of its peculiarities.

At a distance of about 20 miles below Fort Jackson, according to Capt. Talcott's survey, the river loses its character of one united stream, and divides itself into three distinct branches. This point may be considered as the commencement of the Delta. These branches are designated as the *Northeast pass*, the *South pass*, and the *Southwest pass*. The first is the widest channel. At about 4½ miles from its point of divergence from the main stem, it throws off a large branch towards the east, called *Pass-a-Loutre;* and adjacent to the bar it again divides itself into two passes, the smaller of which is called the *Southeast pass*. But neither the *Pass-a-Loutre* nor the smaller Southeast pass just named, admit of more than from 6 to 8 feet of water over their respective bars. There are various small bayous to each of these passes, but of inconsiderable width and extremely shallow. The entire length of this pass, (the Northeast,) by its principal outlet, and to 18 feet water on the outside of the bar, is about 15 miles. The shoalest water on this bar, in the channel-way, is noted at 12 feet; and the length across the bar, from 18 feet depth inside to the same depth outside, does not equal 4,500 feet. The second (the South pass) is the narrowest of the three. This pass is in the prolongation of the line of the river; it divides itself also into several small bayous before arriving at the gulf, and has a length of about 12 miles to a depth of 18 feet water outside; but it has not more than 8 feet of water over its bar. The third, or Southwest pass, is about 16 miles long from its origin, to a depth of 18 feet water outside. Its discharge is aided, also, by several small bayous, but none of size or note except the one on the west, immediately adjacent to the bar, too narrow, however, and too shoal for use. The length of this bar from the 18 feet curve inside, to the 18 feet curve outside, is about 6,500 feet.

A singular peculiarity of all these passes is, that they may be considered channels through the shoal water of the gulf, as the narrow belts of very soft mud, in many cases not over 500 feet wide, rising but little above the common water of the river, and overflowed in high freshets, which marks the outline of these channels, can scarcely be called terra firma.

The bars at the mouths of these passes may be considered as formed from the earthy matter brought down by the river, a part of which is deposited by the river diminishing its velocity on coming in contact with the waters of the gulf, and also from precipitation of the earthy matter, which there is reason to believe takes place on a mixture of the salt water of the gulf with the fresh water of the river; also, from the reaction of the surf of the gulf upon the river. Careful observations do not indicate the existence of any littoral current, as the deposite forms uniformly, in all directions, around the mouths of the outlets.

Three different plans for improving these outlets appear to have attracted attention: first, to close up at the termination of the main trunk all the passes but one, and thereby to force the entire stream into this one pass.

I do not see how this plan would produce any other effect than to prolong the main trunk into one of the present passes, where, from the same cause which produced the division before, the river would again divide itself into separate passes, producing, in time, a formation not dissimilar from that which now exists. The shores of these passes are equally as soft, if not softer, than those of the main trunk at the present dividing point, are very low, and now equilibrate only with the velocity of the water which passes through them. Increase this velocity, and the sides or bottom, or both, must yield, and more probably the sides, which are overflowed in freshets, and which are exposed to the top, and greater velocity of the stream. To my judgment, therefore, this plan would produce no good results upon the bar, as the stream would, in all probability, be again divided into different passes, before its waters would reach the bar at the gulf.

The second plan is to stop up the bayous of one pass by brushwood and fascines; and then by a work of a similar kind, to confine the passage of the stream over the bar, trusting to the increased velocity thereby obtained, as a power to gouge out and remove the present bar.

The general reasoning involved in this plan is certainly highly creditable to the talents of its projector, nor are his notions without the support of experience in other countries. But how far the plan would be successful in the peculiar locality in which it is contemplated to apply it, is a matter of extreme doubt. Its first effect would be, to my apprehension, to raise the water in the pass, or increase its velocity, which, acting upon the present soft shores, would probably break through them, unless these, throughout their weak parts, were strengthened also by fascine and brushwood.

Supposing all this to be done, and the artificial channel formed across the bar, its effects would be to remove the outlet of the pass, or its present point of contact with the gulf, from its present position inside of the bar to the new position at the other extremity of the new channel, where the same causes which form the present bar still operating, as they would be, I can see no reason whatever, why the bar should not reform, and thus require a continuation of this fascine and brushwork without end.

If, however, a limited experiment were to be made on the plan, I do not agree with its intelligent projector that the Southwest pass would be its best locality. An examination of the map indicates the Northeast pass as a more favorable position. Brush and fascine work might be applied to close the small southeast arm of this pass, the one existing near its outlet, the effect of which would be to force the water, which now goes by the way of that arm, over the bar of the main outlet, and the consequences of the experiment carefully observed, might furnish most valuable data for future operations.

The third plan is the use of the dredge. It has the advantage over each of the others in this; that if it does no good it will do no harm, which really in a matter of this kind, involving such great interests, and invested with so much doubt, appears to me to be a consideration of no small degree of importance. All of these plans are experiments, and, as before remarked, to give a probability of success to either, the work must be pursued with becoming energy and an adequate force.

To dredge with effect, the power applied must be equal to opening the contemplated channel, and to removing the deposites continually made. The amount of these deposites then becomes an important element in the consideration of the plan.

The usual way of ascertaining the deposites by collecting some of the water of the river in a vessel, and then deducing the amount deposited from what is found in the vessel, from a quiescent state of the water is, I think, erroneous. The Mississippi carries its waters and a velocity far into the gulf, and must carry a mass of its earthly matter with it. Hence any deduction of the deposite, from a sediment found in a bucket, or other vessel, in which the water has been allowed quietly to make a deposite, would give a result, which applied to the formation of the bar, would lead to erroneous conclusions.

The deposite must be least in the direction of the stream, from the current which exists there, and greatest in the eddies, and in the comparatively still water spaces between the different bars. In the channel way, or main direction of the stream over the bar, a sort of equilibrium becomes established, between the current of the river and the causes which form the bar, resulting in a general uniformity and durability in the character of the bar; the principal deposite taking place on each side and forming the extensive shoals which are found to exist between the several bars.

The deposite in the direction of the stream, is most probably made on the outside slope of the bar in immediate contact with the gulf, the inside slope of the bar being at the same time, proportionally removed. Without these, or some similar suppositions, one cannot well account for the uniformity of character which these bars are known to have preserved for many years, their gradual extension into the gulf, and the total absence of shoals above the bars, in the passes, and where these bars must at one time have been.

The question then is, what is the actual periodical deposite, or extension of the bar into the gulf. Careful observations through a series of years can alone answer this question correctly. But we are without such and in their absence must resort to the best information in our power and see to what consequences it will lead.

A pilot who has lived 19 years at the balize, states that the Mississippi has pushed its bars into the gulf of Mexico two and a half miles in that period, which would be equivalent to about 695 feet per year.

Another authority, to be found in page 77 of a small pamphlet published by the Chamber of Commerce of New Orleans, states "the bar is now one quarter of a mile farther at sea than it was five years ago." This remark has particular reference to the Southwest pass, and the result is equivalent to an extension of 264 feet per year. The great discrepancy between these two results, it must be admitted, tends rather to destroy confidence in either, although, at the same time, the authority for the latter justifies the supposition that it was obtained with the most care, and is therefore the most to be relied upon.

But in discussions of this kind, the safer rule is to adopt the most unfavorable fact, on which account we will apply the reasoning to the greater quantity, namely 695 feet.

Now applying this quantity to the Northeast pass, the amount of deposite which would take the 18 feet curve 695 feet into the gulf in one year, is to be ascertained. But this would, however, vastly exceed the amount of annual deposite which would have to be removed by the dredge, as the dredge would only have to act upon as much of it, as would give to the

contemplated channel its desired depth and width, which, on the supposition of a uniform shape to the bar, or one similar to its present shape, would be no more than a deduction, from the profile of that shape for 695 feet interior from the present outside 18 feet curve, in conjunction with the desired dimensions of the channel.

Applying these considerations to the bar of the Northeast pass, and on the supposition of a channel 18 feet deep and 300 feet wide, the amount of annual deposite to be removed, would be 49,462 cubic yards, and which would be the amount that the dredge would have to remove in addition to the excavation of the contemplated channel.

The entire channel way on the foregoing suppositions of width and depth, and of the distance given between the 18 feet curves inside and outside at the Northeast pass, would be 4,500 feet long; to form which, according to the profile of the bar, would require the excavation of 195,370 cubic yards.

It cannot be expected, in a soil like that of the bar, that the made channel would maintain its integrity, or that the material of the bar, would not slide into the channel, from the edges of the cut. I will suppose the sliding would be equal to the contents of a triangular prism, on each side of the cut, extending horizontally 50 feet from the edges of the same. The whole cut would, therefore, be equivalent to one of the width of 350 feet; 18 feet deep, and 4,500 feet long, under a profile in conformity with the soundings of the bar. These considerations, would make the total excavation for the channel way equivalent to 231,514 cubic yards.

The redeposite would also be made in this additional width, on account of the slope of the sides of the channel, which should also be taken into account, and which, for the entire width, would constitute the annual redeposite to be removed, equivalent to 63,072 cubic yards.

These last two amounts, added to each other, make a sum of 294,586 cubic yards of the soil of the bar, upon which the dredging-machines would have to act, and which, to keep the reasoning in harmony with the supposition of controlling the yearly deposite, and also to keep it in harmony with my judgment, that the experiment to be efficient, should be prosecuted with energy and an adequate force, should be excavated and removed in about one year.

We have, therefore, according to the foregoing suppositions, the probable amount to be excavated, and the time in which it should be done. We will now compare these data with the power of the dredge, and the number of dredge-boats which would be required in order to accomplish the work.

Major Chase, in his report of the 9th of February, 1837, supposes that the dredge-boat may be kept at work on the bar 180 days in the year, or 15 days per month, and Captain Talcott, whose experience in making the survey of the bars, ought to give his opinions great weight, states, that there are at least two months in the year, in which the hands should be withdrawn from much exposure, or else they become completely ineffective from sickness. This will reduce the working period to ten months, which, at the rate of working days previously stated, would make the latter for one year, 150 days.

This number of 150 days, should yet be subjected to another deduction of at least 50 days in the year, from accidents to the machinery of the dredge, and to the discharging tenders and tow-boats. From all which, we may state 100 days as the actual number in a year, in which a dredge-boat may be kept in activity on the bar.

Now, if we suppose the dredge-boat equal to the labor, (that is, the effective labor by proper attention and activity in the discharging boats,) of 100 cubic yards per hour, it will, on the supposition of working ten hours in a day, be equivalent to the daily excavation of 1,000 cubic yards, or in a year of 100 days, be equivalent to 100,000 cubic yards.

But we have seen that the amount to be excavated, is equivalent to 2,945 86 cubic yards, which would be much beyond the power of two such dredge-boats as we have supposed, and nearly equal to that of three.

The quantity to be excavated, has been calculated with some care from the soundings on the bar, and the supposed power of the dredge may be considered as a maximum, from the depth of water in which it will have to operate: on these accounts, I am unwilling to say that less than three dredge-boats would be adequate to a fair experiment upon this plan; with three, two may certainly be kept in constant activity, whenever the weather will admit.

The next question, is the probable cost of this plan?

One dredge-boat has been already provided with its discharging tenders and tow boat. It will require, however, two additional discharging tenders, which, at $12,500 each, will cost - - - $25,000 00
For repairs and modifications to the present equipment - 20,000 00
Two additional dredge boats at $50,000 each, - - 100,000 00
And 8 discharging tenders of 120 tons each, for the two additional dredge-boats - - - - 100,000 00
Two additional steam tow-boats to conduct the discharging tenders to places of discharge, and back to the dredges - 40,000 00

$285,000 00
Contingencies - - - - 20,000 00

Total - - - - $305,000 00

These dredge-boats should never be idle when able to work, for the want of discharging tenders, and as the load has often to be towed to a distance to be discharged, it may be necessary to increase the number of tow-boats.

The expense of keeping one dredge-boat in activity and ready for use, is about $7,000 per month, or $21,000 for three, which in one year, would be $252,000. All persons employed, have to be paid as well on days when work cannot, as when it can be done. This amount, added to that for cost of the boats, &c., as previously stated, will bring the first year's expense to $557,000.

But the supposition is, that with this expenditure, an 18 foot channel can be excavated across the bar: which, should the expectation be realized, will not, I believe be considered an expenditure incommensurate to the object obtained.

The channel being made, however, will not keep open of itself. The same causes which formed the bar, are still acting, and will continue to act. But the channel being opened, the redeposites in the same, will, I think, be perfectly within the controlling power of one dredge, which can be kept at the station. How experience will modify any of these suppositions, it is impossible to say. The object to be accomplished, is very great—the power to be encountered, equally so; and, whether this latter can be successfully managed by the art of man, is the very experiment to be tried.

I have now treated summarily of these several plans, having gone more into detail in reference to the last, as it is the one which has already received the favorable action of the Government.

That either will probably be successful, would be presumption in me to assert; but, that the last will most probably be so, is, undoubtedly, my present opinion. A singleness of view to the great object to be accomplished, will not, however, turn its back upon any method, but will avail itself of any apparently adapted to aid in effecting the great object. On this account, I would recommend a union of the brush and facine work, with the action of the dredge, by the application of the former to close the small southeast outlet—the one which leaves the Northeast pass, immediately adjacent to the bar.

There is another view connected with this subject, having, however, no action upon the mouths of the river, but which it may be proper to bring to your notice. I allude now to the project of cutting a ship canal from the Mississippi, a short distance below Fort Jackson, and connecting the same with the deep water of the gulf, near Sable Island reef. The direct distance across to the reef, from a point on the river, about four and a half miles below Fort Jackson, is about six and a half miles, and 18 feet of water is found within 1,730 feet of the western point of the reef. The idea of the canal is due to Major Buisson, and is one of those bold conceptions which characterize genius, but which are also frequently beyond the Executive disposition, if not the means of the age.

Strong objections have been urged against the measure, from the great difficulty, except at an enormous expense, of obtaining foundations for the necessary guard locks. And judging from the character of the soil, if soil it can be called, through which the canal would have to pass, I should not apprehend less difficulty in making the excavation, and in keeping it free when made, as this soft soil, to my judgment, would be continually bulging, or rather floating in from the sides and bottom of the cut. If abundance of good clay were at hand, and the whole line, to a proper depth and width, were artificially consolidated by its application, a canal that would endure might then be excavated through this artificial bed, but in the present condition of the soil of the proposed line, I should doubt if such a result were practicable, even at the high estimate of ten millions, which has been hazarded in the case. The subject is, however, one of singular interest. The canal would communicate with a fine bay of deep water, passing without obstruction to the gulf, exposed only on its eastern side, where I think it would require the protection of an adequate breakwater.

In speaking of the soil through which the canal would pass, Captain Talcott says in his report, "the perforation of the ground to a depth of 40 feet, indicated a firm bottom of sand mixed with mud, tenacious of water, and altogether such as would be considered favorable for excavating, and on which there would be no difficulty in securing a foundation for locks or structures of any kind." That is, at a depth of 40 feet below the surface, a bottom, such as is described, was found to exist. There can be no doubt, if this bottom was adequate to sustain the locks, that the depth at which it is found would constitute no insurmountable difficulty, because Major Turnbull, of the corps of topographical engineers, has succeeded in establishing foundations for the piers of an aqueduct over the Potomac, in the middle of that river, and 38 feet below its high-tide water, upon the solid

rock. But still such a bottom, at this depth, does not relieve the excavation of the trunk of the canal from its difficulties.

However, I do not think the examination of the soil of the line was such as to justify any canal project; in my opinion, an examination far more thorough than it was in the power of Captain Talcott to make, under his many other and pressing engagements, should be made, before any plan or estimate is furnished.

How far the views of Major Buisson might have been modified, when he originated the idea of this canal, had a familiar knowledge of railroads been as extended then as now, would be extremely interesting to know. There can be no doubt, if the sole object be to connect the deep water of the Mississippi with the deep water of the gulf, that a series of railways, occupying what would probably be the best site for the canal, would effect this object at the least possible cost. This plan, however, like that for the canal, yet not more so, would require a breakwater to protect the shipping in the bay, between Sable Island reef and Isle-au-Breton, from eastern weather. Its expense, however, would be so much less than that of a canal, that there is no doubt with me, the railroads, as well as the breakwater, would be made for about what the canal would cost.

The effects would be to create places of deposite at each end of the railroads, where vessels would have to break bulk, and the freight pass over the roads.

Each plan is, however, subject to a very weighty objection, independent of considerations in reference to the construction of either; which is, that both would be alike exposed to the maritime efforts of an enemy, and would involve the Government in enormous expenses for their protection. This consideration, and all of its consequences, would, in my judgment, justify the Government in the rejection of both, and would turn all its views back to the previously exposed methods of improving some one of the passes of the river.

The foregoing completes the exposition of the harbor and river improvements, which are being made upon the Alantic and gulf frontier. I shall now bring to your notice those in the interior, being also river and harbor improvements, the latter chiefly on the great western lakes.

WORKS ON LAKE CHAMPLAIN.

These consist of a breakwater at Burlington, a breakwater at Platsburg, deepening the passage between the Hero islands, and the improvement of the harbor at Whitehall.

The inspecting officer, Major J. D. Graham, gives the following statement in his report in reference to these works:

70. *Burlington breakwater.*—"The unexpended balance of the last year's appropriation for this work enabled the agent for its construction to resume the operations upon it on the opening of spring, and they have been prosecuted with vigor throughout the present season. Since the 1st of May last, four cribs of 100 feet long each, have been put down, three of which are now nearly finished, and will be quite so by the end of the present month (November). The fourth is already filled with stone, so far as to secure it in its position. The work now presents a line 900 feet long, resting upon a firm and even bottom, at a depth of 30 to 32 feet water on the interior side, and in its present unfinished state, affords very

important protection to the commerce of Lake Champlain. Many vessels have found a safe and smooth anchorage behind the work during the prevalence of northwest, west, and sonthwest winds, which have a sweep of ten miles across the lake, creating a heavy sea, and rendering it heretofore extremely hazardous to attempt to land, or to ride at anchor off the Burlington wharves.

"The plan of the work appears to me to be judicious, and, when completed to the extent contemplated, will doubtless secure to the increasing commerce of the lake all the advantages anticipated by its projector.

"The cribs are made 100 feet long, 50 feet wide at the bottom, and 35 feet wide at the water's surface, having a slope on the interior side of about 65 degrees with the horizon. The exterior side is perpendicular. From the water's surface the work is built up perpendicular, both upon the interior and exterior sides, for an additional height of 8 feet, making a total height of 40 feet from the bottom, presenting an entire vertical wall on the exterior side to resist the force of the waves. By a reference to the report of Major H. Bache, of the corps of topographical engineers, of February, 1834, who executed the surveys for the harbor improvements on this lake, I find this plan of presenting a vertical wall, to resist the action of the waves, particularly recommended. It has so far proved advantageous as regards this work, no part of it having yet suffered injury from the force of the waves during heavy gales of wind.

"All the funds appropriated for this work will have been expended at the close of the present working season, and I beg leave to recommend that a farther appropriation be asked for, in accordance with the estimate of the local agent, Mr. Haswell, in order that it may be advanced as far as practicable during the next year. There now remain 1,100 feet in length to be constructed in order to complete it. The materials which have been used upon it are all of excellent quality; they have been obtained at fair prices and the work has been faithfully done. The additional estimate for this work amounts to $50,000."

71. *Plattsburg breakwater.*—"The operations for this work have been suspended the present year for the want of an appropriation. It has already been raised above the level of extreme high water, or within two or three tiers of timber of what is intended to be its upper surface, for a distance of 708 feet in length, reckoning from its southwest extremity. The cribs that have been sunk, are well filled with stone, and are firmly secured in position.

"The plan of construction is nearly similar to that pursued for the Burlington breakwater, presenting a vertical wall to resist the action of the waves. It is placed in 20 to 22 feet of water, and is designed to be 1,500 feet long when finished.

"This work also begins to afford very important advantages to the commerce of the lake, in the protection it offers to vessels from the violent easterly winds which sometimes prevail on the lake. There is sufficient timber now on hand for the construction of a crib 150 feet long, and I would recommend that an appropriation be asked for the continuation of the work on the opening of the ensuing season, with a view to its completion as rapidly as practicable, the estimates for which will be furnished by the local agent for this work, Mr. C. Watson."

This estimate calls for $50,000.

72. *Improvement of the Hero channel.*—"The operations for deepening this channel between the north and south Hero islands have not been continued this year because it was more important to the public interests that the dredging-machine should be employed, as it was during the season, for the improvements at Whitehall.

"By this arrangement great advantages have resulted in removing some of the most serious impediments to the navigation at and near Whitehall, while no inconvenience has been experienced in regard to the Hero channel, for the reason that the lake remained throughout the summer and autumn about two feet higher than usual. This circumstance combined with the effect of the dredging last year, gave constantly a sufficient depth for the navigation through that channel. As it is only once in many seasons that the waters of this lake remain as high as they have done the present year, the dredging of this channel will be resumed at the earliest practicable period next spring, and it is expected that, with a small addition to the balance now on hand applicable to this object, a sufficient depth may be produced by dredging, next year, to ensure the safe navigation of this channel at the lowest stages of the water."

The amount required, in addition to the balance on hand, is $2,000.

73. *Harbor of Whitehall, N. Y.*—"The unexpended balance of the last year's appropriation for the improvements at Whitehall, has been applied with great industry by the local agent, during the past season, to the excavation and removal of the sand and other alluvial deposites which had so far accumulated in Wood creek, between the town and the Elbow, (as it is called,) as to prevent steamers and other vessels of the larger classes navigating the lake, from approaching within more than half a mile of the proper landing places. This caused great inconvenience both to the travelling and the commercial community upon so important a line of communication, and was for sometime a subject of great regret and loud complaint. I have the satisfaction to state that the evil has been so far remedied by the operation of dredging, as now to afford a channel quite up to the wharves and landing places, of from 9 to 12 feet at low water.

"The most serious impediment now existing to the navigation near Whitehall, is the very short and narrow turn opposite to the mouth of Poultney creek, known by the name of the 'Elbow.'

"On approaching this point, steamers and other vessels are compelled to slacken their speed, and to make use of bow and stern hawsers, communicating with the shore, in order to weather it.

"In the case of two vessels, bound in opposite directions, meeting at this point, it would be extremely difficult, if not impossible, for them to pass each other.

"The obstacle is one which causes constant delay and perplexity in the navigation, and ought to be remedied immediately, which can no doubt be done at a very small expense. With a view of obtaining exact information of the most feasible mode, and the quantity of work necessary for effecting this object, and also to show the exact capacity of the channel since the late operation of dredging, Lieut. Humphreys, of the corps of topographical engineers, was directed to make a minute survey of this position and its vicinity, including the village of Whitehall, and extending a sufficient distance below the 'Elbow.' This duty has been performed in the most satisfactory manner by that officer, and he is now occupied in completing his map, and the necessary plans and estimates, all of which I have

directed him to submit to you when finished, being myself under orders for duty at a distant point, where I shall no doubt be occupied during the ensuing winter.

"I beg leave here to recommend that the necessary appropriation for effecting this improvement may be asked for."

The amount of the estimate is $10,000.

"The importance of continuing the works upon this lake it is presumed is sufficiently evident, both in a commercial and a military point of view. The great scarcity of natural harbors, or positions affording safe anchorage to vessels in boisterous weather, especially upon the widest portions of the lake, makes it indispensable that the defect should be remedied by artificial works."

WORKS ON LAKE ONTARIO.

These consist of harbor improvements at Black river, Salmon river, Oswego, Big Sodus bay, Genesee river, and Oak Orchard creek.

74. *Piers at Black river, Jefferson county, N. Y.*—The operations for prosecuting this work were resumed in August last, and were continued, under the superintendence of Lieut. J. E. Johnston, of the corps of topographical engineers, until the small balance of the appropriation appertaining thereto was expended.

At the close of the last year's operations, the north pier had been carried out 2,719 feet from the shore, 1,330 feet of which were raised only to the surface of the water. The south pier had been carried out, up to the same period, to a distance of 2,408 feet from the shore, 210 of which were raised to the surface of the water only.

Since August last, Lieut. Johnston reports, that 42 cribs of 30 feet long and 10 feet wide have been added to the north pier, and 10 cribs of like dimensions, have been added to south pier. These 52 cribs have been placed in water, varying from 3 to 10 feet in depth, and raised only to the surface of the water, and filled with stone.

The total extent of the north pier is now, therefore, 3,979 feet, of which 2,590 feet are raised only to the surface of the water, and the total extent of the south pier is 2,708 feet, of which 510 feet are raised only to the surface of the water.

The effect of that portion of the work which was erected last year has been, by contracting the width of the channel, and increasing the velocity of the current from Black river, to deepen the channel included between the piers as much as 4 or 5 feet, and now as much as 9 or 10 feet are found between those piers.

Those cribs that were constructed the last and the present year were made open at bottom, in order that, if the soil about them, which is here soft mud, should be displaced by the action of the current, the stone might settle in its place and prevent the cribs being overturned. When the stone subsides the cribs are again filled at top, and in this manner, it is believed, a firm foundation will be formed at a depth not to be affected by the current. Those cribs that were erected the first year were closed at bottom, and some of them belonging to the south pier, near the shore, have been undermined by the current, and have sunk considerably. No serious damage has yet resulted, but the other mode of construction is preferred, where the bottom is yielding and a strong current is to be encountered.

An estimate was submitted to the department last year, by Lieutenant Johnston, of the funds required for the completion of this work, to which I beg leave to refer, and to recommend that the sum therein specified be asked for.

The estimate is for an amount of $22,000.

75. *Mouth of Salmon river, New York.*—The local agent, Mr. Pettes, reports: "That portion of the work laid down last year, although in an unfinished state, has stood the test of the storms of the fall and spring without injury. The settling has not been as uniform as was hoped for; indeed, on the river side of the southwest pier the cribs remain from four to six feet, while on the lake side they are only from one to two feet above the water. This, however, can easily be remedied, but I shall not consider the foundation as perfectly secure in this state.

"The work put down this season has generally settled uniformly.

"The changes which have taken place in the harbor since my last report have been these: About the last of September the lake had fallen so much that the bar at the entrance had but four feet ten inches water, and the entrance, instead of being near the mouth of the space between the outer end of the north pier (as it is now) and the angle in the southwest pier, had shifted to the extreme end of the north pier, at a point marked A on the accompanying sketch of the harbor.

"Towards the last of October, after the fall rains set in, the river cut its way through the shoal, and formed a new entrance near the end of the south pier, (as left last year,) at a point marked B, having a depth of 8 feet. In this place the channel remained, varying in depth from 7 to 8½ feet.

"In pursuing the original plan of the harbor, it was found that the south pier would cross this channel, and force the river again to flow near the place which it occupied at the period of the survey made in 1837, by Captain Canfield. At present the lake is about two feet lower than in 1837, or, about the same as last year at this time, (1st September.) From the scanty supply of water in the river since the pier crossed the channel, the water on the shoal has not deepened much, but has remained at 5½ feet. There can be no doubt, however, that as soon as a heavy rain shall have swollen the waters of the river, a channel sufficiently wide and deep will at once be formed along the direction of the south pier.

"A change has been made this season in the cribs. The upright posts have been entirely dispensed with, and in their stead iron bolts (1½ inch diameter) are used to bind the courses together. A plan of the new mode of construction accompanies the report.

"It having been decided to construct the remainder of the work wholly with hemlock timber, and to raise the southwest pier but 5 feet, and the north pier but 3 feet, above the water-line, it follows that the estimate for completing the piers will be proportionally diminished. The original plan contemplated an average height above the water of 9 feet throughout the entire length of piers, 2,805 feet, whereas the present plan contemplates but an average height of little more than 4 feet. The cost of the timber will also be but one-half of that in the other case.

"The contracts entered into this year have been for 700 cords of stone, and 593 hemlock logs, or, 17,790 feet. On the contracts of 1838, 741 cords of stone, 48,014 feet of hemlock, and 2,576 feet of pine, cedar, and chestnut timber, have been received.

"The disbursements in 1839, up to date, (1st September,) have amounted to $12,254 07, including the amount retained to ensure the completion of the contracts made last season, and which have since been fulfilled. Twenty-five cribs, or 735 feet, have been added to the southwest pier this summer, having an average depth of 10½ feet. The whole of this will be raised during the season to 5 feet above the water, and two cribs more sunk in continuation of the north pier. The work of 1838 will be suffered to remain another season without being finished, trusting that it may eventually settle into a better shape than at present.

"The entire length of the south pier is now (including 138 feet on shore) 1,433 feet, and requires but 240 feet to complete its entire length, (exclusive of the pier head.)

"The direction of the outer part of the south pier, having been changed from north 50° west, to north 44° west, in order to preserve an opening of 400 feet at the entrance, it will be necessary to shorten the north pier from 1,080 feet, to 810 feet in length. This length will, in my opinion, be all that is necessary; it will cover the harbor from the effect of northerly winds, while at the same time it will not be sufficiently far advanced to intercept the drift put in motion by the southwest gales, but will facilitate its passing by the gap. The diminution in length of the north pier will also cause a material change in the estimate for the completion of the work in timber.

"I estimate the sum necessary to complete both piers at $39,256 70. The south pier having an entire length of 1,853 feet, plus 60 feet for a pierhead, and the north pier with a length of 810 feet, plus 60 feet for pierhead. This, with the sum already appropriated, ($45,000,) will make a total of $84,256 70. From this should be deducted $7,000, expended by the former agent before the piers were commenced, leaving $77,256 70 as the sum applied and to be applied to the work. During the coming season, I apprehend the best policy will be to continue both piers simultaneously, and for this purpose, the sum of $25,000 should be available.

"The period of completion may still be stated in 1841, from the known fact that the appropriations are passed so late in the season during the long sessions of Congress, as to deprive the work of the advantages to be derived from an early commencement.

"The great importance of this harbor has been fully set forth in my report of 1837. A glance at the map must be sufficient to convince one of its exposed situation, subject to the violence of the southwest and westerly gales, having the entire sweep of the lake; added to which, we must consider its position within a deep bay, opening to the west, and without searoom to admit of vessels beating out during the prevalence of heavy westerly gales.

"I have referred in my former reports to the project of a canal hence to the Oneida lake, as connected with the prosperity of the village of Port Ontario, situated at the mouth of Salmon river.

"I transmit a printed report of a survey made last season; in which its practicability is made manifest.

"The tonnage of the port remains about the same as heretofore, or 953 tons. The exports have consisted of considerable quantities of pine lumber, butter, cheese, potash and pork, but by far the greater portion for the season is yet to be exported. From present appearances, the amount will much exceed that of any previous year, since the commencement of the work."

76. *Oswego Harbor.*—A highly interesting exposition of the advantages of this harbor, will be found from the pen of Captain Smith, and printed in Senate doc. No. 1, pages 291–306 of the last session of Congress.

The local agent at this place, is Mr. J. W. Judson, from whose report the following extract is made:

"The direction of the work having been confided to me on the 11th of October, 1838, it was administered under the supervision of the Engineer Department, until January 22, 1839, when its transfer to the Topographical Bureau was announced. What follows will be considered as having reference to the condition and progress of the work since the date of the last annual report rendered by my predecessor, Lieutenant Smead, of the 4th artillery.

"The residue of the season for active operations was spent in completing the masonry of that portion of the west pier already commenced, in receiving and preparing materials, in repairing the old work, and restoring the paving of the mole, which had been displaced by the action of the waves. A large quantity of limestone for the masonry of the pier, was dressed during the winter, but in conformity to instructions from the Topographical Bureau, active operations were not resumed until the last of June. The preparation of materials, the building of machinery, cranes, crane-scows, wharves, &c., were nevertheless continued, and all the necessary facilities for carrying on the work with vigor were put in readiness. On the 24th of June, was commenced the work of removing a portion of the old piers, preparatory to rebuilding in masonry, according to the plan approved by the chief Topographical Engineer. A grillage of strong timber-work was to be sunk on the foundation, prepared by cutting down the old piers one foot below the lowest water line; on this grillage, the superstructure of masonry, 24 feet in thickness, was to be raised, and to terminate on the harbor side, at three feet above highwater mark, in a quay 12 feet wide; the seaward side to be carried up 9 feet higher, forming a parapet 10 feet thick at the summit, having its exterior face vertical, and for its inner face a slope of 5 to 1; the whole to be built of solid masonry, laid in hydraulic mortar.

"The continued high stage of the water in the lake, enhanced very materially the difficulty of removing the old and dilapidated work to the necessary depth. This circumstance, together with the necessity of guarding in the most effectual manner against any possible defect in the foundation itself, induced a departure from the plan of construction, as originally approved, so far as to substitute for the grillage a mass of concrete, raised to the surface of the water, and forming a stratum 4½ feet thick. On this mass of concrete, it was proposed to erect the superstructure of cut stone masonry.

"This change of plan having received approval on the 5th of August, measures were immediately taken to carry it into effect.

"The concrete having been deposited on the first section, by the 1st of September, was sufficiently indurated on the 17th to receive the masonry. The superstructure was accordingly commenced on that day, its profile having received such modifications as were necessary to adapt it to the change of plan.

"The facility with which concrete can be employed, and the great economy in time and money, which in most situations will result from its use in foundations under water, give it strong claims on the consideration of the Engineer.

"The superstructure has already been carried up six feet above the concrete, and will be raised two feet more before the close of the season. Whatever doubts may have been entertained of the stability of the structure, they are fast disappearing before the evidence of experience. For myself, it gives

me great pleasure to say, that each succeeding day's observation only confirms my first conviction, and strengthens my confidence in the entire success of the plan.

"To guard the work against interruptions from the violent storms which are here encountered, to give security to the harbor, while the demolition of the old piers was going forward, and to protect the masonry until it should have time to consolidate, a temporary breakwater has been thrown up on the mole, in front of that part of the work under construction. The objects in view have been fully attained, and at no additional expense, since the debris from the old work furnished the materials, and the labor of putting them together would have been required for scaffolding, the necessity of which has been thereby superseded.

"The mole has been strengthened in its weakest points, by throwing in masses of rough limestone in sufficient quantity to enable it to maintain itself until the permanent works shall have been completed. For reasons already stated to the department in my report for the first quarter of the current year, to which I beg leave to refer for my views relative thereto, no farther progress has been made in extending or paving the mole, and the materials collected for that purpose will be applied to constructing the permanent work.

"No new contracts have been entered into during the year. Contracts for a large quantity of rough and dressed limestone were in the course of fulfilment, when I assumed the direction of the work. Under these two contracts, I have received 403 tons of flagging and coping, 2,136 tons of wall stone, 1,133 tons of rough stone for mole: 1,292 tons of wall stone remain to be delivered.

"After completing the portion now in progress, a large quantity of these materials will be left to be applied to the constructions of the ensuing year.

"Result of the operations: removing 125 feet in length of west pier 5 feet below the surface, 33,292 cubic feet; depositing 10,240 cubic feet of concrete; masonry, 7,746 cubic feet; stonecutting, 6,371 square feet of ashlar, stonecutting, 874 running feet of coping; 170 feet in length of temporary breakwater; 280 feet in length of bridging and wharves; 1,133 tons of rough stone deposited in the mole.

"Projected operations of 1840. A thorough examination of the old piers has convinced me, that besides completing the work already commenced, it will be necessary to rebuild about 600 feet in length of the west pier during the next season. The timber of that portion of it is so much decayed, as to justify the apprehension, that it will not be able to resist the violence of the waves more than one year longer. Large sums must annually be expended in the repairs necessary to keep the decayed wooden piers from falling to pieces—a source of expense which must continue to increase until the permanent work shall be substituted in its stead; moreover, the water in Lake Ontario is now fast subsiding, and should it continue to fall, a favorable opportunity will be afforded to rebuild with the least expense. *True* economy would be consulted by pushing the work forward to its completion with the least possible delay.

"These considerations have induced me to ask, and most earnestly to *urge*, an *early* appropriation of the amount stated in my estimate, viz., $57,695 15."

77. *Big Sodus bay.*—There having been no appropriation for this harbor at the last session of Congress, and no balance left from the appropria-

tions of previous years, nothing has been done there, nor has it been in our power to prevent partial dilapidations from the want of means for immediate repairs.

On this point it was stated by Capt. Smith, in his report of last year: "The woodwork above the surface of the water is extremely defective; the timber so rotten, (from exposure and time,) that unless the permanent work be forthwith commenced, large portions of the pier will, in a short time, be swept away. To keep the work in proper condition, those parts would have to be replaced by woodwork, which would soon again decay, and again and again require repair. It would be studying true economy to begin immediately the construction of the permanent work, and to prosecute it to completion with as little delay as possible."

The importance of the position of this bay may be inferred from the following extract from the report from the general superintendent, General Swift:

"This bay is an estuary of Lake Ontario, and has an area of eight square miles, and is of a capacity and depth of water sufficient to anchor the largest fleet. It receives the water of three small creeks, whose volume causes a small outward current, though insufficient to move sand, and which current is once in every hour overcome by an inward action of the lake, which may arise from the same influence that produces tides. A canal is now constructing to connect Sodus bay with the Susquehanna, in Pennsylvania, and which canal, from the fact that it will be free from ice earlier and later than any other northern route to the lakes, may become of importance to the General Government in a period of war."

Of the work upon this harbor by the United States, the piers were commenced in 1829, and formed of a succession of cribs framed, as the Salmon river plan will explain, in cribs of, first 14 by 30, and afterward, 18 by 30 feet, and making an extent of 5,700 feet in length, running over a shoal of 8 feet of water. This shoal has been opened by dredging out a channel of 15 feet depth of water, and which should be widened 15 yards in addition, to make the whole bed 49 yards wide.

It is contemplated to commence the permanent masonry on this plan in 1840, and for the safe advancement of which the decaying timber piers must be repaired in the same year. The estimate for 1840 is $50,700.

78. *Genesee river.*—This river flows from Pennsylvania, and empties into Lake Ontario seven miles north of Rochester, where the United States have formed a harbor, which is connected with Rochester by a railroad; and the valley canal will extend the intercourse with the Allegany river.

Before the harbor was improved, vessels could not enter in the night over the then existing crooked shoal of seven feet depth of water; the current between the piers has removed this shoal, and opened a direct channel of 14 feet depth from the river to the lake.

"The work was commenced in 1829 upon a bed of soft sand and earthy matter brought down by the river, and therefore it has subsided more than any other work on the lake. This subsidence has terminated.

"The piers extend into the lake in two lines, making a length of 5,300 feet, formed by cribs of 18 by 30 feet, framed as those at Salmon river and Sodus bay. The timber is decaying rapidly, and will require repairs in 1840, to enable the permanent masonry to be laid down successfully.

"The local agent, Mr. Chas. W. Rees, reports in reference to this work: 'It remains in the same condition in which it was left last year, with the

exception of the dilapidations of time, and that owing to the small amount of funds available in 1839, it was deemed advisable to defer the commencement of the superstructure of masonry contemplated in Capt. Smith's report of 1838, and to expend the funds in the purchase of materials. Of the $9,000 in the treasury applicable to this work in 1839, $3,056 38 were due the contractors and day-laborers; the greater part of the balance, $5,943 62, has already been expended in accordance with the above view.'

"What has been submitted by the former superintendent in regard to the general importance of this harbor, the dilapidated state of the piers, and the urgent necessity deduced therefrom of a speedy completion of the permanent superstructure, (see Capt. W. Smith's report, in Senate document, No. 1, pages 293 and 294, of the last session of Congress,) applies at this time with greatly increased force, and the estimate, $51,500, is respectfully recommended for 1840.

"The advantages already resulting from this work to the community are now in jeopardy, and can only be secured by a vigorous prosecution of the permanent work."

79. *Oak Orchard creek.*—This work, like that of Big Sodus bay, was without appropriation for the past year, and without balance from former appropriations.

This stream empties into the lake about 30 miles west of Genesee. It passes over a bed of pebbles at its mouth, but has a basin within, of about one mile in extent, having a depth of three fathoms. It will be found well discussed in the report from Captain Smith, printed in Senate doc. No. 1, p. 291, of the last session of Congress. Captain Smith's estimate for this work was $25,000.

Works on Lake Erie.—These are divided into two superintendencies; one at the east end of the lake, under Captain W. G. Williams, of the corps of topographical engineers, and one at the west end, under Colonel Henry Smith, formerly of the army. The first embraces the works at Black Rock, Buffalo, Cattaraugus, Dunkirk, Portland, and Erie; the second, those at Conneaut creek, Ashtabula, Grand river, Cleveland, Black river, Vermillion river, Huron, Cunningham's creek, La Plaisance bay, and the river Raisin.

These, as well as all other similar works, were without appropriation for the last year, and operations upon them were limited to the balances of former appropriations, in the cases in which there were balances.

80. *Buffalo and Black Rock.*—These two may be considered as constituting one harbor, as the works for each have necessarily a connexion or relation with each other. It needs only to examine its position, to be convinced of the great importance of the harbor, and of the necessity of completing the works now in progress, as well as of making the extensions proposed.

The new work contemplated at Buffalo, is the extension of the pier upon which the light-house stands farther into the lake, at a proper angle, and then to have an isolated pier extension, or breakwater, in the offing, (leaving a sufficient passage between its upper end and the pier first spoken of,) to be extended in a direction towards the work at Black Rock. Such a plan will form a capacious outer harbor of great size, protected from prevailing winds and floating ice.

A full account of this, and of all the harbor improvements under the superintendence of Captain Williams, together with estimates for their exten-

sion or completion, as required in each case, will be found in his report, a copy of which is hereunto annexed, (see Appendix B.)

A sum of $30,000 is deemed necessary for the works at Buffalo during the year 1840.

81. *Harbor of Cattaraugus.*—This harbor, formed by Cattaraugus creek, is about 25 miles westwardly from Buffalo. Its object, history, and the estimates for its completion, will be found in the Senate document No. 1 of last session, pages 388 and 389, and further information in Captain Williams's report for the present year, hereto annexed.

An amount of $20,000 will be required for the operations of the ensuing year.

82. *Harbor of Dunkirk.*—The printed document previously referred to, pages 380 to 384, inclusive, together with the report of Captain Williams for the present year, embrace a full account of this work, and the estimates in detail for completing it.

A sum of $25,000 will be required for the year 1840. The position of this harbor is about 15 miles to the westward of Cattaraugus.

83. *Harbor of Portland.*—Its situation is about 20 miles westwardly from Dunkirk. A description of it, of the work done, and estimates in detail, will be found in pages 390 and 391 of the printed document beforenamed, and in Captain Williams's report of this year.

For the service of the year 1840, a sum not less than $20,000 will be required.

84. *Harbor of Erie or Presque isle.*—This is one of those highly important harbors. Its position about 30 miles westwardly from Portland, in reference to which too much cannot be said, nor too great pains bestowed upon its improvement. It is undoubtedly one of the finest harbors on the lake; and its position is so completely free from the floating ice, driven towards the eastern end of the lake in the spring, that it may be considered, on this account, as having extraordinary commercial advantages. Connexions are also now being made between it and the Atlantic, by means of railroads and canals through the interior of Pennsylvania.

The beautiful and perfectly protected bay which forms this harbor, is on an average 4 miles long and 1½ wide, with adequate depth. Its defects are chiefly at its points of entrance, where our efforts at improvement are being made. Full descriptions of it, and the estimates in detail, will be found in the printed document before referred to, and in the report B, from Captain Williams.

There will be required for the service of 1840, $30,000.

All the works on this lake (Erie) which constitute the superintendency of Colonel H. Smith, were inspected during the last season by a board, of which Lieutenant Colonel Kearney, of the corps, was the president. His report is hereto annexed. It goes so fully into whatever is desirable to know in reference to these harbors, that I shall limit myself to a short notice of each, and to the estimates.

The several views of Lieutenant Colonel Kearney in reference to these harbors, are full of interest; and without the expression of opinion in favor of either at this time, I will submit as an estimate the amounts which will be required, under any supposition, for the ensuing season.

85. *Conneaut harbor, Ohio.*—The creek forming this harbor originates in the State of Pennsylvania, whence entering Ashtabula county, after a winding course, it discharges into Lake Erie, near the boundary line be-

tween Pennsylvania and Ohio, and is thus in a convenient position for both States. It is about 30 miles west of Erie.

Lieutenant Colonel Kearney takes in his report three separate views for completing the improvement.

For the first he estimates - - - - -	$38,184
For the second he estimates - - - - -	70,806
For the third he estimates - - - - -	102,301

As, under either supposition, $19,000 will be required for the service of the ensuing year, that amount is placed in the submitted estimate.

86. *Ashtabula harbor, Ohio.*—This harbor is at the mouth of Ashtabula river, about 15 miles west of Conneaut, in Ashtabula county. The report of Lieutenant Colonel Kearney exposes several views for the completion of this harbor, for which he estimates—

For the first - - - - - - -	$42,730
second - - - - - - -	80,645
third the same as the second - - - -	80,645
fourth - - - - - - -	110,885

Under either supposition, not less than $21,000 will be required for the service of the year 1840.

87. *Grand River harbor, Ohio.*—This harbor is about 38 miles west of Ashtabula. The river by which it is formed originates in Turnbull county, thence running north through about two thirds of Ashtabula, it deflects suddenly to the west into Geauga county, and, after crossing about two-thirds of that county, it turns towards the north, and discharges itself into Lake Erie.

It will be seen, by the report of Lieutenant Colonel Kearney's inspection, that he submits several views in reference to the completion of this improvement:

For the first he estimates - - - - -	$48,094
second he estimates - - - - -	85,936
third as above - - - - - -	85,936
fourth he estimates - - - - -	111,243

As in the harbor beforementioned, so in this, not less than $24,000 will be required for the service of the year 1840.

88. *Cleveland harbor, Ohio.*—This harbor is about 38 miles west of Grand river harbor. Cuyahoga river, by which it is formed, may be considered as having its origin about midway on the boundary line between Ashtabula and Geauga counties, whence, running southwestwardly to the vicinity of Ravenna, in Portage county, it there receives a clever accession from a stream which has its origin in Stark county: from this point, it continues westwardly, passing near Northampton to within a very short distance of Medina county line, from whence it runs slightly west of north to Cleveland, at which place it discharges itself into the lake.

For the completion of this harbor, the estimate in the report of Lieutenant Colonel Kearney is $74,721, of which not less than $25,000 will be required for the service of the year 1840.

89. *Black River harbor, Ohio.*—The river forming this harbor has its origin near the southern boundary line of Medina county: pursues across that county a course nearly north, and then forms the boundary between Cuyahoga and Huron counties to Lake Erie, into which it discharges itself, about 35 miles west of Cleveland.

The estimate for the completion of this harbor, by the board of inspection, of which Lieutenant Colonel Kearney is the head, and whose report is hereto annexed, going into the requisite details, is $90,210; of which not less than $25,000 will be required for the service of 1840.

90. *Vermillion harbor, Ohio.*—This harbor is about 13 miles west of Black river. The river by which it is formed originates in Richland county, crosses Huron county in a course somewhat east of north, and discharges itself into Lake Erie at the point before named.

In the report of Lieutenant Colonel Kearney, no less than seven different views are imbodied in reference to the completion of this harbor:

For the first the estimate is	$42,545
second the estimate is	136,978
third the estimate is	150,840
fourth the estimate is	194,453
fifth the estimate is	161,066
sixth the estimate is	162,425
seventh the estimate is	137,191

Not less than $21,000 are required for the service of the year 1840.

91. *Huron harbor, Ohio.*—This harbor is formed by the Huron river, which empties into Lake Erie about 20 miles west of Vermillion.

The river has its origin in the northwest part of Richland county, and, after crossing Huron county, empties into Lake Erie.

Lieutenant Colonel Kearney, in his report, presents the details and reasoning in reference to five different views for the improvement of this harbor. The estimates for each are as follows:

For the first	$18,086
second	64,478
third	115,205
fourth	120,875
fifth	151,345

As under any view, not less than $18,000 will be required for the service of 1840: that amount is placed in the submitted estimate.

92. *Cunningham's Creek harbor, Ohio.*—In reference to the improvement of this harbor, the board of inspectors is of opinion that it should be abandoned, as unworthy of any further expenditure. Yet if it should be determined to complete it upon the plan commenced, the board has estimated for the same the sum of $22,600. But in consequence of the opinion just alluded to, no item for this harbor is placed in the submitted estimate.

93. *River Raisin harbor, Michigan.*—This point is about equi-distant between Huron and Detroit, being about 50 miles from the former, and about 55 from the latter.

The river Raisin has its origin near Springville, in Lenawee county, Michigan, thence crossing the southeast corner of Jackson, it enters into Washtenaw county, passing near Manchester, from which place it turns south, re-entering Lenawee county at Clinton, from which place it continues south across more than two-thirds of this county to Wadsworth, receiving, in its course from the west, two clever tributaries, Beaver and Bear creeks: from Wadsworth it deflects suddenly to the northeast, entering about midway of the dividing line into Monroe county, in which it continues until its discharge into La Plaisance bay of Lake Erie. Lieutenant Colonel Kearney, in his report, takes four views of the improvement of this harbor.

For the first he estimates	- - - - -	$23,982
second he estimates	- - - - -	95,890
third he estimates	- - - - -	81,952
fourth he estimates	- - - - -	120,958

Under any view, therefore, not less than $20,000 will be required for the service of 1840:

94. *Piers at La Plaisance bay, Michigan.*—All that is required in this case is to keep these piers in repair until the river Raisin work is more advanced or completed, for which the sum of $2,000 is required.

WORKS ON LAKE MICHIGAN.

There are but three harbor improvements now being made on this lake, namely, at the mouth of St. Joseph river and at Michigan City, on the eastern, and the harbor of Chicago, on the western shore of the lake. These are all under the general superintendence of Captain Thomas S. Cram, of the corps of topographical engineers, from whose annual report the following extracts are made:

95. *Harbor at the mouth of the St. Joseph Michigan.*—"The plan adopted for the improvement," Captain Cram reports, "of the entrance at the mouth of the St. Joseph river, was to divert the main stream from its old channel into a direction bearing nearly towards the west, so as to compel all the water of the river to flow through a new channel in a more direct line towards the lake. The extent and positions of the constructions for this object are indicated, as far as they have been carried on up to the present year, by the black lines on map No. 6. The effect of forcing all the water through the new channel, has been, thus far, to wash away the bar that was 8 feet above water, so that there is now a depth of 15 feet of water at the place formerly occupied by this bar or sandpit, and also to remove the outer bar or deposite to a distance of several hundred feet out into the lake, where it is now accumulating in deeper water, in the position represented in the map.

"The directions of the piers seem to have been well assigned, both as respects the object of obtaining a better channel, and of entering the mouth of the river under the action of the prevailing winds. It would, however, be advisable to extend the south pier for 500 feet, and the north pier for a distance of 620 feet, respectively, in such forms and directions as are shown by the red lines on the map. The south pier would then be left in about eleven feet and the north pier in about seventeen feet depth of water, and the inequality in the lengths of the piers would be such as to allow the north pier to serve as a breakwater to the entrance of the channel in times of the severest gales, which blow from the west and northwest, and ample room and convenience would be secured for the safe and easy entrance of vessels coming before the wind either from the south or west. And although it cannot be reasonably supposed that the formation of deposites or bars will be prevented, still it is hoped that the directions and extents of the piers would be such as to compel the deposites or bars to form in such directions, shapes, and positions, as shall not obstruct the entrance of the harbor, so long as the general formation of the lake shore, in the vicinity, shall continue in its present state.

"The proposed extension of the south pier should be 20 feet thick, and be raised up to a height of 6 feet above the surface of the water, with cribs fastened by piles, and with rough rubble stone packed in up to the level of

the water. The extension of the north pier should be 30 feet thick, and raised to a height of 8 feet above the water, and the cribs fastened with piles, and stone packed in to a height of four feet above the surface of the water.

"There is great danger of the river breaking a new channel through the low sand deposites, between the sand hillocks into the lake, at the place shown in the map. An effect of this kind would be very injurious, and should be guarded against with all possible despatch. The construction for this purpose should consist of a crib with sheet piling; the thickness of the crib should be six feet, and the crib be raised to a height of two feet above water. The whole length of this construction would be no less than 1,600 feet.

"The importance of a safe and commodious harbor at the mouth of St. Joseph river, cannot be otherwise than very considerable, in an agricultural and commercial point of view, to the western part of the State of Michigan, and also to a part of the State of Indiana. The extent of the valley of St. Joseph, the fertility of its soil and adaptation to the purposes of agriculture and to the manufacture of flour, by means of the excellent water-powers that are distributed through the valley at different points of the river, the susceptibility of the river for the improvement of its navigation, at a moderate expense, are so many evidences that this valley will require every reasonable facility for the entrance of vessels at the mouth of the river.

"Commencing at the mouth of the St. Joseph and ascending to the State line of Indiana, a distance of 56 miles, the total difference of level amounts to 68 feet. In Indiana there are 43 miles of the river in which the whole difference of level amounts to 99 feet; from thence to Three Rivers, 23 miles, the total difference of level is 53 feet, and after ascending for 10 miles above Three Rivers, the navigation for many miles is as good as it is for 30 miles below. The river is navigable in spring and fall for small steamers of 2 feet draft, for 80 miles up to Mishewaka ironworks, and regularly up to the town of Niles, 47 miles, until summer drought sets in. Scows loaded with produce and drawing 14 inches of water descend, however, from Three Rivers, a distance of 122 miles, during the whole season.

"The exports from the mouth of St. Joseph river, for the year 1839, up to the 1st September, have been 60 packages of furs, 22,234 lbs. bacon, 20,233 lbs. flour, 671 bbls. whiskey, 898 bbls. pork, 79,838 bushels wheat, 4,874 bushels corn, 4,005 bushels oats, 116 tons pig iron, and castings, 534 dry hides and skins, 500,000 feet of lumber, and many parcels of household goods, farming utensils, provisions, cattle, horses, wagons, &c., belonging to emigrants to Illinois, Wisconsin, Iowa, and Missouri. The imports during the same period have been 2,000 lbs. of Onondaga salt.

"With regard to the general commerce upon the lake, it may be said that the improvement of the harbor of St. Joseph would afford an excellent shelter for vessels caught in sudden storms, which are frequently met with on making or leaving the south part of the lake; such places of safety are very much needed at several points, and it is believed that the works at Chicago, St. Joseph, and Michigan City, can be rendered amply sufficient for all the like wants pertaining to the navigation of the southern portion of Lake Michigan.

"In a military point of view, reasons altogether similar to those which will be mentioned in treating of the harbor at Michigan City, (see the report on this harbor below,) will apply with equal force to the importance of a good harbor at St. Joseph.

Approximate final estimate of cost of completing the work at St. Joseph, agreeably to the foregoing design.

500 running feet extension of south pier, materials and labor at $43 50 per running foot of pier work - - -	$21,750 00
620 feet extension of north pier, materials and labor at $84 50 per running foot of pier work - - - -	52,390 00
1,600 running feet crib and sheet piling work, (to prevent the river from breaking through in a new place into the lake,) at $8 25 per running foot - - - - -	13,200 00
Superintendence and contingencies, 5 per cent. - -	4,367 00
Total cost - - -	91,707 00

REMARK.—The additional expense for the process of kyanizing all the timber that would be exposed to rapid decay, would be $25,368 00.

Required for the year 1840 $20,000 00.

96. *Harbor of Michigan City, Indiana.*—"The construction," Captain Cram reports, "of two parallel piers has been commenced at this place, having such positions and lengths at this time, as are shown by the black lines on map No. 5. The present depth of water at the lake extremity of the east pier, is 11 feet. It is deemed advisable to extend this pier into the lake only to the distance of 400 feet beyond its present termination, giving the extension such form and position as are indicated by the red lines on the map. This pier would then be left in 13 feet depth of water, and extend beyond all sand-bars that have been detected at the mouth of the channel; farther than this it would be inexpedient to extend the pier, until time and circumstances shall have clearly indicated the necessity of an additional extension.

"The depth of water at the lake extremity of the west pier is found to be only 6 feet. This pier should be extended into the lake 260 feet beyond where it is now terminated, as indicated in the map; it would then be left in 12 feet depth of water.

"The timber crib-work of these proposed extensions should be built to a height of 8 feet above the surface of the lake, and rough rubble-stone packed in up to a height of 4 feet above the surface of the water, and the thickness of the crib should be 20 feet.

"A knowledge of the character of the lake shore, in the vicinity of Michigan City, forbids the idea that the piers if thus extended would necessarily prevent the ultimate accumulation of sand deposites off the mouth of the channel; but it is believed that with the occasional use of the dredging machine the mouth may be kept sufficiently clear for many years to come, at an expense far less than the interest upon the cost of extending the piers much beyond the distance now proposed.

"The average depth of water now between the piers does not exceed 2½ feet, and vessels are necessarily loaded and unloaded by the intervention of scows, at great expense of labor and much occasional injury to the freight, besides the inconvenience arising from detention; and before a vessel can pass up the channel to a convenient place for discharging or receiving, it will be necessary to excavate sand from between the piers.

"It is judged from the draft of vessels which would be likely to enter the channel, that this excavation should be made so as to leave twelve feet

depth of water below the present level of the lake, which would give 46,674 cubic yards of sand for the whole amount of excavation.

"The dredging machine which, but for the tardiness of the contractor for making the engine, would have been employed in excavating the channel this season, will not be completed in time to be of any practical utility for the navigation of this channel this year.

"The breadth which was assigned to the channel between the piers, is only one hundred feet, and should the requisite amount of excavation be taken from between the piers, it would be advisable beforehand to sheet pile on the insides of the cribs of each pier next the channel, otherwise the stability of the piers would be endangered, or the stones which have been put into the cribs might fall out from the bottom into the channel, and thereby not only give inconvenience, but might induce the necessity of great expense of refilling the cribs.

"The space between the piers is deemed insufficient to accommodate the trade that now centres at Michigan City, without widening, by excavation, the channel of the creek at a place just above the extremity of the piers, as shown on the map by red lines at B. The depth of water in this proposed basin should be not less than twelve feet, and its channel diameter not less than 500 feet, and its transverse diameter not less than 250 feet, and its sides should be lined with a tongued and grooved cribwork, eight feet thick, and built up to a height of three feet above the surface of the water, and fastened in position with a double row of sheet piles, and filled with sand and covered with plank. Such a basin, well constructed, would entirely subserve all the trade for many years hence at Michigan City, and it would also serve for a place of safety, into which a vessel, on being caught in a storm, might run from any point of the lake in the vicinity, and if in future years it should be found necessary to enlarge the basin, it might be very readily done by extending it up the creek.

"Owing to the natural formation of the lake shore at the mouth of the creek, it will be impossible for the town to extend, in proportion to its increase, toward the lakes; the extension must take place up stream. The proposed site of the basin, however, is only so far up as to be even with the lowest natural business sites of the town.

"During the last twelve months preceding 1st September, 1839, there have been imported at Michigan City, 150 barrels whiskey, 50 barrels cider and vinegar, 50 barrels apples, 7,887 bushels salt, 1,344 barrels bulk of goods, and 1,105 tons merchandise. During the same period, the exports have been 96,951 bushels wheat, 68,018 bushels corn, 2,515 bushels barley, 37,350 bushels oats, 500 bushels rye, 675 barrels pork, 25 barrels lard, 2,950 barrels flour, 10,000 pounds butter, and 100 tons of other articles.

"From this account of trade, and from the fact that the town is deemed to be the only point where a harbor can be constructed at a reasonable cost, upon the part of the shore of the lake which belongs to the State of Indiana, the commercial and agricultural importance of the work which has been commenced at Michigan City, may be inferred.

"This work if properly completed would be possessed of that military importance and value which would always attach to a depot, at which supplies of provisions, and the militia from the interior of the State could be rapidly and economically concentrated, and thence transported either across or down the lake toward the scene of operation as occasion may, and, in all probability will hereafter require.

Approximate final estimate of the cost of completing the harbor, agreeably to the foregoing suggestions.

660 running feet extension of east and west piers beyond their present termination, materials and labor at $60 per running foot of pier work - - - -	$39,600 00
1,445 running feet of piers to be sheet piled previous to dredging from between the piers - - -	2,022 00
46,674 yards of 25 cubic feet excavation of sand from between the piers, (8 cents for raising and 4 cents for depositing,) at 12 cents per yard - - -	5,600 88
75,704 cubic yards excavation for the proposed basin, 12 cents per yard - - - - - -	9,084 48
1,325 running feet cribwork, lining for do. at $16 50 per running foot, materials and labor - - -	21,862 50
Superintendence and contingencies, five per cent. - -	3,908 49
Total cost - - -	$82,078 35

REMARK 1. From this sum deduct $5,300 60 worth of timber on hand, and there will remain $76,777 75 to be provided for the completion of the work.

REMARK 2. It requires an additional sum of about $16,000 to cover the cost of kyanizing the wood in the upper parts of the constructions from two feet below water.

97. *Harbor at Chicago, Illinois.*—Of the works at this place, Capt. Cram reports, introducing at the same time some interesting general remarks on Lake Michigan, its shores, and the rivers emptying into it:

"Along the west side of Lake Michigan, it is observable that the principal constituent of the banks for large portions of the shore is sand, whose specific gravity is about 1.900. From examinations made at several points, it is inferred that under this sand a substratum of clay may be generally met at a depth of about twenty feet below the present level of the surface of the lake, at a distance off shore from 1,200 to 2,000 feet. This clay bottom is such as to afford good foundations for constructions, as well as good holding for anchors; indeed, such is the tenacity, that anchors seldom drag during the most violent storms.

"At many places, for many yards in extent, the high bank of the lake is being continually worn away; the action of the surf destroys the tenacity of the ground in the vicinity of the water line; the bank is then left without a base adequate to its support, and, of course, a portion of its crest, in virtue of its own weight, and want of sufficient cohesion of its particles, slides off into the water's edge, and is soon washed away. Slips of the bank bearing large trees are thus precipitated into the water, and the sand is carried along by force of wave and current, until the velocity becomes checked by a counter current, a projecting bluff, or by some other cause, when a deposite of earthy particles immediately ensues.

"Along the east side of the lake, a vast number of white sand hillocks are seen on the shore for many miles in extent, varying in height from 10 to 150 feet above the level of the water. The sand of which they are composed varies in the size of its grain, also in weight. The specific gravity of the finest, when dry, is 1.409, and, when saturated with water, 1.653; that of the coarsest, when dry, is 1.697, and, when saturated with

water, 1.984. These sand hillocks are continually changing, and seem to be very much at the mercy of wind and waves.

"At the mouths of the streams emptying into the lake on both sides, sand deposites are universally found. These depositions are accumulated, both from the sand brought down from the interior by the force of the stream, and from that brought along from the lake shore.

"It is not to be admitted as an invariable rule that the streams, if contracted ever so much, would thereby acquire sufficient momentum to keep their mouths free from sand deposites for any considerable length of time. The fury of the lake waves might be so great that, in one storm, the deposite would be reproduced, or the old mouth of the stream entirely blocked up, and the stream forced to seek a new place of entry into the lake. Indeed, such has been the case with the largest streams on both sides of the lake. The mouth of Milwaukie river presents a striking example of this effect.

"The construction of parallel piers on the sides of the streams at their mouths, with a view to increase the momentum, and thereby wash away the deposite, cannot be attended with any considerable degree of success upon either side of Lake Michigan. Such piers, if extended so far into the lake as to meet with about 24 feet depth of water—with a proper direction with respect to currents—might prevent the lake shore sand from accumulating in sufficient quantities to obstruct the entrance of the channel for several years; but a bar would ultimately be formed of sufficient magnitude to impede the motion of vessels of considerable draught, and it is very doubtful whether it would be practicably possible to prevent the immediate formation of bars by the construction of piers. But it is altogether probable, however, that such shape and position may be determined for piers, as would compel the bar, while forming, to take a direction that no material inconvenience need ensue to vessels of the largest class on entering or leaving the harbor.

"Unfortunately, however, such shape and position have not been given to the piers at Chicago up to the time of the transfer of the work to the Topographical Bureau. On commencing operations this year, a sand bar was found extending, not only entirely across the entrance of the channel, but to a distance of 450 yards beyond. The total length of the bar, estimated from the north pier, was found to be 583 yards. The position of the bar was a few yards exterior to the heads of the piers, and transverse to their direction, as shown in map, No. 3. The depth of water over the bar, at a point on the prolongation of the north pier, was 5 feet; at a point opposite the middle of the channel, the depth was 7½ feet; and, on the prolongation of the south pier, the depth over the summit of the bar was 8½ feet. The length of time consumed in the formation of this bar could not be ascertained with any accuracy. It has accumulated from sand from the lake shore in the immediate vicinity, north of the town.

"The piers seem to have been carried out from the commencement without due regard to the direction of the prevailing winds, which are from the north and northeast, (see map, No. 1.) It also seems to have been an object of solicitude to reach the lake on the shortest possible line of direction, without regard to the difficulty, that might have been foreseen, of entering the consequent artificial channel during the action of said winds. The direction which was given to the piers required the maximum cost of construction for the north pier, because of its requiring the maxi-

mum thickness to resist the direct shock of the prevailing force of the surf. The position of the piers was also such as to compel a vessel, on entering at times of severest storms, to move with 'wind abeam.'

"The width of 200 feet, which was assigned for the distance between the piers, is too small by at least one-half. If it were supposed that the contraction of the channel to the width of 200 feet, or to any smaller dimension, would increase the momentum of the Chicago river sufficiently to remove the deposite at its mouth, the supposition must have been made without the necessary preliminary examination of the character of this river, which, for six miles up each branch, is but an arm of the lake, having no currents, except what are due to the effect of winds upon the lake water, and to, now and then, an accidental freshet. The total fall in the river for six miles is too small to produce a sensible current in either branch.

"The south pier is deemed to have been extended 900 feet too far into the lake. It is much to be regretted that the labor and material consumed in this extra extension had not been applied to extending the north pier in a proper direction. Had this been done, a comparatively small addition would have answered the immediate wants of the work. The extra extent of the south pier has proved injurious, inasmuch as vessels, on missing the entrance during the action of the north winds, have been unable to round to and come in, without striking the extremity of this pier. It would seem that the original design was to extend both piers equally into the lake. The execution of this design would effectually prevent the east part of the north pier from serving as a breakwater in a manner to secure a vessel, on making the channel, from the effects of said winds. The directions of the prevailing winds and of the channel are such, that the north pier should be made at least 1,600 feet longer than the south pier. Besides an unnecessary length, an unnecessary thickness has been given to the south pier.

"The method adopted for combining the timber for forming the cribs, and for combining the cribs with each other, and for fastening them in position by means of piles, is good and economical; the same, however, cannot be said of the distribution of the different kinds of material which enter into the work. Too great a portion of the perishable material has been put between 'wind and water,' and above water, to the exclusion of the more durable material. In combinations of wood and stone for constructions in water, after a due regard to a stable equilibrium, it should be the aim to place as much of the wood as possible that necessarily enters into the work under water; and as much of the stone as may be, in the superstructure. The reverse of this rule, however, has been allowed to prevail, at the work under consideration. Another omission is observable: no particular pains have been taken to prepare a proper foundation for the work to rest upon, although machinery was at hand that could have been applied for obtaining good foundations. The method suggested for the improvement of the work, after its transfer to the Topographical Bureau, was to extend the north pier, and to carry out the extension, not on the old line of direction, but on a line deflecting $25\frac{1}{2}$ degrees more towards the north, and to remove the bar, which has been described as having been formed across the channel.

"The additional underwork of the north pier, which has been sunk, following the new direction, amounts to 405 feet, and the bar has been dredged

off sufficiently to admit the largest classes of vessels navigating the lakes to enter the channel. This pier work and dredging will have been accomplished by means of the remains of the appropriation for the year 1839. The cost of completing the said 405 feet of pier work, and of completing and repairing work that had been commenced and left unfinished prior to the present year, will be $25,564; with this sum the preservation of the work and the immediate necessities of the trade at Chicago may be provided for; but only for one or two years at the utmost, nor would the harbor be left, with this sum expended upon it, in a state at all adequate to the present demands of the general commerce which exists upon Lake Michigan. The commerce of this lake will very naturally centre more at Chicago than at any other place of deposite, and trans-shipment upon either side of the lake.

"In 1833 the building of the city of Chicago was begun; now, after the lapse of only six years, it numbers from five to six thousand inhabitants, and presents the lively aspect incident to a thriving commercial town. Its position upon the west shore of Lake Michigan, the only great lake exclusively within the limits of the United States, the two natural channels of water communication extending some miles into the interior by means of the navigable branches of Chicago river; the excellent site for a capacious ship basin, in the very heart of the town at the junction of said branches; its being one of the termini of the Illinois and Michigan canal, a State work in rapid progress of execution, to connect Lake Michigan with the Illinois river, and thus afford a complete water communication from the city of New York, by means of the Hudson river and the Erie canal to Lake Erie, thence, by the chain of the great lakes to the south end of Lake Michigan, thence, by means of the said Illinois and Michigan canal, the Illinois river and the Mississippi river, with the gulf of Mexico and the Atlantic ocean, and the vast extent of the adjacent fertile soil, are advantages which, when collectively or severally considered, forcibly impress the mind, that the present city of Chicago is but the nucleus about which there will grow up, at no remote period, one of the most important commercial towns upon the lakes. During the present year, eight steamers, averaging 600 tons each, are making regular trips between Buffalo and Chicago, and two of less tonnage between Chicago and towns on the east side of the lake. Besides these, there are several ships, brigs, and large schooners, plying regularly to and from Chicago. The imports of salt, lumber, iron, and goods of less weighty character, will have been very large at the close of the navigation this year.

"The commercial interest of all the States that border upon the lakes is intimately connected with Chicago, as a place of trans-shipment and deposite. And the agricultural prospects of Illinois, Indiana, Iowa, and Missouri, are to become greatly dependant upon facilities for business upon a large scale, at some point on the southwest part of Lake Michigan, which lake is a part of the great channel by which the staples of these States will best reach the eastern market. The continuity of a never-failing water communication for so many miles, and the favorable temperature for the preservation of produce, are advantages peculiar to the lake route.

"The importance of Lake Michigan, in a military point of view, should not be overlooked. Its facilities for procuring provisions and for transportation, and its unequalled adaptation for harbors, into which armed steamers and other armed vessels might retire for repairs and supplies, would add particular value to this inland sea; and in the event of war between the

United States, and the power in possession of half of all the other lakes, Lake Michigan might become the scene of contention. A loss of its possession would be attended with consequences of serious import to the commerce, agriculture, and safety, of a large portion of the west.

"From general considerations of agricultural, commercial, and military interest, pertaining to a large section of the United States, it would seem that the construction of a safe, convenient and permanent harbor at some point on the west shore not far from the south extremity of Lake Michigan is required. The bottom of the lake near the mouth of Chicago river, is well adapted by nature for such a construction, and the works already commenced here, though in many respects faulty, might nevertheless be used for a part of the required whole.

"It is believed that the best plan for carrying on the future construction of the works now in progress so as to form the harbor required, would be,

"1st. To extend the north pier 1,200 feet in the form of a curve (see red lines on map No. 4) beyond the point where the work is now about to stop for the want of funds. The proposed extension would run off into 23 feet depth of water, and would perform the office of a breakwater to the entrance of the harbor; and its position would allow vessels to enter the channel or to ride out the storm, in times of the severest gales, in perfect safety.

"2d. To terminate the extremity of the pier with a circular head, so constructed as to serve for the foundation of a lighthouse 60 feet high, exclusive of the lantern, which would make the light 67 feet above water. The light could then be seen at least ten miles off, even supposing the eye at the surface of the water and no horizontal refraction. The diameter of the base of the house should be 20 feet, and the exterior of the house should have a battered curve surface, and the masonry of the house should be of stone with proper joints and laid in the proper kind of cement.

"There are *three* methods differing in cost and durability for the construction of the proposed extension of the north pier.

"First method, to consist of timber cribs built up from the bottom to a height of 5 feet above the highest known water level, and fastened in position with piles 40 feet in length, and filled with rough rubble stone well packed in and planked over the top, according to the general plan hitherto in use on Lake Michigan. The thickness of the cribs to be 24 feet.

"Approximate final estimate of cost of first method $73,080.

"This method will require an expenditure every ten years of $10,143, for repairs consequent upon the decayed timber.

"Second method; the same as the first method, excepting to subject the piles and all the wood necessary to carry up the work from two feet below the lowest known level of the water, to the process of Kyan for saturating timber with a solution of corrosive sublimate before it is put into the construction.

"Approximate final estimate of the second method, $89,775.

"It is supposed from the results of experiments in the process of Kyanizing timber in England, that this method would require no expense for repairs for a great number of years.

"Third method; to consist of timber cribs fastened in position with piles 40 feet long, and stone broken to a size to pass through a ring 3 inches in diameter, carefully packed into the cribs up to within two feet of the lowest known water level, and the remainder of the construction to be completed with stone masonry laid in proper cement to a height of 5 feet above the

highest known water level; the north face of the masonry to have a battered curve surface, and the south face to be plumb—the thickness of the masonry to be 22 feet at its base, and 14 feet at top.

"Approximate estimate of cost of third method, $215,472.

"Representing the cost of the first method by 1, the relative costs of the different methods may be expressed thus: cost of first method 1; cost of second 1.23; cost of third 2.95.

"Approximate final estimate of pierhead and light house exclusive of lantern, $15,434 50."

With Captain Cram's views in reference to the extension of the northern pier (of Chicago harbor) I fully concur, nor do I doubt the advantages which would follow from the construction of the southern pier as proposed: But there are consequences flowing from the latter, replete with such great local advantages, that it does not appear unreasonable that some aid in its construction should be anticipated from the State of Illinois.

98. *Improvement of the Cumberland river.*—Lieutenant Colonel G. H. Long, of the corps, was directed early last spring to examine into the operations on this river, and to report not only on the plan which was then being pursued, but also upon any which, in his judgment, might be more efficient and of more general utility. His report is as follows:

"This work was transferred to the Topographical Bureau in January, 1839. It now becomes my duty to report on the nature and progress of the work, the attention and intelligence with which it has been prosecuted, and the benefits likely to result from its accomplishment. In discussing these topics, we shall first treat of them in their relations to that portion of Cumberland river situated above Nashville, and then of that portion below Nashville, and conclude with a few remarks on the course proper to be pursued with a view to a more effectual mode of improvement adapted to the future exigencies of the country.

"*Of Cumberland river above Nashville.*—An instrumental survey of this part of the river, commencing at the falls of the Cumberland, in the State of Kentucky, and extending to Nashville, appears to have been made with due skill and attention in 1834; and a report thereon, accompanied by numerous drawings, has been rendered by H. Stansbury, Esq., U. S. assistant civil engineer, under date of February 12, 1835. (See Document No. 171, 23d Congress, 2d session.) The instructions given by the Engineer Department, relative to the improvement of this part of Cumberland river, merely required of the superintendent, (Captain McKnight,) that he should carry into effect the views and plan set forth in the report and drawings just cited, in so far as they related to the removal or reduction of obstructions in the bed of the river, and to the felling of trees on its banks. The manner of executing the work appears to have been confided to the judgment and experimental knowledge of the superintendent. The papers referred to are replete with details of information, description of the river, its shoals, and various plans of improving its navigation. To these I beg leave to refer for any particulars that may be required in relation to these subjects.

"The mode of improvement therein proposed, and the points at which improvements should be made, have been attended to only in so far as relates to the removal of rocks, logs, snags, &c., from the bed of the river, and the felling and cutting of trees standing on its banks and overhanging its channels. Ameliorations of this character are all the improvements

deemed advisable under existing circumstances, of which we propose to treat, briefly, in the sequel of this paper.

"The extent to which these improvements have been carried, on this part of the river, embraces a distance of 340 miles: commencing at the foot of a rapid in Kentucky, called Smith's shoals, at the head of steamboat navigation, 2 miles above the mouth of the South fork of the Cumberland, and about 7 miles below that of Laurel river, and extending downward to Nashville. The navigation of this part of the river is obstructed by numerous shoals, across which there is not a sufficient depth of water for steamboats to pass during a period of more than four months annually, and for keelboats and arks more than six months in each year. At the present stage of the water, which is unusually low, the depth at the shoals, even in the deepest channel, does not exceed four or five inches; and an empty skiff or canoe would merely be able to pass them without impinging frequently against the bottom.

"The extreme range of the river, from its present very low stage, to the summit of the highest freshets, amounts to sixty feet, and has been known at some points even to exceed this enormous rise. During a low stage, the declivity of the channel is observable only at the shoals, between which there is scarcely a perceptible current; but during the stages suitable for boating, the declivity becomes equalised, and a uniform current, strong and rapid, prevails in most parts of the river. In order to effect a safe and commodious passage for ascending as well as descending boats, in all navigable stages of the river, it has been found necessary to remove a vast number of logs, snags, and rocks from its bed, and to fell innumerable trees standing on its banks and overhanging its channels.. These services appear to have been effectually performed wherever they have been undertaken, and no points on the river within their scope appear to have been neglected or inadequately improved, except in a few instances where operations are still in progress or soon to be applied.

"The amount appropriated for improvements on this part of the river, viz, above Nashville, is $55,000; the amount expended prior to 1st July, 1839, is $50,000, leaving a balance, $5,000 to defray the expense of operations during the 3d and 4th quarters of the current year. It is expected that this balance will have been expended on or about the close of the 3d quarter, consequently the whole amount of the appropriation will have been exhausted at that time.

"With reference to the benefits resulting from the improvements thus made, there can be no doubt they are very considerable, in so far as they relate to periods during which the river is navigable; but during the low stages of the river, which prevail from one-third to one-half of the year, as before remarked, very little or no benefit can be expected to result from them.

"Among the improvements proposed in the report of Mr. Stansbury above cited, is the construction of dams, jettees, &c., at certain points, for the purpose of collecting the water during the low stages of the river, either into a single channel, in cases where the river passes the shoals in several channels, or into a narrow channel where the water has but one broad passage across the shoal. Improvements of this character can be of no use unless adopted at numerous points on the river, and executed in a manner to render all the shoals equally navigable. The cost of such improvements would be very considerable, and when completed, they would only serve

to facilitate the navigation of the river during a very short portion of the year. The sluices formed in this way would afford a very imperfect navigation, especially for ascending boats, by reason of their declivity and the consequent rapidity of the current through them.

"The improvement proposed at Smith's shoals, in the report just cited, I consider very objectionable, except perhaps merely for descending navigation. At Smith's shoals the aggregate descent of the river, in a distance of a little less than 6 miles, is said to be 54 feet, or something more than 9 feet to the mile. The current created by such a declivity, and through such a distance, unless it were confined to a straight and equable chute, prepared with great care and at great expense, would be too rapid for boats to descend in safety, or to ascend by any other means than those afforded by the use of powerful warps, windlasses, &c. At the same time such a structure, viz: a straight chute, must be composed in such a manner and position, and of such parts as would unavoidably oppose serious, if not insurmountable, obstruction to the navigation during the higher stages of the river.

"In cases of this nature, and, indeed, in reference to all of the shoals on this part of the river, I am decidedly of the opinion that the only effectual mode of improving the navigation in a manner to render the river navigable during the lower stages of the water, is that afforded by the erection of locks and dams, or by the adoption of slackwater navigation, by means of which the river is susceptible of being made constantly navigable. A dam about five feet high should be constructed at or near the foot of every rapid, and a lock of about the same lift should be connected with it, the locality of the latter being invariably fixed on the eddy side of the river. The walls and gates of the lock, as also any guard walls, pierheads, or moles connected with the locks, should be carried about eight feet higher than the dam, in order to admit the passage of boats ascending and descending, till the river, when swelled by a freshet, shall have risen nearly to the top of these parts of the work, when, instead of passing through the locks, boats may pass and repass across the crest of the dam.

"The appropriate position, extent, and probable cost of works of the character here contemplated can only be determined by a careful survey, both horizontal and vertical, of those points of the river bed where such works may be required. Such a survey may very readily be effected in a very low stage of the river, as at present, when the whole fall of the river is found at the shoals, while the intervening basins present stagnant pools very nearly on dead levels.

"*Of the Cumberland river below Nashville.*—This portion of the Cumberland river is similar in most respects to that above Nashville, of which we have already treated. Its shoals, however, are less frequent and of less declivity, the depth across them in its present improved state, and at its present unusually low stage being six to eight inches in the deepest channels; of course it cannot be regarded as navigable, even for loaded canoes, or lighters in the shape of flat boats, during the lowest stages of the water. A season of ordinary moisture may probably give a low water depth across the shoals of about one foot.

"So far as I can learn no instrumental survey of this part of the river has ever been made, and no description of the same relating to the works of improvement that have been executed thereon, has ever been published. A reconnoisance and careful examination of this part of the river appear to have been made in 1832, by Major Delafield and Captain Shreve, the

results of which are exhibited in a manuscript report jointly made by these gentlemen. This document may probably be found on the files of the engineer office at Washington; a copy of it accompanied by pencil sketches of the various shoals at which improvements were deemed advisable, was furnished to the superintendent, Captain McKnight, for his guidance in carrying on the works of improvement executed under his direction on this part of the river. The instructions given to this agent, in so far as they relate to the improvement of the Cumberland river below Nashville, were based on the projects set forth in those papers.

"An examination of the several shoals and other points at which improvements were proposed in the document above cited, and the advancement of any appropriate opinion of my own in reference to the same, would prove a mere repetition of the details contained in the report; accordingly I take leave to refer to this document for any information that may be required in reference to this topic.

"The plans of improvement proposed in the report have been executed with *due skill and judgment so far as they relate to the construction of* wing-dams, dikes, and jettees, the removal of snags, logs, and rocks, from the bed of the river, the reduction of rocky bars, and felling of impending trees, &c., in various parts of the river.

"The dams and jettees in transverse section respectively present an area bounded by an isosceles triangle, the height of them varies from four to eight feet, and the base from eight to sixteen feet. They are invariably constructed of stones of such irregular shapes as usually come from ordinary quarries, the larger stones being applied to the crest and sides, and the smaller to the base and body of the dam. Dams of this construction appear to resist the force of the current remarkably well, and the interstices between the stones of which they are composed being soon filled and *closed by floating weeds, leaves, &c., they* become impervious to water, and answer the purpose for which they were intended. Dams of this description, and of various lengths, as hereinafter indicated, have been construction at the following points, viz:

At Flaxpatch bar head of Harpeth shoals - - -	650 yards long.
At Harpeth island in do. - - -	2,152 do.
At Davis's ripple, foot of Harpeth shoals - -	425 do.
At head of Dover island - - - -	400 do.
At Dover Island chute - - - -	125 do.
At foot of Dover island - - - -	500 do.
At head of Line island - - - -	513 do.
At Keelboat chute of Line island - - -	485 do.
At Steamboat chute of do. - - - -	825 do.
Aggregate length of wing-dams - - -	6,075 yards.

"These several dams have been located and constructed in conformity to the recommendations of Messrs. Delafield and Shreve, as set forth in their report before cited, and appear to have answered all the purposes reasonably to be expected from structures of this nature. Without opposing difficulties in the way of navigation at any stage of water, they serve to deepen the channel very considerably during the lower navigable stages of the river; at some of them, however, as might be expected, a current is generated in the sluices during the stages just mentioned, so strong that steamboats

(the smaller classes of which can only be used in such stages) are compelled to use warps in ascending.

"The period of navigating this part of the river is, no doubt, considerably prolonged annually by these improvements, but still falls far short of embracing the whole year. The exigencies of trade are not yet adequately subserved; nor is it practicable to accomplish this object effectively by means of sluice navigation; for, were the entire volume of the river concentrated at the several shoals into a sluice not more than 50 feet wide, during the periods of low water, which embrace on an average about one-third of the year, a depth sufficient to float a loaded keel or steamboat of the lightest burden would not be afforded.

"The obstructions occasioned by snags and logs in the river, as also those occasioned by impending trees, have been sufficiently removed. The reduction and removal of rocks at several points, is still to be effected, and a few rocky bars still require a deepening of the channel across them.

"The improvements by means of wing-dams, dikes, &c., as originally contemplated, have not yet been made at the following points, at which dams of the extent and probable cost herein designated are deemed necessary, in order to render the plan of sluice navigation sufficiently complete and perfect:

At the head of Nashville island, a wing dam 450 yards long, at $7 50 per yard - - - - - -	$3,375 00
Above mouth of Harpeth river, a low wing-dam 800 yards long, at $5 per yard - - - - - -	4,000 00
Below mouth of Harpeth river, a wing-dam 450 yards long, at $7 50 per yard - - - - - -	3,375 00
At the head of Palmyra island, a wing-dam 400 yards long, at $7 50 per yard - - - - - -	3,000 00
Little River shoals, a low wing-dam, 400 yards long, at $6 per yard - - - - - - -	2,400 00
The head of Shelley's island, a wing-dam 350 yards long, at $7 50 per yard - - - - - -	2,625 00
Ingram's shoals, a low wing-dam 850 yards long, at $6 per yard - - - - - - -	5,100 00
Removing rocks, snags, &c., from the channel, especially in Harpeth shoals, probably - - - - -	3,000 00
Amount of estimate - -	26,875 00

"The foregoing estimate has been prepared after a careful inspection of the river at its present exceedingly low stage, and in joint consultation with Captain McKnight, who fully concurs in the recommendation of dams at the several points indicated, and in the several statements relating to their probable cost, and also to the expense of the improvement contemplated in the last item of the estimate.

"The average quantity of stone contained in each lineal yard of the dams already constructed is about six perches; and the cost per perch for quarrying and conveying the same to the work, and laying them appropriately in the dams, is about $1 25.

"The aggregate amount heretofore appropriated on account of improvements in the Cumberland river, below Nashville, appears to have been $100,000; of which there remained undrawn on the 1st of July, 1839,

only $6,500. This balance will probably have been expended in or about the close of the third quarter of the present year.

"In case it should be deemed advisable to carry out the system of improvements that has been adopted in reference to this part of the river, of the propriety of which I have no doubt, in view of the temporary advantages likely to result from such a measure, an additional appropriation to the amount exhibited in the foregoing estimate, viz, $26,875, will be required.

"Of the method of improvement best adapted to the future exigencies of the trade of Cumberland river, it is admitted, I believe, by those best acquainted, both in theory and practice, with the various plans of sluice-navigation, that have been adopted on innumerable fresh-water rivers of the United States, that no method of this character has proved or will prove effectual in ensuring a permanent, constant, and easy navigation. Temporary and occasional accommodation, to a limited extent, is all that has been attained or can be expected to result from improvements of this description.

"The adoption of lateral canals as a means of ensuring constant navigation in the valley of Cumberland river would be very objectionable, if not utterly impracticable, on account of the excessive floods that prevail annually, or oftener, in this river. The idea of locating a canal of this sort in a manner to secure it from the inundations of a river, whose range from extreme low to extreme high water, is sixty feet perpendicular height, is altogether untenable. Of course, this mode of improvement cannot be recommended as suitable for the Cumberland river.

"The only method remaining for consideration, is that of slackwater navigation, to be effected by the construction of locks and dams, in the way suggested in a former part of this paper.

"The bed of the river, especially at its several shoals, is generally composed of hard gravel and pebbles, resting on extensive beds of fast rock. Of course, the practicability of erecting dams and locks on secure and stable foundations, is unquestionable. The quantity of water afforded by the river in its lowest stages is amply sufficient, not only to supply the requisite water for lockage, but to subserve various manufacturing purposes in connexion with each dam. Low-water navigation may be rendered certain and constant by the method here proposed, while the navigation, in more elevated stages of the river, will be accommodated by passing freely over the crests of the dams, by the means and in the way already suggested under our first head.

"The Cumberland river, in all respects save that, perhaps, of the prevalence of excessive floods, is remarkably well adapted to the introduction of slackwater navigation. It presents few or no instances of shoals situated in a straight part of the river. Wherever obstructions of this sort occur, the river is more or less crooked, being bounded by a concave shore on the one side, and a convex one on the other. Consequently, by locating the locks, in every instance, on the convex shore, they will be protected from high-water currents and the drift brought down by them, and will remain secure during the periods of their submersion. With regard to the extent, position, height, number, &c., of the dams that will be required, they can only be determined by careful surveys, from which the size, curvatures, and declivities of the river may be correctly inferred. No such surveys having been made, I take leave to recommend that an appropriation sufficient for the

purpose be called for, and authority to execute the same, in a manner to show not only the appropriate localities, &c., of the locks and dams, but their probable cost be given.

"The amount deemed requisite to cover the expense of a thorough survey of the river from Nashville to its mouth, sufficiently minute for the purposes above contemplated, is assumed at $3,000.

"The privations suffered at Nashville, and numerous other points on the Cumberland river, by reason of the lowness of the river, and the protracted periods during which its navigation has been obstructed, within the last two years, added to the uncertainty of any exemption from similar inconveniences in all time to come, seem already to call loudly for improvements on a plan more efficient than that of sluice navigation; while, at the same time, there is little doubt that the increasing wealth and importance of the country drained by this fine river will soon justify any efforts that may be made to render it a channel of uninterrupted navigation, not only from its mouth to Nashville, but even to the extensive and inexhaustible coalfields that occur three to four hundred miles higher up the river.

"Sluice navigation is no doubt commendable in certain situations, and in cases where facilities for navigation are required to subserve the exigencies of a limited trade and occasional transportation. But in the Cumberland river, especially below Nashville, however serviceable improvements of this sort may be in yielding temporary accommodations, yet they obviously fail to answer all the purposes required of them; and although it is deemed advisable to carry out this system at the expense of an additional appropriation, under the certainty that the benefits resulting from the improvements already made will thereby be enhanced, yet, in view of the limited advantages that can be expected to result from the system, and of the increasing demands for a more efficient method of improvement, I do not hesitate to recommend the immediate adoption of measures tending to the eventual introduction of slack-water navigation, as the surest means of attaining the desired object."

In these views of Lieutenant Colonel Long I fully concur, except in those parts which rather lean in favor of persevering in a system which he proves to be of limited and temporary utility, and rather inadequate to probable prospects of trade upon that river. I unite with him fully in his recommendation of a plan of slackwater navigation, and that, previously to its adoption, a most thorough and careful survey should be made, to determine exactly all the elements involved in such a plan and in its probable cost.

To carry out this view of a survey, and to meet claims for arrearages, I respectfully submit an estimate of five thousand dollars.

The work which has been done on this river has no doubt produced great facilities to its navigation, probably equivalent to its cost; but, being considered defective in extent of view and of utility, and one which must, at no distant day, yield to the plan of slackwater navigation as proposed by Lieutenant Colonel Long, I can see no adequate advantage in its further prosecution, but at once recommend the necessary preliminary measures for putting the better plan into execution.

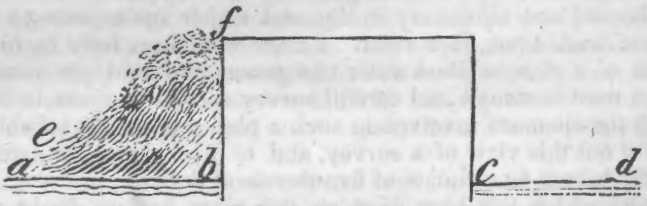
99. It may not now be out of place to indulge in a few remarks in reference to the plans of construction pursued in the harbor improvements on the lakes. The objects of the improvements are exposed in the descriptions of each locality. I mean, now, to allude only to the plans of the works. These plans consist (I may say universally, the exceptions are so few) of

large cribs of timber filled with stone, and sunk in their destined places; then additional stone is thrown in, and the crib raised to the desired height above the water, the stone being carefully laid in this last part of the process. Two kinds of cribs have been used, one with a close or tight bottom, that will not admit of a passage through it of any of the stone thrown into the crib; the other with an open or grillage-work bottom, which admits of the stone passing through, as the earth and sand are washed from beneath the crib.

100. Experience in the use of these two kinds of cribs has exposed the following results: The tight bottom is apt to sink irregularly, to cant or tilt to one side, and is liable to have the earth forced by the water from underneath the crib, when the crib is left without support of earth, and is subject, where these void places are large, to bend or break. The open crib, on the contrary, has been found to sink uniformly, and not to cant or tilt, always to preserve the perpendicularity of its position, and to have no void spaces underneath filled only with water. On these accounts the open bottom crib is considered the best, and will be adopted in future, unless some local and particular circumstances justify a different course. Although these cribs are open at the bottom, the opening is not that of one or several parallelograms made by the cross-ties being above each other, but these cross-ties are irregular in their position, something like steps or grillage-work, so as always to present a surface that will hold sufficient stone to retain and sink the cribs.

The object of these cribs is generally to fulfil the double purpose of aiding the current in its passage over a bar, and of operating as a breakwater. The effect is, therefore, to constitute an enclosed harbor of comparatively still water. The outer face of the crib being exposed to the surf of the lake, it is evident that there must be at times a great difference of level between the water on the outer, and that on the inner, side of the crib, and a consequent difference of hydrostatic pressure.

101. Suppose the following figure to exhibit the transverse profile of a crib,



in which the line *a*, *b*, *c*, *d*, is the level of the water within and without the harbor in quiet weather. Now, on any commotion or blow, waves are raised and thrown against the outside face of the crib, suppose as exhibited by *e*, *f*, while the level of the water inside the harbor remains about the same. This creates a difference of hydrostratic pressure, often equal to, and frequently greater than, the difference between the water inside and the height of the crib. This pressure, acting upon the soil underneath the crib, can have no other effect than to remove it, and subject the crib to tilt, cant, sink irregularly, bend, or break.

102. But if the crib had been an open bottom crib, as the earth was removed, the ballast stone of the crib would have followed and supplied its place, the same being again restored to the crib by reloading. The sinking

of the stone is found soon to cease, the crib acquires a firm foundation, the stone spreads outside, forming a slope, and cribs on this plan have been found to preserve the integrity of their position, and effectually to resist the action of the surf.

Experience has exposed another error in the construction of these cribs, or rather in their protection, after being placed; it is in throwing vast bodies of stone adjacent to the outside face, sloping regularly from the top of the crib to the surface of the water, with the slope carefully covered with large blocks of well-shaped stone. This case is to be found in the works at Oswego. In about a year of trial its inutility was proved. In moderate weather the lower part of the slope is exposed to continued attack from the concussion of the waves and their hydrostatic pressure. The courses of stone at those points were, in consequence, rapidly displaced; the upper being without support, except from their friction, and being also attacked in turn as the waves would rise, were also displaced and hove out of position. Our effort is now to preserve these fine facing stones from loss, by removing them.

103. Another bad effect from the plan was, that it formed a way for the waves to slide upon, leading them often up to the crest and over the top of the cribs, in such volumes that, in a storm which occurred during the period of my inspection in that quarter, the waves poured over the top of the cribwork in such masses as to move stones weighing nearly two tons the whole breadth of the crib, throwing some of them into the harbor. At the same time of this storm, a part of the line of cribwork equally exposed, which had been injured by a previous storm, was under repair. It was protected from the surf by a temporary breakwater, presenting a face nearly perpendicular to the action of the lake. Over this face no wave passed—merely the spray from its breaking; while in other parts having the inclined stonework before described, the sea, led up by it, made a complete breach over them, moving heavy stone as before described.

104. The object of this slope stoneway was to afford additional protection to the cribwork, which, in my judgment, would have been more successfully accomplished by an additional width of new cribwork, properly connected with the old, or, by removing the covering of the old crib, then to have packed in the same more stone; then, also, sounding round the cribs and finding out those places from which the earth had been washed from beneath the crib, to have thrown stone into the same through a conducting trough; or, to have opened the cribwork above these places and to have allowed the ballast stone to pass through, reloading the cribs at the same time.

105. Observations made here and elsewhere prove, very satisfactorily, that the face of a work exposed to the surf should be nearly perpendicular, and as unbroken a line as possible. Against such a face the surf does not rise by virtue of any facility in the shape of the face, but strikes directly against it, recoils upon the succeeding wave, counteracting much of its force, and throws only a spray over the works.

106. The works at Buffalo are of a permanent character, being made of masonry. But in works so exposed, the hydraulic lime alone ought to be used. It costs more than the common lime, but it yields useful and valuable results. The common lime, although cheaper, will not harden in such exposures, and, in consequence, hazards the durability of the work.

107. There was a fault in the manner of laying the stone at the end of the pier head where the light-house stands. These were laid inclined in direction to the surface of the water, and their edges perpendicular to the assumed slope. It is clear that a wall of this kind receives no aid from its weight, but the weight rather tends to push the lower course out of its place, which, yielding, all the rest slide down like an inclined row of bricks. We find instances of this kind of wall, sometimes, on the inner slopes of canals, but even with the slight commotion of such confined water, it is found not to stand, and has been long since abandoned in practice, as well as having had its errors exposed in theory. The engineer seems to have been aware of its defects, as he has strengthened the lower course by a mass of loose stone, the whole of which is held in place by piles. It is now, therefore, well secured, exposed to no other ill effect than that of affording a convenient way to lead the surf against the base of the light-house. In the extension of these works these defects will be easily remedied.

108. In the examination of the works at Erie, there appeared to be defects in the plan of the cribwork erected to protect the western end of the island. These defects were in placing the buttresses on the outside face. The buttresses are cribwork connected with the main cribline. The wave striking against these projecting parts, would there break, pass violently by the angles, remove the sand from underneath the same, and from the whole end of the buttress, leaving it without support. In this condition it had the action of a powerful lever, tending to overturn the whole line, to preserve which, some of the buttresses had to be cut loose. I directed one to be cut loose during my inspection, considering it as already acting injuriously upon the main cribline.

109. It has already been said that these cribs are built of wood. We have as yet found no worm or other insect to prey upon timber under water in these lakes.

It has been found in such positions after many years, as sound as when first laid down, leaving no doubt that (in such positions) it may be considered a material well adapted to produce the most durable structures. The convenience of handling it, and of arranging it for works under water, give to it great advantages. But near the surface of the water, and above, it is, like all other timber so exposed, liable to rapid deterioration. These parts, therefore, have deteriorated, and require, in some cases, extensive repairs. To repair with the same material is to anticipate the same deterioration, and the same expenses for repairs *ad infinitum*. Such evident consequences call for a modification of plan, either of masonry from below low-water mark, or of well laid, dry masonry within a crib-work of Kyanized timber, or of timber mineralized by the sulphates of iron or copper.

110. The process of mineralizing timber has been patented by E. Earle, Esq., of Philadelphia, and from his exposition of it in his letter of the 27th of October, a copy of which is hereto annexed, (see Appendix C,) it appears that it may produce a durable material, and be much cheaper than Kyanizing. It wants the test of more extensive experiment, which could be made at some of our lake harbors.

It is not for timber under water that these experiments are desirable, as we have already ascertained that, in such positions on the lakes, timber is extremely durable; but it is for exposures, alternately wet and dry, and where the continued action of a damp atmosphere is encountered.

111. The use of concrete or beton in the formation of piers or jettees, exposed to the violence of the sea, has been lately practised with so much success by the French, in works to protect the harbor of Algiers, that one need no longer doubt its efficiency or economy, nor the facility with which it can be applied. We have ourselves tried it successfully to a limited degree, in establishing a foundation for a part of the jettee or mole at Oswego; and as we acquire experience in its manifestation, I have no doubt that we shall also prove it to be as economical as it is known to be durable. No experiments are necessary to prove its utility; this is already well established; we require only to become more familiar with its practical and varied application. Its use will be found to be extremely advantageous at many localities on the lakes, where building stone is both scarce and costly, but where the kind adapted to the formation of beton is abundant and of convenient access.

112. The plans of parallel piers or jettees to aid the strength of a stream in removing obstructions at its mouth, have been generally too limited in their views. These appear to have been too much confined to the single consideration of constructing the jettees in the most direct line to the deep water of the lake, without sufficiently weighing the effect of prevailing winds, the peculiar action of the waves at the locality, and the indications which the stream or current itself may have exhibited in the channel which it had previously maintained, all of which form important elements to a judicious plan.

113. As these artificial outlets present narrow mouths, they become difficult of access in heavy winds, unless the pier or jettee on the weather side has been prolonged so as to form a breakwater, under the lee of which a vessel may make the entrance. This prolongation of one pier should generally form a part of the plan, or there should be a pier or breakwater in the offing. The former is, however, the most economical course, and, in many localities, will be found equally as efficacious as an isolated breakwater in the offing.

114. In many cases, also, in my opinion, mistakes have been committed in the choice of local agents from civil life. Integrity of character and accountant abilities are frequently the sole qualifications possessed by them, and adapted to their stations. Now, as these agents have the actual charge of these works, and must be depended upon by the general superintendent, the inspecting officer, or the bureau, to carry into effect directions in reference to the construction, it is clear that, unless to the integrity of their character is added the knowledge of the engineer, they cannot, except in very simple cases, comprehend the plans nor properly execute the instructions. Nor, for the want of that course of thought and turn of reasoning generated by the studies of the engineer, do they sufficiently estimate or ever collect facts of various phenomena bearing upon the character of the works under their charge, and which are so necessary to an intelligent direction of them. Neither are they competent accurately to make those estimates, measurements, soundings, and partial surveys, so requisite, and so frequently required to aid the judgment of the inspecting officer.

115. From these considerations only, can I account for the lamentable deficiency at several of the agencies which the inspection of the last season exposed, in matter essential to a judicious opinion of the plan and execution of the work, and which forced the inspecting officer to reason frequently from hypothesis, instead of well ascertained data.

116. In concluding this report, I beg leave to remark, that I have also submitted in my estimate, the usual item of $30,000 for surveys of a military and civil character. The want of this appropriation, has proved extremely embarrassing to the operations of the department, as dependance is placed upon it for making military surveys and for reconnoitrings; for examining the frontier, and procuring geographical and topographic knowledge of the Indian country; for surveys of roads on the frontier; for surveys of harbors and rivers, and for the repairing and procuring of instruments. This enumeration of objects, will, I hope, sufficiently prove the necessity of having this item among the appropriations; and the embarrassment which the department has felt for the want of it during the last season, when it was so desirable to possess a minute knowledge of the frontier, is too fresh in your mind to need further remark.

117. We have officers for such duties, but without some appropriation of that kind, we have no means to procure the necessary hands, to feed them, to procure boats, instruments, baggage-wagons, and other similiar contingencies, without which, surveys cannot be made.

118. In the estimate herewith submitted, I have been governed by an anxiety to reduce each item to the smallest amount required, for a proper and judicious action on the several works during the next season. Generally, the great amount of expenditure is for materials—timber, stone, lime—and it is no difficult matter to prove, that if estimates are so reduced as to oblige us to procure these articles in small quantities, we shall be obliged to pay for them at much higher prices than were contemplated by the estimates for the work.

119. The annual outlay on the part of contractors, who furnish materials, is necessarily great, and if the amount of the article produced is small, from the smallness of the appropriation, as the contractor has to levy his outlay and profit upon the quantity furnished, it will, of necessity, enhance the cost of the quantity, and very disproportionally, when that quantity is small. In other words, small appropriations are constantly forcing the engineer into a species of retail trade for materials, and into consequent enhanced prices.

120. On many of the works, arrearages are due, which the estimates are intended to cover; on others, materials are collected for the use of which, funds are wanted; with a great majority, the works are in such condition, that without additional appropriations, dilapidation will be extremely rapid, and in many cases, total destruction will ensue. In all, additional funds are necessary to complete the original design, or the modifications which experience has suggested.

121. Since the management of these works has been transferred to this office, I have endeavored to collect the information which would enable one properly to appreciate the value of each; and if I have not been successful in every case, an excuse will, I hope, be found in the shortness of the period since the transfer was made.

Respectfully submitted.

J. J. ABERT,
Colonel Topographical Engineers.

Hon. J. R. POINSETT,
Secretary of War.

BUREAU OF TOPOGRAPHICAL ENGINEERS.

Estimate for various roads, river and harbor improvements, and for surveys for the year 1840.

Military and geographical survey of the country west of the Mississippi, for arrearages - - -	$6,000	
For the continuation of the work - - -	10,000	
		$16,000 00
To complete the survey of the Des Moines and Iowa rivers		2,000 00
For repairing and completing the military road from Detroit to Fort Gratiot, Michigan - - - -		5,500 00
For completing the road from Detroit to Saginaw, Michigan		16,250 00
For the continuation of the road from Detroit to Grand river, Michigan - - - - - -		25,000 00
For the continution of the road between Sheldons, and the mouth of the St. Joseph, Michigan - - -		20,000 00
For the continuation of the road from Clinton to the rapids of Grand river - - - - - -		15,000 00
For the completion of the road from Niles to the mouth of St. Joseph, Michigan - - - - -		9,800 00
For the completion of the road from Detroit to Chicago, within the limits of Michigan - - - -		14,500 00
For completing the road from La Plaisance bay to the Chicago road, Michigan - - - - -		7,797 00
For the continuation of the road from Fort Howard, Green bay, by the way of Milwaukie and Racine, to the Illinois line, Wisconsin - - - - -		20,000 00
For the completion of the road from Sauk harbor, on Lake Michigan, to the Wisconsin - - - -		11,700 00
For completing the road from Milwaukie, by the way of Madison, to Dubuque, on the Mississippi, Wisconsin -		15,000 00
For the continuation of the military road from Fort Crawford, by Winnebago, to Fort Howard, Green Bay, Wisconsin		20,000 00
For the completion of the road from Racine, by Janesville, to Sinipee, on the Mississippi, Wisconsin - -		22,600 00
For the completion of the road from Burlington towards the seat of the Indian agency, on the Des Moines, Iowa		23,000 00
For the continuation of the road from Dubuque to a point on the northern boundary of the State of Missouri, Iowa		24,000 00
For the continuation of the road, opposite Memphis, to the St. Francis river, Arkansas - - - -		30,000 00
Harbors and rivers.		
For the continuation of the improvement at Kennebunk, Maine - - - - - - - -		15,000 00
For the continuation of the breakwater at Stanford's ledge, Portland, Maine - - - - -		20,000 00
For the completion of the improvement of the Cocheco branch of the Piscataqua river, New Hampshire -		10,000 00
For completing the breakwater at Sandy bay, Massachusetts		6,000 00
For the preservation of the dike at Newburyport, Mass. -		1,500 00
For the preservation of Duxbury harbor, Massachusetts -		1,500 00
For the preservation of Plymouth harbor, Massachusetts -		2,000 00

For the continuation of the breakwater at Hyannis harbor, Massachusetts	$11,000 00
For the continuation of the breakwater at Bass river, Massachusetts	10,000 00
For the preservation of Provincetown harbor, Massachusetts	4,500 00
For removing obstructions in the harbor of New Bedford, Massachusetts	5,500 00
For the continuation of the breakwater at Church's Cove, Rhode Island	12,000 00
For continuing the improvement of the Thames river, Connecticut	10,000 00
For the continuation of the improvement at the mouth of the Connecticut river	10,000 00
For the continuation of the improvement of Bridgeport harbor, Connecticut	20,000 00
For the preservation of Black Rock harbor, and Fairweather island, Connecticut	11,727 00
For completing the improvement of Southport harbor, Connecticut	2,600 00
For the continuation of the improvement of New Brunswick harbor, New Jersey	3,000 00
For the continuation of the preservation of Little Egg harbor, New Jersey	5,800 00
For the continuation of the improvement of the harbors of Chester and Marcus Hook, Pennsylvania	1,000 00
For the repairs of the piers and preservation of the harbor of Newcastle, Delaware	18,000 00
For the completion of the improvement at Port Penn, Del.	24,200 00
For the Delaware breakwater	150,000 00
For rebuilding the light-house on the Brandywine shoal, mouth of Delaware bay, in addition to the present balance	90,000 00
For deepening the harbor of Baltimore, Maryland	20,000 00
For improving the natural channels at the northern and southern entrances of the Dismal swamp canal	20,000 00
For the improvement of Core sound, North Carolina	20,000 00
For the improvement of Pamlico river, North Carolina	2,000 00
For the continuation of the improvement of Cape Fear river, North Carolina	20,000 00
For the continuation of the improvement of Savannah river, Georgia	20,000 00
For the improvement of the inland navigation between the St. Mary's and the St. John's, Florida	7,500 00
For the removal of the raft, and improving the navigation of Yellow river, Florida	20,000 00
For the improvement of the entrance of the Suwanee, Florida	15,000 00
For completing the improvement of the harbor of Mobile, Alabama	55,450 00
For deepening the mouths of the Mississippi	250,000 00
For the continuation of the breakwater on Lake Champlain, at Burlington, Vermont	25,000 00
For the continuation of the breakwater at Plattsburg, on Lake Champlain, New York	25,000 00

For deepening the channel between the two Hero islands, on Lake Champlain	$2,000 00
For the improvement of the harbor of Whitehall, New York	10,000 00
For the completion of the improvement at Black river, New York	22,000 00
For the continuation of the improvement at Salmon river, Lake Ontario, New York	20,000 00
For continuing the improvement at Oswego, Lake Ontario, New York	25,000 00
For continuing the improvement at Big Sodus bay, Lake Ontario, New York	25,000 00
For continuing the improvement of Genesee harbor, Lake Ontario, New York	25,000 00
For completing the improvement at Oak Orchard Creek, Lake Ontario, New York	25,000 00
For continuing the improvement of Buffalo harbor, Lake Erie, New York	30,000 00
For continuing the improvement of Cattaraugus harbor, Lake Erie, New York	20,000 00
For continuing the improvement of Dunkirk harbor, Lake Erie, New York	25,000 00
For continuing the improvement of Portland harbor, Lake Erie, New York	20,000 00
For continuing the improvement of the harbor of Erie, Lake Erie, Pennsylvania	30,000 00
For continuing the improvement of Conneaut harbor, Lake Erie, Ohio	19,000 00
For continuing the improvement of Ashtabula harbor, Lake Erie, Ohio	21,000 00
For continuing the improvement of Grand river harbor, Lake Erie, Ohio	24,000 00
For continuing the improvement of Cleveland harbor, Lake Erie, Ohio	25,000 00
For continuing the improvement of Black river, Lake Erie, Ohio	25,000 00
For continuing the improvement of Vermillion harbor, Lake Erie, Ohio	21,000 00
For continuing the improvement of Huron harbor, Lake Erie, Ohio	18,000 00
For continuing the improvement of River Raisin harbor, Michigan	20,000 00
For repairing the piers at La Plaisance bay, Lake Erie, Michigan	2,000 00
For continuing the improvement of St. Joseph harbor, Lake Michigan, Michigan	30,000 00
For continuing the improvement of the harbor at Michigan City, Indiana	20,000 00
For continuing the improvement of the harbor of Chicago, Illinois	30,000 00
For surveys and examinations of a military and civil character	30,000 00
	1,807,424 00

APPENDIX.

A.

Report from Major H. Bache on Brandywine light-house—1839.

OFFICE OF THE BRANDYWINE LIGHT-HOUSE,
Philadelphia, November 1, 1839.

SIR: The following report of the Brandywine light-house for the past season, made in compliance with the general regulations of the bureau, is respectfully submitted:

The operations have, in consequence of the failure of Congress to make the additional appropriation called for last session, been limited to such expenditures as could be covered by the balances from former years, and, from the insufficiency of these, were confined to measures preliminary to taking position at the site of the work. Among the most important of these are the building of the caisson, by means of which it is proposed to establish the foundation, and the preparation of the foundation stone. The caisson, with unimportant exceptions, was completed some months since. It is elliptical in form, about fifty feet in length by forty feet in width, and twenty five feet high, constructed entirely of white oak, thoroughly iron-fastened, and in all respects a substantial vessel, capable, it is believed, of resisting the shock to which it will be exposed, and fully equal in other respects to fulfil the objects for which it was designed. It is still on the stocks, where, protected by a roof from the weather, it will remain until required for use. The drawing, with the explanatory notes, annexed hereunto, will show the details of construction. The stone for the foundation, or the foundation rock as it may very properly be called, is now preparing under the contract of the 9th of January last. Two courses are finished, and two more are in a state of considerable forwardness, and will, with the remaining courses, be ready before the opening of the coming season of operations. The foundation rock is 42½ feet long by 31½ feet broad, and 20 feet high. It is formed of 671 blocks of rough-hammered stone, disposed in ten courses. Of these blocks, 372 weigh, each, three tons, and are regular and alike in form; and 299 weigh, each, from one to three tons, and are irregular and unlike. A single course weighs 161.33 tons, and the entire foundation rock, 1,613.3 tons. Each course, as finished, is laid dry at the quarries, where the necessary platforms and cranes are provided, to prevent delays in building, arising from errors in working the stone, which might prove fatal to the success of the work. The brick pavement bond is the one adopted for the foundation rock; the joints of each course lying at angles of 45 degrees, with those of the courses adjacent, in order to resist, in the most effectual manner, the disposition which the mass, from un-

equal subsidence or other cause, might have to fall or break off. To give still greater security against this tendency, copper dowels and cramps will be used to bind the whole together. Of the latter, nearly 1,700 will be employed.

The original design for this work contemplated a foundation, built on a mole of breakwater stone from the level of low water. The objections to this mode of construction were stated in a communication addressed to the bureau on the 14th of July, 1837, in which, for reasons then given, it was recommended to establish the foundation by means of a caisson. Further reflection has served to confirm these views. Fears were entertained that, by the plan first proposed, the superstructure, being built upon breakwater stone thrown at random on the bottom, would by unequal settling be liable to fracture; and it was doubted whether heavy masses of masonry, raised upon such a base, ever proved entirely satisfactory. It was also urged that, as the masonry, until it reached high-water, would necessarily have to be carried on at short intervals of time, and under very great disadvantages at so exposed a position, the cost of construction would thereby be very much increased. These objections are obviated by the use of the caisson, as the work may be carried on at any stage of the tide, and the masonry built from the bottom, saving the thickness of the caisson, which it is presumed will settle in the sand; thus affording a reasonable expectation that the subsidence will be equal, and the superstructure secured from liability to fracture. It will be remarked that the employment of the caisson does not necessarily constitute a modification of the first design, but rather furnishes a means by which that design may be securely carried out. It would fail, however, to yield all the advantages which belong to such a mode of construction, were the foundation not to receive, under the facilities afforded, a more perfect and stable character. It has, therefore, been deemed proper to substitute for this part of the work, masonry of wrought-stone, instead of the rubble masonry resting on breakwater stone, as was proposed in the first instance. These changes involve, upon the whole, a considerable increase in the cost of the work—an increase, however, which is fully justified by the additional security afforded, of prosecuting the operations to a successful termination, and by the greater stability that will be given to the work itself. This increase, as well as that arising from advance in prices since the date of the first estimate, will be indicated under the proper heads. The most prominent among the latter, is in the cost of breakwater stone, advanced 20 and 11 per cent. respectively for the two sizes, and which is now set down at the contract price of the present season for the Delaware breakwater. It will also be seen that the contingencies have been raised to 17 per cent. as that has been the average, nearly, for several years at the above work, and there is no reason to suppose they would be less for the Brandywine light-house.

The following statements will show the increase which the proposed modifications and the advance in prices will cause in the cost of the work:

The original estimate for the space which will now be occupied by the foundation, established by means of the caisson, was as follows:

41 tons of breakwater stone, of pieces of two tons and upward, at $2 50 per ton - - - -	$102 50
1,436 tons of breakwater stone, of pieces of ¼ to 2 tons, at $1 80 per ton - - - - - -	2,584 80

340 cubic yards of heavy building stone, at $5 20 per cubic yard	$1,768 00
Laying the same, including all expenses, at $17 20 per cubic yard	5,848 00
	10,303 30
Contingencies, 15 per cent.	1,545 50
Total amount by original estimate	11,848 80

The revised estimate, by the modified plan, for establishing the foundation by means of a caisson, and under the advance in prices, is as follows: caisson	$11,011 63
962 cubic yards of rough-hammered stone, including lewis-holes and cramp-holes and channels, at $22 95 per cubic yard	22,077 90
Laying the same, including all expenses, at $8 60 per cubic yard	8,273 20
2,092 copper cramps, at $1 25 each	2,615 00
	43,977 73
Contingencies, 17 per cent.	7,476 21
Total amount of revised estimate by modified plan, &c.	51,453 94
Do. original estimate	11,848 80
Do. increase	39,605 14

How much of this increase is fairly attributable to the new plan, and how much to the advance in prices and increase for contingencies, it is not easy to determine. If, however, the average prices now paid for breakwater stone be taken as a criterion, more than $8,000 is probably assignable to the latter causes.

The exposed situation of the Brandywine shoal, lying as it does in the widest part of the bay, and within eight miles of the ocean, renders it absolutely necessary that the protecting work be formed at once on bringing the caisson in position; as on the one hand, were the foundation constructed and no protection provided, the action of the waves, in their recoil from the mass, by washing away the sand composing the shoal, would in a very short time undermine and destroy the work; so on the other, were the protecting work completed in the first instance, deposites of unequal density and irregular form would be induced, where now the bottom is singularly hard and flat. The removal of these deposites, and of any stone which from carelessness or design may have been thrown within the same space, would be attended with much labor and no inconsiderable expense, and, what is of much more importance in a work of this character, with a delay which might prove fatal to the undertaking. The two operations, indeed, should be carried on as nearly simultaneously as their very different characters will permit, and, to be secure against the ice and storms of the succeeding winter, be brought to a close in a single season. At so exposed a position as the Brandywine, this may be set down at barely three months, commencing with the 20th of May, a period certainly very

limited to complete a work of the extent contemplated, considering the difficulties and vexations under which it must be prosecuted.

The following estimate for the next season is based upon the views just given. Admitting their soundness, the necessity of providing at once ample means to carry them out, need not be urged. The appropriation of a less amount would merely take from the Treasury a sum that could not be applied profitably to this work. It is also proper that the appropriation be available at least two months before the opening of the season, to afford time for making the necessary contracts and arrangements; otherwise, all operations must be postponed until the following year.

Breakwater, which will form a part of the protecting mole.

11,711 tons of breakwater stone of pieces of two tons and upward, at $3 per ton - -	$35,133 00	
21,438 tons of breakwater stone, of pieces of ¼ to two tons, at $2 00 per ton - -	42,876 00	
Cost of breakwater - - - - -		$78,009 00

Foundation to floor of cellar.

Caisson - - - - - -	11,011 63	
775.24 cubic yards of rough-hammered stone, including lewis-holes and cramp-holes and channels, at $22 95 per cubic yard - -	17,791 75	
Laying the same, including all expenses, at $8 60 per cubic yard - - -	6,667 06	
1,686 copper cramps at $1 25 each - -	2,107 50	
Cost of foundation to floor of cellar -		37,577 94
	-	115,586 94
Contingencies, 17 per cent. - - - - -		19,649 78
Total amount -		135,236 72
Amount already appropriated - - - -		45,000 00
Additional appropriation required for next season - -		90,236 72

It is proposed to carry on the operations under the foregoing estimate, in the following manner:—

The proper position for the light-house is at the point, where a line drawn on the usual sailing course of vessels, proceeding up the bay, bisects the mouth of the channel between the Brandywine and Brown shoals, and strikes the former at the assumed depth. To determine this point, it will be necessary to lay down the lower half of the channel between the Brandywine and Brown, including the seaward points of those shoals, and the western side of the former, with their relation to the meridian and the shore. This operation will consist, in the first instance, in fixing the position of not less than four permanent stations, well selected on the abovenamed shoals, from which the detailed hydrography, so essential to a correct determination of the point in question, will be carried on. These permanent stations will, each, con-

sist, of a single tripod of timber, 35 to 40 feet in height, properly strutted out and weighted at the foot, with a fourth spar rising from the apex, and surmounted by the usual tin cone to ensure its being seen distinctly from the shore. To one or more of these will be attached the tide registers, necessary to a correct reduction of the soundings to any given plan. Of the permanency of these tripods under all circumstances, except against ice and the worm, no doubt is entertained.

The next operation in order is to mark out the site with piles, to guide in placing the caisson and depositing the stone which will surround it. The small number of these piles will allow of their being driven in a few days, by a pile engine placed on a flat form, resting on timber tripods of the kind already described, but smaller in size. To ensure the completion of these operations in proper season, they should be commenced as early in the spring as the boisterous character of the locality will permit.

The placing the caisson in position is an operation of great delicacy; and on giving, at once, the necessary protection to the bottom around it, depends the success of the work. It is in fact the turning point in the undertaking, and, in comparison with which, the subsequent risks and difficulties are of small moment. No means should, therefore, be neglected to ensure it against failure; and a shortsighted economy would prove fatal to it. These means have been the subject of much anxious reflection, and, being predicated on the truth of the proposition that the soil composing the shoal is capable of sustaining the work, are all directed to the single object of retaining this soil in its natural position. In what manner it is proposed to effect this object will now be explained.

The caisson, provided with the necessary moorings and machinery for hoisting stone, having had laid on board as much of the foundation as will cause it to draw about 15 feet water, will be towed by one or more steamboats to some convenient harbor in the immediate neighborhood of the Brandywine shoal. This point will likewise be the rendezvous for vessels carrying breakwater stone, and that portion of the foundation coming next in order in the construction. Here the final arrangements will be made, and taking advantage of a settled state of the weather, the whole will move down to the scene of operations. The site it will be remembered, has already been marked out. It will, also, be borne in mind, that the caisson is supposed to be loaded to a draft of 15 feet, or 3 feet more than the depth at the proposed site, at the lowest spring tides. It will be evident, therefore, that the caisson cannot be placed in position at less than half tide; and, to allow sufficient time for securing it over the selected spot, this should be done on the flood. At half ebb the caisson will fall on the bottom, when the work of loading it with additional foundation stone will be prosecuted with great diligence, in order to prevent, if possible, its floating again on the rise of the tide. To effect so desirable an object, it will be necessary to take on board about 200 tons in the time that will elapse between half ebb and high water, or about 8 ½ hours. For this purpose two boom-cranes attached to the caisson, will be employed. These fully manned and unloading from separate vessels, will be able, in a favorable state of the weather, to take on board in the time above stated, 85 stones weighing 255 tons; affording a large excess of weight as a set-off against the difficulties and delays incident to so exposed a position, over and above the quantity required to retain the caisson on the bottom at any stage of the tide. The stone thus transferred to the caisson, will be placed conveniently on the decks for being

laid by the masons. The eight mooring piles, attached to the caisson, will now be driven, by the engine provided for the purpose, in order to prevent any lateral motion to which it may be liable from currents or waves, until the further loading shall make it perfectly secure. If from stress of weather, or other cause, the amount of labor calculated upon above be not accomplished, arrangements will be provided, for flooding the caisson to ensure its safety until such time as the work may be resumed.

The caisson being now secured, the next object is to prevent the sands of the shoal from being carried away by any new action given by its presence, to the current or the waves. This will be effected by paving the shoal with breakwater stone. To this end about 75 vessels will be provided which, estimating their average load at 60 tons, will carry 4,500 tons, a quantity sufficient to cover the bottom to a depth of 3 feet for 60 feet round the caisson : allowing that this space will accommodate ten vessels at the same time, and that two hours would be required to unload a vessel, this quantity may be deposited, in moderate weather, in sixteen hours. The early completion of this measure is deemed so important to the success of the undertaking, that a large force will be employed to prosecute the work as rapidly as possible ; and to ensure, as far as practicable, a uniform distribution of the stone over the designated space, the place of each vessel and of her deposite will be represented on a diagram. No importance is attached to any minor irregularities which may occur in the paving, as the tides in flowing over the general surface of the shore, so far from removing the sand, will cause deposites in the spaces between the stone. And, again, with a view to compensate for any loss which may have occurred before the paving is completed, a result not anticipated, but principally to prevent the great sill-piece from the attacks of the worm, clean sharp sand will be deposited in large quantities along side the caisson. The vessels, as they successively deposite their loads, will return to the quarries for more stone to form so much of the final mole as is considered necessary to place the work in a condition of safety against the storms of the approaching winter. This quantity is set down in the estimate at about 33,000 tons, and may be deposited in eleven weeks, or at the rate of 3,000 tons a week, the average quantity frequently received at the Delaware breakwater. The laying of the stone of the foundation rock will be resumed immediately, on the caisson becoming fixed upon the shoal, and the work rigorously prosecuted until completed. As two and a half courses will be laid before proceeding down the bay, but seven and a half of the ten courses will remain to lay after arriving at the shoal. These consist of 500 blocks, and as they will be furnished with lewis and cramp holes, and lettered and numbered, agreeably to diagrams in the hands of the workmen, the hope is entertained that even half the time stated above may be sufficient to finish this part of the work.

In thus laying down a plan of operations, it is not for a moment supposed that it will be expedient, or at all times practicable, to adhere to it. The object is more to elucidate general views in regard to the principles which should govern the mode of proceeding, than to point out the details, which, in a work of so novel a character, must depend upon circumstances which cannot always be anticipated, and be provided on the spur of the occasion.

It now remains to give a revised estimate for the entire work, under the modifications and increase in prices already noticed. No revision has been made in the plan of the light-house proper, or lantern, nor is it probable that any changes in either will be found necessary, that will materially af-

fect the cost of the work. The present object is the successful establishment of the foundation, in which consists the only real difficulty in the construction.

Artificial island, or protecting mole.

14,734 tons of breakwater stone, of pieces of 2 tons and upward, at $3 00 per ton - - -	$44,202 00	
25,037 tons of breakwater stone, of pieces of ¼ to 2 tons, at $2 00 per ton - - - - -	50,074 00	
Cost of artificial island, or protecting mole - - -		$94,276 00

Foundation.

Cost, as already stated - - - - - - - -		43,977 73

Light-house proper.

The original amount under this head was - -		21,787 75	
From which substract (now estimated for in the foundation) the cost of 340 cubic yards of heavy building stone at $5 20 per cubic yard - - - -	$1,768 00		
And for laying the same at $17 20 per cubic yard - - - - -	5,848 00		
Also for laying 148 cubic yards of superstructure, reduced from $17 20 to $8 60	1,272 80		
		8,888 80	
Cost of light-house proper - - - - - - -			12,898 95

Lantern.

Cost, the same as originally estimated - - - - -		1,340 39
		152,493 07
Contingencies, 17 per cent. - - - - - - -		25,923 82
Total amount - - -		178,416 89

It is not improbable that complete security may be given to the structure short of the fulfilment of the profile on which the above estimate is founded, and that the protection given in the first instance may prove amply sufficient, reducing correspondingly the aggregate expense. The grounds for this hope may be found in the fact that the proportion of two to one gain to the exterior slope of the latter work, is the same, up to the 30th September, 1836, as that of the Delaware breakwater, a work certainly exposed to greater shocks, though, on the other hand, more secure from the greater depth of water in which it is founded. The result may likewise show that the mason's work is set down at too high a rate. Nevertheless, it is deemed safest in a work constructed under such novel circumstances as the Brandy-

wine light-house, to retain both the items at the highest rates, to meet any unforeseen contingencies to which the operation may be liable.

I have the honor to be, sir, very respectfully, your obedient servant,

HARTMAN BACHE,
Major Topographical Engineers, &c.

Col. J. J. ABERT, *Topographical Bureau.*

B.

Annual report of Captain W. G. Williams, U. S. Topographical Engineer and General Superintendent of Harbor Improvements, on the southeast shore of Lake Erie. Submitted September 30, 1839.

SIR: When I had the honor to submit my last annual report, the views and statements therein contained were the result of a cursory examination while receiving from my predecessor the several works which had lately been consigned to my charge; since that time, my whole attention has been directed to a careful investigation of their various properties and capabilities; and I shall now have it in my power to enter upon the subject with more assured reference to details. In regard to general considerations, however, connected with this subject, I have seen nothing to alter my opinion as therein expressed, and to which I beg leave to refer you.

In assuming charge of these duties in September last, I deemed it unadvisable, as the season of operations was about to close, to make any changes or in any manner to arrest the progress of the several works. I preferred, preparatory to offering suggestions whether in regard to plan or modes of construction, to make full and detailed surveys of the harbors under consideration, and to collect the necessary data to enable me to act advisedly and understandingly in relation to them. In my estimate, therefore, at that time, I introduced a requisition for the necessary funds to effect this desideratum at the first opening of spring. This being accorded, operations were commenced simultaneously at Erie, Pennsylvania, and at Buffalo, New York; the surveys for Cattaraugus, Dunkirk, and Portland harbors having been regarded as sufficiently extensive for immediate exigencies.

The tour of inspection made by you during the last summer, by putting you in possession of numerous facts, and, indeed, every important consideration of a general character, in connexion with these harbors and the navigation of the lakes, dispenses me from the necessity of bringing them before you in the present report. I have, therefore, confined myself to details, connected with my immediate duties upon the several works committed to my charge.

The organization of officers, with whom I have had the honor to be associated on these duties, has been as follows: First Lieutenant J. H. Simpson, corps topographical engineers, engaged early in the summer on surveys of Buffalo, subsequently relieved by first Lieutenant J. E. Blake, corps topographical engineers; Second Lieutenant J. C. Woodruff, corps topographical engineers, who effected surveys under my direction at Erie, Pennsylvania, and who likewise completed those of Buffalo harbor.

J. F. Petu and H. Lovejoy, as their assistants, have likewise rendered useful services on these surveys. The local agents will be referred to in relation to their respective harbors.

To all these gentlemen the utmost praise is due for their exertions.

The officers of the corps of topographical engineers, serving under me, I beg leave particularly to commend to the bureau, for their zeal and efficiency in every duty with which they have been intrusted.

BUFFALO AND BLACK ROCK HARBOR.

The survey for this harbor has progressed very satisfactorily; soundings have been made, the currents carefully ascertained, and the prevailing winds noted, with the rise and fall of the surface of the lake, as dependant upon them: in fine, all the data for the proposed object have been procured in a systematic manner, so as to enable us to submit to the bureau well defined and satisfactory results. During the winter, the measurement of a base line was effected upon the ice and carefully verified, extending from Black Rock pierhead to a point on shore above the south channel, a distance of four miles and 1,225 feet. By this means, I have been enabled to connect, in the most accurate manner, the opposite shore of Canada with our own by a system of triangles, and extend the survey to Point Abino on the Canada side, and Sturgeon point on the American side. In order to prosecute my survey in a satisfactory manner, and to enable me to measure the three angles of principal triangles, I solicited the privilege of establishing stations, &c., on the Canada side, which was with great courtesy accorded me by the British authorities, by whom, indeed, every facility to the progress of the work was cheerfully tendered. I have now effected surveys, in very minute detail, between Windmill point on the Canada shore, a point opposite on the American shore, and Strawberry island, below the ship lock at Black Rock harbor, comprising a distance, between the two extremes of the survey, of nine miles. We have, therefore, before us, the principal data necessary to enable a judicious projection of plans for the enlargement and improvement of *Buffalo and Black Rock harbor.*

Although there has been no storm since I have taken charge of the works, of the character represented to have occasionally occurred, yet I have had an opportunity of witnessing the action of heavy gales from the southwest, and the tremendous effect exercised by them upon this locality.

By referring to the notations on the map, it will be seen that the wind from this direction sweeps over the whole length of the lake, and, as may be inferred, accumulates the water in the bay at the extremity of which this port is situated. The wave rolling in and passing the mole-head, even in a moderate gale, has a great deal of power, and vessels seeking protection from the storm are at times thrown upon the beach below the entrance of the harbor.

For the due protection of commerce, both now and prospectively, an outer harbor has become essential, and every delay to its construction is pregnant with mischief to the interests of the whole community engaged in the valuable commerce of the upper lakes. My surveys have been executed with this object constantly in view; and upon the map herewith presented, a plan is submitted for its construction of such dimensions as will meet the present and prospective exigencies of the case.

Accurate soundings have been made within the limits above referred to, and the present water-line of the shore carefully noted and compared with similar lines of former surveys, by which the encroachment of the lake, dependant upon its greater elevation of late years, will be approximatively

ascertained. Permanent landmarks, accurately located by triangulation, have been established by my survey at various points, so as to form the basis of a system for future observation, by means of which any changes, whether by abrasion or alluvial deposites, may be readily ascertained and accurately located by means of a few lines of soundings, from time to time, run between characteristic points of the survey, which would require but a few hours for the execution, and by which, eventually, if adopted as a general system, certain of the laws of the frequent changes that occur on the shores of the lake, may be definitely ascertained. Changes at this point, as appears by common consent, have occurred, both in the configuration of the shore and the depth of water, but only an approximation to their amount can be procured, by reference to former maps, for want of the necessary common points of coincidence. These essential data can only be rendered available by means of a careful and systematic series of rigorous observations.

The hydrographic survey, which has been made under my directions this summer, is, I believe, the first commencement of a systematic character that has been executed of this vicinity, or, I believe, of any portion of the lake; and it is worthy to be noted, that in a field where so much money has been already expended in public improvements, the very groundwork upon which they may be said to depend for their judicious contrivance has been postponed for want of an appropriation by Congress for that object; and I cannot here refrain from the expression of the earnest hope, that an extensive geodesic and trigonometrical survey, such as ought to serve *as the basis of a great system*, which, undoubtedly, these improvements are destined to become, will, as a natural preliminary measure, be at once resorted to, not only in reference to Lake Erie, but in reference to the other lakes.

The trigonometrical points of my survey have been determined by myself personally with elaborate care, the three angles of all the principal triangles having been measured and verified. I have been thus careful from regarding this operation as ultimately a part of the system already adverted to, and which, I presume, cannot fail to be eventually carried into effect. No accurate chart of the several lakes, or even one of them, is, I believe, in existence; hence, during every gale, a number of vessels are driven ashore, having neither soundings nor landmarks by which, at night or in foggy weather, to direct their course.

The surveys for this point being completed, it remains to project a work, in addition to what has been already executed, commensurate with the exigencies of this grand terminus of lake navigation.

In my last annual report, I adverted to the fact, that the present harbor was utterly inadequate to the protection of the vessels resorting to it, whether for shelter or for commercial purposes. It is proposed, therefore, to render available the reef of rocks which extends from Black Rock pierhead, in a southerly direction towards the prolongation of the Buffalo mole. This is a fortuitous circumstance of topography, which will greatly conduce to a favorable plan for the work, both in regard to strength and economy. The present pier will be extended in its western prolongation to a distance of two thousand and forty feet, into a depth of twenty-three feet water, in such a way as to cover the entrance to the harbor, and give a favorable ingress or egress to vessels in all circumstances of weather; and to repel and deflect ice into the current of the Niagara at the breaking up of winter. It will be so far advanced into the lake, that both by reason of the

depth and the current of the Niagara river, which has the required velocity at that point, it will be entirely guarantied from the effect of alluvial deposites, which, under ordinary and less favorable circumstances, accumulate and form bars at the entrance of harbors.

A primary object in the arrangement proposed, is to procure a safe harbor for vessels running for the port during the heaviest gales from the southwest; for, not only vessels bound to the port seek its shelter from the storm, but vessels from all parts of the lake are compelled to direct their course towards it, unable, oftentimes, to resist the violence of the tempest, and run into harbors less easy of access.

This point becomes, then, an object of peculiar importance to the protection of commerce upon the whole lake. The great importance of the city of Buffalo, as a commercial depot, need scarcely be adverted to; its rapid growth and great resources are proverbial.

The breakwater, and indeed a great portion of the extension of the pier, would be founded immediately upon the rock; a desideratum of great importance, as no arrangement will be necessary for the preservation of the undermining of the foundation. In contemplating the projected work before us, considerations other than those connected with the force of the wave, will enter to determine its profile; considerations, indeed, which may in some measure conflict. The ice accumulating in vast fields, and floated by the current towards the outlet of the Niagara river, is impeded in its course by the pier projecting into the bay. Impelled by the force of the current, and aided by the southwest wind, these masses impinge with a momentum that may be readily conceived, but cannot be definitely expressed by any known scientific formula. Assuming a given mass, moving at a given rate, in a given direction, and of a hard unyielding substance, the result could be readily obtained of its absolute force to overthrow a resisting obstruction; but, the case before us only offers a modification of these elements. The ice yields, and is broken by the impact more or less in proportion to its thickness and solidity; hence, the concussion loses its intensity in a degree dependant upon these circumstances; were it otherwise, its force would be almost irresistible; but, as it is, enough remains of its power to exhibit very serious effects. At Black Rock, in the year 1827, a line of pier work, or perpendicular wall of eighteen feet in thickness, filled with stone, and of solid construction, was entirely swept away upon a distance of about twelve hundred feet. This exhibits its power sufficiently at the point in question; but the force and general effects of floating ice are too well known to need discussion. In the case of a perpendicular resisting wall, sufficiently high to be above the waves in time of storms, the ice piles up against it, offering a horizontal thrust of great intensity, without in any manner serving by its own gravity to consolidate the mass. If the wall have a gradual slope to the water's edge, although, perhaps, exceptionable in regard to the action of the wave, it would have the advantage, by reference to the accumulation of ice, that the accumulating mass would be superincumbent upon it, and by its gravity serve to keep in place the masonry or stone work beneath it; an advantage, it is true, which may be compensated in a perpendicular wall by a commensurate breadth, that is, by building up square from the foot of the slope; thus anticipating with a mass of construction, and indeed in a more efficient degree, the advantage of gravity referred to; but, at the same time, at an expense proportionate to the increased area of section, and the additional cost of a facing in masonry. My

reflections upon the subject, and some research, have led me to the conclusion, that no general theory should be applied on the subject of works exposed to the action of the water, under the influence of a tempest. The conflicting opinions of engineers, the various plans projected in such cases, and the various results derived from even similar plans under different circumstances, have invested the subject with all the interest of uncertainty, and have rendered the protection of maritime ports, in the estimation of scientific men, one of the most difficult problems in the whole field of civil constructions; hence the controversies, that have grown out of the subject on the part of the supporters of different theories. It is but too often, that some ingenious suggestion, valuable in regard to a particular case, is so caressed by the excited imagination of its author, that it assumes in his mind the importance of a general principle, and becomes to him the foundation of a theory to be universally applied. In a work by M. Giuliano de Fazio, inspector-general of hydraulic constructions, &c., at Naples, we find a very interesting reference to many ancient maritime works of the description referred to; and a critique of modern works of the same kind, instituted upon the ground of their continuity of mass, which, in lieu of allowing the detritus held in suspension by the littoral current from passing freely, accumulates it upon its upper or windward side, and eventually, when it surpasses the extremity of the work, forms a bar by its deposite; and recommends, as a general principle, that a system of arches be substituted, after the manner of the ancients, by means of which, the marine alluvion be transmitted along the coast, and a degree of quiet preserved to the enclosed anchorage. This reasoning appears good in the main; of which, indeed, we have many proofs on these waters; but, I think, does not admit, judiciously, of universal application. It holds in the case where there is a littoral current in a constant direction, but not where these littoral currents alternate in opposite directions, and in nearly equal amount. It holds, where there is a prevalent wind in the direction of any coast not subject to violent tempests. But I cannot perceive its utility, when the detritus is carried either in one or the other direction, according to the circumstance of wind, and in nearly an equal degree; nor could I consider it expedient, where the elevation and intensity of the wave were considerable; because, independently of the little security imparted by elevated arches to the harbor itself, without a great outlay of money these arches could not be elevated sufficiently to guaranty them from the upward pressure of the wave, which would be very likely to destroy them, unless a very heavy mass were superincumbent upon them. But it seems that these piers were, in the time of the Romans, covered with depressed arches, springing from their abutments at the level of low water, in order to restrict the opening as much as possible, and preserve a degree of calm within the harbor; hence, the full destroying force of the action referred to, would be constantly at work during the agitation of a storm. The eulogium, I think, might as well be made of their stupendous aqueducts across valleys and ravines, at such enormous cost, on the score of expediency, as of arches to sustain a superstructure, springing from the level of low tide, exposed to the shock of the ocean waves. In fine, the influence of hydrostatic pressure seems to have been little understood by the ancients, at least, as a scientific principle, and we should therefore be cautious in adopting their plans of construction for works, in which that principle exercises such a powerful agency. Supposing, however, the superstructure sustained by the arches, in the case of

the port of Pouzzol for example, described in the work referred to, made up in some measure by its excellent masonry and solidity of mass for the inherent defect of its plan, we have yet certain knowledge, that two superstructures have been at different intervals destroyed, while the piers, upon which they were constructed, remain to this day. This would suggest as a permanent structure, where circumstances did not require a continuous pier, a simple establishment of masses at short intervals; but that, in opposition to this theory, it is found in the cases referred to, Pouzzol, Missene, and Nisita, where similar piers do still exist, that the harbors are very far from offering the necessary protection to shipping.

Applying this reasoning to the locality in question, we remark that Buffalo is situated at the termination of the narrow bay made by Point Sturgeon and Point Abino, where, by the southwest winds which sweep the whole length of the lake, the waters are heaped up, and attain, during the heaviest gales, an elevation of about nine feet above their ordinary level. This is a peculiarity of a striking character, and influences, in a remarkable degree, the intensity of the wave at such times; another is, that it is at the outlet of the lake into the Niagara river, where the current becomes sensible, and finally, it possesses a peculiarity growing out of the circumstance just mentioned, added to the rigor of the climate, namely, the vast accumulation of ice at this point at the breaking up of winter.

The first of these considerations teaches us to avoid a structure of the character above referred to, which would be acted upon at every point of its concave surface by a column of water of about seventeen feet in elevation; that is, the vertical rise of the lake added to the height of the highest wave at this point, estimated at about eight feet, independently of the lateral shock imparted to the side wall by the impetus of the wave; the second points out the means of disposing of the alluvion, by carrying out the piers into the river, to a point, where the current is sufficiently strong to carry off the heaviest particles that, by the agitation of the waves, may be thrown into suspension; and the third, warns us to avoid a structure, dependant upon the character of its masonry, and the nice adaptation of parts by means of cements, which the frost, and the shock of floating masses of ice, would be likely to attack before its final consolidation. The mole, therefore, would be in the present case a continuous mass, and no formation prejudicial to the harbor would be the result; on the contrary, the alluvions being deflected beyond the extremity of the pier, would secure the harbor of Black Rock from the debris, that would, in the case of apertures, pass through and encumber, or perhaps eventually destroy it. And in reference to this consideration, it is well to observe, that the sands are accumulating opposite the existing Black Rock pierhead to an alarming degree, even from the mere amount of abrasion produced from the beach immediately at the north of the channel piers. The encroachment of the lake at this point is a subject deserving of attention. By reference to the map accompanying my report, it will be seen, that the shore at this point has been gradually receding, while at some distance below, the shore is advancing, and tends to fill up the harbor of Black Rock. The evils are, therefore, twofold; the first is, the probable destruction of the Black Rock harbor; the second, the encroachment of the water above that point, which promises, unless it be arrested, to invade, not only the property of individuals, but the portion of the Erie canal situated upon its borders. The encroachment that has already taken place since the year 1816, is nearly half the distance comprised

between the canal and said line. To remedy this evil, a construction of cribwork had been laid down, previously to my assuming charge of the works, opposite Black Rock pierhead, (see the map,) which has, up to this time, answered the object intended in arresting the deposite; but the sand has now surpassed its extremity, and the deposite will continue to encumber the harbor, unless some remedy can be adopted.

My plan is to begin at the foundation of the evil, and guaranty the beach which has served to supply these deposites. From the point where the abrasion commences, immediately below the Buffalo mole, the cribs should be laid down at intervals in the way of spurs, nearly at right angles to the line of shore. The sands would then be kept in their position, and the harbor below be in that manner relieved from their prejudicial effects.

We perceive, likewise, a tendency to alluvions in the channel of the creek which will require immediate attention.

I have thus adverted to the general considerations which I thought should influence the plan of the work to be constructed for the enlargement and protection of the harbor. I shall now proceed to submit my views in reference to the general arrangement of plans and profile, for the adoption of which I hope sufficient reasons will be given.

It has been found by experience at this place, that, of the two forces acting to overthrow works constructed for the protection of the harbor, that arising from the masses of floating ice is the most to be apprehended; and that, in fact, no serious injury to the works from the effect of the wave alone, has ever been sustained at this point. Resuming, therefore, what I have already generally referred to, the relative stability of the slope and vertical wall, it would follow as a natural induction that, on the score of economy, the slope wall or ramp would possess superior advantages to resist the shock of large masses of ice. It would form a better assemblage with the work already executed, and would be sufficient, from the surplus strength, given to it for protection against the effect of the ice, to resist entirely that of the wave. It is impossible, nevertheless, to blind ourselves to the fact, that an inherent weakness exists in this form of construction, the wave alone considered, (independently of the loss of the gravitating mass of superstructure which in a vertical wall so eminently performs the the part of self-consolidation;) a weakness, arising from a cause I think not sufficiently appreciated, or which has perhaps escaped attention in the critical memoirs on the destruction of works so constructed; and particularly in reference to the sea-wall of St. Jean de Luy, a plan, the result of able engineers, after a war against the surf of near a century, and the experience derived from the destruction of several successive works. In the one case it is thought to have arisen from parts of the enrockment at the foot of the work having been rolled up, serving as a battering-ram to break up the mason-work of the revetment; in another, that the revetment of the platforms at the upper surface being broken by the shock, the blocks from that point in a similar manner, produced the effect; but a better initial cause appears to me to exist, in the e osion of the sandy foundation of the work, arising in this way: the wave rolling up the slope fills up all the interstices of the stonework beneath the revetment to the elevation, to which the wave, at the exposed point referred to, ascends above the mean level of the sea; a force, then, with an intensity due to a column of water of great elevation, acts upon every point of the work below the surface of the water. The moment the wave returns, and more especially

upon the sandbeach upon which the work is founded, a consequent erosion takes place, and with a degree of rapidity easily conceived; in a short time the cribs are without support at their base, incline outward, and allow the crust of revetment to slide downward. It must not be overlooked, also, that an upward pressure due to a column of various heights, is acting from the crest to the foot both of the exterior and interior revetments, at every instant during the reaction of the wave, and helps the process of its destruction. Hence I attribute the disaster to the unstable nature of the foundation alone; and am impressed with the belief, that, had the foundation been of a nature to resist the eroding effect of the water, rushing outward with great violence from the foot of the cribwork, the superstructure would not have been so easily invaded. Hence in works similar to the one proposed, the bottom being principally of rock, as is the case in regard to our projected work, the evil from the above cause need not be apprehended; for, even where a prism of sand does intervene, it is found to be of so slight a depth that it may by the dredge be easily removed with an additional outlay, which we think would not be considerable.

With regard to the effect of the column of water contained in the interstices of the stonework, and its power to throw out of place the stones or blocks of the revetment, we may obtain its maximum limit thus:

Let the height of a column of water be represented by - - h;
specific gravity of the stone by - - - - G;
specific gravity of the water by - - - g;
area of cross section of blocks by - - - A^2;
length of blocks by - - - - - x;

we shall have in order to procure an equilibrium—

$$x\ A^2\ G = g\ A^2\ h$$

$$x = \frac{gh}{G}\ ;$$ introducing the respective values of

G, g, and h, viz: $G = 2.6$; $g = 1$; and $h = 2.65$ yards;

$$\text{then } x = \frac{2.65}{2.6} = 1.019 \text{ yards}$$

thus: for the maximum elevation of the wave acting upon the lower tier of blocks of the revetment, it would appear that blocks of about three feet in length would remain in equilibrio.

The direct force of the wave being broken by the enrockment and sustaining crib at the foot of the work, the next tendency we would discuss is the sliding motion of the rocks of the revetment, independently of their mechanical arrangement. To establish an equilibrium between the power of resistance to this tendency and the column of water due to the assumed elevation of wave, the natural slope of the stone or relation between friction and pressure in large blocks being 1.20; (see Annales des Ponts et Chaussees, Travaux Maratimes.) We have for the general equation of resistance of the blocks to slide—

$$R = A^3\ G\ (s.\cos x - s \text{ in } x);$$ and for the effect of a column of water to displace them,—

$$R' = h\ A^2\ g;$$

but in the case of equilibrium we should have—

$$R = R';$$ and therefore,

$$h\ A^2\ g = A^3\ G\ \ (s.\cos x - \sin x), \text{ or}$$

$$\frac{h\ g}{A\ G}\ \frac{1}{\cos x} = s - \text{tang. } x;$$

hence, resolving the equation by reference to the tangent of the angle of slope, which we wish to determine for a given elevation of wave, we find—

$$\text{Tang. } x = -\frac{A^2\ g'^2\ s}{h^2 - A^2\ g'^2} + \sqrt{\frac{A^2\ g'^2\ s^2 - h^2}{h^2 - A^2\ g'^2} + \frac{A^4\ g'^4\ s^2}{h^4 - 2\,h^2\,A^2\,g'^2 + A^4\,g'^4}};$$

substituting the numerical values, $A = 1$; $\frac{G}{g'} = g' = 2.6$; $h = 2.65$; and $s = 1{:}20$; and we have—

$$\text{Tang. } x = 0.1667;$$

and this value conforms approximatively to the slope we have assumed for our work. Thus we find that for blocks of stone such as may be adopted for our construction and the assumed elevation of wave, there would be no disposition to displacement either by the upward pressure of the column of water to which they would be subjected, and very little by that which would create in them a tendency to slide; hence, with the sustaining crib at the foot of the slope, and the favorable disposition of the stone to promote stability, we have the strongest assurance of the entire permanency of the work.

With regard to the location of the breakwater, it is sufficiently indicated by our soundings and the nature of the bottom; but another very important element is involved in the consideration, namely: the currents of the river and their probable action upon the harbor when it shall be constructed. By a systematic set of operations we have acquired very accurate knowledge of their direction under every diversity of wind. The mean of these observations is recorded upon the map, and shows that the reef referred to above divides the current, which sweeps directly down the Niagara on one side, and on the other, after a curvature towards the shore, tends to pass between the reef and Black Rock pierhead; hence we see the importance of leaving an opening between the termination of the breakwater and this last point, so that this advantageous tendency of the current may not be lost. It will afford the means of outlet to such alluvions as may enter the harbor, whether brought down by the creek, eroded from the beach, or entering between the Buffalo pierhead and breakwater. The opening, while it in no way jeopards the quiet of the harbor, since it is covered by the opposite shore from the southwest gales, will be a vast saving of expense to the project; this, without militating in any manner to a further extension of the work to its final connexion with Black Rock pierhead, should such plan at any future time be deemed expedient. The general plan and profile of the work, however, may be studied, collated with the data of soundings, currents, &c., &c., as laid down on the accompanying map, in a much more satisfactory manner than can be conveyed by any description, however minute. To this I beg leave to refer you. But in submitting my estimate, I must respectfully call your attention to a leading feature in the plan herewith submitted; taking a prospective view of the future development of the resources of this remarkable position, and the vast amount of commerce which must inevitably and even rapidly concentrate upon it, I have projected a plan of an extent commensurate therewith, but at the same time a plan which *at every step will bring with it a proportional benefit to the commercial and protective advantages of the harbor.* It will be seen by reference to the map that every foot of pier that is laid down tends to shelter a proportionate area of harbor from the

action of the storm; and that the first crib that shall be sunk at the western extremity of the breakwater will have its immediate effect in creating tranquillity within the space proposed to be sheltered. Hence, although the estimate frankly states the cost of a final completion of the general plan, yet it must not be understood that this whole amount is immediately necessary to render available the advantages referred to. The work under the system I propose, will progress in a degree merely commensurate with the exigencies of the existing amount of shipping on the lakes. As a primary measure, I propose, for the present, only to extend the pier or its prolongation into the lake, as laid down on the projected plan, with such other collateral arrangements of minor importance as the protection of the harbor may appear to require; leaving the remaining portions of the project to be executed from time to time, as the exigencies of commerce or the views of Government may in its wisdom direct.

In reply to the requirement of the bureau to be furnished with an historical sketch of this harbor, I have to state the following facts derived from J. S. Smith, Esq., former local agent of this harbor, whose practical experience, integrity, and general efficiency have greatly facilitated me in the discharge of my official duties:

"A committee of the citizens of Buffalo applied to Congress for an appropriation. Their estimate was made without any particular knowledge or experience on the subject, and placed at the lowest amount that was thought sufficient to build a loose stone wall, 12 feet above water, without reference to great permanency or finish, but merely to answer until the exigencies of commerce would justify an amount requisite to make it perfect.

"The line of the old work was irregular, having two angles or bends, thus:

"The plan for rebuilding extended to the inside only of the foundation for a light-house, at the outer extremity of the pier. An appropriation of $34,206 was made by Congress on the 19th May, 1828.

"In 1829, the plan was altered to extend the stone mound around the lake side of the pierhead, and to raise the summit of the mound to a height of sixteen, instead of twelve, feet above water. Captain Maurice made an estimate, on which Congress made an appropriation on the 23d of April, 1830, of $15,488.

"In 1830, in consequence of the old pierhead, and a part of the work between it and the shore, having been washed into the mouth of the harbor, it was determined to straighten the front line; construct a towing path or landing in front, and remove the old pier, which had been undermined and fallen into the channel; it was also determined to construct a cross or sea wall nearly at right angles from the eastern end of the mole, so as to enclose the old light-house and keeper's house, and prevent the lake from making a breach between those buildings and the mole. The appropriation for those objects, made 7th March, 1831, was $12,900.

"A new and permanent mole-head was determined upon, to be constructed of rocks, and serve as a foundation for a light-house. For this object

d to erect a light-house, an appropriation was made 7th March, 1831, of 2,512, in addition to balance of appropriations reappropriated 18th March, 30, of $2,500.

"In 1831 it was determined to pave the inclined plane of the mole and e mole-head with rocks, finish the north pier, remove obstructions, lay e front wall with masonry, and place stone posts in the towing path. here was made an estimate of balances wanted, amounting to $38,000, t Congress appropriated, on the 3d of July, 1832, only $10,300.

"In 1832 it was deemed best to remove all the old timber work in front the mole and towing path several feet below the water, rebuild the path ith rock wall, and flag the summit of the mole with large flat stones. or these objects, and to complete the plans of the preceding year, Congress propriated, 2d April, 1833, $31,700.

In 1833 it was decided that a contiguous row of piles should be driven the hole length of the mole, on the towing path side, and extend as far east s the extreme point of the Government land; also that the wall of the wing path should be laid in hydraulic cement; that the surface of the wing path should be flagged with large stones; the path itself extended p the creek; and the sandy bend of the south side of the creek be re-oved, and the creek dredged out; an appropriation was made 28th June, 34, of $20,000.

"Joseph D. Selden, general agent, having expended on the light-house nd its foundation more than the appropriations, another was made for his lief, on the 7th June, 1834, of $1,610 53."

No appropriation was made from this time until July, 1838, of which ere is yet a balance on hand.

Estimate of funds required for the prolongation of the Buffalo mole in a depth of water of fourteen feet.

Stones, 3,313 cubic yards, at 85 cents per yard - -		2,816 05
Masonry—1,740 feet, requiring 26 barrels of hydraulic lime, at $2 50 - -	$65 00	
Sand, 300 bushels, at 4 cents -	12 00	
Masons and laborers - -	63 00	
		140 00
Flagging summit and tow path, 1,020 feet, at 10 cents per foot		102 00
Levetting inclined plane and horizontal plane on the lake side, 2,400 feet, at 30 cents per foot - - -		720 00
Removing woodwork and stones to build front and towpath wall—stones, 300 yards, at 33⅓ cents per yard - -		100 00
Stones in rear - - - - - -		100 00
Front wall of tow path—large stones, 30 yards, at $1 00 per yard - - - - - -		30 00
Two cribs, each 20 feet deep, at $340 - - -		680 00
Forty piles, at $3 50 - - - - -		140 00
Stone posts, 50 feet apart, cost $30÷⅝ - - -		18 00
Dredging - - - - - -		1,000 00
Damages to work, machinery, and from storms - -		253 95
Cost of one crib in fourteen feet water - - -		6,100 00
Seventeen sections, (170 yards,) at $6,100 per section -		103,700 00

Estimate of funds required for the prolongation of the Buffalo mole, in a depth of water of twenty-three feet.

Stones, 8,908 cubic yards, at 85 cents per yard		$7,571 80
Masonry, as in preceding estimate		140 00
Flagging summit and tow path, as in preceding estimate		102 00
Revetting inclined and horizontal planes,	do.	720 00
Removing woodwork and stones,	do.	100 00
Stones in rear,	do.	100 00
Front wall of tow path—large stones,	do.	30 00
Two cribs, each $475 00		950 00
Forty piles, each $4 00		160 00
Stone posts		18 00
Dredging		1,000 00
Damages to work, machinery, and from storms		308 20
Cost of one crib, in 23 feet water		11,200 00
Fifty-one sections, (510 yards,) at $11,200 per section		571,200 00

Aggregate estimate of funds for the prolongation of Buffalo mole.

Seventeen sections, (170 yards,) in 14 feet water, at $6,100 per section		$103,700 00
Fifty-one sections, (510 yards,) in 23 feet water, at $11,200 per section		571,200 00
Pile driver	$800 00	
Eight scows, at $350	2,800 00	
Twenty cranes, at $100	2,000 00	
Shanties, tools, and ropes	3,800 00	
		9,400 00
Securing work each year, molehead, and removing light-house		12,000 00
		696,300 00
Contingencies, 10 per cent.		69,630 00
Aggregate		765,930 00

Estimate of funds required to construct breakwater, in a depth of ten feet water.

Stones, 2,633 cubic yards, at 85 cents per yard	$2,238 05
Masonry—lime, sand, and labor	140 00
Flagging summit and tow path, 1,020 feet, at 10 cents	102 00
Revetting inclined and horizontal planes, 2,400 feet, at 30 cts.	720 00
Removing woodwork and stones for front and towpath wall—stones, 300 cubic yards, at 33⅓ cents per yard	100 00
Stones in rear	100 00
Front wall of tow path—large stones, 30 yards, at $1 00	30 00
Two cribs, each 16 feet deep, at $280 each	560 00
Forty piles, at $3 50	140 00
Stone posts	18 00
Damages to work, machinery, and from storms	251 95
Cost of one crib, in 10 feet water	4,400 00
Forty sections, (120 yards,) at $4,400 per section	176,000 00

Estimate of funds required to construct breakwater, in a depth of twenty feet water.

Stones, 4,383 cubic yards, at 85 cents per yard	- -	$3,725 55
Masonry, as in preceding estimate	- - - -	140 00
Flagging summit and tow path, as in preceding estimate	-	102 00
Revetting inclined and horizontal planes,	do. -	720 00
Removing woodwork and stones,	do. -	100 00
Stones in rear,	do. -	100 00
Front wall of tow path,	do. -	30 00
Two cribs, each 26 feet deep, at $430	- - -	860 00
Forty piles, at $3 50	- - - - -	140 00
Stone posts	- - - - - -	18 00
Damages to machinery, &c.	- - - -	264 45
Cost of one crib, in 20 feet water	- - -	6,200 00
Forty sections, (120 yards,) at $6,200 per section	-	248,000 00

Estimate of funds required to construct breakwater, in a depth of twenty-five feet water.

Stones, 5,321 cubic yards, at 85 cents per yard	- -	$4,522 85
Masonry, as in preceding estimate	- - - -	140 00
Flagging summit and tow path, as in preceding estimate	-	102 00
Revetting inclined and horizontal planes,	do. -	720 00
Removing woodwork and stones,	do. -	100 00
Stones in rear,	do. -	100 00
Front wall of tow path,	do. -	30 00
Two cribs, each 31 feet deep, at $505	- - -	1,010 00
Forty piles, at $3 50 each	- - - - -	140 00
Stone posts	- - - - - -	18 00
Damages, &c.	- - - - - -	317 15
Cost of one crib, in 25 feet water	- - -	7,200 00
Forty sections, (120 yards,) at $7,200 per section	-	288,000 00

Aggregate estimate of funds for breakwater.

Forty sections, (120 yards,) in 10 feet water, at $4,400 per section - - - - - - -	$176,000 00
Forty sections, (120 yards,) in 20 feet water, at $6,200 per section - - - - - - -	248,000 00
Forty sections, (120 yards,) in 25 feet water, at $7,200 per section - - - - - - -	288,000 00
Contingencies, 10 per cent. - - - - -	71,200 00
Aggregate - - - - - -	783,200 00

Estimate for repairs of channel pier, preserving depth in channel of creek, and protecting beach.

Ten sticks timber, 30 feet long = 300 feet, at 6 cents per foot	$18 00
Eighteen ties, 6 feet long, = 108 feet, at 4 cents per foot -	4 32
Thirty-six dovetails and gains, at 12½ cents - -	4 50
Sixty dowels and driving, at 6¼ cents - - -	3 75
Use of scows, cranes, and tools - - - -	1 00
Waste timber and labor lost - - - -	6 73
Stone, 22 cubic yards, at 85 cents per yard - - -	18 70
Cost of one crib - - - - - -	57 00
Eighty cribs, (30 feet long, 5 feet high, and 6 feet wide,) at $57 per crib - - - - - -	4,560 00
Contingencies, 10 per cent. - - - - -	456 00
Aggregate - - - - - -	5,016 00

Estimate of funds required for the service of the public works at Buffalo harbor, New York, during the year 1840.

First. For the prolongation of Buffalo mole :

For 10 sections, (100 yards,) in 14 feet water, at $6,100 per section - - - - -		$61,000 00
For 8 scows - - -	$2,800 00	
For 20 cranes - - -	2,000 00	
For shanties, tools, &c. - -	3,800 00	
		8,600 00
		69,600 00

Second. For repairs of channel pier, preserving depth in channel of creek, and protecting beach :

For 80 cribs, (2,400 feet,) at $57 per crib, and contingencies - - - - -	$5,016 00

Recapitulation.

First. For prolongation of mole - - - -	$69,600 00
Second. For repairs of channel pier, &c. - - -	5,016 00
Amount required for 1840 ! - - - -	74,616 00

Buffalo Sea-Wall.—The Buffalo sea-wall has progressed rapidly upon its original plan. My only change has been in the adoption of hydraulic lime exclusively, and giving a coping to the top of the wall with sufficient slope to throw of the water which would otherwise be likely to lie upon it and insinuate itself into the interstices. The money on hand it is hoped

will be sufficient to fulfil the object intended by it, and therefore no further estimate is submitted.

The effect of this work upon the harbor has been very advantageous, although it cannot be expected to prevent the rise of water in the creek in a degree proportionate to the rise of the lake, in heavy gales from the west; yet it mitigates the evil in a very important manner. It prevents the surf rolling over the low flat between the creek and the lake as it formerly did, to the destruction of every species of property, and causes only a gradual rise of the water, which is not attended with much injury to property and no danger personally to the inhabitants. The accompanying sketch shows the condition of the wall at the time I took charge of the work, 30th September, 1838, and the progress that has since been made:

Scale 400 feet to 1 inch. Scale elevation 20 feet to 1 inch.

September 30, 1839. The wall has been extended 840 feet, which with 1,480 feet built last year, makes 2,320 feet completed and coped.

The average height this season equals 13 feet. The base $5\frac{6}{10}$ feet thick. All the masonry this year, except a few yards early in the season, has been laid in hydraulic lime. The embankment or mound of earth on the inland side of the wall is yet to be raised about 3 feet. Experiments in regard to the character of the lime used have been made and are now in process; it was found that the admixture of common and hydraulic lime, which had been previously used, did not become indurated, and its adoption was therefore rejected. This probably pertains to the quality or some peculiarity of the hydraulic lime, as in other cases it has been found to succeed in the same proportions.

Cattaraugus Creek Harbor.—Since my last annual report, this harbor, although but a small amount of money has been expended upon it, has developed its advantages and its capacity for improvement in a very signal manner.

The following facts are derived from a very intelligent statement, afforded me by Thomas B. Stoddard, Esq., deputy collector for the port, in reply to my official note requesting statistical information from his office.

The official statement of arrivals and departures of vessels since the opening of navigation this season, exhibits an increase of direct commerce with tide water of more than 400 per cent. over that of the preceding year. This increase has resulted entirely from the progress of the national improvements executing in reference to the harbor. Other impulses have likewise originated in the same cause, and we may note particularly the development that has taken place in regard to the manufacturing resources of the country adjacent. The stream, which falls into the lake at this point, and constitutes the harbor, has a vertical fall of 200 feet in a distance of 13 miles; and a partial improvement at the head of the inner harbor, alone furnishes a power adequate to the operation of 60 run of stone.

Vessels of burden of upward of 100 tons have been built at a distance of about one and a half miles above the harbor, at the village of La Grange, since the commencement of the public works; and the settlement of the west side of the creek has rapidly progressed. It is scarcely to be doubted that this point will, by its local advantage alone, become extremely important as soon as the territory on the east side of the creek shall be relinquished by the Indians, who now inhabit it. This land, however, being yet uncleared of its growth to any considerable extent, supplies the best of timber for building purposes or naval architecture on the lake coast. Cattaraugus is characterized, also, as the highest point on the lake to which canal boats through the Erie canal habitually resort; thus furnishing an important depot for the goods destined to the east, which, arriving too early in the spring to find admittance at Buffalo, owing to the accumulation of ice, may be consigned to canal boats at Cattaraugus, to await the first opening that presents itself.

The historical sketch of the public improvements at Cattaraugus, required by the bureau, and furnished to me by T.S. Brown, Esq., local agent, is as follows: The original surveys, preparatory to the commencement of these works, were executed by Mr. Stoddard, under the direction of Captain Henry Smith, of the United States army, in the fall of 1835 and winter of 1836. The first appropriation, amounting to $15,000, was made in 1836: the superintendence was confided to R. T. P. Allen, Esq., who remained in charge until the 8th of October, 1838, when they were consigned, with the other works on the southeast shore of the lake, to my charge, as general superintendent. In 1837, there was an appropriation of $10,000 for its improvement; and in 1838, an appropriation of $32,410, making, in all, $57,410. Of the appropriation made in 1838, one half was to be expended in that year, and the remainder in 1839. In 1839, no appropriation was made.

The mouth of Cattaraugus creek, in its natural state, was liable, every summer, to be obstructed by a beach of sand, which was thrown across it by the lake surf; whenever a freshet occurred, the creek would force a channel across the beach, but the obstruction would always be renewed when the water subsided to its ordinary level.

The first object of the proposed improvement, was to keep the mouth of the creek open by parallel piers of cribwork filled with stone, projecting sufficiently far into the lake, and having between them the channel of the creek, which was to be deepened and kept clear by the force of the current. After properly securing the entrance, the next object was to increase the depth of water in the creek for about half a mile above the mouth, for which object it was thought that dredging would be necessary in aid of the current, the force of which was to be increased by confining the creek within limits sufficiently narrow by crib-work of a cheap kind, extending upward, along its banks. On assuming charge of the work, and after making the necessary examination, Mr. Allen proceeded to carry on the works according to these principles. Up to the time of his resignation, his operations were chiefly confined to the west channel pier, of which a length of 600 feet was built up 8 feet above the water, planked over and finished; a length of about 300 feet was made nearly ready for planking, and 380 feet in length was raised and filled with stone to the surface of the water. On the east channel pier, a commencement was made, by putting down a few courses of timber for a length of 150 feet, leaving a channel way 300

feet wide. Up to the 30th September, 1838, Mr. Allen had expended $38,073 86.

On taking charge of the work, I was impressed with the conviction, from the information that I was enabled to procure, in regard to the character of the stream, at the mouth of which the harbor is situated, that, although at certain seasons its velocity was considerable, it could scarcely be relied on for the accomplishment of the original plan in effecting a channel of adequate depth upon so wide a section as had been therein contemplated. I ordered, therefore, that the channel should be reduced to a width of 200 feet only, a width amply sufficient for the object intended. This view of the case was concurred in by T. S. Brown, Esq., the local agent, whose opinion, by his experience and intelligence, is entitled to confidence; and whose valuable services it gives me pleasure to acknowledge.

I will now state what has been executed during the past summer as to amount of work, and the changes that have been effected by it in regard to the improvement of the entrance.

Of the east channel pier, a length of 660 feet has been constructed in water varying from two to ten feet in depth, of which 630 has been raised four feet above the level of the water, and nearly filled with stone. For about 280 feet at the outer end, the pier is eighteen feet wide, the remainder is twelve feet wide. The general direction of the channel is north 68° west.

On the west channel pier, a length of 340 feet has been planked over and finished, and a length of 380 feet has been built up eight feet above the water, and one-third filled with stone. The width of the part which has been built upon this season, is 24 feet. The actual length of the west channel pier is 1,270 feet.

The channel piers are now extended as far into the lake as it is proposed they shall be during the present season. The amount remaining available will be expended this fall in extending the piers up the creek. If the weather should prove favorable, several hundred feet of pier may be begun and built up to a sufficient height, fully to test the effect on the bottom during the next spring floods. The results of the disposition already effected have been equal to our most sanguine anticipations. A permanent channel of sufficient width has been effected by the increased velocity of current, produced by the contraction of the channel, and it now offers a safe harborage to vessels that may resort to it. There is now a clear expanse of water subsisting between the parallel piers of 200 feet in width, while in September, 1838, when I assumed charge of the work, the width of the entrance to the harbor was not more than fifteen feet, and at that season inaccessible to any species of vessels.

I have caused a careful survey to be made of the piers and of the creek, the map of which accompanies my report, and to which I respectfully refer you for further minute details, as also for the changes that have taken place in the outline of the lake shore in the vicinity of the harbor.

The amount available on the 30th September, 1838, was -	$19,336 14
The amount expended from that date to September 30, 1839 -	14,991 63
Of which there was disbursed under my direction - -	14,851 83
The amount in the hands of agent, 30th September, 1839 -	344 51
The amount in the treasury - - - - - -	3,997 00
The amount available for 4th quarter of 1839, is therefore -	4,341 51
The materials, buildings, machinery, tools, &c., which remain on hand have cost - - - - - - -	3,250 25

During the next year it is proposed, first, to contract the channel of the creek by cribwork for a length of probably 900 feet, which will cost, according to the estimate (A) accompanying this report, $17,815 78; second, to extend the west channel pier about 256 feet into the lake, and to construct at its outer extremity a pierhead, forty feet square, which will cost, (see estimates B 1 and B 2) $12,784 22.

The following estimate has been submitted to this office by the local agent, and approved. To effect the object intended, advantageously, and in fact to prevent injury to what has already been effected, an early appropriation of funds to this amount is absolutely essential.

Estimate of funds required for continuing the public works at the mouth of Cattaraugus Creek, New York, for the service of the year 1840.

A.

For extending the piers 900 feet up the creek, to contract the width of the channel:

For one pier 900 *feet long.*

360 flat side sticks, 32 feet long, 13 by 18 inches, at $2 each	$720 00
1,080 cross tie pieces, 6 feet long, 10 inches in diameter, at 25 cents each	270 00
180 red beech square piles, 20 feet long, 13 by 13 inches, at $1 25 each	225 00
146 cords soft pier stone, at $3 per cord	438 00
169 cords hard pier stone, at $8 per cord	1,352 00
1 ton bolts	200 00
Superintendence, carpentry, and labor, 6 months, at $816 per month	4,896 00
Contingencies	806 89
	8,907 89
For the two piers	17,815 78

B 1.

For extending the southwest pier into the lake, 256 feet:

208 flat side sticks, 32 feet long, 13 by 18 inches, at $2 each	$416 00
4,096 feet finishing timber, 13 by 13 inches, at 8 cents per foot	327 68
552 cross tie pieces, 24 feet long, 10 inches in diameter, at 62 cents each	342 24
48 squares red beech piles, different lengths, 13 by 13 inches, at $2 98 each	134 10
589 cords soft pier stone, at $3 per cord	1,767 00
352 cords hard pier stone, at $8 per cord	2,816 00
1 ton bolts	200 00

Superintendence, carpentry, and labor, to construct pier, &c., 3 months, at $816 per month	$2,448 00
Add 20 per cent. for contingencies on $8,451 02	1,690 20
Amount required for the object is	10,141 22

B 2.

For a pierhead at the northwest end of the southwest pier 40 by 40 feet:

2,400 feet flat side sticks, 13 by 18 inches, at 8 cents per foot	$192 00
1,280 feet hewn timber, for finishing, 13 by 13 inches, at 10 cents per foot	128 00
142 cross tie pieces, 40 feet long, 12 inches in diameter, at $1 each	142 00
20 red beech squares piles, 45 feet long, 13 by 13 inches, at $4 each	80 00
187 cords soft pier stone, at $3 per cord	561 00
100 cords hard pier stone, at $8 per cord	800 00
½ ton bolts, at $200 per ton	100 00
Superintendence, carpentry, and labor, for constructing same one month	400 00
Contingencies	240 00
Amount required for this object is	2,643 00

RECAPITULATION.

1st. For extending the pier 900 feet up the creek	$17,815 78
2d. For extending the southwest pier into the lake	10,141 22
For a pier head for same	2,643 00
Aggregate amount required for 1840, is	30,600 00

Dunkirk.—From the time of rendering the last annual report to the termination of the season of active operations, about the first of December, the work executed consisted in building up and finishing off 120 feet in length of the detached pier, constructed during 1838; building up and finishing 60 feet in length of west pier, by an increased elevation of three feet; removing stone from the shore to the piers, filling in, &c.; hewing, framing, and preparing timber. As the weather was extremely bad during the most part of the fourth quarter of 1838, but few hands were kept in service, and no additional extensions to either of the piers have been executed. No work has been done during the present season, in consequence of the failure of the harbor appropriation bill.

There has been disbursed, from the 1st October, 1838, to the 31st May, 1839, inclusive - $3,337 27

Amount of receipts during the same period, to wit:

In agent's hands on the 1st October, 1838	$215 81	
Received from United States Treasury for October, 1838	2,000 00	

Received from United States Treasury for November, 1838 - - - - -	$1,000 00	
Received from sale of a yoke of public oxen -	61 06	
		$3,276 87
Excess of expenditures over receipts -		60 40

The amount estimated for carrying on the works for the year 1840, accompanies this report, together with a statement of the several appropriations made on account of Dunkirk harbor, up to the year 1838, inclusive, as well as amount of disbursements, &c. The only changes perceptible in the harbor, in relation to abrasion or alluvial deposite, since my last annual report, have taken place on the beach and alongside the western pier; the sand has accumulated upon a distance from A, running eastward about 304 feet, averaging about 16 feet in width; and thence running in shore the formation has been about 33 feet in width; making the formation length, from where the pier commences on the main, to its termination alongside of the pier eastward, 1,000 feet, averaging in width about 176 feet. The formation on the south side of the pier (see map) has been removed (by the heavy swell coming in, made by the seas entering the bay between the western pier and breakwater, and striking against the detached pier, and then setting in shore to the west end of the bay) 112 feet in length, a great deal of which has been thrown on the main shore. These are the only apparent changes that have occurred during the past season. The exhausted state of appropriation for this harbor did not allow us to make such surveys as would have enabled us to note changes in the depths; we do not apprehend, however, that there are any material alterations since they were last taken; the average height of the lake is about the same as it was at the time of the last survey. The lake appears to have receded and fallen since the first of July from eight to ten inches.

I beg to recall to mind, that the condition of this valuable harbor is such as to require the attention of the Government, inasmuch as the works are in a most unprotected condition, left in their unfinished state; and that true economy would render imperative an immediate supply of the means necessary to continue the work.

The following is a concise history of the appropriations that have been made from time to time, in relation to this work, furnished by Thomas Forster, Esq., the local agent for that harbor, whose fidelity and general usefulness, in the discharge of his duties, I take this opportunity to acknowledge. I herewith, likewise, transmit the estimate submitted by him to this office, for the further prosecution of the work:

Statement exhibiting the estimates, appropriations, and expenditures, &c., in relation to the public works constructed at Dunkirk harbor, New York, from 1827 to 1838, inclusive.

Years.		Estimate.		Appropriations.	Expenditures.	
In which estimate was made.	In which to be expended.	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending, &c.
1826	1827	– –	$3,000 00	$3,000 00	$3,000 00	
1827	1828	– –	–	6,000 00	6,782 32	Major T. W. Maurice.
1828	1829	– –	–	9,812 75	11,473 17	
1829	1830	– –	–	1,342 75	1,904 25	
1830	1831	– –	–	6,400 00	5,330 10	
1830	1831	– –	–	702 50		
1831	1832	– –	–	10,200 00	3,772 88	J. D. Selden, Esq., general agent.
1832	1833	– –	–	–	6,621 81	Do.
1833	1834	– –	–	4,000 00	3,415 72	Do.
1834	1835	– –	18,446 86	10,988 43	9,335 17	Lt. T. S. Brown.
1835	1836	Lt. T. S. Brown -	47,748 09	11,000 00	6,981 70	Lt. Brown and Capt. Smith.
1836	1837	Capt. H. Smith -	48,020 50	15,000 00	21,002 40	Capt. H. Smith, and T. S. Brown.
1837	1838	T. S. Brown, Esq. -	50,000 00	10,000 00	8,271 58	T. S. Brown, and Capt. Williams.
1838	1839	Capt. W. G. Williams	50,000 00	–	3,337 27	Capt. W. G. Williams.
				88,446 43	87,951 47	

Estimate of funds required for the service of the United States works at Dunkirk harbor, N. Y., for the year 1840, for the purposes hereinafter mentioned.

First. For commencing a permanent stone wall of 9 feet high, on the breakwater in front of the harbor already constructed, of large, heavy quarried stone, to be laid in hydraulic cement, and fastened together with iron clamps, &c.:

6,000	cubic yards quarried stone, at $2 per yard	$12,000 00
6,000	cubic yards masonry, at $1 30 per yard	7,800 00
4,000	bushels hydraulic cement, at 37½ cents per bushel	1,500 00
14	laborers, 2,548 days, at 90 cents per day	2,293 20
	For carrying off stone, lime, sand, and doing all necessary labor while constructing works, &c., 20 per cent. for contingencies, which is to cover all expenses for extra scows, boats, machinery, tools, smithery, &c.	4,718 64
	Add for unforseen contingencies	1,581 36
	Amount required for the above object is	29,893 20

Second. For extending breakwater eastward 750 feet, by crib work, filled with common stone to the surface, at which the masonry commences:

600	side sticks, each 32 feet long, 13 × 18 inches, at $2 each	$1,200 00
1,090	cross tie pieces, 20 feet long, 10 in. diam., at 62 cts. each	681 25
150	red beech posts, 20 feet long, 14 × 14 in., at 72 cts. each	108 00
3,000	white oak treenails, 2½ feet long, at 2 cts. each	60 00
4,000	lbs. bolts, at 10 cts. per lb.	400 00
1,406	cords pier stone, at $3 per cord	4,218 00
25	laborers, 8 months each, 5,200 days, (board included,) at 90 cts. per day	4,680 00
1	chief carpenter, 8 months, 208 days, at $2 33 per day	484 64
2	assistants, 8 months, 416 days, at $1 33 per day	556 28
4	horses, 8 months, 832 days, a $1 per day	832 00
1	superintendent, 9 months, 275 days, at $2 50 per day	687 50
	Add 20 per cent. for contingencies	2,780 93
	Amount required for this object is	16,685 60

Third. For extending detached pier, erected in 1838, 60 feet westward:

30	side sticks, 32 feet long each, at $2 each	$60 00
92	red beech posts, 20 feet long, 14 × 14 in., at $1 20 each	110 40
100	cross tie pieces, 20 feet long, 10 in. diam., at 63 cts. each	63 00
500	feet hewn timber, red beech, at 6 cts. per foot	30 00
1,000	white oak treenails, 2½ feet each, at 2 cts. each	20 00
150	cords pier stone, at $3 per cord	450 00
500	lbs. bolts, at 10 cts. per lb.	50 00
	Carpentry, at 90 cts. per day	200 00
	Labor, 600 days	540 00
	Smithery	25 00
	10 per cent for contingencies	154 84
	Amount required for this object is	1,703 24

Fourth. For putting in repair and securing the breakwater and western pier, which is fast decaying, until a stone wall be erected thereon:

4,800	feet hewn timber, 13 × 13 inches, at 6 cts. per foot	$288 00
120	cross tie pieces, 20 feet long, at 63 cts. each	75 60
200	cross tie pieces, 18 feet long, at 60 cts. each	120 00
500	lbs. bolts, at 10 cts. per lb.	50 00
300	cords pier stone, at $3 per cord	900 00
	Carpentry	60 00
	Labor	150 00
	Contingencies	74 36
	Amount required for this object is	1,717 96

Recapitulation.

1st.	For commencing a permanent stone superstructure	$29,893 20
2d.	For extending breakwater eastward	16,685 60
3d.	For extending detached pier westward	1,703 24
4th.	For repairs, &c., on breakwater and west pier	1,717 96
	Total amount required for service of 1840	50,000 00

Portland harbor.—Owing to the expenditure of a large amount of funds for materials by R. T. P. Allen, Esq., who was in charge of the work before I was assigned to it, the appropriation was so far exhausted that very little money remained for the necessary labor to lay down the work. It is presumable that Mr. Allen, in making this arrangement, supposed the appropriation would be renewed by Congress at the ensuing session, and that purchases could be made with greater advantage at that time. The appropriation for continuing the work having failed, a vast quantity of materials is now on hand, as shown upon the quarterly returns in possession of the bureau. In order to prevent an entire loss of the timber, which is now in a great measure exposed to decay, an immediate appropriation of funds is necessary, so that these materials may be worked up, and a heavy expense saved to the Government, which would accrue in their renewal. Independently of this desideratum, it may be urged that the work is in its unfinished condition, exposed to danger from every gale of even moderate violence. During the last fall much injury has been done and a large portion of the stone has been washed out of the cribs. No survey has been made of this harbor, but from inspection, it is perceived that the shore is washing away at the eastern portion of the harbor, in the vicinity of the Barcelona pier; while it is forming at the west side in the vicinity of the Government work. The beach, in fact, has made on both sides of the work, at its intersection with the shore. This unusual effect on the east or leeward side, arises from the action of the current, reflected from the wharf, which has been thrown out for the facility of commerce, by the local authorities or by individuals.

An approximation to this change will be shown on the map. I beg leave to subjoin the estimate for this harbor, based upon that of the preceding year, as no circumstance has occurred to change materially the amount required.

According to statements received from individuals engaged in commerce at this port, there has been a considerable increase in its trade during the

last year. Several steamboats now touch there regularly; and even in its present unfinished state, it offers a good protection to vessels during the heavy storms. The following statement shows the amount of work executed, with the means at our disposal since my last annual report.

During the 4th quarter, 1838, the work resulted as follows:

Finishing timber,	7,000 feet,	scored, hewed, and framed.	
Ties,	11,200	do.	do.
Side logs,	6,650	do.	do.
Sills and posts,	300	do.	do.
Treenails,	6,200, hewed and driven.		
Finishing timber,	7,100 feet,	placed on the pier.	
Ties,	5,050	do.	
Plank,	6,400	do.	
Timber,	240	sawed.	

Two cribs, built and sunk.
Workshop erected, 70 by 20 feet.
Three scows drawn out of water.
About 10,000 feet of timber, piled away in yard.

During the 1st quarter, 1839, the hands were employed in preparing timber for the ensuing season:

Side logs,	7,776 feet,	scored, hewed, and framed.	
Ties,	15,028	do.	do.
Finishing timber,	4,922	do.	do.
Posts,	317	do.	do.
Sills,	352	do.	do.

During the 2d quarter, 1839, there was laid on the pier:

Timber,	4,200 feet.	
Ties,	2,870 feet.	
Plank,	41,720 feet.	
Stone,	65 cords.	
Finishing timber,	200 feet,	hewed and framed.
String pieces,	1,200	do.
Ties,	630	do.
Treenails,	500, prepared for use.	

Annual estimate of funds for the service of Portland harbor improvements during the year 1840.

For finishing timber, 7,000 feet, at 10 cents per foot -	$700 00
For side logs, 20,000 feet, at 8 cents per foot - -	1,600 00
For ties, 1,200, at $1 each - - - - -	1,200 00
For posts, 3,000 feet, at 10 cents per foot - - -	300 00
For sills, 2,000 feet, at 8 cents per foot - - -	160 00
For stone, 2,000 cords, at $5 per cord - - -	10,000 00
For stone, 500 cords, at $7 per cord - - -	3,500 00
For labor and subsistence, 150 months, at $25 per month -	3,750 00
For contingencies, &c. - - - - -	2,000 00
Amount required for 1840 is - - - -	23,210 00

Total estimate of funds, showing the probable cost of the western breakwater, at Portland harbor, including also the cost of the eastern breakwater.

For side timber, 40,000 feet, at 8 cents per foot	$3,200 00
For ties, 2,500 logs, at $1 each	2,500 00
For posts, 5,000 feet, at 10 cents per foot	500 00
For sills, 4,000 feet, at 8 cents per foot	320 00
For stone, 4,200 cords, at $5 per cord	21,000 00
For labor and subsistence	7,000 00
For contingencies, agent's salary, &c.	3,500 00
Amount required for completion	38,020 00

Erie.—In my last annual report, I adverted to the fact that no surveys of a character commensurate with the improvements projected at this place, had hitherto been executed. Funds having been provided me for this object, I entered on the work at the first opening of spring, and am now enabled to submit to the bureau a map in detail of the harbor, bay, and Presque isle of Erie, upon which the plans and projections will be founded. The Presque isle, so called, but now isolated by the breach that took place some years ago at the western extremity of the bay, has likewise been carefully surveyed, because its protection was deemed of vital importance to the preservation of this valuable harbor; a strict reconnoisance has been made, and all the peculiarities of the ground carefully noted on the map. The results of this examination point out the necessity of attending to its protection at certain points, where the waters of the lake have already invaded the island, and almost found their way across to the bay. The expense of precautionary measures for the protection of these points would be comparatively insignificant, while the neglect of them might lead to the destruction of the harbor, or an incalculable outlay of money. The point particularly referred to is at the west end of the bay, indicated upon the map, from Y to Z, where the growth of timber has been destroyed. A line of cribwork, very narrow and inexpensive in its character, would be sufficient to accumulate the sand, and by keeping out the water from the lake, restore the land to its former state of vegetation. It is true, that the lake is at present receding, which may obviate the necessity of immediate measures, but we deem it prudent to be prepared for contingencies; and a small portion of the appropriation might be judiciously expended upon this object, should circumstances at the opening of the ensuing spring seem to require it. Indeed, the more care must be observed in this respect, because the Presque isle being, by the channel, detached from the main land, the transmission of sand along shore, which, according to observations, generally supplies erosions, will be by this means cut off. This, nevertheless, does not hold good in the present instance, so far as my observations have extended, for the sand has made at the outer or northern side of the channel to a degree more than would seem commensurate with the fall of the lake. The changes that have taken place by the formation of sand bars, &c., in such localities as have been formerly surveyed, will be shown upon the map, which exhibits, moreover, the data we have procured with a degree of perspicuity that leaves comment unnecessary.

I will nevertheless make an observation here in regard to some of its most notable developments. We perceive that the average length of the bay is four miles, and the breadth is one and a half miles; that there is an average depth of water of 25 feet, and that no shoal of any kind obstructs its free navigation; that it is entirely land-locked and protected from the heaviest gales, with the best bottom for anchorage; and that it thus forms a roadstead which leaves nothing to be desired for the accommodation of any amount of the largest class of shipping that may be imagined upon the lakes; and as a national naval rendezvous would assuredly be unsurpassed.

Turning the attention to the curves at the inner side of the east channel, it will be perceived that a spit of sand, forming a bar, interposes to a direct course from the channel piers towards the harbor; the channel makes a curve somewhat to the northward of the pier; this we think arises as follows: heavy gales from the west, from their action on the surface, force the water to a superior elevation in the little bay; during this time, the lower prism of water being acted upon by a superior column on the inside, rushes out with an intensity due to the difference of elevation, and erodes and carries in its current the light sand which forms the bottom. This creates and keeps open a depth about the mouth of the Little bay. By a similar action the channel between the piers is eroded; and in both cases, the sand held in suspension, which must necessarily be deposited when the under current loses its intensity, reaches a common point and forms the irregular shoal above alluded to. This complicated action appears necessary to explain the depth of water at the north of the channel piers on the inside, as the mere deposite from the erosion of the channel would throw a bar entirely across the entrance.

As considerations connected with this obstruction would necessarily have an influence in any modifications or further plans devised for the eastern entrance, I think it proper to advert to it thus particularly in order that I may have the advantage of such suggestions or instructions as you may think proper to communicate.

I shall now proceed to a statement of the work executed during the past season. The constructions have progressed more advantageously than usual, owing to an early commencement in the spring, permitted by the money being on hand, and thus not being obliged to await the appropriation by Congress, which generally protracts the commencement of operations to a period too late in the season to effect as much as could be desired. Since my last annual report, the pier at the western extremity of the harbor on the northern side has progressed in a very satisfactory manner. The work has been executed from section No. 82 to No. 105, amounting to a development of 690 feet, by sinking cribs filled with stone in about 3 feet water. The cribs are 12 feet wide. The sand has accumulated on both sides of the work in proportion as they were laid down. On the lake side, the accumulation takes place with a rapidity that is observable from day to day. From No. 77 to No. 82, on a distance of 150 feet, the upper portion of crib-work was laid down, bolted with iron, and filled in with stone. These counterforts at sections Nos. 85, 92, and 99, have been executed on an elevation of 8 feet, filled with stone and bolted. I have deemed it prudent also to secure the low ground, which was threatened by the lake at the northeastern termination of the work, by having the line of cribs extended across the lowest part, as a precautionary measure; and the work is

now completed from section No. 20 to No. 29, a distance of 300 feet. This has rendered the island secure from any irruption of the lake at that point. At the eastern entrance of the harbor and on the southern side, repairs have been made from section No. 80 to No. 85; 150 feet of the breakwater, which had been injured by the storm, have been repaired, involving an expense of about $400; a number of snags, amounting to 150, which were scattered about the harbor with their roots imbedded in the sand, have been removed.

In reply to the request of the bureau to have an historical sketch of the commencement and progress of the several works under my charge, I have the honor to transmit the following information mainly derived from the report of P. S. V. Hamot, Esq., local agent, Erie, Pa.

The improvements at the eastern entrance of this harbor were commenced in 1824, under an appropriation of $10,000, by the State of Pennsylvania, carried on under the direction of three commissioners, Thomas Forster, Thomas Laird, and Robert Brown, all now deceased. These works were commenced at No. 11 on the southwestern breakwater, extending into the sand, and carried northwardly towards the channel to No. 78, being constructed six feet wide, and the foundation timber laid in a declination from a plane of about 10 degrees, and built up to the surface of the water; the horizontal timbers were tied with cross ties and pinned into the under timbers and piled. The top timbers have had to be repaired repeatedly, the lower timbers having become rotten at the top. The work from No. 13 to No. 1, southwardly, was erected in the year 1838, in consequence of the overflow of the bay, and the water cutting around this point, to the extent of 300 feet; this work is permanent, the timbers laid horizontally eight feet wide, well tied and filled with stone.

In 1823, the board of engineers made an estimate for the construction of these works, and an appropriation of $20,000 was made in 1824, by Congress, and the works placed under the superintendence of Captain T. W. Maurice, who gave the plan as now constructed, and they were carried on by him under various appropriations by Congress until the year 1831, when he died. The works at that time had assumed their present form, and as far as to No. 25 of the northern breakwater, left for finished, having extended it to a point of land from the peninsula. But at this time, and in consequence of the rise of water in the lake, the waters of the lake and bay became united at this northern point; and the works were afterward carried to No. 98, the present termination of the northern breakwater, where is making an accumulation of sand on the lake side.

In the years 1832, 1833, 1834, and part of 1835, these works were under the general superintendence of Joseph D. Selden, who attended to the repairs and construction of the northern extension of the north breakwater. In 1835, Lieutenant T. S. Brown, of the engineer corps, took charge of these works and made the survey and estimate of the works for the western end of the bay.

The channel at the eastern entrance was from 4 to 5 feet deep, and very crooked and narrow, running from the south shore and crossing into the bay at the point where the channel piers are now erected. Part of these channel piers were laid in quite shallow water, some part not over 4 feet. By contracting the outlet by means of the south and north breakwater and the channel piers, the channel was made straight with an average depth of water of at least 12 feet, and is now abundantly deep for all vessels navi-

gating the lake. At an earlier day, viz, in 1806, the sand beach on the southern side of these works was quite extensive, extending perhaps 100 rods farther into the lake than at the present time.

The works at the western end of this harbor were planned by Lieutenant T. S. Brown, of the engineer corps, in 1835, and were commenced in the summer of 1836, under his directions, with some little alterations of the point of commencement; the line of work being put nearer the lake at the western end of the peninsula. When Lieutenant Brown left this place the works were placed under the general superintendence of Capt. Henry Smith, of the United States army, who had the charge until the spring of 1837, when their superintendence was again placed under Lieut. T. S. Brown, who exercised the general superintendence until the 1st September, 1838. These works, in the year 1836, were extended 594 feet, viz: From No. 1 to near No. 20, and were all laid down in sand one foot deep below the level of water, leaving a space of sand and some trees standing between the work and the lake. In 1837, the water of the lake encroached on this part, and in 1838, prostrated the few trees, washed away the sand, and the lake extended its waves to the works; now the sand is accumulating again, commencing at No. 12 and following our works, and has made to a considerable extent as far as No. 84. In 1837 the southern extension was continued from No. 20 to No. 65, laid in water at an average depth of 2 feet. This year, also, was laid 120 feet, running from No. 1 to No. 4, northeastwardly, to secure the head of the peninsula; the waters of the lake making a demonstration to cut through this narrow neck. This portion of the works was farther extended in 1838 from No. 4 to No. 20, to protect the peninsula; the waters of the lake, in the spring of that year, having actually encroached a considerable distance, and in high winds quite across. This part, laid in water 2 and 4 feet deep, is now permanent, all being built of pierwork, 12 feet wide, 8 feet high, and well filled with stone; and was farther extended this year, 1839, from No. 20 to No. 29, to a sand point of some elevation; and, in consequence of the waters of the lake receding, gives hope that no farther encroachment on that part of the peninsula will be made. The whole extent of this protection pier is 870 feet long, 12 feet wide, and 4 feet 9 inches above water, and 8 feet high from No. 6 to No. 14, and then 7 feet to No. 20. In 1838, the southern extension of pierwork at the head of the bay was also continued from No. 65 to No. 82 at 8 feet of elevation, 12 feet wide, and averaging from 18 inches to 3 feet deep, well tied and filled with stone. This work is becoming very permanent by the accumulation of sand on both sides, and particularly on the lake side, interspersed with pebble stones.

In 1839, this southern extension of pierwork was farther extended from No. 82 to No. 105, of the same dimensions but in deeper water, being not less than 3 feet. The sand has now made around the works from No. 12 to No. 96.

In addition to the pierwork, it was found necessary to build quarters for the men, boarding rooms, and also shed, shop, and stable, that, in rainy weather, the men might be employed in framing timbers. &c.; a workshed, 50 by 30 feet; smithshop, 20 by 30 feet; and stables 45 by 30 feet; and 53 feet additional to quarters and cooking rooms were accordingly erected.

In September, 1838, I was ordered to take charge of the work, since which time a detail of operations is found in the present report. In regard to the advantages of the project, of which it was question in my last report,

namely, to effect a channel at the west end of the bay, there can be but one opinion. It will save several miles to every vessel entering the port, and frequently enable vessels to prosecute their voyage, while, under circumstances at present existing, they would be compelled to remain in the harbor. In my last annual report (see Senate doc. No. 1, last session, page 376) its advantages as a naval depot were alluded to; I shall, therefore, not repeat a view of the case, which was therein urged with all the zeal that a strong conviction of the importance of the subject suggested. The rather that yourself having, on your late tour of inspection, been enabled to judge of its claims, they will be advanced by you to the consideration of the Government in a manner due to your just appreciation of their value. By reference to the accompanying map the general plan of the work will be shown. I have carried the direction of the channel upon the shortest line of shoal water, or the present natural channel through the breach. This appears, likewise, to accord with the best arrangement of channel in regard to the prevailing winds, as it will allow vessels to enter with a quartering wind, and, at the same time, shelter the channel itself from their direct sweep, which would perhaps create too much agitation in the bay.

From the present termination of the work, the cribwork will be extended 1,620 feet to the proposed emplacement of the channel piers. They will be increased in width as they approach the channel, because they will not only be sunk in deeper water, but it is probable that there may be a tendency to erosion in the outer angle on the north side of the channel piers. In the outer angle, on the south side of the channel piers, there will, on the contrary, be a tendency to accumulate the sand as it is brought down by the action of the prevailing winds; hence the cribs are reduced in width to 12 feet, which will be sufficient to serve as the nucleus of a sand bank, which it is hoped will be formed there, as a barrier to any further irruption of the lake, and become sufficiently consolidated to be improved and fortified by a covering of vegetation. The piers have been carried along upon the whole development of sand beach to the shore rather as a precautionary measure than one of immediate necessity. By establishing a narrow line of cribwork, the sands will accumulate in a greater degree and be raised higher above the surface of the water, and be thus prepared for any tempest that may occur during some future rise of the lake. The channel piers will have to resist the erosion that will necessarily take place by the dredging of the channel; and I have given them, therefore, a width of 31 feet. They will be carried out to a depth of 15 feet, as shown on the accompanying map. The superstructure, to surmount the channel piers, will not be estimated in my present report, because, preparatory to commencing this work, it is desirable to see the effect produced by the plan, and to institute such modifications as may be deemed necessary. The superstructure, however, would be principally confined to the channel piers at either entrance of the bay, and would amount to comparatively a small amount; having neither the ice nor the great elevation of water during a gale to encounter as at Buffalo.

A vertical wall established upon a bed of concrete, superposed upon the cribwork referred to, and corresponding to its width, will, we believe, procure sufficient stability to the mass. A similar superstructure will, we think, have to be adopted for the piers at the eastern entrance of the bay, and, indeed, at this time the advantage of commencing the work is apparent. The upper timbers are rapidly decaying; nevertheless, as they are

greatly protected by the island from the action of the surf, I should regard it as expedient to postpone it to the prosecution of the plan at the west end of the bay, by which means, having the ensemble of plans and many useful developments before us, we shall be prepared to make such modifications as may be found necessary at a comparatively moderate expense.

The local superintendence of the works at Erie from the time of my assuming charge, has been up to a late date administered by P. S. V. Hamot, Esq., who has since retired from these duties. It is but justice to Mr. Hamot to state that, during the time he has been under my supervision, he has shown a zealous interest for the public service.

Estimate of funds required for the service of public works at Presque Isle, Erie, Pennsylvania, in the construction of the western entrance.

First.—A crib 30 feet long, 16 feet wide and 10 feet high:

20 side sticks, 30 ft. long, 12 inches square, 600 ft. at 7 cts. per ft.	$42 00
35 ties 16 do. 8 × 8 inches at 75 cts. each	26 25
8 piles, oak 24 do. at $2 each	16 00
Brush	5 00
124 ft. white oak tor cap and cross pieces, at 12½ cts. per foot	15 50
33 cords stone, at $7 per cord	231 00
Workmanship and boarding	75 00
Driving 8 piles, at $1 50 each	12 00
Proportion of team, hauling timber	6 00
Iron bolts, extra work, and contingencies	71 25
Cost of one crib, is	500 00
Cost of 34 cribs, (1,020 feet) at $500 per crib is	17,000 00

Second.—A crib 30 feet long, 19 feet wide, and ten feet high:

30 side sticks, 30 feet long, 1 foot square, 900 feet, at 7 cts. pr. ft.	$63 00
70 ties 10 do. 6 × 8 inches, 2,800 ft. at 1 ct. pr. ft.	28 00
Brush	8 00
12 piles, 24 feet long, at $2 each	24 00
174 feet white oak for caps and cross pieces, at 12½ cts. per foot	21 75
38 cords stone, at $7 per cord	266 00
Driving 12 piles, $2 each	24 00
Proportion of team, hauling timber	8 00
Iron bolts, extra work, &c.	157 25
Cost of one crib, is	600 00
Cost of 20 cribs, (600 feet,) at $600 per crib, is	12,000 00

Third.—A crib 30 feet long, 6 feet high, and 12 feet wide:

12 side sticks, 30 ft. long, 1 foot square, 360 ft. at 7 cts. per foot	$25 20
21 ties 12 do. 6 × 8 inches, at 50 cts. each	10 50
150 feet for bottom, at 7 cts. per foot	10 50
14 cords stone, at $7 per cord	98 00
Brush	5 00
50 lbs. iron for bolts, at 7 cts. per lb.	3 50

4 piles, at $1 50 each	$6 00
Driving 4 piles, at $1 50 each	6 00
84 feet white oak, for caps and cross pieces, at 12½ cts. per foot	10 50
Boarding and workmanship	35 00
Proportion of team, hauling timber	2 00
Extra work, counterlining, framing ties	87 80
Cost of one crib, is	300 00
Cost of 300 cribs, (9,000 feet,) at $300 per crib, is	90,000 00

Fourth. A crib (double,) 30 feet long, 31 feet wide, and 15 feet high:

45 side sticks, 30 ft. long, 1 ft. square, 1,350 ft. at 7 cts. per ft.	$94 50
95 ties 16 do. 8 × 8 inches, at 75 cts. each	71 25
51 piles, oak, 24 do. at $2 each	102 00
Driving 51 piles, at $2 each	102 00
Brush	10 00
153 feet of white oak, for caps and cross pieces, at 12½ per ft.	19 12½
98 cords stone, at $7 per cord	686 00
Boarding and workmanship	100 00
Proportion of team, hauling timber	10 00
Iron bolts, extra work, framing, &c.	105 12½
Cost of one crib, is	1,300 00
Cost of 135 cribs, (65 north channel and 70 south,) is	175,500 00

Recapitulation.

For amount required for repairs of east breakwater	$2,000 00
1st. For 34 cribs, 30 feet long, at $500 per crib	17,000 00
2d. For 20 do. 30 do. do. at $600 do.	12,000 00
3d. For 300 do. 30 do. do. at $300 do.	90,000 00
4th. For 135 do. 30 do. do. at $1,300 do.	175,500 00
	296,500 00
Contingencies, 10 per cent.	29,650 00
Aggregate	326,150 00

Estimate of funds required for the service of the public works at Erie, Pennsylvania, during the year 1840.

1st. For 34 cribs, 1,020 feet at $500 per crib	$17,000 00
2d. For 20 do. 600 do. at $600 do.	12,000 00
3d. For 30 do. 900 do. at $300 do.	9,000 00
4th. For repairs on east breakwater	2,000 00
	40,000 00
Contingencies, 10 per cent.	4,000 00
Amount required for 1840, is	44,000 00

Statement showing the financial condition of the harbors under charge 30th September, 1839.

Summary of items.	Dunkirk.	Presque isle.	Portland.	Cattaraugus.	Buffalo.		Remarks.
					Sea-wall.	Harbor.	
Amount of appropriation by Congress up to 30th September, 1839, from commencement -	$88,446 43	$142,858 43	$55,466 00	$57,410 00	$48,000 00	$181,211 31	As near as can be obtained from the data accessible.
Total amount of expenditures up to 30th September, 1839, from commencement - - -	87,951 47	141,552 77	54,202 62	53,351 75	25,456 63	172,597 63	
Amount of appropriation by last Congress, available in 1839 - - - - - -	3,832 23	15,000 00	17,733 00	16,205 00	24,000 00	10,250 00	
Amount of appropriation by last Congress, available in 1840 - - - - -	341 64	1,305 66	1,263 38	4,058 25	22,543 37	8,613 68	
Balance on hand of former appropriations -	341 64	1,305 66	1,263 38	4,058 25	22,543 37	8,613 68	
Amount expended in 1839 - - -	3,337 27	18,867 34	21,054 16	15,277 89	15,299 95	1,636 32	
Balance on hand 30th September, 1839, including available appropriation for 1840 - -	341 64	1,305 66	1,263 38	4,058 25	22,543 37	8,613 68	
Amount required for 1840 - - -	50,000 00	44,000 00	23,210 00	30,600 00	22,543 37	74,616 00	
Amount of appropriation necessary at the coming session of Congress, for exigencies of 1840 -	49,658 36	42,694 34	21,946 62	26,541 75	-	66,002 32	
Amount required to complete the works to the extent estimated - - - - -	201,581 56	326,150 00	38,020 00	30,600 00	22,543 37	1,549,130 00	
Amount yet to be appropriated to complete the works.	201,239 92	324,844 34	36,756 62	26,541 75	-	1,540,516 32	

With my report, I have the honor to submit the maps of Buffalo, Cattaraugus, Dunkirk, Portland, and Erie harbors, with the plans relating to the constructions for their improvement.

I am, most respectfully, sir, your humble servant,

W. G. WILLIAMS,
Captain U. S. Topographical Engineers.

J. J. ABERT,
Colonel Topographical Engineers.

C.

PHILADELPHIA, *October* 27, 1839.

SIR: The important interests over which you preside furnish both occasion and privilege for the communication I have the honor of addressing to you; the nature of which will be best explained by the papers which accompany this. I hope they may not prove too long for your leisure, and, in addition to them, will but notice one advantage attending my treatment of timber, which has not been particularly adverted to.

In seasoning timber in the ordinary way, no length of time can protect it against the assaults of worms and other insects abiding in it, and the tendency to decay it may already have taken on at the very time it is wrought for use, although both may be invisible to the closest scrutiny. As my "process" is conducted with heat by boiling the timber sufficiently long (a few hours) to convey the heat to every part of it, you will at once perceive *it must necessarily* be destructive to the first of those causes, and to the last there is abundant reason to believe it a complete corrective. You are more competent than I am to estimate the extent of the value of such effects, but I would suppose that even if they bounded the advantages to be expected from such treatment, they might still be thought enough to justify its adoption.

Colonel Kearney and Captain Mordecai have both had an opportunity of examining wood thus cured, and of receiving from me a verbal exposition of the process, and they will excuse the freedom with which I refer you to them for their impressions regarding it; so I do not doubt will Colonel Humphreys.

The process is easy and cheap, and requires but a few hours, though the wood be perfectly green; and, by my present improved apparatus, which also is unexpensive, timber of any size and length may be prepared in quantity and expedition suited to any occasion.

I have the honor to be, sir, very respectfully, your obedient servant,

EDWD. EARLE

Colonel J. J. ABERT.

Mineralized timber.

The subscriber having obtained letters patent of the United States, for a *new and useful improvement in the mode of preserving timber from the ravages of insects and from the dry-rot*, commends it to the public.

His "right" embraces several unusual advantages. It extends to two distinct patents (offered as one) for the employment of different minerals, viz.

Lime, according to one; and the *sulphates of iron and copper*, according to the other; either of which may be employed, (with equal advantage, it is believed,) to suit the use to which the timber is to be applied: the process is easily conducted, is applicable to every kind of wood, and, in a few hours, reduces timber of any size, from a perfectly green to a perfectly cured state, so that neither dry-rot nor shrinking may be apprehended; and these effects are produced without any deterioration of the quality of the timber. It is strongly recommended by its cheapness also, and by the abundance of the materials employed, the cost of which can never be affected by the most extended consumption.

With such advantages, this process seems well adapted to the preparation of timber for *ships, their masts and spars; for steamboats and boats of every kind; wharves, canals, railroads, and bridges; mills and machinery of every description; farm-houses, and farming utensils; posts for fencing, and for every purpose, in short, for which perfectly seasoned timber can be desired.* To houses, especially, in which the floors and other woodwork are exposed to the drying influence of cellar furnaces and grates for anthracite, now so generally used, it is particularly suited.

But the purpose to which this mode of preserving timber is most particularly adapted and likely to be most usefully applied, is that already briefly noticed: *the construction of railroads.* This mode of travel and transportation, in our extensive and still extending country, has already gained a general preference; and our short experience of its superior advantages is every day producing new associations for an almost unlimited continuation of it. Yet it is a fact, much to be regretted, that the enterprise and liberal investments of our numerous companies have not hitherto been rewarded by an adequate return of profit. Independent of the great outlay for construction, in the first instance, the subsequent disbursements for a numerous retinue of agents, superintendents, mechanics, and laborers, constantly retained in service; and, still more, the rapid wear and demand for renewal, of the track and cars, cause abundant and absorbing waste of the receipts, which otherwise might afford a satisfactory dividend. For this last inconvenience, (the wear of timber,) a remedy has often been sought in the substitution of stone for sills or bearers; but ample experience has proved this to be an increase of evil: the stone sills, in consequence, have been almost universally discarded, and the hard woods, locust and cedar, sought in their stead. But these, even at the great prices they command, cannot be procured in sufficient quantity to effect, in any appreciable degree, the expense intended to be removed. Here, then, this process presents a powerful claim for adoption. Holding an intermediate position between the softness and destructibility of wood in its natural state, on one hand, and the perfectly hard, unyielding quality of stone, on the other. Timber thus prepared, furnishes, in a very great degree, a remedy for the defects and the deficiencies of each, by its close, firm, resisting surface; by its retained elasticity, and by its incorruptibility. The preference due to it, for its greatly superior cheapness, has already been adverted to.*

Though wanting, in its present *combined* form, those proofs in its favor so largely enjoyed by Kyan's valuable process, (by corrosive sublimate,) this improvement, in the method of treating timber, has so many and strong

* To prepare timber by this process, with the *sulphates of iron and copper*, will not cost more than $5 per thousand, board measure; with *lime*, $2 20—average of the two, $3 60.

claims to confidence from *partial* experience, from analogy, and from the appearance and physical characters of wood which has been subjected to it; that few, if any, of the great number who have become acquainted with it, have entertained a doubt of its sufficiency. Among such may be reckoned men of general science, chemists, presidents, and engineers of railroad companies, and other intelligent men, whose occupations and interests have made them skilful to judge of every kind and quality of timber, and who, having examined pieces thus prepared, have pronounced unreserved commendation of it, and confidence in its power to confer durability.

To give assurances to those who, at a distance, may be inclined to avail themselves of this improvement, it may be proper to show what others, having access to more direct information, think and are doing in respect of it. This may be partially done by reciting the fact, that the Philadelphia and Reading Railroad company, directed by a board of managers, and by engineers, distinguished for intelligence and prudence, have already contracted for the use of it; and that several other equally respectable companies wait only for the arrival of the proper season to do the same thing. To which may, with equal effect, be added the following extract from the report of the Committee on Highways, to whom a memorial on the subject was referred by the councils of Philadelphia.

EXTRACT FROM THE REPORT OF THE COMMITTEE ON HIGHWAYS.

"*The Committee on Highways, &c., report:*

"That they have fully considered the subject submitted to them, and, through the medium of a personal interview with Dr. Earle, have availed themselves of all the information they can at present obtain on the nature and probable value of his method.

"Dr. Earle exhibited to the committee specimens of different kinds of wood, which, from the green state, had in a few hours been perfectly seasoned and fully impregnated, by his method, with the different mineral agents employed, (the sulphates of iron and copper, and lime,) as proved by chemical tests applied to the interior by splitting the pieces: wherever there was *sap*, the infiltration had evidently been most abundant, though it had very perceptibly imbued the *heart* of the wood.

"It is well understood that the dry-rot in timber is the result of the corruptible nature of the albumen which is contained in its pores in greater or less proportion, according to the kind of timber, and by its tendency to putrefaction, lays the foundation of decay. Though found in the heart, it abounds most in that part of timber called *sap*, and hence the great liability of this to be destroyed by dry-rot. All processes, therefore, that have for their object the preservation of timber, to be successful, must be based upon the principle of either removing the albumen, or altering its character by chemical agents, so as to render it incapable of decomposition.

"That the ingredients used by Dr. Earle, and his mode of applying them, are calculated to produce this result, is probable, from the fact that some acids and their salts have this property by coagulating albumen; and that lime is extensively known to be preservative of timber.

"There are some (perfectly authenticated) facts also, that go strongly to prove the preservative character of Dr. Earle's process. *It is familiarly*

and well known; for example, that the wooden tanks or vats, in which copperas or the sulphate of iron, and the sulphate of copper are prepared, are not subject to dry-rot, but become hard and indestructible. Vessels, also, that are constantly employed in transporting lime, are not known to decay; the timbers remaining sound for a long period.

"It must, however, be confessed, that this method has not (in its *present* form) been subjected to such severe tests as other processes can boast; but when time and experience have confirmed its efficacy, it will present a two-fold advantage not enjoyed by any other mode. These are *cheapness* and *expedition.* It will cost near two-thirds less than the process by corrosive sublimate, and, instead of requiring fifteen to twenty-two days, as many hours are sufficient. As stated by Dr. Earle, the cost, at the present prices of the minerals is, with the *sulphates*, 7 cents per cubic foot, or $5 28 per thousand, board measure; with *lime*, 3½ cents per cubic foot, or $2 33 per thousand, board measure."

(In this estimate are included the labor and fuel employed in the process: also several other expenses that will seldom if ever occur. It is believed the *actual* cost, with the *sulphates, including labor and fuel*, will not exceed 5½ cents per cubic foot, or $4 60 per thousand, board measure; nor, with *lime*, 2 $\frac{7}{10}$ cents per cubic foot, or $2 25 per thousand, exclusive of fixtures, which are not expensive.)

"From the foregoing considerations, the committee are of opinion that Dr. Earle's method will be found, on trial, to be adequate to the purposes intended; in confirmation of which, they beg leave to present to councils the following letters to Dr. Earle, from Messrs. John Farr, and E. Durand, both well-known practical chemists:

"PHILADELPHIA, *November* 1, 1838.

"DEAR SIR: From the reputed effects of corrosive sublimate, in the preservation of timber from dry-rot, I can see no just cause to doubt that similar effects may be obtained by a solution of the salts of iron and copper. The specimens of wood submitted were evidently strongly penetrated with the solution.

"Very respectfully, yours,

"JOHN FARR.

"Dr. EARLE.

"PHILADELPHIA, *November* 1, 1838.

"DEAR SIR: It affords me much pleasure to give you the favorable opinion I entertain of your process for preserving timber from the attacks of insects and from the destruction of dry-rot.

"The materials you employ, lime and the sulphates of iron and copper, are, I think, admirably calculated to produce the desired effect; and your method of applying them is judiciously contrived to give them their greatest influence.

"Yours, very respectfully,

"E. DURAND.

"Dr. ED. EARLE, *Philadelphia.*

"In conclusion, the committee would respectfully recommend Dr. Earle's process to the favorable notice of councils, with a view to its employment

whenever the public service may demand the use of timber for wooden pavements or other purposes.

"JOHN LINDSAY,
"CALEB B. MATTHEWS.
"WILLIAM MORRIS,
"THOMAS G. CONNOR,
"CORNELIUS TIERS,
"JAMES ROWLAND."

Desirous to diffuse, as widely as may be, advantages which are thought important to the community, by rendering them accessible, and accommodated to the convenience and interest of every one; the patentee will grant, on easy and liberal terms, licenses to use his "right" of every grade of cost, from $50 upward: so that those who desire it for their own private and limited purposes, need not be encumbered with privilege and expense suited to those only who would employ it in larger operations.

Applications to the patentee may be directed: "To the care of John C. Montgomery, Esq., President of the little Schuylkill and Susquehanna Railroad company, Philadelphia;" or, "Messrs. Wm. Cooke & Son, merchants, Baltimore; or immediately to the patentee himself, Savannah, Georgia.

EDW. EARLE, *Patentee.*

PHILADELPAIA, *December* 15, 1838.

Applicants will please to state the *nature and extent* of the employment for which the "right" is required.

Copy of a letter, &c.

"PHILADELPHIA, *October* 4, 1839.

"RESPECTED FRIEND: In compliance with thy request that we should communicate to thee the result of any experience we may have had in the employment of wooden vessels in our copperas and blue vitriol works, we may briefly state, that about two and a half years ago we had a number of large crystallizing vats, made of seasoned white pine planks, into which the hot solution of sulphate of iron is drawn from the generators. The first effect observed was a shrinking of the wood and consequent leaking, to obviate which the crystallizers were successively buried, nearly to the top, in a moist clay soil. Several of those which have been thus buried have, from time to time, been taken up and examined, and we have found no indications of decay, the texture of the wood appearing generally quite firm and sound, except in places where there have been fissures into which the saturated solution penetrating has, by its crystallization, forced apart the fibres of the wood. We have no doubt that the impregnation of wood with the solution of copperas tends to its preservation, possibly in a high degree; but the facts above recited are all that have come under our notice. We formerly employed wooden vessels for the sulphate of copper; but finding that the wood was softened by the strong acid solution, we have substituted lead; we should, however, observe, that that effect would not be produced by a dilute solution, such as that thou usest; on the contrary, we think it quite probable that in such proportion it may increase the efficiency of copperas in preserving the wood.

"Respectfully,
"CARTER & SCATTERGOOD,
"*Manufacturing Chemists.*

"Dr. E. EARLE."

Resolution of Committee, &c.

"*Resolved*, That this committee, having tried the process of Dr. Earle, are satisfied, from the effect of chemical tests on the split blocks and other evidence before them, that he has fully succeeded in impregnating the wood with the salts of iron and copper.

"Extract from the minutes of the Committee on Public Highways, Philadelphia, August 13, 1839.

"WM. STEVENSON, *Secretary*."

The above "resolution," in connexion with the fact that, under the authority of the said committee, several portions of the streets of Philadelphia have already been paved with blocks of wood prepared according to this process, and that the same work is still proceeding in other parts of the city, is strongly expressive of their confidence in the effect of it; and the letter of Messrs. Carter & Scattergood, (a couple of our most respectable manufacturing chemists,) confirms, in a great degree, the fact recognised by the committee in their "report" to the councils—forming a part of the annexed circular.

E. E.

PHILADELPHIA, *October* 22, 1839.

Improvement of Savannah river.

SAVANNAH, *December* 6, 1839.

SIR: The large amount of money heretofore expended with a view to the improvement of the Savannah river, and the small benefit derived therefrom, show that, unless some other method is pursued, no permanent advantage can arise from the present mode of operations to the commerce of the city of Savannah. The visible diminution of the river on the south side of Hutchinson's island slowly and surely continues, and the consequent increase of the quantity of water in the back river goes on in the same proportion. The reasons for this are doubtless the obstructions which have been allowed to accumulate from time to time in the branch of the river running by the city. It is seen by the map, herewith forwarded you, that the channel by the back river is not only wider and deeper, but also shorter; the water, therefore, from the head of Hutchinson's island gets to the point beyond the wrecks in a shorter time than by the smaller channel by the city. From this, it is plain that any impediment placed in this latter channel will have the effect of diminishing the quantity of water which passes up and down this way. The vessels sunk by the Americans, and others afterward sunk by the English, in the Revolutionary war, near the junction of the channel with the back river channel, began the cause of shoal water at the wrecks, and now from the want of sufficient velocity of the river at this point, there is a constant deposite of mud and sand. It is evident, if some measures are not taken to prevent the increase of water passing by the back river, the process now going on will finally prevent vessels of any thing like a deep draught coming to Savannah at all. If the water can be checked in passing up and down the back river, it will at once strengthen the tide enough in the southern branch to prevent in it further alluvial formations. The plan formerly proposed by some of the citizens of Savannah, and afterward by Captain Mansfield, of the engineer corps, when he took charge of the river improvement, of making a dam

across the channel, from Argyle to Hutchinson's island, was objected to on the part of some individuals who were authorized to do so by the State of South Carolina, under a former treaty entered into between the States of South Carolina and Georgia in the year 1787.

The plan I now propose I do not conceive can injure any individual or public interest, nor can any one object to it under any law or treaty. It will not impede the free navigation of the back river, and will merely have a tendency to cause the water in the channel by Savannah to be increased in velocity enough to keep it open.

I would respectfully recommend that, at the points marked on the map, herewith sent, between Argyle and Hutchinson's islands, and also from the lower end of Hutchinson's island to the point marked "A," a system of piers be placed so as to diminish the breadth of the inlet and outlet of the back river, and thereby cause the water to be slightly checked in its course, both in flood and ebb tide, and at once turn it to the desired direction. By this manner of placing piers, instead of a continuous jettée, the strength of the rush of water will be divided, the same effect obtained, and neither pier will be required of such strength, nor will the work be so liable to be carried away as if but one opening were left of a larger size.

If the channel were diminished by a jettée, run out from each side, it would cause a tremendous deepening in the interval, and probably a bank would be formed somewhere below; but, by dividing the obstruction across the river, I think the deposite would be less liable to be at any one point. I would at first wish these piers to be built so as to narrow the surface of the river at both points about a third of its width. The tide in the Savannah river runs probably an average of two miles an hour, and this would, according to well known experiments, cause a slight rise in the water on the outside of either pier, according as the tide is ascending or descending. This will increase the rapidity of the river in the south branch, and it will soon be seen whether the water continues to make alluvial deposites in this channel. If it does, the piers may be gradually widened until velocity enough is attained to prevent further deposites, the banks and shoal places may then be dredged to advantage; and, as the velocity contemplated will only be enough to keep it free, without being strong enough to lift up the bottom, there will be no danger of banks forming above the wrecks. By placing obstructions at both ends of Hutchinson's island, the river by the city of Savannah will feel the influence at once in both the ebb and flood tide, and there will be no tendency in the flood tide to force the water through the branch of the river on the north side of Argyle island.

I would propose that these piers be made by driving two rows of piling, — feet apart, tying them by capsills and crossties, and filling in between them with old vessels, flats, stones, ballast, &c. The obstructions corresponding to the abutments can be made solid enough to prevent the earth from washing, with fascines and mud.

To effect the object here contemplated, an appropriation will be necessary from Congress, as there was on hand on the 30th September last, only $6,240 76 of the last appropriation for the Savannah river improvement. Twenty thousand dollars, in addition to what is on hand, would be as much as I would require for the next year. When you take into consideration the monthly expense of $1,100 to keep the dredge-boat in operation, it would certainly appear a judicious saving to expend this money so as to

dispense, after a time, with the dredge-boat altogether, by partially stopping the back river, and forcing the water into the channel to which it belongs.

The total width of the river in the direction of the obstruction, where the upper piers are recommended to be placed, is 2,120 feet; by making 7 piers of 100 feet each, 8 intervals of 175 feet each will be left between the piers. At the lower end of Hutchinson's island the width, in the direction of the piers, is 4,080 feet; by placing 8 piers of 170 feet each, there will be 9 intervals of 302 feet each. These openings are wider than necessary for any purposes of navigation.

The above plan is respectfully submitted to you for your approval.

I have the honor to be, with great respect, your obedient servant,

J. MACKAY,
Capt. Corps Topographical Engineers.

Colonel J. J. ABERT,
Corps of Topographical Engineers.

D.

REPORT OF THE BOARD OF INSPECTION OF LAKE HARBORS.

DETROIT, *July*, 1839.

SIR: In compliance with your orders of the 18th of March, we have inspected the following works on Lake Erie:

1st. The works for removing obstructions at Conneaut creek, Ohio.
2d. The works for removing obstructions at Ashtabula, Ohio.
3d. The works forming a harbor at Cunningham's creek, Ohio.
4th. The works for removing obstructions at Grand river, Ohio.
5th. The works for the improvement of Cleveland harbor, Ohio.
6th. The works for removing obstructions at the mouth of Black river, Ohio.
7th. The works for improving the mouth of Vermillion river, Ohio.
8th. The works for the improvement of Huron river, Ohio.
9th. The pier and breakwater at La Plaisance bay, Michigan.
10th. The works at the river Raisin, Michigan.

The inspection embraced, according to your instructions:

1st. The consideration of the plan of each work.
2d. The object to be accomplished by each, and the probability of success.
3d. The cost up to the time of inspection, and the probable cost of completing each work.
4th. Modifications to be recommended, and the anticipated advantage of such modifications.
5th. The effects which have already resulted from, and the present condition of, the works.
6th. The influence of the improvements upon the agriculture of the adjacent country, and upon the commerce of the lakes.
10th. Their advantage with reference to measures of defence, or means of annoying an enemy.

We have now the honor to present to you the results of this inspection, so far as they concern the points here enumerated, reserving, for a separate

report, other matters embraced in your instructions; such as the qualifications, duties, accountability, compensation, &c., of agents employed on the works, as also the necessary measures to be adopted for the care and preservation of the works, and for maintaining a proper police upon them. All that we have to say in relation to the points Nos. 1, 2, 3, 4, 5, and the first clause of No. 6, we have arranged under the head of the particular work or improvement to which it belongs, and have annexed it hereto in form of an appendix; and we have added a succinct sketch of the progress of each from its commencement, and a description of its present condition, followed by a tabular statement of the sums appropriated for, and expended upon, the works; as also the several methods by which we have thought they might be rendered permanent, with estimates of their probable cost. The modifications, so far as we deem any to be necessary at this time, are also described, and the cost of executing them.

At all the harbors the works are composed of timber and loose stone; and at some of them the timber is already in a state of decay, and in a few years all the work above the level of the water must necessarily fall to ruin, unless repaired and renewed. Should it be the intention to maintain the works in a sound condition, the repairs and renewals will be a constant source of expense, unless measures are taken to employ imperishable materials in replacing such as are decayed. We have therefore estimated, in all cases, for materials of an indestructible character, or we have added the cost of rendering them so. Where we propose the use of timber, and add the cost of *Kyanizing*, we mean to include, under that term, any approved process by which wood may be preserved from *dry rot*. Having no hesitation in assuming that it is the policy of the Government, whenever it is about to renew the portions of the works above water, to substitute for it permanent work, we have at the same time deemed that considerations other than those of a professional nature entered into the question of the most acceptable mode to be applied to each, and that question being also a question of cost, the decision of which, in relation to each work, might depend upon the opinion entertained of its importance, we have thought that we would better fulfil our duty if we presented to the department several, that the one the cost of which might be judged the most suitable to the importance of each, in the estimation of those having the ultimate decision, might be applied to it. For two of the harbors we have estimated for but one mode of reconstructing the works, the reasons for which will be found in their proper place.

We have also estimated the cost of completing, as well as of rendering permament, the work at Vermillion river, and the river Raisin, with slight modifications of the plans already proposed for those harbors.

The older works, with the exception of those at Grand river, we found to be deficient in the breadth which we conceive necessary, not only to their protection, but for the accommodation and convenience of commerce. We have therefore proposed to increase their breadth not only at the base below the surface of the lake, but for their whole height, and to construct parapets on the outer sides of the piers; and that in no instance ought the breadth to be less than the whole height of the pier above its base. We have accordingly estimated for their enlargement at several of the harbors; but we have not found it necessary to do so for the works inside of the coast line, and therefore the extent of pier proposed to be enlarged, is by no means equal to the length of the original work, for at all the harbors these were commenced

within the line of shore, as it stood when the piers were begun; since which, in nearly every case, the shore has advanced in the direction of the length of the piers—in some cases to no great extent, while in others, especially the more eastwardly of the harbor, the beach has increased very much. For the proposed permanent work above water, we have also confined our estimates to that portion of the piers which lies outside of the present coast line in the lake.

The piers are frequently, and at some of the ports are constantly, used to store large quantities of the wood which the steamboats consume; and it is often of consequence that this should be piled as far out as a regard to its safety will justify, and that in many cases there should be space towards the extremity of the piers, not only for this purpose, but for the landing of passengers and freight, carried by the numerous class of boats engaged in the general business of the lakes, running periodically between Buffalo and the extreme upper ports, and which only touch at intermediate points for the indispensable purpose of wooding, or to take and discharge way passengers and freight, and to whom, especially in unpropitious weather, and during unfavorable seasons of the year, the question of time is all important. These considerations among others, have influenced us in recommending the increased breadth above water we have already mentioned, and we have less hesitation in doing so, and in recommending the construction of parapets in case of piers having beacon lights at their extremity, as narrow piers without parapets become extremely dangerous, and sometimes impracticable to communicate with them from the shore in stormy weather, when they are most needed; and we have assumed under all the circumstances bearing upon the question, in the case of these particular works, that the best form we can recommend to be given to the sides of the piers, is one perpendicular to the surface of the lake, except so far as where the peculiar nature of the bottom on which the cribs may be placed, may require a sufficient quantity of loose stone to be thrown for the purpose of protecting the foundations against the action of the waves, or to refill any void that may have accidentally occurred near the bottoms of the cribs—a contingency which doubtless is possible, whatever precaution we may use in the original design and framing of the cribs. A contingency too, the extent of which we cannot well appreciate, and for which therefore we do not purpose to make any estimate. Having assumed a perpendicular form for the sides of the piers, and in the cases where we are not precluded from carrying out our own opinions, we consider that the additional convenience and security afforded thereby to the public, would well warrant any difference of cost that may be supposed to result from its adoption.

The several methods proposed for the permanent work, and their estimated cost, the extent and estimated cost of the modifications, which we would recommend for the several works, and the extent and dimensions of the present piers, their cost, the breadth of the channels or water way between them, the navigable depths at different periods, the extent to which the shores in contact with the piers, has advanced beyond the original coast line since the commencement of the works, &c., are given in the accounts of the annual progress of each work, and in the tabular statements annexed, to which we take leave to refer for more specific information.

These works have all cost much more money than appears to have been anticipated at the time they were commenced. This is attributable to various causes, most of which, with reference to each work, will appear upon

a careful perusal of the account we have given of its progress. Some of them we will now notice. The project of opening permanently the mouths of the rivers so as to permit the passage of vessels at all times, was at the first considered to be an experiment of very doubtful result; and it was not until some progress had been made in carrying it into effect, that the public confidence could be enlisted in it to the extent to justify the enlarged and more expensive plans which the importance of some of them would seem to have required. Moreover, the importance to which some have arisen since the commencement of the works, is in many cases owing to the influence of the works themselves, without which necessarily the harbors must have remained to this day as formerly they were, inaccessible to the commerce and shipping of the lakes, as well as measurably useless to the surrounding country. Moreover, the channels of communication which have been opened with the interior, since some of them were planned, have added vastly to their consequence. Thus they have nearly all of them in fact attained a degree of importance which they could not possibly have been expected to possess at so early a period. Moreover, works of this character, and hydraulic works generally, were but little understood among us at that period, and the force and effect of the lake storms do not appear to have been always foreseen, since the earlier structures were not calculated to resist them, nor were they contrived apparently with reference to the nature of the foundation on which they were built. This being a moveable sand, liable to be removed by a very slight force, was frequently swept away by the waves as they washed the foot of the piers. They had rarely the strength which should have been given them—consequently being undermined by the waves, they would yield under the weight of the stone with which they were always loaded, and hence very large and unanticipated expenditures became necessary in readjusting them, as well as for the additional protection required at their base. The formation of sand-shoals near the heads of the piers, and at the entrance of the channels, and the increased draught which the rapidly increasing commerce of the lakes demanded for the vessels employed in it, suggested additional extensions of the piers into deeper water. These causes of expense have served to swell the expenditure beyond the original estimates, and added to these the rapid decay of the wooden portions of the structures, and the consequent repair and renewal of the work above water. Again, at the period of the commencement of nearly all the works, the laborers of the neighboring country being measurably without employment, and produce having no outlet to a market, labor and provision and materials for the works, were extremely cheap. The impulse imparted to industry, and the facilities of conveyance for the produce of the country, provided by the works themselves, had the effect greatly to enhance their cost by the increased prices which labor and materials could command. The extraordinary high stage of the waters of the lake, exceeding by some feet any other on record, has indicated the necessity of a corresponding increase of the height of the piers beyond the original design, and hence an additional unanticipated expenditure.

At two of the harbors, Cleveland and Black river, progress has been made in giving permanency to the works, thereby adding to the expenditure beyond the sums proposed for them. With respect to the future, we have only to say, that in making out the annexed estimates and in arranging the plans for completing the works temporary or permanent, we have availed ourselves we believe of the experience of the past, and have used every

precaution in our power to provide for every contingency affecting the question of their cost or stability. The proposed work, too, being chiefly above or near the surface of the water, comes more within the reach of a probable estimate than the greater part of the original structure; besides which, it is not by any means likely that any causes can arise materially to enhance the prices which we have affixed to the several items composing the estimate.

The original design of procuring a sufficient depth of channel for the largest class of vessels navigating the lakes, is accomplished at nearly all the points within the limits of our inspection at which it has been directed to be done, and wherever that depth has not been attained, we are satisfied of the sufficiency of the measures proposed for effecting it. Whether the entrance at these places will continue unobstructed by the sand which drifts along the shore of the lake in the general direction of the prevailing winds, without any other aid than the piers which project beyond the coast line, or whether these have attained the depth of water and distance from shore the most suitable to the object for which they were designed, is a problem not to be solved with our present limited acquaintance with the forces operating upon the sands which are found immediately to windward of nearly all the works, and extending from the base of the cliffs or the highest reach of the waves to a depth beneath the surface of the lake which we have not been able always to ascertain with the precision we could desire. We incline, however to the opinion, that in nearly all the cases where the plans already adopted have been carried into execution, the piers extend as far into the lake as is desirable with reference to the purpose for which they were designed. Nevertheless, in order to be assured on that point, and to leave nothing to uncertain conjecture, and with a view to the developement and collection of facts, without which, as we conceive, no enlightened view can be taken of the ultimate effect of the works already erected, or of those which may suggest themselves for the farther improvement or extension of the harbors, should the increasing trade require them, we are of opinion, that a careful and minute topographical and hydrographical survey and examination under competent direction should be made of the whole of the lake shore, so as to include all the works, and to extend from the crest of the cliffs or banks on shore to a depth in the lake at which the waves or undertow shall be found to have lost their influence upon the drifted matter at the bottom; or if a sensible current exists in the lake in the general direction of the discharge of the surplus water of the lake, at such a distance from the shores as to be within the limits of any work which it might be deemed expedient to erect in connexion with those already there—then to that distance. The details of such a survey would require great skill and care on the part of those who might be charged with its execution. It should be intrusted to those only who were capable of appreciating the value of its details with reference to the specific object for which it was made. Added to this, we think there ought to be instituted at each harbor, a series of observations with reference to the effects produced upon the shoals, channels and beach, by the storms and freshets occurring at them. These might be conducted by the local agents in charge of the works, and they would doubtless in a short time yield a body of highly useful facts bearing upon questions which are constantly arising with respect to the proper length, direction and position of the works and their ultimate effects upon the navigation. The variation of the level of the lake compared with some fixed point ought also to be ob-

served at all the works. We have ourselves caused a rapid survey of part of the lake shore to be made during the period of our inspection, and although it was necessarily, from our limited means and time, of a very superficial character, the facts developed by it go to strengthen our opinion of the expediency of a more perfect examination.

Respecting the influence which the several works under examination may have had in advancing the agricultural prosperity and increasing the population of the country adjacent to each, we have stated whatever has fallen within our knowledge, under its appropriate head, in the account we have given of the progress of the works; some idea of the relative value of each to the general commerce of the lakes may also be collected from the same source.

That the population, trade, and agriculture of the region of country connected with the lakes have increased with extraordinary rapidity within a few years, and especially since the commencement of these harbor improvements, is known every where. This prosperity is doubtless to be attributed to the industry, enterprise, and intelligence of the people, the climate, the fertility of the soil, and the facilities of intercourse which nature every where provides, and which are rapidly increasing by art.

Prior to the formation of these harbors, there were none upon the south side of the lake which could be entered at any time by vessels drawing over seven feet, and, during low stages of the lake, this depth of water was much reduced. With the harbor and exposed anchorage at Dunkirk, the harbors of Erie, Sandusky and Maumee bays, which had never a depth of more than seven feet at their entrance, all the harbors were usually closed by sand bars. We do not here speak of the Niagara and Detroit rivers, lying at the opposite ends of the lake, and under certain circumstances exposed to serious objections, as places of shelter for vessels, nor of the anchorage to be found among the islands near its head. The only landing places, at the close of the war of 1812, were Black Rock, Erie, and Sandusky bay.

Thus destitute of outlets for its produce, the agricultural enterprise of the country lying south and west of Lake Erie was dormant. The shipping employed upon the lake was exposed to the most fearful hazard of encountering the sudden and violent gales to which this region is exposed, upon a lee-shore deficient of harbors. At this period, too, the country was without those lines of canals, roads, and other means of intercommunication which have since been created. Channels of communication with the lower lake, with the Atlantic, and with the valley of the Mississippi, have since then been opened or perfected, and, as indispensable adjuncts to these, harbors have been formed. Since then, and as the necessary and unquestionable consequence of these improvements, the industry and enterprise of the country have assumed a degree of activity altogether unrivalled; the tide of emigration has advanced upon it with an extreme velocity, sweeping away, at the same moment, the wandering Indian and the steadfast forest. We see in how few years all this has been achieved—already the soil sends forth its millions of surplus grain, to receive in return the fruits of the industry of other regions. Commerce also increases with the population and productive ability of the country, and in proportion to the security afforded by its harbors.

The annexed tables and memoir will show the dates at which the several works for the formation of harbors were begun, the periods when they

afforded protection to ships, and the times at which the harbors were rendered accessible, as well as the times of commencing and completing the principal canals connected with the lake trade. The first harbor undertaken was that of Presque Isle (Erie) in the year 1824, and from that time forward to the year 1835, there were fifteen other works projected and authorized to be constructed on Lake Erie, viz: at Black Rock, Buffalo, Dunkirk, Cattaraugus, and Portland, in the State of New York, and at Erie, in Pennsylvania; at Conneaut, Ashtabula, Cunningham's Creek, Grand River, Cleveland, Black river, Vermillion river, and Huron river, in the State of Ohio; and at La Plaisance bay and the river Raisin, in Michigan. Several of the earlier works already afforded protection to vessels in the year 1831, and by the year 1833 some of the most important of the harbors were rendered accessible to vessels of the largest class upon the lakes.

The Erie canal was completed in the year 1825.

The Oswego was opened in 1828.

The Welland canal was opened in 1829.

And the Ohio canal in the year 1832.

In the year 1825, there was but one steamboat, of 350 tons burden, and thirty or forty small craft on the American side of the upper lakes, and the tonnage was, in all, somewhere about 2,500 tons. In the year 1830, the registered and enrolled tonnage was yet but 3,497 tons; and the canals which connect the trade with the St. Lawrence and with the Hudson had been completed.

In 1831, when the works on Lake Erie had begun to afford some protection to vessels, the tonnage employed upon it had nearly doubled that of the preceding year. There were now eleven steamboats and one hundred other vessels, the aggregate tonnage of all amounting to 6,582 tons.

In 1832, the Ohio canal, connecting the lake trade with the valley of the Mississippi, was completed. The aggregate licensed and enrolled tonnage, according to the Treasury statements, (we have no other account of the shipping for that year,) was 8,552 tons. During this and the succeeding year, the harbors as already stated were becoming at all times accessible to the largest class of vessels, and in the latter year (1833) this accessibility was effected. In that year the aggregate tonnage was 10,471 tons. Since that time, it has continued to be steadily progressive to the present period. We have more precise accounts of it for the years 1836, 1837, 1838, and 1839, for the latter of which we have a very detailed statement which we obtained from the collector of the port of Cleveland, a copy of which, with some slight additions, we annex to this report, and we insert here the aggregate tonnage for these four years, distinguishing between that of steamboats and rigged vessels.

In 1836, there were 45 steamboats (9,017 tons) and 211 vessels, (15,030 tons,) in all 24,047 tons.

In 1837, there were 50 steamboats (10,509 tons,) and 230 vessels, (16,934 tons), in all 27,443 tons.

In 1838, there were 52 steamboats (17,429 tons) and 234 vessels, (16,848 tons), in all 34,277 tons.

In 1839, there were 61 steamboats (17,324 tons) and 225 vessels, (17,799 tons), in all 35,123 tons.

The value of the shipping of all classes in the year 1839 is $2,400,600, as may be seen by the annexed list, and they furnish employment for two or three thousand persons. In the year 1836 it was estimated that the capi-

tal invested in steamboats was $1,000,000. In the year 1839 the cost of steamboats enumerated in the list, already referred to for particulars, is stated at $1,741,200. In the year 1837 it was estimated that, taking into view the average number of trips made by each class of vessels, the trade per month, during the business season, amounted to 75,898 tons. Following this rule, and applying it to the year 1839, we would have about one hundred thousand tons as the monthly business. To the tonnage proper of Lake Erie, at this time, should be added the tonnage owned on Lake Ontario, doing business through the Welland canal, calculated for the passage of vessels of one hundred and twenty five tons burden, and having a depth of eight feet of water. Three-fourths of the property passing through this canal is conveyed in American vessels doing an American business. The tonnage on the Welland canal in 1834 was 37,917 tons, in 1837 it was 80,697 tons, and in 1838 it amounted to 95,397 tons. We refer for particulars concerning this trade to the Appendix, and to the note therein respecting the business of the Erie, Oswego, and Ohio canals.

That this rapid extension of trade could not have developed itself in the absence of suitable harbors is, as we think, very apparent from the facts we have stated, and we are borne out in this by the general opinion, every where prevailing within the reach of the lake trade. That this extension is very far from having reached its maximum is unquestionable, and it is altogether probable that in a few years the amount of business to be transacted at some of the harbors will require a much greater space than is now to be found in them. We may take as an example the harbor of Cleveland, which, during the present season, has been crowded with 70 or 80 rigged vessels at a time, a number which unquestionably falls far short of that which the increasing trade of the port will hereafter bring to it.

If we do not err in the degree of influence which we suppose these works to have had upon the population and resources of the lake country; in the creation or encouragement of so many channels of communication with the seaboard and the interior, and in multiplying the number of our ships and seamen on the lakes, their value to the military power of the country, whether for defence or attack, must be unquestionable. It is scarcely necessary indeed to discuss the question after what we have already said, for much that has been advanced applies equally to this branch of the subject. The details, too, would occupy a space sufficient for a separate report; we, therefore, hope we are fulfilling your expectations in limiting ourselves to a few general remarks.

Under the view we have taken of them, every harbor constitutes a point of convergence for numerous routes, by which a military force may be concentrated, or on which the materials of war may be conveyed, and a point from which to assail an enemy, or on which to retire for refuge and supplies.

For the building, equipping, and supplying of vessels, considering the nature of the naval warfare most likely to occur on the lakes, there is perhaps not one of those we recommend for completion that might not become of importance to some naval armament.

Taking into view all the ports on the lake, we find Buffalo, Erie, Cleveland, and the river Raisin, presenting themselves as important points in a line of operations of attack or defence, the first two communicating, as the third soon will, by extensive series of canals and river navigation with the remotest parts of the Union. The river Raisin, lying southwardly from

Detroit, and beyond the immediate reach of a hostile force, holding the left bank of the latter river, would strengthen in a very high degree the defensible means of that frontier, while its railroad, projected to terminate upon the head of Lake Michigan, now completed into the heart of the most populous district of the State, would carry the supplies destined for the more western States uninterrupted by an enemy not in possession of the naval supremacy of the lakes. Besides these there are other artificial harbors on Lake Erie, to communicate with which very extensive lines of railroads have been projected, leading towards the Atlantic cities, all of which would serve for the conveyance of troops and the munitions of war.

Among the maps and plans connected with this report, will be found a sketch of nearly all the lines of canals and railroads projected or executed to connect the business of the upper lakes with the interior or with the seaboard. We have spoken of the rapid increase of population, within the last few years, and we have referred it in a great degree to improved facilities of intercourse, and to the protection which commerce has received. The increase in Ohio, Indiana, Illinois, Michigan, and Wisconsin, since the year 1820, has been nearly four-fold. In 1820 the population of Ohio amounted to 581,434, and it may now we think be reasonably estimated at 1,500,000. Indiana, in 1820, numbered 147,178 inhabitants; they will now probably amount to 700,000. Illinois had 55,211: in 1838 it had 225,000. Michigan in the year 1820 had 8,896 inhabitants; now her population will amount to 250,000. Wisconsin, as a separate Territory, did not exist until 1836; what her population may be now it were difficult to conjecture; the influx of emigrants is so great it cannot fall much short of 35,000 or 40,000. The country northwest of the Ohio, therefore, may be reckoned to contain at least 3,000,000 of inhabitants at this time. In the year 1810 it had, exclusive of Indians, a population of 262,324.

While engaged in the inspection of the several works, to which our attention had been directed by your order of the 18th of March, we received from gentlemen interested in the harbor of Sandusky bay, and from others having extensive interest at Brest, a harbor situated a few miles to the northward of the river Raisin, some communications relative to those places. Although they do not expressly fall within the limits of our specific duty, under your order, we have thought it due the highly respectable character of the gentlemen from whom we received them, to present them for the information of the department, and we have, therefore, annexed them to this report.

All which is respectfully submitted.

JAMES KEARNEY,
Lieut. Col. Top. Engineers.
HENRY SMITH,
General Superintendent, &c.
JOHN R. BOWES,
United States Agent.

Col. J. J. ABERT,
Corps of Topographical Engineers.

CONNEAUT HARBOR.

Conneaut creek lies about 30 miles to the westward of the town of Erie, and thirteen east of Ashtabula creek; it joins the lake a little to the west of the western boundary of Pennsylvania, and although a narrow stream

it is deep enough for any vessel navigating the lake to ascend a mile and a half above its mouth.

Prior to the erection of the works for its improvement, it was barred by sands which rendered it inaccessible to vessels, as it had never more than 2 feet of depth on the bar, and in summer it was often dry. Underneath the sands, and at a depth varying from 4 to 8 feet below the level of the lake, was a stratum of slate, which, suddenly plunging into the creek, on the one hand, there lost itself, while, on the other, it elevated itself above the level of the lake for about a quarter of a mile, beyond which there was good anchorage in moderate weather. It hence appears that a greater depth than 8 feet could not have been reckoned on as the result of any operations which should rely solely upon the scouring power of the stream; nor was a greater depth either expected or desired at that period, inasmuch as that was sufficient for the then commerce of the lake, the extension of which to its present magnitude, considered with reference to the tonnage and draught of vessels, being by no means anticipated by those whose interest and duty connected them with the subject.

The original intention was simply to form a port for the commerce of the village of Salem, which lies about a mile and a half inland, in a rich and productive district of country, the population of which, however, was at that period little more than half its present amount. Its commerce was also necessarily very much restricted and embarrassed by the necessity which existed of landing every thing from a very exposed anchorage in the open lake, the landing place itself being an equally exposed and naked beach.

1829.

The opening a navigable communication with the lake was begun in May, 1829, agreeably to a plan of Major Maurice, similar to the plans of most of the other harbors then projected, viz: two parallel piers of crib-work, filled in with cobble and other stone convenient to the work, without much, if any, regard to quality or size, reliance being had upon the bottom flooring of the cribs, together with the top flooring or deck to retain the stone loosely thrown in. Brushwood was likewise used in the bottoms of the cribs.

The dimensions of the piers then proposed were, 210 yards for both, and 60 yards for a dam, the breadth of channel way between the piers being 95 feet. These dimensions were afterward greatly enlarged, and the amount of the estimate for the piers and dam was increased from $1,200 to $20,001 65. The appropriation for the year 1829 was $7,500. Before its close, a crib dam of 60 yards in length was placed across the outlet of the creek, in order to divert its current to the new direction which it was proposed to give it, viz: across a point of sand which, as usual on the shores of this lake, had drifted across the entrance of the stream, so as occasionally, and especially during the summer months, to bar all access to it, or nearly so.

Towards the formation and maintenance of the new channel, portions of two piers parallel to each other were placed in a direction nearly perpendicular to the shore to the extent of 120 yards on the eastern, and 90 yards on the western side, with the intention thereafter of prolonging them to deep water in the lake. They were, however, in an unfinished state at the close of the year.

1830.

There was added this year to the west pier 258 yards, and to the east pier 100 yards, or a total length of 358 yards.

The dam laid across the old channel had diverted the course of the creek into the new direction given to it by the piers, and there was already a depth of at least 6 feet of water in it—sufficient for lake vessels of the second class.

There was expended during the season, $8,747 28.

1831.

The depth of water continued to increase with the extension of the piers, which were this year carried 358 yards farther into the lake, and in the autumn there were 8 feet on the bar.

1832.

The piers were still farther extended into the lake 60 yards, and the chief engineer reported the opinion that the funds were sufficient to complete the project. A beacon-light was recommended to be erected for the safety and accommodation of vessels approaching the harbor at night.

The amount of appropriations thus far was $20,005 65.

1833.

The work was inspected by Lieut. Col. Totten, of the corps of engineers, who reported that it consisted of two nearly parallel piers running north 330 feet, and then northwestwardly about 800 feet into the lake, at which point they diverged, and continued 120 feet farther, causing the channel, which was elsewhere about 100 feet broad, to increase to 176 feet. The total length of each pier was then 1,250 feet.

Excepting at one spot, where there was a narrow gravel bank, with but 8 feet of water upon it, the channel had this year a depth varying from 9 to 16 feet, without change.

The available funds were deemed to be sufficient to complete the then project, including the dredging of the channel. It was proposed, however, to erect a beacon-light on the end of one of the piers, at an additional cost of $2,700. The amount of appropriations thus far had been $27,805 65.

The indispensable necessity of converting the perishable materials of the structure above water into strong stone walls, at considerable expense, was suggested by the inspecting officer, who does not, however, give an estimate of the cost of the permanent work, he not having the requisite data for that object.

The general agent, J. D. Selden, at the same period reported that the piers extended into the lake 415 yards, (1,245 feet,) and that there was a depth of 8½ feet in the channel; and he remarks that the stone had settled considerably, and must be filled up, and that the pierheads required to be protected by brushwood and large stones, deposited around them.

He estimates for this work $3,500 for the year 1834.

Two hundred and two feet of pier had been built this year, and some dredging had been done.

1834.

The small balance of appropriation left the past year was not found to be sufficient for the objects towards which it was applied, viz: the

deepening of the channel and the repairing of the works; and the general agent estimated that 760 cords more of stone would still be required to replace the settlement which had taken place in the piers, and for the protection of the exterior of the works, and that it would cost, to do this, the further sum of $3,040. He recommended, also, the extension of the piers 100 feet farther into the lake to a shoal, at a cost of $5,560; making in all $8,600 yet required for the improvement of the harbor.

The shoal here mentioned, and which was composed of sand, had, in the latter part of the last season and during the whole of the present, been found frequently to form from 80 to 100 feet from the end of the piers. A number of vessels had grounded upon it; and the agent supposed that the proposed extension of the piers would cause its removal, and thus free the entrance to the harbor. He does not state the depth of water upon it. It appears that he assumes it to have existed prior to the piers.

1835.

With the expenditure up to this year, $27,812 57, the work, as originally planned, was entirely completed, and some dredging of the channel was also executed with it.

There was now a depth of 9 feet of water into the harbor, and it gave shelter, within the period of a month preceding the annual report, to 26 vessels, which at one time sought refuge there during a gale of wind; thereby manifesting its great value to the commerce of the lakes. The work, however, above water, had greatly decayed, and the sand accumulating at the western pierhead, had begun to pass around it, and to form a bar across the channel, near its outer end. The agent likewise states in his report, that, at one or two places the piers were threatened to be undermined; but he does not think any immediate measure required to be taken against these evils.

The narrowness of the channel rendering it impossible for steamboats to turn or *wind* in the river, and the difficulty and danger of backing out, especially whenever the lake is rough, being stated, the agent recommends the forming of a winding place on one side of the creek; and an appropriation for that purpose, to the amount of 2,500. This suggestion was approved of, and a small sum of money was appropriated towards carrying it into effect.

1836.

The appropriation of this year had thus far been applied to forming a winding place for steamboats. A further appropriation of $8,000 for continuing this work was now asked for, viz: for removing 40,000 cubic yards of earth; 2,500 cubic yards had been removed.

The sand-beach does not appear to have advanced upon the piers since the last year, nor had the harbor been injured by it since then. No repairs had been deemed necessary on the piers during the year.

Numerous vessels are said to have sought refuge in the harbor from the storms.

The estimate this year for completing the winding place was $8,000.

1837.

The general agent reported that 17,000 cubic yards of earth had been removed during the year, by which a sufficient winding place had been

formed; that, nevertheless, it would seem to be desirable that the many vessels which sometimes seek the harbor should have still more room for their accommodation; and that the local agent had estimated the cost of the farther enlargement at $5,700; the necessity for which expenditure he refers to the department to judge of.

It appears, also, that the outer crib of the western pier had settled or slid down, in consequence of the sand being washed from under a part of it, by which a space of ten feet was left between it and the crib nearest to it. The agent also states in his report that this pier ought to be destroyed and another larger than it substituted, and he submits an estimate from the local agent for that object, amounting to $1,332.

1838.

Up to the date of the annual report, there were removed, this year, 7,193 cubic yards of earth from the proposed basin, a work upon which it was intended to continue until the exhaustion of the available means for that object.

The repairs of the west pier were also prosecuted during the year, as also the replacing of the decayed plank. A new pierhead was also framed and sunk.

The agent submitted estimates, as follows, viz:

For repairs to pierhead on the east side, and for raising the adjacent woodwork - - - - - - -		$2,146 50
For rendering permanent the work on the west pier -		7,045 00
For rendering permanent the work on the east pier -		7,583 00
For repairing and securing east pier from sliding -		2,206 50
Or for repairs of piers - - -	$4,353 00	
For permanent work on piers - -	14,628 00	
		18,981 00

1839.

The work had but little advanced this year, owing to deficiency of means. The dredging of the basin had been continued, and there remained still some portion of it to be done to complete it to the extent proposed by the local agent in his estimate of 1837. The pierhead proposed in the annual report of that year has been carried above high water, and gives much protection to the work. About $3,000 more would be required to complete the dredging proposed by the local agent. The piers required to be repaired or made permanent. The bar or middle ground, which has been more than once noticed in this memoir, as having formed near the head of the piers in the lake still existed there. It lies about 200 feet to the westward of the west pier, and vessels are liable to ground upon it, but there is room enough and a sufficient depth of water between it and the piers, nor does it appear to present any obstacle to the ingress or egress of vessels under careful management. There can be no reasonable doubt that this shoal has formed since the commencement of the work, nor that it would follow the progress of the piers should they be pushed farther into the lake, and it is probable, also, that the depth of water on, and in some measure the position of the shoal, composed as it is of fine moveable sand, which has

swept around the head of the western pier, is liable to vary under the influence of the current of the creek during the spring months, and in times of high freshets, or in the autumn, especially after the prevalence, for any considerable length of time, of stormy weather. Under these impressions, and believing that the draft of water into the harbor is now sufficient for any vessel upon the lake, the board has not come to the resolution of recommending, at this time, an extension of the piers in the direction of their length.

Since the inspection of the harbor by the board, the bar has disappeared from before the entrance.

There remained of the appropriations applicable to the work, on the 1st of April, 1839, $1,850.

There is now a width of 105 feet between the piers from their inner end to the Beacon light-house, whence they diverge until at their exterior end they are 165 feet apart; the least depth of water between them in the harbor is 11 feet. The piers extend now from the shore into the lake 550 feet on the west and 640 feet on the east side, the beach having advanced into the lake since the commencement of the work 380 or 390 feet on the west and 270 feet on the east side of the piers.

It is recommended to render permanent all the work above the lowest stage of water in the lake, and to add to the width of the foundations in the manner and to the extent shown in one or the other of the annual estimates, in which it will be seen there is no provision for enlarging the winding place, inasmuch as it has not been fully shown to the board that greater space is now or may for some time to come be required by the wants of the general trade of the lake. Should it be deemed expedient, however, to proceed at once with that work, the sum of $3,000 will be required to complete it.

The original estimates amounted to - - -	$20,001 65
The amount appropriated to this date - - -	43,305 65
Cost of the work - - - - - -	41,342 53
Remaining of appropriations applicable to the work	1,850 00

As is stated at the head of this article, the shallowness of the river at its entrance formerly compelled vessels having cargoes to or from Conneaut, or the neighboring country, to lie at anchor in the open lake, exposed to the danger of being driven ashore. The commercial business of the country was therefore extremely limited, as was the increase of population and of agriculture.

As grain and the other productions of the country could not be conveyed to a market but at great hazard and cost there were scarcely any exported, and the imports were necessarily limited to the absolute necessaries of life. These observations apply nearly equally to Ashtabula and to Cunningham's creek, improvements which all lie in the same county of Ashtabula. Ashtabula county is not alone interested in the improvement of Conneaut. Much of Trumbull county, also, in the State of Ohio, and parts of Crawford, Erie, and Mercer counties, in the State of Pennsylvania, are also directly connected with the business of the port. The population thus interested does not fall short of 50,000 souls. The increase of population and of the value of property in these two as well as in all the other counties of Ohio connected with Lake Erie, have been very great, as may be seen by the accompanying statements.

We have no information to show the actual state of the town of Conneaut in 1829, when the formation of its harbor was undertaken. There was necessarily no tonnage belonging to it, and it is altogether attributable to its harbor that it has grown to be a place of any importance. The town has a population of 1,200 souls; 23 stores, 5 warehouses, 14 saw mills, 1 large steam-mill and machine shop, 2 woollen factories, 7 flouring mills, 3 tanneries, and 1 blast furnace. It owns 3 steamboats and 7 schooners; several vessels have been built here. In the year 1836 it exported 1,124,067 feet of sawed lumber, 250,000 pipe staves, 24,786 bushels of grain, 10,849 barrels of flour, pork, beef, &c., 3,947 boxes of glass, 81 tons of mineral coal, 25 tons of cheese, 46 tons of butter, 150 tons of fruit, 200 tons of cast iron, and it imported 14,770 barrels in bulk, 5,230 barrels of salt, 95,000 feet of pine lumber, 150 tons of gypsum, 346 barrels of lake fish, 568 tons of limestone, and 29 tons of burr millstones. The arrivals were 760 steamboats, 275 other vessels, and the departures were 759 steamboats and 275 other vessels.

In 1837 there were exported from it 6,300 barrels of pork, &c., 4,000 bushels of oats, 250,000 feet of lumber, 200,000 pipe staves, 450 tons of castings and pig iron; and there were imported the same year 320 tons of merchandise, 5,300 barrels of sundries, 7,000 barrels of salt, 2,000 barrels of plaster.

The business of the year 1838 did not materially differ from that of 1837.

The improvements projected to connect the town with the interior are, 1st, the Conneaut and Beaver railroad, to lead in the direction of Beaver, on the Ohio river. Should the road be constructed—and it has a charter from the State of Ohio, and has been located—it will add much to the importance of the harbor, as it must pass through some valuable coal fields in Trumbull county. To the Ohio river, the length of the road would be about 100 miles; the southern part of it, lying in Pennsylvania, has a charter from that State. The Ohio portion, it is said, will be completed in two years. The railroad, which is located parallel with Lake Erie, to extend to Maumee river, commences in the vicinity of this harbor. 2d. The Ohio railroad, which is located through the northern tier of counties of Ohio, commencing near this harbor, and extending to the Maumee river, a portion of it being under contract and in progress.

Conneaut creek.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1829	Capt. Maurice -	$20,001 65	$7,500 00	$3,900 71	A. Dart.
1830	- -	-	6,135 65	8,747 28	Do.
1831	- -	-	6,370 00	6,105 92	Do.
1832	- -	-	7,800 00	3,490 83	Do.
1833	- -	-	-	4,449 48	Do.
1834	J. D. Selden -	3,500 00	-	1,093 50	Do.
1835	- -	6,600 00	-	24 85	Lt. T. S. Browne.
1836	Lt. Brown -	2,500 00	2,500 00	771 53	A. Dart.
1837	Capt. Smith -	8,000 00	5,000 00	6,149 41	Do.
1838	Do. -	7,022 00	8,000 00	3,875 22	
1839	- -	18,981 00			
	Beacon light.				
1834	- -	2,700 00			
1834	- -	-	2,000 00	648 76	
1835	- -	-	-	1,351 24	

CONNEAUT HARBOR.

Estimate for permanent work to replace the temporary length of east pier, to be made permanent.

Outer section, length - - - - - -	290 feet.
Inner section, do. - - - - - -	350 "
	640 "

Length of west pier to be made permanent:

Wide or outer section - - - - - -	290 "
Narrow or inner section - - - - -	260 "
	550 "

East pier, section 1: from outer end, length 100 ft., average breadth 23 ft., additional width of foundation 6 ft., average depth of foundation 7 ft. 6 in., up to low water.

Section 2: from section 1, inward, length 220 ft., average depth from low water to bottom 5 ft., average width of additional foundation 8 ft. 3 in.

Section 3: from section 2, towards shore, width 12 ft., height 12 ft., and length 280 ft.

North pier, section 4: from outer end, length 260 ft., average width 22 ft. Average width of additional foundation 9 ft., average depth of additional foundation 5 ft. 6 in.

Estimate for the east pier.

Cost of additional foundation, section 1, 3 cribs, each 30 ft. long, and 1 of 20 ft. long.

1st. For 1 crib, 30 ft. long, 7 courses of timber for sides:

For 14 pieces of timber, 14 in. square, each 30 ft. long—420 ft., at 10 cents per foot	$42 00
For 21 ties, at 25 cents each	5 25
For 6 piles, each 30 ft. long, 1 ft. square—180 ft., at 8 cents per ft.	14 40
For trunnels and iron	10 00
For carpentry and labor	71 75
For stone, 10 cords, at $8 per cord	80 00
Cost of 1 crib, 30 ft. long	223 40
Cost of 3 cribs	670 20
For 1 crib, 20 ft. long	148 93
Cost of additional foundation to section 1	819 13

Cost of additional foundation to section 2, 6 cribs, each 30 ft. long, and 1 crib of 40 ft. long.

For 1 crib, 30 ft. long, 5 courses of timber for sides:

For 10 pieces of timber, 14 in. square, each 30 ft. long—300 ft., at 10 cents per foot	$30 00
For 15 ties, at 25 cents each	3 75
For 6 piles, each 30 ft. long, 1 ft. square—180 ft., at 8 cts. per ft.	14 40
For trunnels and iron	10 00
For carpentry	58 15
For stone, 9⅔ cords, at $8 per cord	77 33
Cost of 1 crib, 30 ft. long	193 63
Cost of 6 cribs, 30 ft. long	1,161 78
Cost of 1 crib, 40 ft. long	242 04
Cost of additional width to section 2, east pier	1,403 82

Estimate for west pier.

Additional width to section 4, 8 cribs, each 30 ft. long, and 1 of 20 ft. long—260 ft.

1 crib, 30 ft. long, 5 courses of timber:

For 10 pieces of timber, each 30 ft. long, at 10 cents per foot	$30 00
For 15 ties, at 25 cents each	3 75
For 6 piles, each 30 ft. long, 1 ft. square—180 ft., at 8 cts. per ft.	14 40
For trunnels and iron	10 00
For carpentry	58 15
For stone, 11½ cords, at $8 per cord	92 00
Cost of 1 crib, 30 ft. long	208 30
Cost of 8 cribs, 30 ft. long	1,666 40
Cost of 1 crib, 20 ft. long	138 87
Cost of additional width to section 4, west pier	1,805 27

Cost of Kyanizing timberwork in the superstruction of both piers:

For 25,000 ft. of timber, 14 in. square, at 10 cents per foot	$2,500 00
For 935 ties, at $1 each	935 00
For cost of Kyanizing the above, 46,440 cubic feet, at 12½ cents per foot	5,805 00
For coffer dams	3,435 00
	12,675 00
For both piers, cost of foundation and timber	16,703 22

First mode—Cribs of timber Kyanized filled with stone:

1st. Cost of removing old work above the value of the materials	$2,000 00
2d. Cost of foundation and timberwork as before	16,703 22
3d. Stone to fill 1,480 cords, at $8 per cord	11,840 00
4th. Concrete for surface 1 ft. thick, 695 cubic yds., at $6 per yd.	4,170 00
Add 10 per cent.	3,471 32
Cost of first mode	38,184 54

Second Mode—Kyanized timber filled with concrete (the ties remaining) for both piers:

1st. Cost of removing old work above value of materials	$2,000 00
2d. Cost of foundation, as above	4,028 22
3d. Cost of timberwork	12,675 00
4th. Concrete filling 7,116 cubic yards, at $6 per yard	42,096 00
Cost of coffer dams	3,570 00
Add 10 per cent.	6,430 92
Cost of second mode	70,806 14

Third mode—Omitted.

Fourth mode—Piers of blocks of stone hammer-dressed, laid in cement, with solid concrete backing the superstruction resting on a bed of concrete 6 ft. thick, placed on the foundation of cribwork:

1st. Removing old, excess over value of materials	$2,000 00
2d. Extra cribs for foundation, as above	4,028 22
3d. Concrete for base, 4,750 cubic yards, at $6 per yard	28,500 00
4th. Cut stone facing 2,468 cubic yards, at $13 70 per yard	33,811 60
5th. Concrete for backing 2,318 cubic yards, at $6 per yard	13,908 00
6th. Cut stone for battlement wall, 529 cubic yards, at $13 70 per yard	7,247 30
Cost of coffer dams	3,570 00
Add 10 per cent.	9,306 51
Cost of fourth mode	102,371 63

ASHTABULA CREEK.

Ashtabula creek, which is situated about 45 miles from Erie, is a short and narrow stream, although it has a depth of water sufficient for the largest class of lake vessels to one and a half miles from its mouth, and when the

plans for its improvement will have been completed, it will continue, as it already does, to afford a safe and commodious harbor for the commerce of the dependant country, and a secure refuge to the general commerce of the lakes.

Prior to the commencement of the works at its mouth, the entrance to it was obstructed by a sand bar, the channel of which had not more than three or four feet of water whereby it was rendered useless for the purpose of commerce; a rocky stratum underlaying the sand formed two planes whose anticlinal line had but three feet depth of water upon it; one of the planes dipping so that at the distance of 60 yards from the shore it lay about nine feet beneath the surface of the water and perhaps two feet beneath the gravel.

The sand bar had been formed "by the sea heaving up the sand from the bottom of the lake coming in contact with the current of the creek, which loses its velocity after leaving its mouth, expanding itself on the surface of the lake, giving a complete ascendency to the seas to make a deposite of the sand." Such is the engineer's account of it, and it was proposed by him in order to remove the obstruction, "to contract and extend the current beyond the reach of any sand," and for that purpose "to project two parallel embankments 150 feet apart from the mouth of the creek into the lake to 10 feet water where the rock is free of sand and from thence to gradually widen them so as to have 300 feet at its mouth, to facilitate the entrance of vessels," and he stated his opinion that "at that distance no apprehension may be felt as to a recurrence of another bar forming at its mouth, at least for many years to come." Respecting the mode, &c., of construction, the details are given in the words of the engineer, as follows, viz:

"As there is no possibility of driving piles to secure the strong timber-work, it is proposed to substitute for them guard or securing posts, to be let in and strongly pinned into heavy sills intended to rest on the surface of the rock, between which logs of timber not less than 12 inches in diameter, hewn on two sides, are to be laid, finished at their ends so as to interlock with the succeeding ones, and at the distance of twelve feet in the clear to be connected together with ties every ten feet, dovetailed into the timbers. Each succeeding timber laid on the top to be pinned through with pins two inches in diameter, and two feet long, and to be tied also. The whole to be finished off with a cap piece of square timber, twelve inches square, and the opposite heads of the posts to be also secured with cap pieces crossing transversely the piers intended for the embankments.

The estimated cost of the embankments and interior piers was $12,000.

1826.

The work was begun in the year 1826. The dike was finished the same year, and the east pier was extended as far as time would permit.

The whole of the work was estimated to cost $21,343 75.

1827.

Two parallel piers were this year constructed of an average length of 214 yards each, leaving 106 yards of each pier to complete the original design. The work executed extended from the mouth of the river to 10 feet depth of water in the lake. The dry sand bar which had obstructed the entrance

was removed, and a depth of 4 feet of water was obtained, which it was supposed the following spring freshets would increase to the depth required for lake vessels. All the contracts had been fulfilled.

The estimate for the ensuing year for extending and completing the piers to 13 feet deep, as at first contemplated, was the maximum $2,403 50; the minimum $2,091 00.

The appropriations to the date of the annual report had been $12,000, of which sum there had been expended to September 30, 1827, $9,635 56¼.

1828.

The work of this year consisted in the raising, planking, and completing the work of last year. The sand which originally covered the rock and gravel at the entrance had been removed by the current, but a small gravel bar was left near the river: this, it was presumed, necessarily would require to be excavated. This done, and the piers carried to their contemplated extent would, it was thought, ensure a safe and commodious harbor to vessels.

Two hundred and seventy yards of pier-work had been done up to September 30th from the commencement of the work. To the end of the 3d quarter of 1828, $12,751 22 had been expended.

1829.

At the close of the 3d quarter of this year the piers were completed to the extent originally contemplated, by which, with the aid of the dredging machine then in operation, a sufficient draught of water was proposed to be obtained into the harbor. During this year vessels lay in security in the channel between the piers. They could not yet enter the river.

The total expenditure to this period was $16,587 87.

1830.

The operation of dredging the gravelly bar was continued, and promised, with the machinery then in use, at a reasonable expense, to remove the obstruction heretofore described.

The piers in 1830 afforded the promised security to vessels moored between them, but it appeared to the agent of the work that they were nevertheless not sufficiently extended, as it was found that the sand accumulated on the outer bar, skirting the south shore of the lake, for which reason it was recommended to extend the piers beyond that bar.

This extension was estimated to cost $7,013 26.

1831.

The original plan having been completed, the operations this year were confined to the dredging of the channel—a work still in operation. The erection of a beacon-light was recommended.

The total cost of the work to the 30th September, was $26,992 46.

1832.

During the year 1832 progress was made in perfecting the works and in removing the obstructions at the mouth of the harbor, viz: The rock, on which was now 6½ to 7 feet of water only. Little progress had been made

in this latter work, owing to the want of knowledge of the proper means of effecting it, to attain which, however, a series of experiments were instituted on the spot.

An estimate for widening the entrance to the harbor was submitted to the department with the annual report, and the recommendation that a beacon-light should be erected was renewed.

1833.

An officer of the corps of engineers was directed to inspect the work.

At this time the piers had been carried about 1,284 feet into the lake, forming a channel of from 100 to 145 feet broad. A slate rock stretching quite across the channel, about 200 yards from the head of the pier, and 200 yards in length, and having a depth of but 6½ feet of water upon it, prevented the current from scouring it to the requisite depth. It was upon this rocky bottom that force had been for some years employed with comparatively slight effect. Its removal continued to be the chief object of attention, and the agent submitted an estimate for it, amounting to $7,600.

The proposition to prolong the piers 150 feet farther into the lake, and to give the channel a greater width at their exterior ends, was renewed, estimated at $7,391 40.

1834.

This year the labor was also chiefly applied to removing the rock from the channel, the machinery for accomplishing which purpose had become materially improved since the first attempts upon it. About 13,000 tons of stone and gravel were removed, and the channel along the east pier was in this way deepened to 8 or 9 feet. With this experience, it was thought that the existing appropriation would suffice for the removal of all the obstructions to the navigation between the piers.

The existence of a shoal, lying a short distance outside the piers, is noticed in the annual report as an additional motive for the proposed extension of the piers.

The report states also that since the 1st May, of this year, 531 vessels had touched at the port, whereas but a few years previous the arrivals would not exceed a dozen vessels the whole season.

1835.

Progress was made in dredging the channel to an extent which encouraged the expectation that it would be completed the ensuing season. The depth, in the shallowest part of the channel, was now 7 feet.

Materials were, in part, collected for the extension of the piers; the sum estimated for that work, viz: $7,591, having been appropriated at the previous session of Congress, $4,844 12 was expended, and a balance remained on hand sufficient for the operations of the year 1836.

Preparations were also made for commencing the foundation of a beacon light-house, with the intention of sinking it during the same autumn, and of completing that work the ensuing spring.

1836.

To prolong the piers, 204 feet of cribwork, 18 feet wide, was sunk and filled with stone on the west side, by which the work was carried to 10 or 12 feet water, with the expectation of securing it during the autumn.

The channel was dredged so as to open a passage on an average breadth of 50 feet, and a length of 215, and giving a depth of 9 feet across the rock heretofore described as obstructing the navigation between the piers.

The beacon-light was nearly completed, and it was expected to be in operation before the season closed.

An estimate was submitted for all the work as follows, viz:

For raising the old work of the piers - - - -	$8,559 44
For stone at beacon pier - - - - -	900 00
For stone at angle of west pier - - - -	900 00
66,400 cubic yards work on channel - - - -	6,400 00
60,000 cubic yards excavating and enlarging inner harbors -	12,000 00
For superintendent and forage - - - -	920 00
Total - - -	29,679 44

1837.

The extension of the west pier was completed, and the old work of the piers carefully repaired and refilled with stone, during this season. Much injury having been done by immense quantities of sand drifting from the westward along shore into the harbor, ranges of brushwood were placed at 200 to 500 yards from the work, and the drift thereby effectually arrested.

Blasting was substituted for the slow and inefficient process of chiselling the rocky bottom heretofore employed, and with the best results. To complete the rock excavation, which, it was supposed, might be easily effected the ensuing year, and to commence the permanent work on the piers, an estimate was submitted for the service of the ensuing year, amounting to $24,025 16.

1838.

The operation of dredging the channel was continued, and some of the sand which had drifted along shore, and had been blown into the harbor, was removed. 152 feet of the old work of the piers in a decayed state was renewed. 550 feet of the outer end of the east pier, and 200 feet of the east pier, were raised two to four feet, and filled with stone—an improvement absolutely required by the high stage of the water of the lake.

1839.

During this year, progress has been made in the removal of the slate from the channel. There yet remain some three thousand cubic yards to be removed, at a cost of perhaps $2,500.

The total amount of appropriations to the present year is -	$64,149 75
Of which was expended to the 1st April, 1839 - -	60,664 15
Leaving a balance applicable to the work of -	3,485 60

The piers now project beyond the shore, the west pier 730 feet, and the east pier 660 feet, the beach having advanced on to the lake 607 feet on the west, and 455 feet on the east side of the harbor since the work was begun. The piers are 102 feet apart at the beacon-light-house, where they diverge as they advance into the lake. Immediately within the present

line of beach, the piers are 138 feet apart. A sand bar has formed about 150 feet beyond the end of the west pier, having now 8 feet on its eastern end, 9½ on the west end, and 8 feet on the shoalest part of it. Between this and the heads of the piers, there is a depth of 10½ feet. The bar or shoal is liable to changes resulting from the action of the currents. There is a depth of 11 to 12½ feet inside of the pierheads, and a narrow channel of 9½ feet through the ledge of slate rock under the east pier.

It is recommended to increase the width of the piers outside of the present coast line in the manner proposed for Conneaut, and to replace the upper works with imperishable materials after one or other of the modes proposed in the annexed estimate, giving to the piers above extreme low water a breadth equal to the old and new foundations together.

Previous to the commencement of the formation of a harbor here, many vessels trading with the neighboring country were driven ashore, and much property was lost because the river was inaccessible during the greater part of the business season, owing to the sand bar which then usually obstructed the entrance. From the year 1827 vessels could lie securely within the piers, and as the work advanced, they even entered the harbor. The consequences of this security afforded to commerce have been very striking. The value of the trade has advanced very rapidly from the period at which vessels could find safety under the lea of the piers until the present time. We have staements of the value of the exports and imports for every year from 1825 to 1833, inclusive, and for the year 1838, which we annex.

Year.	Value of exports.	Value of imports.	Aggregate of exports and imports.
1825	$25,300 00	$30,275 00	$55,575 00
1826	27,000 00	31,000 00	58,000 00
1827	44,000 00	61,210 00	105,210 00
1828	59,000 00	81,000 00	140,000 00
1829	70,000 00	90,000 00	160,000 00
1830	75,360 00	110,000 00	185,360 00
1831	80,000 00	115,000 00	195,000 00
1832	90,000 00	120,000 00	210,000 00
1833	93,175 00	214,000 00	307,175 00
1838	225,000 00	275,000 00	500,000 00

It is estimated that the exports and imports of 1835 and 1836 each nearly equalled 1838.

In 1836, four hundred and seven steamboats, and one hundred and fifty-six other vessels, entered the port. There were owned at it six vessels besides those from other ports engaged in the trade created by it. The population and wealth of the country, in immediate connexion with the harbor, have also greatly increased since its commencement. In Ashtabula, Columbiana, and Trumbull counties, the population in the year 1830 was 75,246; in the year 1839, it has been estimated at more than 100,000 souls. And the assessment of taxable property in those counties has risen, according to the assessor's returns, from $3,164,051, in 1829, to $6,902,009, in

1839. A corresponding increase has taken place in the western parts of Pennsylvania, having a direct intercourse with it.

The country more immediately interested in the work varies from 20 to 30 miles in width, and extends south 96 miles to the Ohio river, and a large amount of business is carried on with Pittsburg, 136 miles distant from it.

Lines of stages run daily between the town of Ashtabula and Warren, in connexion with the canal packet-boats, thence to the Ohio river at Beaver and to Pittsburg. Stages ply regularly between Ashtabula and Erie, and also between it and Cleveland.

A railroad is projected and chartered to Liverpool, on the Ohio river, in Columbiana county, to pass through Warren, on the Mahoning river. Several excellent roads radiate from Ashtabula.

Ashtabula harbor.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditures.
1826	– –	–	–	–	Major Maurice.
1826	– –	–	$12,000 00	–	Mathew Hubbard.
1827	– –	$28,357 22	–	$9,635 56¼	Do.
1828	– –	–	2,403 50	3,115 65¾	Do.
1829	– –	–	6,940 25	3,836 65	Do.
1830	– –	7,013 66	–	4,539 91	Do.
1831	– –	–	7,015 00	5,864 62	Do.
1832	– –	–	3,800 00	1,875 35	Do.
1833	– –	18,476 38	3,400 00	2,187 38	Do.
1834	– –	–	5,000 00	2,341 05	Do.
1835	– –	–	7,591 00	4,844 12	Do.
1836	– –	–	–	8,296 86	Do.
1837	– –	32,639 44	8,000 00	5,708 30	
1838	– –	–	8,000 00	6,766 15	
1839					
	Beacon-light.				
	Maj. Maurice, foundation - - -	1,528 21			
	Do. tower	541 20			
		2,069 41			
1831	– –				
1834	– –	–	2,000 00	–	M. Hubbard.
1835	– –	–	–	35 30	

Dimensions of east pier—

390 feet (to 6 feet water) 270, (from 6 to 14 feet water;) average breadth at present 12 feet 6 inches; average breadth to be added 8 feet 6 inches; depth 5 feet 6 inches.

Dimensions of west pier—

430 feet from shoulder out; 300 feet from shore to shoulder; from shoulder out, mean breadth of addition 5 feet; mean depth 5 feet 6 inches; mean breadth of finished piece 21 feet.

Estimate for the east pier—		
No. 1. For additional width of foundation, 9 cribs, each 30 feet long, 8 feet 6 inches wide, and 5 feet 6 inches deep, 5 courses:		
For 10 pieces of timber 14 inches square each, 30 feet long; 300 feet, at 10 cents per foot, counter-hewed - - - - -	$30 00	
For 15 ties, at 25 cents each - - -	3 75	
For 6 posts and sills, each (post and sill) 30 feet long, (Kyanized) 180 feet, at 20 cents per foot	36 00	
For carpentry and labor - - -	79 75	
For stone, 13 cords, at $8 per cord - -	104 00	
For trenails and iron - - - -	10 50	
Cost of one crib - - - -	263 50	
East pier, cost of 9 cribs - - -	-	$2,371 50
West pier estimate—		
No. 2. For additional width of foundation, 13 cribs 30 feet long and 1 crib 40 feet long; cost of one crib 30 feet long, 5 feet wide, 5 feet 6 inches deep, 5 courses of timber;		
For 10 pieces of timber, 14 inches square, each 30 feet long; 300 feet, at 10 cents per foot -	30 00	
For 15 ties, at 25 cents each - - -	3 75	
For 6 posts and sills, each (post and sill) 30 feet long; 180 feet, at 20 cents per foot (Kyanized)	36 00	
For trenails and iron - - - -	10 00	
For carpentry - - - - -	79 75	
For stone, 6½ cords, at $8 per cord - -	52 00	
Cost of 1 crib - - - - -	211 50	
Cost of 13 cribs 30 feet long, at $211 50 each -	2,749 50	
Cost of 1 crib 40 feet long - - -	264 88	
Cost of all the extra foundation to west pier -	-	3,014 38
Cost of Kyanized timber work in the superstruction of both piers:		
Removing old work above the value of materials	2,000 00	
For 27,800 ft., running measure, 14 in. square, at 10 cents per foot - - - -	2,780 00	
For 1,050 ties, at $1 each - - -	1,050 00	
For Kyanizing the above 46,680 cubic feet of timber, at 12½ cents per foot - - -	5,835 00	
For carpentry and labor - - -	3,830 00	
For stone, 1,696 cords, at $8 per cord - -	13,568 00	
Cost of superstruction - - - -	-	29,063 00
Concrete to form the surface of both piers 1 foot thick, 730 cubic yards, at $6 per yard - - - -	-	4,380 00
		38,828 88
Add 10 per cent. for contingencies - - -	-	3,882 89
First mode -		42,711 77

2d mode. Kyanized timber filled with concrete, the ties remaining. For both piers:

1st. Foundation as above	$5,385 88
2d. Removing old work above the value of materials	2,000 00
3d. Timber work, Kyanized as above	13,495 00
4th. Concrete filling, 8,041 cubic yards, at $6 per yard	48,246 00
	69,126 88
Coffers	4,170 00
	73,296 88
Add 10 per cent. for contingencies	7,329 69
Cost of second mode	80,626 57

3d mode. Piers of solid concrete. The cost of Kyanized timber and placing in the second mode, is, within a very few dollars, the same as the concrete to fill the space. The cost is therefore assumed as in the second mode - $80,626 57

4th mode. Piers of blocks of stone, hammer dressed, laid in cement, with solid concrete backing, resting on a bed of concrete 6 feet thick, placed on the old foundation of cribwork:

1st. Cost of removing old materials above the value	$2,000 00
2d. Extra cribs for foundation, as before	5,385 88
3d. Concrete for base, 5,332 cubic yards, at $6 per yard	31,992 00
4th. Cut stone for facing, 2,883 cub. yds., at $13 70 per yd.	39,497 10
5th. Concrete for backing, 1,557½ cub. yds., at $6 per yard	9,345 00
6th. 613 cubic yards cut stone laid in battlements, at $13 70 per yard	8,398 10
	96,618 08
Coffers	4,170 00
	100,788 08
Add for contingencies 10 per cent.	10,078 81
Total cost of 4th mode	110,866 89

Cunningham Creek harbor.

Cunningham creek in Ashtabula county, Ohio, is 62 miles west of Erie, 16 west of Ashtabula, and 20 east of Grand river. It is a very small stream with scarcely any current where it approaches the lake, from which it is separated usually by a sandy beach. It was not supposed to have sufficient force even with the aid of dikes and piers to open a navigable communication with the lake, nor was it apparently the intention to form a harbor at this place. The original appropriation for it was $2,000 and the estimate and preliminary plan of the engineer charged with the execution of the work, appear to have been limited to the repairing and extending of an open pier or wharf erected there by a private company, and the construction of a detached pier in advance of and nearly, at a right angle with it, the cost

of which should not exceed the amount of the appropriation. His estimate was:

For repairing the old pier - - - - -	$506 00
For extending it - - - - - -	272 24
For the detached pier - - - - -	1,154 72
And for contingencies - - - - -	66 40
Total - -	2,000 00

The plan of the work shows the intended length of the inner pier or wharf to have been 350 feet including the old work, and the detached pier 375 feet. A sketch was also given of a harbor of open pierwork with a breakwater in front of it, on the assumption that the wants of the neighboring country might possibly require some such extension of the plan thereafter.

1826.

The open pier or wharf was employed to allow the sand drift, which sets along the shores of the lake, to leeward in order that it should not accumulate to windward as it necessarily would, if they were solid, and it was believed that the work would stand unloaded with stone. This was the opinion entertained by the company which had commenced the work, and it was the intention now to proceed upon the same hypothesis. The timber was procured and framed for it by contract during the winter of this year.

1827.

The pier was carried forward this year on the plan and to the extent proposed originally, with the exception of the detached pier which had not been commenced for the reason, that the funds applicable to the work were found not to be sufficient for it, inasmuch as it had become apparent that it ought to be loaded with stone, an item of expense not contemplated in the first instance, and which it was estimated would add $1,517 76 to the cost of the improvement. This was for a length of 350 feet. The addition to the old pier was 60 feet.

1828.

The work of last season, owing to the severe storms of the winter and to the omission of the usual stone filling of the piers, was all swept away; carrying with it the old pierwork which was in a decayed state. It was proposed therefore to sink wooden cribs loaded with stone, and to leave intervals to be bridged for the passage of drifting sand, and in this manner the old pier, 290 feet, was replaced during the year.

The appropriations heretofore, corresponding with the estimates, amounted to $3,517 76 all of which was applied to the work, and the further sum of $2,956 06 was asked for.

1829.

According to the annual report of the engineer, the block pierwork and bridging commenced last year "as a landing place" had been extended this season to within 34 yards of their proposed length, and he was of opinion that these being completed, there ought to be a pierhead formed for their protection, the cost of which would be $1,430 90. The length of pier now done was 137 yards.

The expenditure for the year had been $1,781 05, and the whole amount appropriated, corresponding with the estimates, was $6,473 76, and the cost of the work up to September 30, $5,298 81.

1830.

The pier was this year reported as having been completed with the exception of the pierhead, an estimate for which had been submitted the year previous, but no appropriation having been made, it was now repeated.

1831.

Nothing was done this year in consequence of the failure to obtain an appropriation for constructing a pierhead, the estimate for which was again repeated by the engineer office in its annual report.

1832.

There was this year appropriated for the continuation of the pierhead, the sum of $1,500.

The engineer reports that the means provided for the erection of a pierhead were not sufficient, and that only two thirds of it had been constructed and secured, and the department therefore estimates for the amount required to complete it. It was to have been 90 feet long and 18 feet broad. Sixty feet of it had been put down and filled with stone. Another crib 30 feet long was in readiness, but the requisite sum to enable the agent to load it was wanting.

1833.

The general agent reports that the appropriation of $500, of the last session of Congress, was not sufficient to complete the pierhead, it being larger than the plan formerly proposed for it. He states that much loss and damage have resulted from the insecure state in which the work had necessarily been placed in consequence of the insufficiency of the appropriations, and was of opinion that the least sum that would be required to place the works in a state of security was $1,884.

The agent also proposed the conversion of the works into a harbor (it was now one solitary pier or wharf) by the erection of a pier to the eastward of the existing work, and a breakwater in advance of these. The east pier to be 500 feet long, or long enough to range with the present one; and he estimates, for the new pier, $6,665 20, viz: One of 500 feet by 18 wide, and for the breakwater, 200 feet long, 28 feet wide, and 22 feet high, $6,388 90, these several works to be constructed after the fashion of the existing pier. In all, $13,054 10 was required, besides the sum of $1,884 for completing and securing the work already authorized, to which is also added an estimate of $2,000 for a beacon-light-house.

Of the large plan suggested by Captain Maurice, in whose charge the improvements had originally been, the western side had been carried out its intended distance from the shore; and the proposition of the present agent and of the inspecting officer was but the execution of that plan, with the modification only of changing the proposed direction of the eastern pier, and making it converge at its outward extremity towards the western pier, by which it was supposed the expense would be reduced, and a better shelter for vessels provided with or without the breakwater. Plans of the pro-

posed modification of Captain Maurice's project were furnished to the department.

1834.

An appropriation of $2,000, made during the last session of Congress for the purpose, was applied to the erection of a beacon-light-house, which was completed during the year. No appropriation had been made for extending and securing the piers. An estimate was therefore again furnished for that purpose by the agent, who predicted in his annual report the ruin of the old work, should it not be repaired during the ensuing year.

The further sum of $1,200 was asked to enable the agent to finish and secure the foundations on which the beacon-light-house was built, as also the sum of $1,056 to complete the pierhead to connect it with, and to finish and to repair the old pier.

For the eastern pier, of the plan of last year - - -	$6,255 00
And for the breakwater, proposed last year - - -	6,388 90
	12,643 90

The amount of the estimates made this year was therefore $14,899 90.

1835.

Nothing was done this year for want of the requisite appropriations.

1836.

The appropriation, made at the last session of Congress, was applied during the year to the connecting the cribwork of the beacon-light-house with the pier, and to the repairing, strengthening, and securing the foundation of the beacon-light.

No appropriation for extending the work had been made since 1833.

The agent estimates now for the east pier, on plan No. 2, the sum of - - - - - - - -	$8,960 00
For the breakwater - - - - - -	8,121 50

The quantities being the same as those heretofore given by Col. Totten, of the corps of engineers, in both cases, the difference between the estimates resulting chiefly from the difference of prices assigned to the several items.

The appropriations for the year were - - -	$1,275 00
And there was expended of these to the 30th September -	1,116 66

1837.

There was appropriated for the works this year $5,000, which were applied to the repairing of the existing pier, and the renewal of decayed portions of it, and the construction of part of the pier intended to form the eastern side of the harbor, proposed heretofore, and modified in 1833; for this purpose the inner side of the pier was established according to the report of the agent, at the distance of 608 feet from the old pier, and was carried out so far as to sink and secure separate cribs, each 32 feet long, of strong timbers, secured by posts, iron bolts, and three inch trenails, and loaded with stone, laid in the interior of each. The bottom of the lake here being of rock, and piles therefore inapplicable, sills of 18 inch square

timber, 40 feet long, were sunk under the cribs. Posts outside of the cribs were strongly braced to these sills, and tied across the cribs by caps at their head. The cribs were separated by intervals, as in the west pier; and these occupied a total length, including the intervals, of 590 feet, and there remained to be added but one more to complete the proposed length of the pier. They yet required to be finished, as well as the connecting bridge-work, to fill the intervals; the appropriation not being sufficient to complete these also. The beacon light-house was finished and in use.

The estimate to complete this pier was now - - -	$3,003 00
And for the proposed breakwater - - - -	13,546 76
	16,549 76

1838.

There was appropriated for this work in 1838, $5,000.

The west pier, which had been injured by the ice, was repaired for about 90 feet of length. The cribwork of the east pier was reported to have been carried forward this season to its proposed termination, 175 feet in length, of new work; and the whole of it was raised 4 feet in height in consequence of the increased height of the water of the lake. All the stone for this additional height, however, was not filled in, owing to the insufficiency of the appropriation; nor would the planking or flooring be laid until the ensuing season. Some requisite machinery was also made.

The superintending agent reports that the appropriation would be exhausted in October, and that the harbor would be of but comparatively little utility without the breakwater; and he recommends, without approving it in its origin, the prosecution of that portion of the work, and estimates

its cost at - - - - - - -	$21,128 60
And the completion of the east pier at - - -	932 50
	22,061 10

The amount of appropriations for this harbor, from its commencement, was:

For the piers - - - - - -	$19,748 76
And for the beacon-light - - - - -	2,225 00
	21,973 46

All of which had been drawn from the Treasury.

The balance remaining in the local agent's hands, is stated to be $380.

All of which may be considered as being liable for claims arising from the execution of the work.

1839.

The work remains in the condition in which it was left last year. Its present form and extent are shown in the accompanying drawings. Much of the east pier remains in an unfinished state, and the west pier had not received all the stone which was originally intended to be put in it.

There has been added to the original design, on the eastern side of the east pier, near the shore, an additional pier, about 94 feet long, connected

with the pier proper by a bulk-head 24 feet long, designed for the purpose of protecting the floating machinery at the works against storms.

There is a sufficient depth of water, within about 150 feet of the shore, for the largest class of vessels.

The board not being of opinion that the wants of agriculture or of commerce, or the business to be drawn to this place by them, can be of sufficient value for many years, to justify the larger expenditures necessary to carry out the plans proposed in the local agent's estimate of 1837, does feel warranted in recommending them to the department. Should it be deemed advisable to finish the temporary work already begun there, the sum of twelve or fifteen hundred dollars may be required.

Cunningham creek.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1826	Capt. Maurice -	$6,473 10	$2,000 00		
1827	- -	-	-	$1,850 64	A. Wheeler.
1828	- -	-	1,517 76	1,667 12	Do.
1829	- -	2,956 00	2,956 00	1,781 05	Do.
1830	- -	-	-	1,043 66	Do.
1831	- -	-	-	131 29	Do.
1832	- -	-	1,500 00	1,195 95	Jos. D. Selden.
1833	- -	-	500 00	732 13	Do.
1834	- -	-	-	33 57	Do.
1835	- -	-	-	39 35	Lt. T. S. Brown.
1836	R. Harper -	1,769 03	1,275 00	1,116 66	R. Harper.
1837	Do. -	17,081 50	5,000 00	4,539 94	Do.
1838	Do. -	16,547 76	5,000 00	3,243 00	Do.
1839	Do. -	22,061 10			
	Beacon-light.				
1834	J. D. Selden -	2,000 00	2,000 00	1,366 00	
1835	- -	-	-	634 00	
1836	- -	-	225 00		

GRAND RIVER HARBOR.

Prior to the commencement of the works at the mouth of Grand river, there had been an extensive sand-bar extending east and west, and having an extreme breadth of 400 yards, from the river to 15 feet of water in the lake, beyond which was a good anchorage, with a clay bottom, where vessels drawing over 6 feet water were obliged to be in order to discharge or receive their cargoes. But, it was in favorable weather only that they could, with any degree of safety, avail themselves of this, and especially was it unsafe with the winds, west or east, round by the north, having a range of 100 miles up and down the lake, and a clear sweep across the widest part of it. Even vessels of 6 feet draught could enter the river but occasionally, "the passage being sometimes entirely closed by sand heaped up by the violence of the sea, which the strong freshets of the river

would again remove, clearing out a channel sometimes sufficiently deep to admit vessels drawing 7 feet water to enter the river." For this reason, it was the opinion of the engineer who framed the plan and drew the estimate for the improvement of the navigation at the entrance, "that, by excluding the sand from the channel so formed, it was reasonable to believe that the obstructions might be removed at least for the present, and for many years to come;" and he proposed to construct two embankments at 200 feet distance from each other, extending from the deep water at the mouth of the river to 10 feet water in the lake, whence the west embankment was to be extended 50 yards farther westwardly, in order to facilitate the entrance into the channel, and also to guard it from the prevailing westerly winds.

1826.

The work was undertaken on this plan in 1826, and prosecuted to completion, with some modifications. It was estimated to cost $26,997 81. It had been projected immediately after the works of Ashtabula and Cunningham's creek, and contracts for materials for it were made at the same time with those, and the stone was delivered prior to the close of October, but the workmanship was delayed for want of the requisite machinery.

1827.

The requisite machinery had been procured, and the work this season progressed nearly to the completion of the east pier and a wing of the west pier. The effect of the work already done had been to remove a dry sand-bar and to give a sufficient depth for any lake vessel, if it were not for the impediment of a small bar a little beyond the end of the east pier, on which there was now but 6 feet of water. The extension of the east pier to its predesigned length it was presumed would remove this bar.

1828.

The east pier was extended 60 yards still farther into the lake, and the west pier 130 yards. The east pier, which had experienced some settlement, was raised to its proper height. The harbor, in consequence of the works thus far executed, had become accessible during summer.

The appropriations for the work were, in the year 1825, $1,000; in the year 1826, $5,620; of which there had been drawn from the Treasury $5,620.

1829.

The west pier received this year an addition of 270 yards, thus carrying it to its full extent, into 14 feet water in the lake. The whole of the pier was yet in an unfinished state.

The east pier had been completed to the covering, to the distance reported last year. It still required an additional length of 170 yards to carry it to the proposed depth of water, viz: to 14 feet.

There was now a depth varying at times from 7½ to 8½ feet in the channel, which was then deemed to be sufficient for the largest vessel on the lake. The sum required last year for completing the work had not been granted. Its early suspension, therefore, became unavoidable.

The number of yards of pierwork executed since 30th September, 1828, were 270; in all 821 yards. The sum which had been disbursed was $16,263 81.

The amount estimated last year for continuing the work was $3,268. This year there was required, including that sum, $5,563 18, to enable the piers to be raised, they being expected to settle during the ensuing winter and spring.

1830.

The piers had sustained some damage from being left in an unfinished state last year for want of funds, in consequence of which the report of the Engineer Department states that the appropriation, $5,563 18, destined for their completion, had proved to be insufficient.

1831.

The Engineer Department reports this year that, to complete the piers, it is necessary only to raise portions of them which had settled, and to complete the beacon light-house undertaken at the request of the Treasury Department, the appropriation for which was this year $1,000. The piers extended 480 yards into the lake, into 12 feet water.

1832.

The harbor was reported to be in good condition, and it was supposed that it would require no further funds; the appropriations to September 30th, amounted to $29,576 29, exclusive of the cost of the beacon light. There had been expended $27,195 69.

1833.

The general agent reports his opinion, that the piers had been carried to a greater depth than could have been wished, viz: to 12 feet, and that thus it had become necessary to protect them against the action of the current by greater quantities of stone and brushwood than had been anticipated, and that similiar protection would be required on each side of the piers on their whole length, and he estimated for this object, for the year 1834, $14,902, and for repairing the piers $3,448 50; total for that year, $18,350 50.

The work was this year inspected by an officer of engineers, who reported that it consisted of two piers 200 feet apart, running nearly north 600 feet beyond the original shore, into the lake. Here, the eastern pier terminated, but the western turned westwardly, 150 feet farther. Within the original shore, the western pier was continued south about 200 feet; thence, southwest about 308 feet, to the left bank of the river. The eastern pier was continued nearly a south course about 400 feet, until it joined the private wharves. He also states, that before these improvements were made, the mouth of the river was often entirely closed, and that now there was at all times a straight channel with a depth of 12 feet water in it.

During the year, the available balance of $1,200 was expended in driving piles, and in planking and filling withst one the two piers. A foundation also had been laid near the end of the east pier for a beacon light, the house being yet to be erected.

1834.

During this year, progress was made in refilling with stone such portions of the piers as had settled.

1835.

The west pier was lengthened 300 feet to guard the channel against the sand which had continued constantly to accumulate, at this, as it had at all the other harbors. This extension removes, the agent says, all danger from that cause for many years, and greatly facilitates the entrance into the harbor; means were in hand to pay arrearages and bring this new portion of the work to completion during the autumn. The beacon light had been in use all summer; the balance in hand for that object, was to be expended in securing the foundations of the light-house crib.

It was proposed to take measures the next year for the permanent security of the work, which could not be any longer delayed, and an estimate for that purpose was submitted to the department to be applied to the service of the ensuing year.

1836.

This harbor being probably more exposed to storms than any other on the lake, it had suffered much injury since the last annual report. The end of the west pier was torn up, and large bodies of stone washed out of the cribs.

The expenditure for the year was chiefly for repairs, which were in progress throughout the season.

1837.

The operations of the year 1837, were, 1st, the rebuilding and repairing the damages sustained by storms of the preceding years; 2d, securing them as far as practicable against similar disasters, and in preparations which had been authorized for the permanent work intended to rest on the existing foundation, and also, in securing the inner portions of the piers against the strong tendency they had manifested to be underwashed, and the latter purpose has been effected by throwing in brushwood and stones at the edges of the piers.

The agent estimates:

For repairing damages occurring from storms in 1835 -	$7,736 00
For repairing old decayed work - - - -	4,284 05
For preventing cribs from tilting - - - -	700 00
For commencing permanent works - - - -	18,264 00
For sundry contingencies - - - -	1,440 85
	32,424 90

1838.

The work of this season consisted of the repairing of damages sustained by the storms of the latter part of the last year on the west pier, the prevention of the tendency of the west pier to incline inward, and the securing of the beacon light crib by piles and ripraping. The agent states, that it might become necessary to secure the beach on the west side from being forced by the current during freshets.

A bar (a small one) was in the process of forming beyond the head of the piers by reason of the sand which washed around the head of the west pier. The remedy proposed for this by the agent, was an extension of that pier

by 10 cribs of 30 feet each. This he presumes, (with the aid of the spring freshets,) would not only suffice to remove the bar, but prevent its reappearance.

He estimates:

For the absolutely necessary repair of the west pier - -	$3,952 90
For the extension of the west pier - - - -	8,947 60
For continuing the embankment inside east pier - -	2,250 00
For removing sand bar at mouth of river - - -	1,000 00
For commencing permanent work - - - -	21,776 00
For contingencies - - - - - -	948 16
	38,874 66

1839.

But little had been done this year toward the works at the period of the board's visit to them. The piers had been extended as far into the lake prior to this period as it is deemed advisable now to carry them. They extend beyond the present shore, the west pier 555 feet, and the east pier 635 feet, the beach having advanced, since the commencement of the work, 1,180 feet on the west, and 440 feet on the east side of the piers. The entrance between them is sufficiently great to enable vessels, under every circumstance of weather, to gain the harbor without apprehension of danger. The width between the piers is 218 feet; the depth of water in the channel is 11 feet.

A sand shoal has formed here as at Conneaut and Ashtabula, in advance of the piers, and it has continued to progress with the extension of the work; it has but 8 feet depth of water upon it, with a channel lying upon each side between it and the heads of the piers of 10 feet of depth on the west, and 12 feet on the east side. The depth of water in the channel opposite the beacon light-house is 14 and 15 feet.

The piers being very nearly sufficiently broad already, it is recommended only that they be taken down from the line of the present beach outward to the depth of extremely low water, and rebuilt after one of the methods proposed in the annexed estimates.

Grand river enters the lake in Geauga county; its head branches interlock with those of Chagrin, Cuyahoga and Tuscarawa; it has many mill-seats on it, and is now navigable two miles from the lake. At its mouth lies Fairport, which was already a place of some small business prior to the opening of its channel; 1½ to 2 miles from the lake, at the head of navigation, lies Richmond, a very thriving town, laid out in 1832, and a mile above that is Painsville, connected with Fairport by a railroad. We have not received much statistical information relative to these towns. Painsville is on the great mail route from Buffalo to Detroit, and it is a point of passage for the Ohio railroad, as are also Conneaut and Ashtabula; a road the capital stock of which is taken, and by which it is proposed to convey passengers and merchandise parallel with and near the lake from the eastern boundary of the State to the Maumee railroad during the seasons in which the navigation is closed. Portions of this work are in progress of construction, and it is meant to connect it with a road projected to lead from the Maumee, through Monroe (Michigan) to Detroit. Painsville is a very flourishing village of 1,200 inhabitants. Three lines of stages pass through it daily, viz: to Buffalo and to Detroit, to Pittsburg,

and also to Wellsville on the Ohio river, to which latter place is projected a railroad, for the construction of which a company is chartered by the State of Ohio, and its stock taken. Richmond contains a steam mill, a ship-yard, and several large warehouses; at it is the office of the Ohio Railroad Company. Painsville has also very rapidly increased since the works have given it a harbor equal to, and as accessible as, any upon the lake.

The central position of this harbor upon the lake shore, as well as the ease with which it may be entered in any weather, recommends it to all who are engaged in navigation. These advantages, together with its position in the line of travel between the upper portion of the Ohio valley and the northwest, and the very fertile country lying south of it, cause it to be much resorted to. We can only add to this meager statement, the following extract of a letter addressed to us by a former agent of the Government:

"No person can duly appreciate the advantages of the harbors on the south shore of Lake Erie, who was not acquainted with the business on it before 1826. Before the harbors were made, it was not unfrequent that Grand river, Cuyahoga, and the other streams had a dry beach across their mouths during the business season of the year. Most of the goods landed and shipped was done in lighters from the beach of the lake; the vessels were obliged to anchor outside without any protection, and often were driven from their place of destination to the islands or to point Albino, and sometimes drifted up and down the lake two weeks before they could land their cargoes at their place of destination. At this time the business of the lake could not be done without the use of the harbors, unless there was an increase of the tonnage at least fourfold, and then the increase of risk would be at least double for those vessels, and the price of freight accordingly augmented.

"I would give you a correct list of arrivals and departures at this place the year the harbor was commenced and at the present time, if it was in my power to do so. The custom-house officer has not kept a list. I think the average arrivals of schooners in 1826, were one and a half per day, and of steamboats one in four days. At this time there are about four schooners per day and six steamboats; the size of the vessels has increased about 50 per cent. since 1826. I cannot give the amount of shipped or landed goods for the reasons stated above.

"The importance of the harbor is much increased in a public point of view from the fact that it is situated about midway of the lake at the extreme point at which all vessels pass going up or down. The entrance is safe and easy, which induces many vessels to pass other ports in heavy gales of wind and come to this. Steamboats have been known to pass all others below this from Buffalo, and made this port in safety during the fall gales; and they have also passed those above, and run for this place; it it being situated at a point of land, makes it more safe to approach than if in a bay."

Grand river.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
	Capt. Maurice -	$26,997 81			
1825	– –	–	$1,000 00		
1826	– –	–	5,620 00		
1827	– –	–	–	$3,512 96	Henry Phelps.
1828	– –	–	9,113 00	5,633 32	Do.
1829	– –	–	–	7,117 53	Do.
1830	Same for extending	5,679 52	5,563 18	5,214 55	Do.
1831	– –	–	5,680 00	5,519 93	Do.
1832	– –	–	2,600 00	197 40	Do.
1833	Henry Phelps -	10,000 00	–	–	Do.
1834	– –	–	10,000 00	3,130 66	Do.
1835	– –	–	–	6,988 35	Lt. T. S. Brown.
1836	– –	–	6,000 00	–	Henry Phelps.
1837	– –	–	–	–	J. Adams Potter.
1838	– –	32,424 90	10,000 00	6,046 90	Do.
1839	– .. –	38,874 66			
	Beacon-light.				
1831	Major Maurice, to complete pier work	1,455 50	1,000 00		
1834	– –	–	1,456 00		

GRAND RIVER HARBOR.

Estimate for permanent work to replace the temporary east pier: average width 16 feet, average depth 11 feet, and length 635 feet.

West pier: average width 17 feet 10 inches, average depth 11 feet, and length 555 feet.

Present width of the piers nearly sufficient without additional foundation.

1st mode. Cribs of timber Kyanized, placed on the foundation of the old pier, the old superstruction removed to six feet below high water mark, new work raised 5 feet and loaded with stone—a Kyanized battlement of wood placed on the work.

1st. Cost of removing old work above the value of old materials - - - - - - - -	$3,000
2d. 23,800 feet of timber, running measure, 14 feet square, at 10 cents per foot, counterhewed - - - - -	2,380
1,190 ties, at $1 each - - - - - -	1,190
Workmanship, (carpentry and labor) - - - -	3,570
Trenails and iron - - - - - -	500
Kyanizing 45,232 cubic feet of timber, at 12½ cents per foot - - - - - - - -	5,654
Stone, 2,215 cords, at $8 per cord - - - -	17,720
Concrete for covering 1 foot thick 1,618 cubic yards, at $6 per yard - - - - - - -	9,708
	$43,722 00
Add 10 per cent. - - - - - - -	4,372 20
Cost of 1st mode - - - - - - -	48,094 20

2d mode. Kyanized timber filled with concrete, (the ties remaining.)

1st. Removing old work as above - - - -	$3,000 00
Timberwork, Kyanized as above - - - -	13,294 00
Concrete for filling 9,701 cubic yards, at $6 per yard -	58,260 00
Coffers - - - - -	3,570 00
	$78,124 00
Add 10 per cent for contingencies - - -	7,812 40
Total cost of 2d mode - - - - -	85,936 40

3d mode. Piers of solid concrete—cost the same as the 2d mode - - - - - - - $85,936 40

4th mode. Piers of blocks of stone, hammer dressed, laid in cement, with solid concrete backing—the superstruction based on a bed of concrete 6 feet thick, resting on the old foundation of cribwork.

1st. Removing old work as before - - - -	$3,000 00
2d. Concrete for base, 6,210 cubic yards, at $6 per yard -	37,260 00
3d. Cut stone for facing, 2,468 cubic yards, at $13 70 per yard - - - - - - - -	33,811 60
4th. Concrete for backing, 2,707 cubic yards, at $6 per yard -	16,242 00
5th. Cut stone for battlement, 529 cubic yards, at $13 70 per yard - - - - - - -	7,247 30
Coffers - - - - - - -	3,570 00
	$101,130 90
Add 10 per cent for contingencies - - -	10,113 09
Total cost of 4th mode - - -	111,24 99

CLEVELAND HARBOR.

At Cleveland harbor, something had been attempted by the local authorities, prior to the year 1827, when the United States undertook its management. The work, however, had been of the most inefficient character; an attempt to confine the current of the river and to arrest the sand drift by a few piles driven in a direction nearly perpendicular to the course of the shore.

The project undertaken by the United States, consisted of the usual ranges of parallel cribs filled in with stone and brushwood: the work of Captain Maurice, the corps of engineers, who estimated it to cost $27,653 91. This year, contracts were made for materials, of which a sufficient quantity being collected, a dam 85 yards in length was built across the mouth of the river, in order to give the stream the direction which had been found, by experience, to be most effectual.

The arrangements this season were such as to lead to the expectation, that all the materials for the works, as far as the estimates extended, would be ready the ensuing spring, and that the whole amount appropriated would be expended during the year 1828.

1828.

The dam erected last year had the desired effect; the force of the river swept away the dry sand-beach which had lain in the direction of the proposed channel.

A pier 250 yards long was this year laid down, and so far finished as to require but the cap pieces and planking. Although there had been no freshets since the commencement of the work, the depth was already sufficient for most of the vessels on the lake to pass with but little, if any, difficulty.

It was proposed the next year to extend the works into the lake, so far as to place them beyond the reach of any sandy accumulations near their extremities, the bed of the lake being clay.

Up to September 30th, from the commencement, 425 yards in length of pierwork and 150 yards of dike, in all 575 yards of cribwork, were erected.

There had been expended upon the work, during the same time, $8,517 69.

1829.

There was added to the length of piers, during the year 1829, two hundred and sixty-two yards, viz: (by the 30th of September,) at which time the expenditure on the work amounted to $16,085 76; and it was deemed, with this experience, that the sum asked for in the annual estimate, $1,786 57, would suffice to complete the work; the east pier had yet to be carried 150 yards farther to its proposed termination, in 14 feet water, both piers being yet to be covered and completed.

The channel, owing to the dryness of the season, remained in the same state as last year, viz: at a depth of 6½ feet at the least, and that on a short distance only, and it was confidently expected that the first freshets would scour this out to a depth sufficient to admit the passage of the largest class of vessels then navigating the upper lakes.

Two hundred and sixty three yards of pier had been laid since September 30th, 1828, viz: 91 yards on the west to 12 feet water, and 173 yards on the east side, making in all, to that date, 688 yards of pier and 150 of dike, or a total of crib-work of 838 yards.

The estimate for the ensuing year was for completing the covering of the piers with plank, the balance of former appropriations on hand being deemed sufficient to extend and complete the works as far as it had been proposed to carry them.

1830.

It is stated in the annual report of this year, that the harbor had been greatly improved by the works constructed for the removal of the obstructions to the navigation; and that, at that time, it would admit the largest class of vessels navigating the lake. To secure this advantage, a further extension of the western pier into deep water was deemed to be requisite.

The cost of the works to the 30th September, was $22,468 25. The east pier was completed, all but the pierhead, and the west pier had been planked as far as it had been extended last year. The estimate for the year 1831, viz: $3,688 35, was for the farther extension and for the completion of this pier.

1831.

The west pier was finished, and no bar to the navigation existed either in the harbor or beyond the piers in the lake. There was now not less than 10 feet depth of water.

A beacon-light had been erected, at the request of the Secretary of the Treasury, under the direction of the Engineer Office. The sum assigned for that object was $2,500.

It was proposed to complete the works by strengthening the dam across the river, and removing a small spit of sand which projected into it at its junction with the artificial channel, rendering the entrance inconvenient during storms.

There had been completed on the 30th of September, in all, 1,219 yards in length of piers, moles, and dikes; and there remained to be done, to finish the work, 50 yards of pier and 75 yards of mole, according to the engineer's report of that date.

1832.

The funds were applied, this year, to the filling in the piers where they had settled; driving piles to secure them, and guards to protect them from the collision of vessels. By the close of the season, it was believed that the works would be secure, and that no farther appropriations would be necessary for them. No new work had been done, so that the piers, &c., remained of the length stated in the last annual report.

On the 1st of October the works had cost $28,802 06.

1833.

The piers extended now 525 yards into the lake, and there was 11½ feet depth of water in the channel at the shoalest part. There was required, according to the estimate of the agent, for the security of the piers, a large quantity of stone and brushwood for two pierheads, and for other objects, in all $16,942 30, for the service of the year 1834.

The officer of engineers, charged with the inspection of the work, reported that, prior to the improvements we have described, the mouth of Cuyahoga was at times entirely closed, whereas there was now at all times at least 11 feet of depth between the piers leading into the harbor; that the piers (nearly every where parallel) ran about 1,200 feet into the lake, having a breadth of about 200 feet between them; that the outer end of the east pier, bearing a beacon light, was intended to be reinforced by additional pier-work; that at the beach the two piers diverged considerably as they extended up the river, and at their inner extremities they united with the shore. They generally were ten to twelve feet broad, and rose four feet above the surface of the lake; that it was meant to employ the balance of existing appropriations, about $3,400, in placing stone at the foot of the piers, and in adding timber work, &c.; that, to prevent the piers from being undermined, the tendency to which appeared by soundings recently taken, stone to the value of $4,800 should be deposited near them, and that stone should also be thrown in wherever the piers appeared already to have settled.

For these, the whole expense is estimated by him at - -	$7,200 00
For addition to east pier, to protect the beacon-light - -	1,569 50
For a wing and pierhead to the western pier - - -	4,545 70
Showing at present to be necessary, an additional appropriation of - - - - - - -	13,315 20

The opinion is also expressed, that the then height of all the works on the lakes, except those at Buffalo, was too little, especially for the ultimate work in stone; and it is stated, that although the beacon light pier is here 7½ feet, the sea rolls over it, and that the rest of the work being but four feet high, it is swept by a very moderate sea, and it becomes a matter of difficulty and danger to reach the beacon when the light is most needed.

1834.

The piers having the extension required for them, the labor, &c., applied this year was intended to strengthen the works, and keep them in repair. The appropriation, $13,315, of this year, was now deemed to be sufficient for the service of the current and ensuing year.

The depth of water continued the same as last year, viz: from ten to eleven feet.

The timber above water was in a state of decay, and required to be renewed until the period when the works should have attained a sufficient settlement and stability to warrant a superstructure of solid masonry, an estimate of the cost of which, by the superintendent of the work, is given in the annual report, amounting to $125,320.

1835.

The operations of this year were confined to the application in part of the appropriation of last year to the objects for which it was made; that is to say, in depositing stone on the outside of the piers for their security; in placing an additional crib, and in depositing stone for the protection of the beacon-light, and in driving a row of contiguous piles to support the foot of the slope of the permanent stone mole now authorized, and intended to be formed hereafter.

It was proposed to extend, during the ensuing year, the west pier to the "full length necessary to guard against the encroachment of the sand." The length is not stated. An estimate is given by the then general superintendent, Lieutenant Brown, of the corps of engineers, of the cost of this and of a permanent superstructure for the piers.

1836.

The operations of this year were conducted, chiefly, with reference to the ultimate design of rendering the work permanent, to which end stone was, to the amount of 7,000 perches, thrown on the outside of the piers to form an inclined plane, and large stone for the piers, besides piles and other timber, were collected, and in repairing so much of the pier as had been damaged by recent gales.

An estimate for the coming year was submitted at enhanced prices over those of the original estimate.

Estimate for the service of 1837, $53,680.

1837.

The design of rendering the work permanent, was prosecuted during this year, to which end the materials on hand last fall, and a large amount procured this season, were used. From the head of the eastern pier to the shore, an inclined plane of loose stone was formed, having a base of twice its altitude, and rising above the surface of the water. The wooden work of this pier, from the land end outerward, was removed to a depth of two feet below the surface of the water and replaced by permanent masonry, of large rectangular blocks of stone of equal thickness in each course, strongly doweled together, and cramped where necessary; the whole laid in hydraulic cement and grouted; and the whole surmounted by a fair and substantial coping of cut stone to the extent of 180 feet in length.

On the west side, from the pier head to 350 feet towards the shore, a contiguous row of piles 30 feet from the outside of the pier was driven; and between this and the pier, the space was filled with loose stone, so as to form an inclined plane from two feet below the surface of the water at the piles, to the surface at the pier.

Some repairs were also done on decayed parts of the timber of the old cribs above water.

Estimate for the ensuing year $51,856.

1838.

The permanent work of the piers was rapidly prosecuted this season by the aid of the liberal appropriation ($51,856) made for that purpose. Piles were driven around the heads ot both piers, at the proper distance, parallel with the piers near the shore, and the intervening space was filled, as heretofore described, with loose stone. Four hundred and fifty piles were driven and 11,646 perches of stone were deposited; 729 perches of rectangular blocks of stone were dressed and deposited on the piers, nearly ready to be laid. The west pier was thoroughly repaired. Contracts were made to the amount of the appropriations for stone, both rough and in blocks.

It was deemed by the general agent, that the rapid fall of the lake, which had, until lately, attained an unusual height, rendered it advisable to postpone the laying of the masonry of the piers until the year 1839, during which the work might be nearly completed, should the further appropriation of $49,300, now asked for, be made in season; that being the amount deemed sufficient to complete the work.

The sum of $84,903 76 had been expended upon the work from its commencement to the 30th September of this year, and a balance remained unapplied of $39,502 80.

1839.

There had been expended, from the commencement of the works in 1827 to the 1st April of this year, according to the local agent's statement - - - - - - - $95,065 60

There remained in the Treasury part of the appropriation reserved for the year - - - - - 25,928 00

And in the agent's hands, April 1st - - - - 2,501 00

The aggregate of the appropriations for the work - - 124,406 56

The plan adopted by the Engineer Department for rendering the piers permanent was prosecuted this, as it had been during the three preceding

seasons, and it has progressed so far that it would be inexpedient to propose any essential modifications of it now. Nor is there any doubt of its efficiency, unless it be with respect to the depth to which the masonry is being carried—a doubt which has suggested itself to the mind of one member of the board, in consequence of the uncertain and conflicting information he has received respecting the extreme point of depression of the waters of the lake. The work thus far presents a very handsome and substantial appearance, much care having been generally taken in the selection of materials and with the workmanship. The stone, however, though of good quality of its kind, is not perhaps the most suitable for a structure exposed as this is.

The piers have now an aggregate length of 2,970 feet, viz: the west pier 1,470, and the east 1,500 feet. They have received all the extension it is at present designed to give them, and they fulfil the purpose for which they were intended, namely, that of maintaining, at all seasons of the year, a sufficient depth of water to enable the largest class of vessels navigating the lakes to enter the river.

Since the commencement of the works for the improvement of the harbor, and more especially since the completion, in 1832, of the Ohio canal, for the trade of which these works are indispensable, Cleveland has been rapidly increasing in population and wealth, and in commercial importance. In 1826, Cuyahoga county, in which the harbor of Cleveland lies, could number only 10,000 inhabitants; now it has at least 36,000; and the city of Cleveland, which, in 1826, had a population of only 600, may now be safely estimated to have 9,000, if we include in the enumeration the population of both sides of the harbor. The value of property has likewise rapidly increased. In 1826, the assessor's returns state it at $1,032,494 for the county and town; the recent assessment gives, for the value of property in the county, $3,515,966, and for Cleveland, $2,617,000; the total value, $6,133,966. These assessments, it ought to be observed, are made more with the view of equalizing taxation than of arriving at the precise value of property; nevertheless, it is indicative of the growing prosperity of the community.

The port, from its favorable situation about midway of the lake, and at the northern terminus of a navigable communication with the Ohio river and Mississippi valley, necessarily attracts a large amount of the commerce of the lakes and of the interior. By the Erie canal, it communicates with the city of New York, as it does also by the Welland and Oswego canals, by the former of which it trades also with Montreal and Quebec. By the Ohio canal, it conveys the merchandise of New York to Western Virginia, to Kentucky, Missouri, Tennessee, and Alabama, and to the southern portions of Indiana and Illinois, as well as to the interior of its own State, nine-tenths of the produce of which, conveyed to market by the Ohio canal, it in fact receives and transmits to its destination; this will embrace the trade of nearly all the middle and southeastern portion of the State, or 1,500 square miles. Very soon, too, it will form connexions by railroads and canals which are already in a state of great forwardness with Pittsburg, Philadelphia, and Baltimore. It is to be supposed, therefore, that its trade and navigation must not only be very considerable, but that it must continue to increase, and accordingly we find that every year adds to the amount of its tonnage, and to the value of its trade.

The tonnage belonging to Cleveland was,

1825, 806 tons;
1830, 1,330 tons;
1833, 2,800 tons;
1839, 11,459 tons, or 17 steamboats, 1 ship, 2 brigs, and 51 schooners.

The number of arrivals at the port was,

1825,	54	sail of vessels,	21	steamboats,	7,310 tonnage;
1830,	327	sail of vessels,	448	steamboats,	127,489 tonnage;
1833,	800	sail of vessels,	705	steamboats,	232,500 tonnage;
1838,	1,095	sail of vessels,	1,318	steamboats.	

The arrivals of laden canal boats in 1838, exclusive of those used ider permits, were 3,028, and the clearances for the interior the same. he quantity and value of their cargoes for this year, and of the arrivals clearances on the canal in 1837, are shown in the statement annexed. The value of property arrived and cleared at the port is estimated,

		Exports.	Imports.
or the year 1825, at	$182,871, viz:	$50,166	$132,705
or the year 1830, at	1,314,542, viz:	377,197	997,345
or the year 1833, at	6,644,000, viz:	1,944,000	4,700,000
or the year 1837, at	13,000,000		
or the year 1838, at	20,000,000, viz:	5,000,000	15,000,000

To the great advantages which have already been mentioned as cruing to Cleveland from its very eligible position with reference to mmerce, we may add that of the comparatively early period at which the vigation opens, and its great importance to the place and to the public orks forming its harbor. It is affirmed that navigation opens at Cleveand on an average as early as the 20th or 24th of March; at Buffalo, om the 10th of April to the 15th of May, say the 1st of May; and at rie harbor, from the 10th to the 15th of April. These places we note, asmuch as they are doubtless destined to be among the principal ports rough which the commerce of the lakes will be conveyed to the Atlantic.

The following table exhibits the time of opening of the navigation at uffalo and Cleveland for a series of years:

ears.	Cleveland.	Buffalo.	Diff.
830	3d April	6th April	3 days
831	29th March	8th May	40 days
832	28th March	27th April	30 days
833	2d April	28th April	26 days
834	1st February	6th April	64 days
835	27th March	8th May	43 days
836	14th April	26th April	12 days
837	20th March	22d May	63 days
838	25th March	4th April	10 days
839	21st March		

Cleveland harbor.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1827	Capt. Maurice, (original) -	$27,653 91	$10,000 00	$1,356 44	A. W. Walworth.
1828	" "	"	"	7,161 25	Do.
1829	" "	"	12,179 00	7,568 07	Do.
1830	" "	"	1,786 56	6,382 49	Do.
1831	" "	"	3,670 00	5,166 75	Do.
1832	" "	"	6,600 00	2,238 17	Do.
1833	" "	"	"	3,811 22	Do.
1834	" "	"	13,315 00	2,097 99	Do.
1835	" "	"	"	9,287 71	Lt. T. S. Brown.
1836	" "	"	15,000 00	7,654 94	Do.
1837	" "	"	10,000 00	17,947 13	A. W. Walworth.
1838	A. W. Walworth -	51,856 00	51,856 00	14,231 60	Do.
1839	Henry H. Dodge -	55,312 50			
	Beacon-light.				
1831	Major Maurice -	"	2,500 00		
1831	" "	"	"	752 15	
1832	" "	"	"	1,747 85	

Estimate of funds required to complete Cleveland harbor.

[*Note.*—The materials and funds now on hand will complete the east pier to within 250 feet of its length at the outer end.

The remaining length of pier to be completed by this estimate is therefore 250 feet (E. P.) + 700 feet (N. P.) = 950 feet.

The piles will also be driven, and the rough stone thrown in, along both piers, by the balance on hand of the present appropriation.]

The work being well advanced on the mode originally adopted, no other mode is suggested or estimated for.

1. For faces, blocks of stone, hammer dressed, laid in cement, including cost of cramp and dowels, cement, labor, &c., 1,084 cubic yards, at $13 70 per yard - - -	$14,850 80
2. For coping 1 foot thick, including cramps, dowels, cement and labor in placing, &c., 5,068 superficial yards, at $6 75 per yard - - - - - - -	34,209 00
3. For coping 2 lower ranges 2 feet thick, including cramps, dowels, cement and labor, &c., 1,266 superficial yards, at $7 88 per yard - - - - - -	9,976 08
4. Cost of removing old work - - - -	1,620 00
Add 10 per cent. for contingencies - - - -	6,065 58
Required to complete Cleveland harbor - - -	66,721 46

BLACK RIVER HARBOR.

1828.

This work was commenced in the autumn of 1828, and was estimated to cost $25,334 22. It was planned by Captain Maurice, to consist of the usual parallel piers of cribwork, brush wood, and loose stone, running nearly at right angles with the coast line into the lake. Its object was the removal of a sand bar from the mouth of the river, on which there were but three feet of water. An act of the previous session of Congress had appropriated $7,000 for removing obstructions to the navigation of the river, and during the year the requisite contracts had been entered into for the necessary materials for the work. Machinery was also prepared, and the piling required there was commenced the same autumn.

1829.

The west pier was extended 280 yards into the lake, and there were yet but five feet water on the bar. The original appropriation was expended, and an estimate for continuing the work was reported.

1830.

The west pier was extended 130 yards farther out into 10½ feet of depth in the lake, and the other was begun and carried 180 yards from the shore; the total length of pier was then 590 yards. The effect was already such as to promise the most satisfactory results. The cost of the work from its commencement to the 30th of September of this year, was $14,878 60. An estimate was submitted for adding 270 yards in length to the existing piers, and for completing the work, amounting to $9,274 45, making with previous appropriations the sum required by at original estimate.

The sum of $8,559 77 had been appropriated early this year.

1831.

During this year the west pier was completed as far as it had been extended last year, as was also the east pier, to which was given a farther extension of 160 yards.

In the autumn the work had so far progressed as to require but 100 yards more of pierwork to complete the original design, and the channel at the entrance had already a depth of 8 feet in it.

The total expenditure was $23,316 31 to the 30th of September. The estimate for the ensuing year, $8,017 66, was for the completion of the work.

1832.

The east pier having been damaged in November to the extent of 60 feet in length, and to 3 feet below the surface of the water, its repairs had absorbed so much of the appropriation as to render it insufficient to complete the original design, for which reason a further sum was asked for.

It was believed that the pier was now so far secured as to put it beyond the probability of a similar disaster.

1833.

At the period of the annual report the piers, according to the general agent, extended 417 yards into the lake, and had an opening or channel way of 200 feet, the shoalest part of which was 7½ feet deep. While the work was reported to stand well, the stone had yet sunk or settled in the piers nearly two feet on an average, and required to be replaced. A deposite of stone and brushwood on the outside, was at this period of the work deemed to be requisite to give strength to the works, and to prevent the accumulating sand from passing through the cribs.

The east pier required to be extended 30 yards farther to complete the original design; 150 yards had been finished during the season, and an addition of 30 yards was made to the western pier. A dredging machine had been constructed to remove the hardpan from the bottom of the channel, and it was in operation during part of the season.

The agent estimates for extending and securing the works for the service of the year 1834—

For extending the east pier 30 yards farther in the lake, breadth 18 feet - - - - - - -	$1,806 20
For extending the bulkhead, 100 yards in length, along the margin of the river at east pier - - - -	2,482 59
For securing the east pier with stone and brush - -	5,535 00
For securing the west pier with stone and brush - -	2,767 50
For excavating channel, (clay and gravel,) to give a uniform depth of 10 feet - - - - - -	841 50
For excavating margin of the river - - - -	420 75
For machinery - - - - - -	1,146 46
	15,000 00

The inspecting engineer states in his report that the piers extended out from the original beach, the one about 1,300 feet, and the other 1,000; the main course being first north 62° west, and then north 46° west; and that the channel had 10 to 15 feet of water in it, except on a shoal near the mouth of the harbor, extending from pier to pier, on which at the deepest there was but 7½ feet, and 5 feet only near the piers. He estimates for prolonging the east pier, filling piers with stone wherever deficient, protecting their base, dredging the channel and shoal, and erecting beacon-light, the sum of $17,700, in addition to the former appropriation.

The balance of appropriations, $4,700, or thereabout, to be expended in erecting the pierhead of the west pier, and in dredging.

1834.

Progress was made in deepening the channel, with the expectation of obtaining a depth of 9 feet before the close of the season, as also for preparing for the intended extension of the piers into the lake, which the general agent deemed might be reduced from 150, as contemplated by the local agent's former estimate, to 90 feet, thereby effecting for the 60 feet of cribwork a saving of $3,598. The local agent's estimate for completing the works was $9,329, from which, deducting $2,000, the available balance, the difference, $7,329, would, according to him, be the sum required to be appropriated for the ensuing year to complete the work.

1835.

Captain Smith of the 6th infantry, on relieving the late superintendent of this work, found that the west pier was about 1,304 feet and the east pier about 1200 feet long, and that a gravelly bar lying between them was being removed by the aid of machinery, the current of the river although occasionally very strong, being insufficient. The mean breadth between the piers he states to be 189 feet, the bar lying 360 feet within the harbor was 120 feet in width and extended from pier to pier. The west pier was lengthened 40 feet and the east pier 30 feet—each 15 feet wide, this season; of the west pier 380 feet was lined with plank to check the passage of the sand through it—and the gravel taken from the bar together with some brushwood being likewise deposited there for a similar purpose, was found to have a very good effect.

The agent now recommended an addition of 60 feet to the existing length of the east pier in accordance with the original plan.

The erection of a beacon-light was also recommended.

It was believed that with ordinary weather the works already planned would be completed. The depth of water at the end of the east pier was 13 feet, at the west pier 14 feet, and in the channel 13 feet.

1836.

The waters of the lake were this year 2½ feet higher than they had been known for 12 years.

The operations during the season consisted of a general repair and rebuilding of machinery and scows, and of the piers injured by the violent storms to which the harbor is greatly exposed.

Dredging was suspended because of the height of the lake, to be renewed on the subsidence of the waters.

By a new estimate the sum of - - - - -	$1,180
In addition to the balance of Colonel Totten's estimate -	8,000
Was now required for the works - - - - -	9,180

1837.

The requisite repairs and refilling were done upon both piers injured by the storms of last year; and 306 cords of stone were placed on the outside for their protection and to widen their base with a view to a permanent structure. Such progress was made in dredging as the great height of the lake would warrant.

An estimate was made for widening the foundation of the work with a view to permanency by depositing stone outside the piers, and a row of piles to be driven contiguous to each other parallel with the piers and outside of the stone. The cost of removing the remainder of the gravel bar was also estimated.

Estimate.

For continuing the widening of the base of the piers - -	$13,375
For dredging - - - - - - -	500
	13,875

The light-house, the erection of which had been delayed by the storms of the past, was finished early in the present year. It was placed on the west pierhead and its cost had not exceeded the appropriation, proper allowance having been made for expenses chargeable of right to the pier.

1838.

The work of the foundation for the permanent structure was continued—it had not been recommenced until the first of August, that being the earliest day which the appropriation would permit.

A row of piles was begun to be driven on the east and most exposed pier—they were driven contiguous to each other for a length of about 180 feet parallel to and at 30 feet from the exterior side of the pier, and the intervening space was nearly filled with stone—330 cords would have been deposited during the season.

The building of a new crane scow was undertaken and the expenditure of the whole of the appropriation during the season anticipated at the date of the annual report.

Estimate for the year 1839.

For prosecuting the work of preparation of foundations for permanent superstructure - - - - - - -	$24,500
For dredging - - - - - -	500
	25,000

1839.

The plan for the permanent work at this place being already determined upon, and its execution by the department in whose charge it formerly was, being in progress to some considerable extent, nothing is left to us but to estimate the cost of completing it. This estimate is given in the following pages. The extent of the remaining obstruction inside of the piers and the permanent work now in progress, will be seen on the annexed plan.

The entire cost of the work from its commencement in the year 1828, to the first of April, 1839, was - - - - -	$61,928 29
The available balance in the agent's hands - - -	390 43
And the value of materials not in the work, machinery, implements, oxen and horses - - - -	886 05
Total - - - - - - -	63,204 77

Equal to the amount of the appropriations, part of which had been applied to rendering the works permanent, for dredging out the channel, and for repairs and renewals.

The entire expenditure on account of the work, has therefore been - - - - - -	$62,814 34
The original estimate for the work was - -	$25,334 22
Estimate of 1833, for extending, &c. - -	17,700 00
	42,034 22

The piers now extend into the lake; the west pier 759 feet beyond the present shore, which has advanced since the year 1828, 620 feet beyond its then position—the east pier 891 feet beyond the shore, which here has encroached upon the land, especially since the late rise of the level of the lake—the whole length of the east pier is 1,112 feet. The piers are 191 feet apart at their outer extremity—210 feet at the widest place near the shore, and 130 feet at their inner end. There is a depth of 9 to 9½ feet between the piers, and as you proceed towards the lake, the depth increases to 14 feet. Some sand has accumulated about 20 yards beyond the head of the west pier; on which there is somewhere about 18 inches of less depth than there is around it. The beach on each side of the piers is sand; the original bottom at the head of the west pier was clay. The length noticed as that of the west pier, includes the pierhead or crib, on which is erected the beacon light-house. It is proposed to continue to dredge the gravelly bar lying within the piers, so as to obtain the requisite depth there of 10 feet at all times.

Both piers have yielded in some places; the west was injured by piling heavy weights upon it near the shore, and both have failed at some of the joinings of the cribs, in consequence of the removal of the base on which they had rested, by the action of the current. Both piers run out nearly northwest, and the northeast waves consequently set directly upon the east pier, at right angles with it.

Black river is in the State of Ohio. It enters Lake Erie, in Lorain, a county which has been but recently settled, and not organized until the year 1824. In 1828, when the works of Black river had commenced, it had but 5,400 inhabitants, and in 1830, only 5,696. In 1839, the population is stated at 18,210. The following information is derived from Conrad Reid, Esq., the local superintendent of the works:

In January, 1837, the legislature of the State of Ohio incorporated Charleston. The place contained in 1838, two taverns, three warehouses, three dry goods stores, one grocery, fifty dwelling-houses, and three hundred inhabitants. A railroad or Macadamized turnpike from it to Elyria, is in contemplation, and likewise a railroad to extend 50 miles south to Ashland, in Richland county, charters having been obtained for both these objects. The route of the great Ohio railroad, from the Pennsylvania line, near Conneaut, on the east, to Maumee Bay, passes directly through this place. These contemplated improvements, with the exception of the Ohio railroad, terminate at, and are consequent upon the construction of this harbor.

Black River is formed by two branches nearly equal in size, which rise in the south part of the county, and running northwardly, unite in the township of Elyria, eight miles from its mouth. Half a mile above the junction, there is a perpendicular fall of 40 feet, creating an immense water power.

The river is navigable four miles from its mouth, for any vessel that floats on the lake, and has sufficient width for steamboats of the largest class to wind. One mile up the river, there is a place of deposite, where upward of 900,000 staves are now ready to be shipped. Elyria, the county seat, is situated between the two branches at the Falls, and is a place of rapid growth, containing at this time, a court-house, jail, two churches, four taverns, eight stores, a furnace forge, flouring-mill, several saw-mills, and about twelve hundred inhabitants. Oberlin lies eight miles southwest from Elyria, and is distinguished for its theological seminary and preparatory

schools. Iron ore and inexhaustible quarries of sandstone, are found in different parts of the county.

The soil is good, and is nearly all owned by settlers; the most of whom are farmers, lately settled on wild land, which they are improving. A canal to connect the lake at Charleston, with the Ohio canal at Roscoe, in the county of Coshocton, has long been in contemplation, and a company was organized nearly three years since, for the purpose of constructing the work, but the State of Ohio is now making thirty miles of this canal, which will leave seventy for the company, unless the State should construct the whole.

The town of Charleston, at the mouth of the river, has grown up recently, in consequence of the construction of the harbor at that place.

The arrivals and departures at the harbor from the commencement of navigation in the spring, to the 30th of September, 1838, inclusive, were

Steamboats - - - - - -	282
Brigs, schooners, and sloops - - - -	185
	467

Tonnage of the port.

Steamboat Lexington - - - -	363 tons
Schooner Texas - - - -	130 "
Sloop Dart, - - - -	31 "
" Rodolph - - - -	17 "

Exports, 1838.		Imports, 1838.		Property on hand, ready to be shipped, 1838.	
Wheat,	4,234 bushels	Merchandise,	374 tons	Staves,	900,000
Castings,	46 tons	Salt,	1377 bbls.	Ashes,	500 bbls.
Pig Iron,	325 "	Sundries,	1075 "	Flour,	1,273 "
Ashes,	529 bbls.			Pig Iron,	225 tons
Sundries	1332 "			Castings,	100 "
Do.	36 tons			Wheat,	1,200 "
Staves,	540,000				

Steamboats and vessels built at the port.

Steamboats 4, average tonnage - - - - -	300
Brigs and schooners 12, average tonnage - - - -	150

Black river.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1828	Capt. Maurice -	$25,334 22	$7,500 00	$577 20	
1829	- -	-	-	6,824 47	Major Maurice.
1830	- -	-	8,559 77	7,476 93	Do.
1831	- -	-	9,275 00	8,437 71	Jos. D. Selden.
1832	- -	-	8,000 00	5,040 05	Do.
1833	J. D. Selden -	17,700 00	2,400 00	6,002 68	Do.
1834	- -	-	5,000 00	2,489 08	Do.
1835	- -	-	4,400 00	6,018 69	Capt. H. Smith.
1836	- -	-	6,660 00	7,753 85	Do.
1837	- -	-	6,410 00	5,928 10	John Tull.
1838	Conrad Reed -	13,875 00	5,000 00	1,750 17	Conrad Reid.
1839	- -	25,000 00	-	-	Do.
	Beacon-light.				
1836	- -	-	2,600 00		
1837	- -	-	-	1,365 58	

Black River harbor.—Estimate of funds required to complete it.

NOTE.—The length of piers to be completed by the estimate is 680 feet east pier + 600 feet west pier = 1,280 feet. As the work is fairly commenced on the plan of Major Maurice and Colonel Totten, but one estimate is submitted, viz: to complete it on that plan.

1. Piles, 1,250, at $2 50 each when driven - - -	$3,125 00
2. Rough stone to fill remaining space between old work and piles, and to place outside of piles, 3,633 cords, at $5 per cord - - - - - -	18,165 00
3. Cost of removing old work - - - -	3,100 00
4. For faces—blocks of stone hammer-dressed, laid in cement, including cost of cramps, dowels, cement, and labor, &c., 1,325 cubic yds., at $13 70 per yd. when laid	18,193 60
5. For coping 1 foot thick, including cost of cramps, dowels, cement, labor, &c., 2,276 superficial yards, at $6 75 per yard - - - - - -	15,363 00
6. For coping 2 lower ranges, 2 feet thick including all as above, 1,706 superficial yards, at $7 88 per yard -	13,443 28
Add 10 per cent. for contingencies - - - -	7,138 98
	78,528 86
For permanent base to extreme low water - - -	11,682 00
Amount required to complete Black River harbor - -	90,210 86

VERMILLION HARBOR, OHIO—1836.

This work was commenced in 1836, under the direction of the bureau of topographical engineers. Being undertaken late in the year, the attention of the agent appointed to superintend it was directed chiefly to the collecting of materials and to the construction of part of the west pier.

It was estimated to cost $61,563. The project contemplated the erection of the two parallel piers running into the lake, and having an aggregate length of 2,850 feet, and a breadth of 24 feet, with two pierheads, each 48 feet square. The cribs to form the sides of the channel were to be without bottoms, framed and secured after the manner followed so successfully on the harbors of Lake Michigan.

The appropriation in 1836 was $10,000, and the amount expended was $7,547 06.

1837.

The operations of the year 1837 were confined to the western pier, of which 400 feet were constructed. During that season 1,000 feet of cribwork was prepared and sunk in both piers, with the intention of raising them before its close to their intended height. The object of the work as in the case of the other harbors, was to confine and direct the current of the river so as to sweep out the sand bar which obstructed the entrance; this object was already measurably accomplished, but a portion of the bar yet remained, and it was anticipated that the next freshets would entirely remove it.

The sum appropriated this year was $20,000, and the expenditure to September 30, $22,548 52½.

1838.

During this year 500 feet of cribwork was put in place, and that of last year finished, whereby a channel 50 feet wide, and from six to seven feet deep, was opened through the sandy bar which had usually closed the mouth of the river.

The agent in charge of the work reviewed the original estimate of its cost, predicating the new estimate upon the experience acquired during the three years it had progressed under his charge. His estimate for the ultimate cost was found to be $74,342 34, exclusive of any excavations which might be found to be necessary to obtain a depth of ten feet in the channel, should the bottom prove too tenacious for the force of the stream passing over it during freshets.

The appropriation for the work this year was $23,626 57, and the expenditure $12,032 56½.

1839.

The work was prosecuted again in 1839, and from its commencement to June 1st there had been nearly or quite completed 1,800 feet of cribwork, 24 feet wide outside, and 400 feet, 12 feet wide, inside of the mouth of the river, the latter as a dike to protect an exposed point from being forced by the current near the east pier. In all, there had been 2,200 feet of length of cribwork laid, filled and nearly finished, including the dike, leaving, to complete the original plan, 350 feet more of the east and 400 feet of the west pier, beside the two pierheads.

The appropriations for the work amounted in all to	-	$53,626 57
And there had been expended upon it to 1st June, 1839		$45,476 86¾
From which is to be deducted the proceeds of a sale of articles included in the above expenditure, amounting to	-	423 62
Showing the actual cost of the work to be, to June 1st	-	45,053 24¾

There was in the Treasury undrawn - - - -	$8,324 50
And in the agent's hands - - - - -	249 21
Total available on the 1st June, 1839 - - -	$8,573 71

The piers having already a sufficient breadth, it is not proposed to increase them, but various methods are suggested for rendering permanent the work above low-water mark. Estimates of the cost of which, of completing the original plan, and of accomplishing the necessary dredging are given in the following pages.

The original project contemplated the formation of 2,850 feet of piers of 24 feet of breadth with two pierheads, each 48 feet square. There have been completed, with the exception of the covering, which is now being put on, 1,800 feet of piers outside of the line of coast. There have also been constructed, with the same exception, 400 feet of cribwork, 12 feet in breadth, inside of the east pier, to prevent the current of the river from forcing a passage across the beach at that point—a precaution which was found to be indispensable. In all there are now 2,200 feet of cribwork, and it is proposed to extend, in conformity with the original design, the east pier 350 feet farther into the lake, and the west pier 400 feet, and to add the pierheads, each 50 feet square. The work will thus terminate in 13 feet depth of water and on a gravel bottom.

It is proposed also to dredge the channel between the piers to a depth of 10 feet rather than to await the slow and uncertain action of the current, which has swept away the lighter matter of which the superficial covering of the bottom was formed. As at most of the other harbors, a winding place is here much wanted, for, owing to the narrowness of the river and the restricted opening between the piers, as well as the great length of many of the steamboats, they are unable to turn in it without great difficulty.

The appropriations have been very judiciously applied at this place: the plan of the works, the manner in which they have been executed, and the local management being equally deserving of approbation, and this may be said without prejudice to others, seeing that the work has had the rare fortune of remaining without change in the same hands and under the same general management from the period at which it was begun until the present time, whereby a unity of design and of execution is preserved to a degree to be found at few other places. The period at which the work was undertaken has been of advantage to it. The experience which had been acquired on other works having been applied to it in giving greater breadth and stability to the cribs, and in making self acting provision for refilling the foundations whenever they may chance to be underwashed, and, finally, in the more advantageous position and fastenings of the anchor piles, and in the improved mode of uniting the cribs and timbers to each other as they are successively brought into position.

Vermillion is well situated for the building of vessels, having in its neighborhood an abundant supply of the very best ship timber. It was not until late in the year 1838 that the works had produced any very sensible effect upon the bar which had obstructed the entrance to the river, and although they are yet in a most unfinished state, and the draught of water much less than is required for the passage of the class of steamboats which ply between the principal ports with their freight on board, two large steamboats have already been built here; one in 1838 of 400 tons burden, of the value of

$45,000, and one of 750 tons, exceeding by 10 feet in length the largest boat on the lakes, valued at $80,000.

The district of country believed to be immediately connected by the improvement extends back through the counties of Lorain, Huron, Richland, and Knox, to Licking—it is very fertile, and contains already a population of about 50,000 souls. The trade of Vermillion is of course very limited, the year 1838 being the first in which the harbor was accessible to any class of vessels, nevertheless the exports for that year were valued at $46,480, consisting of wheat, corn, pork, iron, &c., and the value of the imports was $33,774. The probable value of exports and imports to come hereafter from the district of country above has been estimated at $180,000 per annum. For the conveyance of this a railroad 42 miles in length has been undertaken by the joint means of individuals and the State.

Vermillion river.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditures.
1832					
1836	– –	–	$10,000 00	$7,547 06	J. R. Bowes.
1837	– –	–	20,000 00	22,548 52¼	Do.
1838	J. R. Bowes -	$74,342 34	23,626 57	12,032 56¾	Do.
1839	– –	–	–	2,925 10	To June 1, 1839.

Estimate for completing the two piers now constructing and other improvements of the navigation of Vermillion river, Ohio, viz:

750 feet of piers, including two pierheads of 48 feet square, raised 10 feet above the surface of the lake; also a beacon-light, and dredging a portion of the channel, for a winding-way for steamboats of the largest class to turn in; appended to which, is an estimate of the modifications recommended by the board of inspection, viz: Dredging the channels between the piers, and Kyanizing that portion of the work yet to be sunk:

371 flooring logs, 25½ feet long, 12 inches square, 9,450 feet lineal, at 5 cents per foot - - -	$472 50
314 logs for sides of cribs, 30 feet long, 14 inches square, 9,420 feet, at 6 cents per foot - - -	565 20
540 cross ties, 24 feet long, 12,960 lineal feet, at 5 cents per foot - - - - - -	648 00
8,100 feet of square white oak, to be used above water, at 10 cents per foot - - - -	810 00
10,800 feet of joists, for diagonal ties, at 5 cents per foot -	540 00
150 white oak piles, 25 feet long, 3,750 feet, at 6 cents per foot - - - - - -	225 00
72,900 feet of oak plank, at 10 cents per thousand - -	729 00

1,688 cords of stone, to fill piers, at $6 per cord		$10,128 00
Labor		4,125 00
		18,242 70
Add 10 per cent. for contingencies		1,824 27
Beacon-light		2,500 00
Dredging channel 16,385 yards, at 20 cents per yard		3,277 00
Modifications of board of inspection:		
1st. Dredging between pier 105,186 yards, at 30 cents per yard		3,155 58
2d. Kyanizing 3,600 cubic feet, at 12½ cents per foot		450 00
Kyanizing 97,200 feet of plank, at 1 cent per foot		972 00
		30,421 55
Deduct materials on hand	$1,500 00	
Deduct portion of channel already dredged	1,110 00	
		2,610 00
Amount required to finish		27,811 55

Estimate of the cost of permanently improving the harbor of Vermillion, in the various ways suggested by the board of inspection.

1st mode, viz: To be rebuilt of Kyanized timber from lowwater mark, 6 feet below the highest of last year, and filled with stone, with a cover of concrete of 1 foot thick, length to be permanently improved 2,150 feet, 21 feet in breadth, and to 12 feet of water. This estimate supposes that 950 feet will have been already finished, as here recommended; and, of course, this estimate is less to that extent than otherwise it would have been.

24,000 feet of timber for faces, 14 inches square, at 10 cents per foot	$2,400 00
1,200 ties, at $1 each	1,200 00
Labor	3,600 00
Kyanizing face and ties 62,000 feet, at 12½ cents per foot	7,750 00
Stone to fill the same, 2,234 cords, at $6 per cord	13,404 00
Concrete covering 1 foot thick, 963 cubic yards, at $6 per yard	5,778 00
	34,132 00
Add 10 per cent. for contingencies	3,413 20
	37,545 20
Taking up old work	5,000 00
Total cost of 1st mode	42,545 20

2d mode. The timber to be Kyanized, as in the 1st mode, and the cribs to be filled with concrete instead of stone; timber for faces and ties as above

	$3,600 00
Labor	3,600 00

Kyanizing timber as above - - - -	$7,750 00
Concrete for filling the cribs, 17,505 cubic yards, at $6 per yard - - - - - -	105,030 00
	119,980 00
Add 10 per cent. for contingencies - - -	11,998 00
	131,978 00
For taking up old work - - - - -	5,000 00
Total cost of 2d mode - -	136,978 00

3d mode. To be constructed of concrete, without timber, from low water up. 21,022 cubic yards of concrete, at $6 per yard - $126,132 00

For concrete, 2,150 feet, at $3 per foot - - -	6,450 00
Add 10 per cent. for contingencies - - -	13,258 20
	145,840 20
For removing old work - - - - -	5,000 00
Total cost of 3d mode - -	150,840 20

4th mode. To be constructed of cut stone, face backed with concrete, and resting on a base of concrete, from low water up to high water, with a battlement of stone 4 feet high. 4,459 yards of cut stone for facing, at $13 70 per yard - - - - - $61,088 30

Concrete for backing, 4,097 cubic yards, at $6 per yard -	24,582 00
Concrete for base, 11,467 cubic yards, at $6 per yard -	68,802 00
Add 10 per cent. for contingencies - - -	15,447 23
Add for constructing concrete base - - -	6,450 00
Add for the expense of taking up old work - -	5,000 00
For battlement of stone, 955 cubic yards, at $13 70 per yard	13,083 50
Total cost of 4th mode - -	194,453 03

5th mode. Cut stone, top Kyanized timber, filled with stone; the timber to be 2 feet under highwater mark, and 4 feet above low: the face stone to be backed with concrete. 9,600 feet of face timber, 14 inches square, at 10 cents per foot - - - - - $960 00

480 piles, at $1 each - - - - -	480 00
Workmanship - - - - - -	1,440 00
Kyanizing 18,240 feet of timber, at 12½ cents per foot -	2,280 00
812 cords of stone to fill foundation, at $6 per cord -	4,872 00
Concrete for backing to face stone, 5,735 cubic yards, at $6 per yard - - - - - -	34,410 00
6,244 cubic yards of cut stone for face, at $13 70 per yard	85,542 80
	129,984 80
Add 10 per cent. for contingencies - - -	12,998 48
	142,983 28
For taking up old work - - - - -	5,000 00
Total cost of 5th mode - -	147,983 28
Add for battlement as above - - - -	13,083 00
	161,066 28

6th mode. Cut down the old work 2 feet below high water, and raise with cut stone faces, and back the face with concrete, and add 4 feet depth of Kyanized timber and rubble stone: 6,244 yards of face stone, at $13 70 per yard - - - - - $85,542 80
5,735 yards of concrete for backing, at $6 per yard - 34,410 00
Taking up 2 feet of old work below water - - 2,500 00
Battlement as before - - - - - 13,083 50
Add 10 per cent. for contingencies - - - 13,553 63
For additional 4 feet of Kyanized timberwork and stone - 13,335 20

Total cost of 6th mode - - 162,425 13

7th mode. Cut down the old work, as in the 6th mode, and raise up with cut stone faces, and back the faces with rubble stone in cement and grout; the plan now pursued at Cleveland, except the profile, which supposes a vertical exterior face instead of an inclined plane as there used, and adding also a parapet wall. A backing of rubble stone takes the place of concrete in the backing, and is the only difference between this and the 6th mode, except that there is added 4 feet depth of Kyanized timber and rubble stone, to carry the work to extreme low water.

6,244 yards of face stone, at $13 70 per yard - - $85,542 80
5,735 yards of backing, at $2 per yard - - - 11,470 00
Battlement as before - - - - - 13,083 50
Taking up old work - - - - - 2,500 00
Add 10 per cent. for contingencies - - - 11,259 63
For 4 feet additional Kyanized timber work - - 13,335 20

Total cost of 7th mode - - 137,191 13

Cost of 1st mode - - - - - - $42.545 20
Cost of 2d mode - - - - - - 136,978 00
Cost of 3d mode - - - - - - 150,840 20
Cost of 4th mode - - - - - - 194,453 03
Cost of 5th mode - - - - - - 161,066 28
Cost of 6th mode - - - - - - 162,425 13
Cost of 7th mode - - - - - - 137,191 13

HURON HARBOR, OHIO.

1826.

The obstruction to the navigation of Huron River was a sand bar, which usually closed it during the summer and autumn. Its removal had been undertaken by some citizen of the county in which it lies, and its management was assumed by the United States, under the authority of an act appropriating $5,000 towards it. The work already done, authorized the belief that the plan proposed for it would be effectual, inasmuch as there were five feet of water on the bar, where formerly it was dry. The lateness of the appropriation for continuing the work, had not allowed much to be done during the year, beyond the collection of materials, and the perfecting of arrangements, to ensure its vigorous prosecution the ensuing season.

It was estimated to cost $15,349 12.

1827.

Very satisfactory progress was made this year, and with such good effect that vessels drawing six feet were enabled to enter the harbor.

To the 30th of September, the sum expended upon the work had been $2,872 75.

1828.

The channel continued to improve in depth, and vessels no longer experienced difficulty in entering the river. There was now 6, 9, and 12 feet of depth, and the clay bottom was reached by the current; the cribs which formed the sides of the channel, had settled very considerably; the operations of the season were therefore directed to the restoring of the piers to their original height.

The sum appropriated had been - - -	$9,413 35
And the amount expended up to this time - -	7,783 61

1829.

The west pier was extended into the lake its proposed length, and the east pier to within 150 yards of its termination in 13 feet water. They were both in an unfinished state, and required in some places to be raised and planked, for which the balance of the appropriation in hand, was deemed to be insufficient; 370 yards of pierwork had been put in place up to 30th September, 1828; and thence to September 30, 1829, there were 310 yards, or in all 680 yards, and there yet remained 200 yards necessary to their completion; the aggregate length of the proposed piers being 880 yards. The channel continued to be sufficient for vessels of seven feet draught, and it was anticipated that in the ensuing spring, there would be depth enough for the largest vessels navigating the lakes.

The appropriation for the year, was $5,935, and the total expenditure to the 30th of September, $14,718 37, and to complete the original project, there was required $1,880 36, in consequence of damages sustained in a heavy storm.

1830.

There remained to be done on the 30th September, but about 60 yards of the eastern pier across the outer bar, to complete the original plan of the work. There would be required, however, $3,478 13 more for readjusting the cribs.

The depth in the channel had increased to 9 feet in the shoalest part.

The greater part of the appropriations for the works, was expended by the close of the season, at which time the total expenditure upon them had been - - - - - - - $17,227 34

The amount of all the appropriations - - - $17,228 71

1831.

The extension of the eastern pier was completed this year, and a sufficient depth of water in the channel thereby ensured to vessels seeking the harbor.

The estimate for the ensuing year, $1,428 88, was intended to be applied to the repair of those parts of the work, which had been built before it was

taken in charge by the United States. The propriety of erecting a beacon-light at the harbor, was suggested in the annual report.

The cost to this date was - - - -	$19,752 33
The amount of the appropriations - - -	20,708 71

1832.

At the close of the season, the works were reported to be in good condition. No new work had been done, but the available funds were applied in strengthening and protecting the old. Additional works were deemed necessary to strengthen and complete the piers, but no further appropriation was required for that object.

The expenditure up to this period was - - -	$21,212 33
The amount of appropriations - - - -	22,208 71

1833.

The general agent, Mr. Selden, in his annual report of this year, states the depth of the channel to be 8 feet in the shoalest place, and that the works were in good condition. He states also that a considerable quantity of stone would be required to fill in the cribs which had settled; and that stone and brushwood would be required on each side of the piers to prevent the sand from washing into the harbor, as well as to strengthen and protect the work. That the entrance of the harbor, which had a breadth of but 140 feet between the piers, was too narrow, and advances the opinion that if the piers were extended 200 feet farther into the lake, and upon an angle to give the entrance an additional width of 100 feet, it would be much safer and easier of access.

An estimate is given for repairing and extending the works, amounting to $11,974 80.

He recommends the erection of a beacon light.

An officer of the corps of engineers inspected the work this year, and reported that, whereas, before the construction of the piers, the entrance to the harbor was often completely shut up by a bank of sand, there was now a straight channel of from 10 to 12 feet deep. The piers were nearly parallel with each other, and 140 feet apart at the outer, and 170 feet at the inner ends. Their whole length was about 1,400 feet, and they projected into the lake about 1,000 feet—their breadth varying from 8 to 18 feet, and their rise 5 feet above the water. The inspecting officer recommended the construction of a head of about 90 feet long to each pier in a direction diverging so as to increase the width of the entrance, and estimates the cost of a beacon-light, which he deems indispensable, at $2,700.

The future cost of replacing the upper work of timber by stone walls, is not estimated for want of the requisite elements.

1834.

By reason of the cholera which prevailed this season, but little was done except the collecting of materials for the purpose of extending the piers 120 feet farther into the lake. One crib for this purpose was ready at the date of the annual report. No further appropriation it was thought would be required, except for repairs, until it should be deemed expedient to undertake the construction of the permanent work.

The general agent reports the works in good condition, and the depth of water 8 feet in the shoalest part of the channel.

The appropriation for the year was $6,700, but little of which had been expended.

1835.

Captain H. Smith, the general agent, reported this year that the works required attention as early the ensuing spring as possible—that he found the parts first done, quite defective, and that the sanddrift continued to pass quite through the piers, filling the harbor and threatening to restore the beach in the present channel way. It was the opinion of the inhabitants that the sand passed around the head of the piers; his own, however, was that which is expressed above. He recommended brushwood and stone to be deposited along the sides of both the piers, and on failure of that mode of defence, the use of pile planking. He also states the necessity of repairing some portions of the old work, and the removal of the sand which had been washed into the harbor, and estimates the cost of these at $4,295 75, over and above the probable balance of appropriations remaining on hand, in all, $6,295 75.

The beacon light-house was finished this season, the appropriation for which was, in 1834, $2,600.

1836.

The appropriation of $6,700, which was exclusively for repairs, was nearly all applied this season.

The agent estimates at the close of the season, as follows, viz:

For the permanent work of the west pier, 68 rods long, from the sandbeach to its outer end to form an inclined plane of 40 feet width at base, and to rise 8 feet above water outside of the pier, 4,144 cords of stone	$24,846
Same for east pier, 60 rods long - - - - -	21,924
For repairing old work - - - - - -	2,565
	49,335

The appropriation for this year, was $4,300.

1837.

The work recommenced this year in the month of May. During the season 290 feet of pierwork, greatly decayed, had been taken down to below the watermark and rebuilt with wood and stone, and nearly all planked over. 60 feet more of the east pier was also taken up as it was in the process of decay, and was renewed in like manner.

Progress was also made in forming inclined planes of stone and piles outside of the piers—portion of the permanent structure. The general agent recommends, in his annual report, the continuation of the permanent work the ensuing year, for which and for dredging, and a new pile boat, he estimates - - - - - - - $10,175 00

The appropriation of the year was for repairs - - 2,565 00

Total expenditure to the 30th September from commencement 33,69185

1838.

One hundred and thirty-one feet of the old work were renewed above water and refilled with stone during the season, and other parts of the work which had settled, were refilled with stone. Piles were driven along the inner side of the piers for their protection and for the convenience of vessels. A new pile engine was constructed, and a large quantity of stone engaged for the outside of the piers towards the construction of the permanent work, thus absorbing the appropriation. The agent, at the close of the season, estimates for continuing the permanent work during the year 1839, and for dredging - - - - - - - $9,300 00
The appropriation this year, was - - - - 5,000 00
And the total amount from the commencement of the works 40,773 71
Of which there was unexpended September 30 - - 3,750 00
Exclusive of the cost of the beacon light-house.

1839.

The balance, remaining on the 30th September, 1838, of $3,750, was expended in continuing the work then in progress.

The expenditures upon the harbor from 1826, when the work was undertaken by the United States, to the 30th June, 1836, when the piers and light-house were completed, was - - - - $26,973 75
And from June, 1836, to the 31st March, 1839, wholly on repairs - - - - - - - 13,256 78

40,230 53
And the value of piles contracted to be delivered for the work 250 00

Showing the cost and liabilities to be - - - 40,480 53
All the appropriations amounted to - - - - 40,773 71
Which shows an available balance of - - - 293 18
The local agent states the balance in his hand - - 596 81
Deducting the above $250 - - - - - 346 81

The appropriation for a beacon-light-house, amounting to $2,600 is not included in the above statement.

The piers have not received any farther extension since the year 1836. The west pier, on which is the light house, including a wing of 30 feet, is 1,587 feet, and the east pier has a length of 1,400 feet.

The piers are but 130 feet apart at the narrowest part of the channel, which has nowhere a less depth than 9½ feet in it. This is too narrow, as is the river itself, for the larger class of steamboats to wind or turn in. A suitable position for a basin lies abreast of the town. Some excavation has already been made there, and it has been stated by the local agent that it could be completed to the requisite extent for a winding place for the sum of $500. The harbor is safer of access than its width would seem to indicate. Lying in a deep indentation of the coast, it is greatly sheltered from the force of the waves during the usual storms. Owing to its position, too, in some measure, the sands have not advanced, with the progress of the work, as rapidly as at most of the other harbors. The beach at the west pier retains very nearly the same position it occupied at the commencements of the works, and, on the east side, it extends beyond the original east line but 330 or 340 feet. There is no bar forming between nor beyond the piers, nor is any sediment brought down the river.

The accompanying plan shows the present condition of the piers, and the depth of water between them, &c. The annexed estimates give in detail the several modes which have suggested themselves for the permanent completion of the piers, and the cost of each. It is proposed to increase the breadth of the piers.

Huron river enters the lake to the eastward of Sandusky bay, about 10 miles from Sandusky city. It is navigable 6 miles from its mouth. Formerly, it was to be entered only by lighters, during the business season, and it had scarcely any commerce. The population at the present harbor did not exceed 20 souls when the works for its improvement were begun. It has already 1,200 inhabitants, 10 or 12 stores, and 6 or 7 extensive warehouses actively occupied. It is entered daily by the largest class of vessels navigating the lake. Nearly all the steamboats trading regularly between the upper and lower parts of the lakes habitually touch at it, and it has daily lines of stages to Columbus and Cincinnati. The value of the harbor to the interior is such as to have induced individual enterprise to construct a ship canal, now nearly completed, from the head of navigation to Milan, a town 8 miles from the lake, with a view of concentrating the trade of the interior there.

In 1833, only seven years after the United States had commenced the work at Huron, the value of its imports had risen to $1,599,472 50, and its exports to $274,840 99. In 1838, the exports were $1,053,576, as shown in the following statement:

Statement of imports and exports at the port of Huron river, during the year 1838.

Description.	Quantity.	Prices.	Agg'te value.
Exports.			
Barrels of pork - - -	4,154	At $17 00	$70,618
Barrels of flour - - -	11,536	7 00	80,752
Barrels of whiskey - - -	2,038	15 00	30,870
Barrels pot and pearl ashes - -	1,058	20 00	21,160
Bushels of wheat - - -	137,036	1 50	205,554
Kegs butter and lard - -	1,767	10 00	17,670
Tons of grindstones - -	100	20 00	2,000
Tons of hay - - -	24	8 00	192
Bushels of timothy seed - -	500	1 25	625
Bushels flaxseed - - -	400	1 00	400
Tons of bacon - - -	10	200 00	2,000
			431,841
Imports.			
Barrels of salt - - -	10,050	2 00	$20,100
Barrels plaster - - -	500	2 00	1,000
Cords steamboat wood - -	4,238	2 00	8,476
Tons merchandise - - -	2,011		1,000,000
Barrels of fish - - -	500	8 00	4,000
			1,033,576

Family goods, cattle, hogs, sheep, &c., not enumerated, as we have no means of ascertaining the number or quantity.

Huron has become the principal port for shipbuilding at that end of Lake Erie. Since the harbor was rendered accessible there have been built at it—

9 steamboats, mostly first class, valued at - - -	$486,000
12 schooners, chiefly first class, valued at - - -	65,000
Total value of vessels built here - - -	551,000

Huron harbor.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1826	Capt. Maurice -	$15,349 12	$5,000 00	–	Jabez Wright.
1827	– –	–	–	$2,872 75	Do.
1828	– –	–	4,413 35	4,910 86	Do.
1829	– –	–	5,935 00	6,934 76	Do.
1830	– –	–	1,880 36	2,508 97	Do.
1831	– –	–	3,480 00	2,524 99	Do.
1832	– –	–	1,500 00	1,460 00	Do.
1833	– –	–	–	515 38	Do.
1834	– –	–	6,700 00	1,107 34	Do.
1835	– –	–	–	3,753 38	
1835	– –	–	–	–	Capt. H. Smith.
1836	John B. Wilbour -	2,565 00	4,300 00	663 26	John B. Wilbour.
1837	– –	2,565 00	2,565 00	6,440 16	Do.
1838	– –	9,300 00	5,000 00	3,213 09	Do.
1839					
	Beacon-light.				
	Maj. Maurice,				
	Foundation -	2,071 13			
1831	Tower	541 20			
1834	– –	2,612 33	2,600 00		
1835	– –	–	–	1,568 53	

Estimate for permanent work to replace the temporary.

East pier—length 800 feet:

Section 1: length 260 feet from shore to shoulder, to be increased in width 4 feet average; foundation to be raised 2 feet; breadth, when complete, 12 feet.

Section 2: from shoulder to outer end, 540 feet long; breadth of additional foundation, 14 feet; depth of foundation, 12 feet; width, when finished, 26 feet.

West pier—1,090 feet:

Section 3: Length from shore to shoulder, 350 feet; present breadth of foundation, 9 feet; increase, 3 feet; depth of foundation, 2 feet; breadth, when completed, to be 12 feet.

Section 4: from shoulder to outer end, length 740 feet; breadth of foundation, 11 feet; depth of foundation, 4½ feet; when completed, breadth to be 20 feet.

Estimate for east pier—for additional foundation.

Section 1: 260 = 8 cribs of 30 feet each, and 1 of 20 feet—2 courses of timber.

Cost of 1 crib, 30 feet long, 2 courses high, 4 feet wide:

4 pieces of timber, 1 foot square, each 30 feet long = 120 feet at 10 cents per foot counterhewed - -	$12 00	
6 ties, at 25 cents each - - -	1 50	
6 piles, each 20 feet long, 1 foot square = 120 feet at 8 cents per foot - - - -	9 60	
Trunnels and iron - - - -	3 00	
Carpentry and labor - - - -	26 10	
Concrete to fill, 9 cubic yards, at $6 per yard -	54 00	
Cost of 1 crib, 30 feet long - - -	106 20	
Cost of 8 cribs, 30 feet long - - -	849 60	
Cost of 1 crib, 20 feet long - - -	70 80	
		$920 40

Section 2: from shoulder to outer end, 540 feet × 14 feet wide × 12 feet deep = 18 cribs, each 30 feet long.

Cost of 1 crib 14 feet wide, 11 courses of timber:

22 pieces of timber, 14 inches square each, 30 feet long = 660 feet, at 10 cents per foot - - -	$66 00	
33 ties, each 25 cents - - - -	8 25	
6 pieces 30 feet long 1 foot square = 180 feet, at 8 cents per foot - - - -	14 40	
Trunnels and iron - - - -	10 00	
Carpentry - - - - -	98 65	
Stone, 29 cords, at $6 per cord - - -	174 00	
Cost of 1 crib, 30 feet long - - -	371 30	
Cost of 18 cribs, 30 feet long = cost of section 2 -		6,683 40

West pier—for additional foundation.

Section 3: from shore to shoulder, 350 feet of foundation of blocks of stone, 3 feet long, by 2 feet high, and 2 feet wide:

127.27 perches at $2 75 per perch - -	$350 00	
Labor - - - - - -	250 00	
Cost of section 3 - - - - -		600 00

Section 4: from shoulder to outer end, 740 feet = 24 cribs 30 feet each, and 1 crib of 20 feet, 4 courses:

Cost of 1 crib 30 feet long, 4 courses:

8 pieces of timber, 14 inches square, each 30 feet long = 240 feet, at 10 cents per foot - - -	$24 00
12 ties, 25 cents each - - - -	3 00
6 piles 30 feet long = 180 feet, at 8 cents per foot	14 40

Trunnels and iron	$10 00	
Carpentry	51 40	
Stone, 9½ cords, at $6 per cord	57 00	
Cost of 1 crib, 30 feet long	159 80	
Cost of 24 cribs	$3,835 20	
Cost of 1 crib, 20 feet long	106 53	
Cost of section 4		3,941 73
Cost of additional foundation		12,145 53
Removing old work		2,000 00
		$14,145 53

First mode.

Cribs of Kyanized timber placed on foundation of crib work and stone.

1st. Cost of superstructure, as above	$14,145 53
2d. 1,590 ties, $1 each	1,590 00
Workmanship	5,390 00
Kyanizing 66,632 cubic feet, at 12½ cents per foot	8,329 00
3d. Stone for filling the above, 2,658 cords at $6 per cord	15,948 00
38,000 ft. timber 14 inches square, at 10 cents per ft.	3,800 00
4th. Concrete 1 ft. thick, 1,569 cubic yards, at $6 per yd.	9,414 00
Add 10 per cent. for contingencies	5,861 65
Cost of 1st mode	64,478 18

Second mode.

Kyanized timber, cribs filled with concrete, (the ties remaining.)

Preparing for superstructure, as above	$14,145 53
Timber work, Kyanized as above	19,109 00
Concrete for filling 11,913 cubic yards, at $6 per yard	71,478 00
Add 10 per cent. for contingencies	10,473 25
Cost of second mode	115,205 78

Third mode.

Piers of solid concrete, the same as the second mode	$115,205 78
Add for caissons, 1,890 feet, at $3 per foot	5,670 00
Total cost of third mode	120,875 78

Fourth mode.

Piers of blocks of stone, hammer-dressed, laid in cement, with additional backing, the superstruction resting on a bed of concrete 6 feet thick, placed on the foundation of cribwork.

Preparing superstruction, as above - - -	$14,145 53
Concrete for bed, 7,844 cubic yards, at $6 per yard -	47,064 00
Cut stone for faces, 3,903 cubic yards, at $13 70 per yd.	53,471 10
Concrete for backing, 2,372 cubic yards, at $6 per yard	14,232 00
Cut stone for battlement wall, 633 yards, at $13 70 per yard	8,672 10
Add 10 per cent. for contingencies - - -	13,758 47
	151,343 20
Add for caissons, 1,890 feet, at $3 per foot - -	5,670 00
Cost of 4th mode - - -	$157,013 20

LA PLAISANCE BAY, MICHIGAN.

1827.

La Plaisance bay, at the extreme westwardly bend of Lake Erie, and about 40 miles to the southward of Detroit, lies within about 4 miles of the city of Monroe, in the State of Michigan, to which it serves as a port, being connected with it by means of a railroad of that length. It is broad and shallow, the greatest depth available for navigation in the year 1827, being 9 to 10 feet, and it is surrounded on all, except the lake side, by a marsh of about a mile broad. The river Raisin, on the banks of which lies Monroe, is connected with the bay near its head as more directly with the lake, but the navigable waters of the harbor and river as well as of that and the lake, are separated from each other by very extensive shoals, on which there is never a sufficient depth to admit the passage of vessels ordinarily navigating the lake.

To provide for the commerce of the lake a harbor of refuge near its head, and to encourage the settlement of the extensive agricultural district of country watered by the river Raisin, it was proposed in the year 1827, to form in La Plaisance bay, a breakwater at which vessels might securely lie, and by which they might be enabled to have convenient intercourse with the shore.

A breakwater was accordingly planned by Captain Maurice, of the corps of engineers, to be formed of timber cribs loaded with stone, capped and secured by piles, and to be 350 feet long. It was estimated to cost $6,296 61. The sum of $3,977 81 having been already appropriated by an act of Congress of the year 1827, for the construction of a pier at a breakwater. During the first season, there was nothing done toward the work except the forming of a contract, under which it was proposed to complete the breakwater the ensuing year, and in pursuance of which, the collection of materials was at once commenced.

1828.

The sum appropriated in 1827, for constructing a pier as a breakwater at La Plaisance bay, was nearly expended during the year 1828. The length of the breakwater on the 30th September, was 350 yards, but it was the opinion of the engineer, that an extension of the work was necessary for the protection of the harbor. He, at the same time recommended the connexion of the navigable waters of the bay with those of the river Raisin, by means of parallel piers, and the dredging out of a sufficiently deep channel between them.

The work had cost up to September 30th, $2,500. Of the appropriation of 1827, there remained yet unexpended, $1,477 81, and the engineer asked for the service of the ensuing year, the further sum of $2,318 80.

1829.

A survey was made under an order of the engineer office, to ascertain the practicability and cost of uniting the navigation of La Plaisance bay with the river Raisin, so that sloops might ascend to Monroe.

There were 70 yards of cribwork added this year to the breakwater, and its whole length was now 420 yards, which cost $5,222 26. The appropriations had amounted to $6,295 81, of which there was a balance for the service of the ensuing year of $1,073 55, which the engineer deemed to be sufficient to complete the work as far as it had been extended.

1830.

The works at La Plaisance bay were this year completed, and they afforded protection to vessels drawing 8 to 9 feet depth of water. While reporting these facts, the engineer renews his notice of the impracticability of the communication between the bay or lake and the river Raisin, for the ordinary class of vessels navigating the lakes, and he submits a plan and estimate of the cost of effecting that object. The length of the breakwater was now 430 yards, and it had cost $6,261 85, leaving an unexpended balance of $33 96 in the agent's hands.

1831.

On the 4th of October, there occurred a very violent storm at the western end of the lake, by which the works at La Plaisance bay sustained serious injury. It appears, that of the portion of the piers which had been built by contract, in the year 1826, nearly three-fourths were destroyed, while the rest, which had been built by hired labor, was not injured. In consequence of this damage, the engineer asked for the service of the year 1832, the sum of $7,841, to be applied to the repairing and reconstructing the work, the appropriation of previous years having been all expended.

1832.

It was not until September of this year, that an examination of the damages sustained by the breakwater, could be made by the officer who had succeeded to the charge of the work, when it was found that the whole of the old pier, with the exception of 200 feet of its length, had been washed away and rendered entirely useless, during the autumn and winter of 1831, and that part of it that had been built by contract had been entirely carried away, leaving but a few stones and foundation timbers to mark its position.

The appropriation for the year was $8,000, but it was not the intention of the department to reconstruct the work until the ensuing year.

1833.

Eight hundred and forty feet of the new pier or breakwater, were sunk this year, and much stone was deposited in it, and the work was otherwise prosecuted satisfactorily to the extent of the appropriation.

1834.

The sum of $4,895 was appropriated for the service of this year. The existence of the cholera in the vicinity of the work, very seriously retarded its progress, the resumption of operations having been thereby necessarily delayed until late in the season.

1835.

The works were prosecuted to completion this year. The pier was now 1,320 feet in length, 12 feet wide, and 10 feet average height. It was formed of timber cribs, capped, filled with stone, and secured by piles.

The cost of the works from their commencement in 1827, to the 30th of September of this year, was $19,014 87.

The cost of the original pier $6,295 81; the difference shows the cost of repairs and reconstruction to have been $12,719 06.

In 1836, and 1837, the work remained sound and in good condition.

1838.

The pier was somewhat injured by ice, and the storms of the winter of 1837, and spring of 1838, and it was the opinion of the superintending agent, that without some repairs it would soon be destroyed by the elements. He estimates the cost of repairing it, at $1,222 57, and urges attention to it on the ground of its value, as the only harbor in that immediate district as sheltering a large amount of commerce and travel, and its maintenance necessary for those uses until the completion of the river Raisin ship canal, which was designed ultimately to supply its place.

Since this period, nothing farther has been done on this work, and owing to the perishable nature of much of the materials of which it is built, and its exposure to the violent storms of the lake and the action of the ice during the winter season, it continues in a progressive state of dilapidation, and if much longer neglected will go to utter ruin.

Two or three thousand dollars would probably be required to put it in repair now.

La Plaisance bay,

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1827	Capt. Maurice -	$6,296 61	$3,977 81	–	Capt. Maurice.
1828	– –	–	–	$2,500 00	Do.
1829	– –	2,318 80	2,318 00	2,132 26	Do.
1830	– –	–	–	1,629 59	Do.
1831	– –	–	–	33 95	Major Maurice.
1832	Major Maurice -	7,841 00	8,000 00	–	Capt. H. Smith.
1833	– –	–	–	7,568 63	Do.
1834	– –	–	4,895 00	1,598 87	Do.
1835	– –	–	–	3,551 57	Do.
1836	– –	–	–	216 88	Do.
1837					
1838					
1839	H. Smith, Esq., agent	1,222 57			

RIVER RAISIN HARBOR, MICHIGAN.

As has been already stated, under its appropriate head, the breakwater designed for the protection and accommodation of vessels entering La Plaisance bay, was undertaken in virtue of the act of 1827, which appropriated a sum of money for that specific purpose. But it was perceived, at an early period, that the advantage to accrue to commerce and to the country more immediately connected with that part of Lake Erie would be very materially enhanced if the navigable waters of the river Raisin, one of whose outlets was in the bay, and which has, with the exception of the shallows at its mouths, a sufficient depth of water very nearly to the city of Monroe, were rendered accessible to vessels of some burden. The subject was more than once brought to the attention of the department by the officer of engineers originally charged with the execution of the act of 1827, concerning the breakwater or pier at La Plaisance bay.

In the year 1829, under an order from the engineer office, such surveys were made as were deemed necessary to enable the engineer to form a plan of the works for establishing such a connexion and to estimate their cost. It was his opinion, for reasons given in his report, that the connexion should be formed with the bay, and upon this hypothesis he reported a plan and estimate for the work. Subsequently, another survey was made by Capt. H. Smith, of the 6th regiment of infantry, the officer who had succeeded to the charge of the work in this vicinity; and his view of the subject leading him to prefer a direct communication between the river and the lake, he reported a plan and estimate in accordance with those views, which he sustained by various reasons advanced in his report to the department. This plan being approved of, it was authorized to be carried into effect, and accordingly works at the river Raisin have been prosecuted in accordance with it.

The report here alluded to and addressed to Lieutenant Colonel J. J. Abert, of the topographical engineers, under date of 20th November, 1834, places the subject in a very clear point of view, as may be gathered from the ensuing quotations from it.

The river Raisin, he there says, from the "head of navigation to the lake, has hardly a perceptible current: it rises and falls with the water of the lake (as east or west winds prevail) as much as 3 feet. Its depth from the head of navigation, nearly to the lake, a distance of about 3 miles, (following the channel,) is sufficient at low water for any vessel navigating Lake Erie, except at three points, where narrow bars lessen the depth to about 6 to 7½ feet. These bars appear to be elevations of the clay bed of the river, and can be permanently removed at a very trifling expense by dredging. The width of the river may be stated at 200 feet. Near the mouth the water becomes shoal, and an extensive sand flat, 6,290 feet in width, forms a serious obstruction to the entrance of the river. Through this the channel of the river is at its shallowest point but 5 feet in depth; and the channel shifts from season to season, according to the prevailing winds.

To construct a harbor a certain and uninterrupted entrance should be secured into the river at all times of navigation and for all vessels on the lake. The indentation called La Plaisance bay, to which point the attention of the Government appeared heretofore to have been directed, had not been found to possess the advantage as a harbor which seemed to have been anticipated. The depth of water was by no means sufficient for the

larger vessels which would have occasion to enter the harbor from time to time—it being, at low water, but 5 feet in depth, with the additional disadvantage that it was yearly filling from the action of the winds. The pier or breakwater constructed by the Government at the place had not and would not remedy these defects effectually. If it were proposed to deepen the bay and its entrance by dredging, the extent of the cost and labor would be such as to render it inexpedient, besides affording but a temporary remedy. The difficulties and cost of connecting that inlet with the river (as heretofore proposed) by a ship canal, had, as he apprehended, either been underrated or had greatly increased within two or three years in consequence of the diminution of the depth of water and the gradual filling of that mouth of the river now in several places but 3 feet in depth, and for more than a mile proposed to be dredged, the mean depth would not exceed $3\frac{1}{2}$ feet.

To attain the proposed object, to wit: So to connect the waters of the lake with those of the river at a navigable point such as to afford a harbor which should at all times be certain, accessible, and safe—he recommended as the best and cheapest plan, to make a thorough cut of 4,885 feet in length, across the long peninsula called "River Raisin point," from the river directly north of the highland called "House island" to the lake.

The canal thus located, it was Captain Smith's opinion, should be constructed 100 feet in width at the surface of the water. The difference in level of the two extremities of the line not being two inches no locks therefore, lift or guard, would be required. But its entrance into the lake should be protected by piers; one on each side, running into the lake perpendicularly to the shore (that is prolonging the line of canal) to 10 feet of water; the length of these piers would therefore be 726 feet each, and to withstand the action of the lake, were required to be 20 feet in width, of timber filled with stone and strongly secured by piles. Where the canal crossed the then course of Sandy creek a dam of piles and pile planks across the creek on the lower (south) side of the canal should be constructed; thus turning the creek (a sluggish and shallow stream) through the mouth of the canal.

The river Raisin, at the proposed point of junction, has a depth of 12 feet, and for a mile and a half above and half a mile below, the depth at low water of 9 feet might be every where attained at the small expense of dredging out the narrow bars abovementioned, the location of which was shown by the soundings given in his map. Stony point, at the distance of $4\frac{3}{5}$ miles to the eastward, would form a complete natural breakwater, protecting the mouth of the canal from the north and northeast storms, as would Raisin point and the extensive flats adjoining from the south winds.

The mouth of River Raisin, he says, presents a point of growing importance not only to the commerce and navigation of Lake Erie, but to the agricultural and manufacturing interests of a growing and fertile country around it, and to the west of it. Its position is at the western extremity of Lake Erie, and it is the natural landing place for most of the numerous emigrants who are or may be destined to the southern and western parts of Michigan, as well as for those who are bound for the northern parts of Indiana and Illinois. It is the point from which the shortest and it would seem the most eligible route across the peninsula of Michigan can be obtained, either for a railroad or a canal, as will be obvious from a slight examination of the map of the country, and the field notes of surveys, which show the ease with which a communication from this point to the mouth

of the St. Joseph of Lake Michigan, can be made, in comparison with any other given route. A stronger proof of the eligibility of the country west for settlement, the natural eastern outlet of which country is the mouth of the river Raisin, cannot perhaps be given than the avidity with which the lands in this portion of the country are sought, and the rapidity with which they are settling. It will be seen, he says, by reference to the census then recently taken in the Territory of Michigan, that the population in this particular division of the country, within the previous three or four years, had nearly trebled, and that comparison of the land sales at the land office in Monroe, with others in the Territory, will show that the sales at that office were nearly or quite equal to those of all others in the Territory. These circumstances are mentioned by him to show that whatever may have been thought heretofore in reference to the improvement of the facilities of navigation at the west end of Lake Erie, the growth of the country was now such, and the agricultural interest had become so extensive, that convenient access to the commerce of the lakes through this channel, was an object to effect which was justly considered of national importance.

The village of Monroe, situated near the foot of the lower rapids of the Raisin, has, he says, become one of the principal marts of the Territory; and in navigating Lake Erie, either with schooners or steamboats, it is one of the natural landing places at the west end.

The commercial importance of this point, Captain Smith thinks, must necessarily be greatly increased, when the water power at the head of ship navigation on the river, shall have been brought into active use, to an amount, as is estimated, sufficient to propel machinery equivalent to three hundred and fifty run of merchant stones.

Appropriations had heretofore been made by the Government for the construction or improvement of harbors at Dunkirk, Portsmouth, Erie, Ashtabula, Conneaut, Grand river, Cleveland, Black river, and Huron, on the southern shore of Lake Erie.

Yet all these improvements had been commenced and matured at a period when the business of either, with the exception perhaps of Cleveland, had not equalled that which now, at the date, sought the mouth of the river Raisin for its centre. Similar obstructions exist, he says, at the mouth of the Raisin to those which the Government in its wisdom had removed from the streams on which the abovenamed places are situated, and if nothing had occurred in the experience of the Government to render doubtful the expediency of thus aiding and protecting the commerce of the upper lakes, there could be no doubt that this point possessed high claims to similar improvement. The improvement proposed by Captain Smith, was estimated to cost $55,885, exclusive of the cost of a dredging machine; this work being to be taxed with its proportion of the expense of constructing one intended for the common use of this and several other harbors.

1835.

A sum of $30,000 was this year appropriated for the proposed work, and the same was commenced early in May, under the direction of the chief of the corps of engineers, Captain H. Smith, of the 6th infantry, having the immediate charge of it.

About the 1st of June such force of laborers as could be employed to advantage, commenced their labors by removing the sods, turf, &c., over

the whole surface of the intended canal, and placing it at the sides; this was done on about half the length of the work, leaving the water about 2 feet deep in the portion thus excavated. The same mode of excavation was employed in cutting a small canal about 12 feet wide, entirely through to the River Raisin, and just within the north line of the canal, for the purpose of facilitating the conveyance of materials, &c., from Monroe to the end of the canal nearest the lake, at which point it was determined to commence the excavation. The driving of piles was then commenced at the lake on both sides of the intended cut, and 10 feet from each one to the next. These were driven (350 in number) along 1,750 feet of the work; on the tops of these piles strong tenons were cut, and caps of square timber, 12 by 10 inches, framed and placed. From these caps of timber, land ties of timber 20 feet long and placed 20 feet apart, extended at right angles under the embankment, being strongly keyed to the caps. On the backside of the caps and piles, pile planks 9 feet in length were driven, (the piles being driven 14 feet into the earth,) being previously well jointed. The plank-dam was then made water-tight by *puddling* with clay from 4 to 6 feet in depth; cross dams were then made and the water drawn from a section of the canal, and the dry excavation made. Setting aside the necessity of adopting this mode, on account of the porous and marshy nature of the soil, there was no doubt in the opinion of the engineer, but that economy was consulted by this mode of construction. The caps were now framed and placed as above on both sides of the work, 1,750 feet in length; the land ties placed and pile plank driven on each side for 1,500 feet of the distance, and the excavation entirely completed, 100 feet wide at the surface by 68 at the bottom, 11½ feet deep, on a distance of 462 feet of the very worst portion of the work. There was also commenced another section of about 500 feet in length, and nearly one half of the length of the whole canal was excavated that fall, leaving enough of the last appropriation to commence the piers in the month of December.

The officer superintending the works estimates, for the year 1836, for completing, $60,660, in addition to the existing appropriations, and accounted for the excess over the original estimate, in a letter addressed to the chief of the corps of engineers, under date of the 13th of May, 1835. Among other causes, he states the unexpected difficulty of procuring, and the consequent enhanced price of labor, and that the cost of a dredging machine, excluded from his former estimate, was now embraced in this.

1836.

The appropriation for the year was $15,000.

This season the operations advanced steadily and satisfactorily, although, in several instances, unfavorably interfered with by causes beyond the control of those engaged. The operations were directed to, 1st. Constructing a permanent dam on both sides of the canal to prevent, for the present, the sliding of the heavy embankments, and to secure them thereafter from suffering injury by the action of the water, whether by currents, or wash of steamboats in passing. Piles were driven, in pursuance of this plan, on both sides of the work, at 10 feet apart, on a distance of about 3,000 feet, the whole length of the canal being 3,960 feet. Caps were framed and secured on these piles along a distance of about 2,020 feet, and sheet piling driven behind the caps, and the dams entirely finished along 1,880

feet of the work. The unusual and continued high water and severe storms had prevented the entire completion of this portion of the labor during the summer; but it was proposed to do it during the winter.

2d. The excavation. The water with which the work was last fall filled was pumped out, and the canal, during the winter and the early part of this season, completed to the length of 1,880 feet, excepting only the remains of the dams across it, two in number, and a small portion of the bottom of the work, not quite finished when the laborers were driven from their work by an unprecedented rise in the water in the west end of the lake, and the forcing in of one of the cross dams. To explain this second occurrence of the like accident, it is proper to state the fact, that an accurate observation had shown the mean height of Lake Erie, at the western extremity, to have been two feet eight inches higher during the whole season, from April to September, than last year even, at which time it was considered unusually high. A highly respectable gentleman, residing near the lake 44 years, had never known the waters so high through any previous season by a difference of two feet. The water at this height interfered somewhat with the progress of the work, but when raised some feet in addition by a violent storm of wind from the northeast, the pressure became so unexpectedly great, that the cross-dam, which had given way the preceding season, was crushed in, and the work filled. The amount remaining of the appropriation of 1836 was so small, that it was deemed preferable to apply it in the construction of the piers and of machinery necessary to complete the work the next season, rather than to remove the water again, until the available amount should be sufficient to complete the excavation. An offer had been submitted (by the contractors for the steam dredging machine engaged for this work) to execute the whole work of excavation at 20 cents per cubic yard, they using for the purpose the machine now being constructed, and the Government completing the pile dam.

3d. Piers. These were in progress on each side of the mouth of the canal to the distance of 450 feet into the lake, that being about half the requisite length. It had been found impossible to make a reasonable contract for timber or stone, and both were therefore purchased in open market. In addition to this, a quarry was opened by laborers employed for that purpose, and the stone procured to fill the piers principally in that manner.

4th. Mechanics were employed in constructing an excellent pile boat, stone and crane scows, for that and the ensuing season, and in repairing the old machinery.

The officer in charge of the work estimates for completing it $61,351 50, in addition to former appropriations, which were now nearly exhausted.

In explanation of the excess of the present estimate and previous appropriation over the original estimates by the same officer, it was remarked by him, 1st. That from causes which could not be known at the time of making the first estimate, and which had since been explained to the department, it was found necessary to change the original plan of simple excavation to one embracing the side dams—an alteration by which economy in the end, as well as durability, was greatly consulted. 2d. All labor and materials were from 50 to 100 per cent. higher the last and the present year than in 1834, when the estimate was made. Labor (ordinary) was, for a laborer, from $10 to $12 a month; now it was difficult to procure goo hands at $30 per month; materials were in the same

proportion. 3d. The state of the lake and of the weather the last season and the present, different from any previous one for many years, had materially enhanced the cost of the work, causing additional expense from unforseen inundations, high winds, and continued bad weather.

These causes combined fully accounted, he says, for the difference. But one cause, in addition, might be mentioned, without impropriety, viz: The small sums appropriated causing cessation of the work frequently, when it could have been prosecuted to the best advantage and with the best economy.

1837.

This year, the piles along the sides of the canal were driven and capped. The sheet piling, with the exception of 198 feet, was also driven, and about 2,500 cubic yards of earth were removed from the bed of the canal, of which 3,387 feet of length was completed this season. The piers were carried to the depth of 10 feet in the lake; the south pier 597 feet, and the north pier 515 feet long; and it was still deemed necessary to construct 200 feet additional on each side, in order to attain a depth of 12 feet at their ends.

An estimate was also made for a beacon-light-house, to be placed on the south pierhead, to cost - - - - - $2,800 00
And an estimate for completing the canal and piers - 31,462 37
The amount appropriated for the year was - - 30,000 00

1838.

There were excavated during the season 27,278 yards of earth from the body of the canal, and from between the piers in the lake, and there were yet to be removed about 19,000 yards, besides that which was contained in the dams. Two cribs on the north, and one on the south, were added to the piers; thus increasing their length by 60 feet and 30 feet.

The great height of the waters rendered it necessary to take measures for the protection of the lake shore on the north side of the canal; and accordingly, six cribs, loaded with stone, were placed there, and proved to be a very effectual security against the encroachment of water. It became necessary, too, for the reason just stated, to raise the timber walls of the canal, by placing upon them a range of twelve-inch square timber, well trenailed and secured by land ties.

An estimate, for completing the excavation of the canal and channel, for cutting across a point of land in the river, for the formation of a winding place for vessels, and for finishing the piers, was submitted with the annual report as follows:

For completing the canal and piers - - -	$21,900
For cutting across a point in the river - - -	20,520
For a winding place - - - - -	12,500
In all - - - - - - - -	54,920

The appropriation for the service of the year was $15,000, of which sum there was retained in the Treasury, December 31, 1838, $7,500, reserved under the act of July, 1838, for the service of the year 1839. It was liable, however, for existing claims, by which it would all be absorbed, and it may, therefore, be said, that the amount of all the appropriations, or $90,000, had been expended on the work at the close of this year.

The river Raisin is not less than 130 miles long, following its winding course through the counties of Jackson, Washtenaw, Lenawee, and Monroe; and it is one of the most important streams in the State, viewing it with reference, not only to its geographical position, but in connexion with its great hydraulic power—a power which has already been much improved, and has contributed, in no small degree, to the prosperity of the numerous towns which are growing up along its banks. Monroe, Dundee, Petersburg, Blissfield, Palmyra, Adrian, Tecumseh, Clinton, Manchester, are seated on the banks of the river Raisin. Their aggregate population is 10,000 souls. Monroe lies southwest of Detroit about 40 miles; it has a population of about 3,000, and possesses a woollen factory, two carding machines, an iron foundry, an edge-tool manufactory, a tannery, three saw mills, two flour mills, with eight run of stones, together with several storage and forwarding houses. The hydraulic power in the neighborhood is estimated to be sufficient to propel 350 run of stones. The mail route by land from Buffalo to Detroit passes through the town.

Many of the reasons which led to the erection of the work at the river Raisin, are to be seen in the preceding pages. They are given nearly in the language of the officer who framed the project, and who has had the general charge of its execution. The progress made on the work, and its cost, have already been stated. Setting aside La Plaisance bay, the objections to which have been noticed, this is the only work upon Lake Erie, within the State of Michigan, undertaken by the United States. It is at the termination of the Southern railroad of Michigan, a State work, intended to extend to New Buffalo, near the southern bend of Lake Michigan. It is also at the eastern end of the La Plaisance bay road, a work constructed by the United States. Doubtless, Monroe must become a place of much importance, when the several works we have named shall have been completed; for, situated as it is, at the head of the lake, and in a very fertile district of country, and lying upon the banks of a stream capable of furnishing a vast amount of water power, and being, as well as Maumee bay, upon the shortest line of communication between the heads of Lakes Erie and Michigan, it will become the commercial depot of a country of very considerable area, and a point through which will pass, at all seasons of the year, a very considerable portion of the travel between the east and west, and at other seasons, the landing place for much of the merchandise destined for the country lying west of Lake Michigan. The Michigan Southern railroad, which we have mentioned in connexion with this work, has been under construction for some time past, and is now being prosecuted under the expectation of the completion of the harbor at an early period. Half a million of dollars has been expended upon the road;—estimated to cost $1,500,000.

The breadth proposed to be given to the piers is the same as that given on the plans of the officer who originally projected the works. No breadth more suitable could well be substituted, inasmuch as it is enough for all the purposes of stability and convenience, without exceeding the limit prescribed by economy. The line of communication between the river and lake is also well chosen, and the width of the artificial channel is sufficient. We do not, therefore, propose, in these particulars, any change in the works at the river Raisin, and we have only to state the several modes which

have occurred to us as suitable for giving permanency to them, and the probable cost of each, and the cost of completing the unfinished portions of the original plan, remarking merely, that the lining of the sides of the canal ought to have all the strength and security required by the character of permanency which is now proposed to be given to them.

River Raisin harbor.

Year.	Estimate.		Appropriation.	Expenditure.	
	By whom made.	Amount.	Amount.	Amount.	Officer or agent superintending the expenditure.
1835	Capt. H. Smith -	$55,885 00	$30,000 00	$12,777 09	Capt. H. Smith.
1836	Do. -	60,660 00	15,000 00	26,633 21	Capt. H. Smith, J. Anderson, and H. Disbrow.
1837	Do. -	61,351 90	30,000 00	26,068 23	N. D. Curtis.
1838	N. H. Curtis -	31,462 37	15,000 00	7,207 66	N. D. Curtis, and H. Smith.

Estimate of funds required to complete the work.

First. To complete the new entrance into the river:

1. For 18 cribs of timber and stone to lengthen the piers in the lake to 16 feet water, each crib 30 feet long by 25 feet wide, average depth of water 12 feet, 6 feet above water, to cost, viz:

18 pieces of timber, 12 inches square, each 30 feet long, 540 feet, at 10 cents per foot -	$54 00	
12 pieces of timber 12 inches square, each 30 feet long; 360 feet, at 8 cents per foot - -	28 80	
90 ties, each 27 feet long, 10 inches by 10 inches, at $1 dollar each - - - -	90 00	
6 piles, each 28 feet long, 12 inches square; 168 feet, at 8 cents per foot - - -	13 44	
Trunnels and iron - - - -	10 00	
Stone, 100 cords, at $5 per cord - -	500 00	
Carpentry and other labor - - -	163 76	
Cost of 1 crib - - - - -	860 00	
18 cribs to cost - - - - -	15,480 00	
2d. For excavating with the spade in the body of the canal (forming the new entrance) the unfinished portion, 450 feet in length; 18.911 cubic yards, at 25 cents per yard -	4,727 75	
3d. For dredging the dams now remaining in the canal, 2,440 cubic yards, at 25 cents per yard	610 00	
4th. For dredging the remaining small bars in the river canal and lake, 25,560 cubic yards, at 25 cents per yard - - - -	6,390 00	
		$27,207 75

Second. To cut across Fisherman's bend in the river; length of cut 1,320 feet:		
1st. For materials and labor for walls of piles, timber and sheet piling, 2,640 feet in length -	$6,000 00	
2d. For excavating and removing 58,080 cubic yards of earth, including cost of dams and machinery, at 25 cents per yard - - -	14,520 00	
		$20,520 00
Third. To widen the river to enable boats to turn or wind:		
1st. For dredging 50,000 cubic yards, at 25 cents per yard -		12,500 00
To all of which add, as recommended by the board of inspection, 10 per cent. for contingencies - - -		6,022 77
The entire cost of completing the present work agreeably to the plans previously submitted - - - -		66,250 52
To this add modifications suggested by the board of inspection, viz: wood of the 18 new cribs, to be Kyanized to 6 feet below the present water's surface, 40,248 cubic feet of timber faces, ties and piles, at 12½ cents per foot - -		5,031 00
500 cubic yards of concrete for covering, 1 foot thick, at $6 per yard - - - - - - - -		3,000 00
Total, -		74,281 52

Estimate of amount required to render the river Raisin harbor permanent.

Cost of replacing the walls of the canal by walls of Kyanized timber and plank, (to be executed in 1848):		
1. 850 piles, 12 inches square, each 16 feet long; 13,600 feet, at 22½ cents per foot (Kyanized) -	$3,060 00	
2. 8,300 feet of timber caps, 12 inches square, at 22½ cents per foot (Kyanized) - -	1,867 50	
3. 132,800 feet, board measure, of 2-inch plank for sheet piling, at $10 per thousand - -	1,328 00	
Kyanizing 132,800 feet of plank, at 12½ cents per cubic foot - - - - -	1,383 00	
4. Driving the piles and sheet piling - -	3,500 00	
5. Carpentry and labor - - - -	2,500 00	
6. Land ties 800, 50 cents each - - -	400 00	
Kyanizing the same - - - -	889 00	
7. Carpentry and labor in placing land ties -	400 00	
		$15,327 50

Estimate of amount required to render the piers permanent.

1*st mode.* Cribs of timber Kyanized placed on foundation of cribwork loaded with stone:		
1. Cost of removing old work - - -	$3,000 00	
2. Face timber, 21,360 feet, 1 foot square, at 10 cents per foot - - - - -	2,136 00	
3. Ties, 18 feet long each, 377, at $1 per tie -	377 00	

4. Ties, 10 feet long each, 691, at 50 cents per face	$345 50	
5. Carpentry	2,858 50	
6. Kyanizing 31,632 feet of timber, at 12½ cents per foot	3,954 00	
7. Stone to fill, 1,201 cords, at $5 per cord	6,005 00	
Concrete for covering 521 yards, at $6 per yard	3,126 00	
Add 10 per cent. for contingencies	2,180 60	
Cost of 1st mode		$23,986 60

2d mode. Cribs of timber Kyanized, filled with concrete, the ties remaining:

1. Cost of removing old work as before	$3,000 00	
2. Face timber, 21,360 feet, 1 foot square, at 10 cents per foot	2,136 00	
3. Ties, each 18 feet long, 377, at $1 each	377 00	
4. Ties, each 10 feet long, 691, at 50 cents each	345 50	
5. Carpentry	2,858 50	
6. Kyanizing 31,632 feet of timber, at 12½ cents per foot	3,954 00	
7. Concrete for filling piers, 11,613 cubic yards, at $6 per yard	69,678 00	
8. Coffers	4,824 00	
Add 10 per cent. for contingencies	8,717 30	
Cost of 2d mode		$95,890 30

3d mode. Piers of solid concrete:

1. Concrete for piers, 11,613 cubic yards, at $6 per yard	$69,678 00	
2. Coffer dams for placing concrete	4,824 00	
Add 10 per cent. for contingencies	7,450 20	
Cost of 3d mode		$81,952 20

4th mode. Piers of blocks of stone, hammer-dressed, laid in cement, with solid concrete backing; the superstructure resting on a bed of concrete 6 feet thick, placed on foundation of cribwork:

1. Cut stone facing, 3,335 cubic yards, at $13 70 per yard	$45,689 50	
2. 8,278 cubic yards of concrete for base and backing, at $6 per yard	49,668 00	
3. Blocks cut stone for battlement wall, 714 cubic yards, at $13 70 per yard	9,781 80	
4. Caissons for concrete, at $3 per foot	4,824 00	
Add 10 per cent. for contingencies	10,996 33	
Cost of 4th mode		$120,959 63

Statement respecting the extent and cost of the works at the following places, September 30, 1829.

Names of works.	No. of running yards completed to Sept. 30, 1829.			Cost of works to Sept. 30, 1829.	No. of running yards yet to be completed.			Total No. of running yards when completed.			Estimates for 1830.	
	Pierwork.	Dikes.	Total.	Dollars.	Pierwork.	Dikes.	Total.	Pierwork.	Dikes.	Total.		Dollars.
Conneaut creek -	270	–	270	3,900 71	585	–	585	855	–	855	Continuing -	6,135 65*
Ashtabula creek -	615	–	615	16,587 87	240	–	240	855	–	855†		
Cunningham creek	137	–	137	5,298 81	34	–	34	171	–	171	Additional pier	1,430 90‡
Grand river -	821	–	821	16,263 81	107	–	107	928	–	928	Completing -	5,563 18†
Cleveland harbor -	688	150	838	16,085 76	150	–	150	838	150	988	Completing -	1,786 57†
Black river -	280	–	280	7,401 67	450	–	450	730	–	730	Continuing -	8,559 77*
Huron river -	680	–	680	14,718 37	200	–	200	880	–	880	Completing -	1,880 36†
La Plaisance bay -	420	–	420	5,222 26	–	–	–	420	–	420‖		

Similar statement for September 30, 1830.

Conneaut creek -	628	–	628	12,647 99	220	–	220	–	–	848	–	6,366 00§
Ashtabula creek -	715	–	715	24,127 78	130	–	130	–	–	845	–	7,013 66§
Cunningham creek	137	–	137	6,342 47	–	–	–	–	–	137		
Grand river -	788	–	788	21,478 36	100	–	100	–	–	888		
Cleveland harbor -	749	150	899	22,468 25	80	–	80	–	–	979	–	5,679 52§
Black river -	590	–	590	14,878 60	270	–	270	–	–	860	–	3,688 35§
Huron harbor -	815	–	815	17,227 34	150	–	150	–	–	965	–	9,274 45§
La Plaisance bay -	430	–	430	6,261 85	–	–	–	–	–	430	–	3,478 13§

*To be completed in 1831. †To be completed in 1830. ‡To be completed in 1829, as far as extended. ‖To be completed in 1829. §Estimate for 1831.

Statement respecting the extent and cost of the works at the following places, September 30, 1831.

Names of works.	No. of running yards completed to Sept. 30, 1831.			Cost of works to Sept. 30, 1831.	No. of running yards yet to be completed.			Total No. of running yards when completed.			Estimates for 1832.	
	Pierwork.	Dikes.	Total.	Dollars.	Pierwork.	Dikes.	Total.	Pierwork.	Dikes.	Total.		Dollars.
Conneaut creek -	750	–	750	18,753 91	80	–	80	–	–	830	–	7,800 00
Ashtabula creek -	825	–	825	26,992 40	–	–	–	–	–	825	–	2,762 77
Cunningham creek -	137	–	137	6,473 76	30	–	30	–	–	167	–	1,507 77
Grand river -	878	–	878	26,998 29	–	–	–	–	–	878	–	2,562 50
Cleveland harbor -	969	125	1,094	27,635 00	50	75	125	–	–	1,219	–	6,520 52
Black river -	750	–	750	23,316 31	100	–	100	–	–	850	–	8,017 66
Huron harbor -	965	–	965	19,752 23	100	–	100	–	–	1,065	–	1,428 88
La Plaisance bay -	430	–	430	6,295 81	270	–	270	–	–	700	–	7,841 00

Similar statement for September 30, 1833.

Conneaut creek -	837	–	837	26,694 22	–	–	–	–	–	–	–	3,500 00*
Ashtabula creek -	825	–	825	31,055 13								
Cunningham creek -	165	–	165	8,401 84								
Grand river -	878	–	878	27,195 69								
Cleveland harbor -	969	125	1,094	33,684 39								
Black river -	820	–	820	34,359 04								
Huron harbor -	965	–	965	24,727 71								
La Plaisance bay -	347	–	347	13,864 43								

*Estimate for 1834.

Statement showing the aggregate cost and amount appropriated, and the balances unexpended on the 1st April, 1839.

Names of works.	Appropriations to date.	Cost to date.	Balance unexpended.
Conneaut creek -	$43,305 65	$41,455 65	$1,850 00
Ashtabula creek -	64,149 75	60,664 15	3,485 60
Cunningham creek -	19,748 76	19,368 76	380 00
Grand river -	55,576 18	55,576 18	
Cleveland harbor -	124,406 56	95,977 56	28,429 00
Black river -	63,204 77	62,814 34	390 43
Vermillion river -	53,626 57	45,302 07	8,324 50
Huron harbor -	40,773 71	40,426 90	346 81
La Plaisance bay -	19,290 81	19,290 81	
River Raisin -	90,000 00	90,000 00	

Statement showing the present condition of the works at the following places, and the extent to which it is proposed permanently to improve them, June 1, 1839.

Names of works.	When commenced.	Present length of pier work, &c. completed.	To be yet completed.	Greatest and least depth between the piers.		Least depth of channel.			Length of pier to be made permanent.
				Inner.	Outer.	At date of commencement.	In 1833.	In 1839.	
		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Conneaut creek - -	1829	2,541	–	95	165	0 to 2	8	11	870
Ashtabula creek - -	1826	2,573	–	141	102	0 to 3	6½	7½	1,390
Cunningham creek - -	1826	995	–	495	275	–	Detached work, 10 to 18 feet.		
Grand river - -	1826	3,147	–	218	218	0 to 6 and 7	12	11	1,190
Cleveland harbor - -	1827	2,970	–	154	204	0 to 7	11	11	2,020
Black river - -	1828	2,492	–	170	226	3	7½	9½	1,280
Vermillion river - -	1836	2,250	950	155	135	0	0	6	3,100
Huron harbor - -	1826	2,987	–	150	130	0	8	9½	1,890
La Plaisance bay - -	1827	1,320	–	–	–	9	–	5 to 8	
River Raisin - -	1835	1,112 piers	788	100	–	0	0	0	1,900
Do. - -	–	3,387 canal	893	–	–	–	–	–	4,280

Aggregate of the estimates for completing and rendering permanent the following works.

Names of works.	Modes.	To complete the temporary works.	To render the works permanent.	Remarks.
Conneaut harbor	1st	–	$38,184 54	
Do.	2d	–	70,806 14	
Do.	3d	–	70,806 14	
Do.	4th	–	102,371 63	
Ashtabula harbor	1st	–	42,711 77	
Do.	2d	–	80,626 57	
Do.	3d	–	80,626 57	
Do.	4th	–	110,866 89	
Cunningham creek harbor				
Grand river harbor	1st	–	48,094 20	
Do.	2d	–	85,936 40	
Do.	3d	–	85,936 40	
Do.	4th	–	111,243 99	
Cleveland harbor	–	–	66,721 46	To complete permanent work.
Black river harbor	–	–	90,210 86	Do. do.
Huron harbor	1st	–	64,478 18	
Do.	2d	–	115,205 78	
Do.	3d	–	120,875 78	
Do.	4th	–	157,013 20	
Vermillion river harbor				
Do.	1st	–	42,545 20	
Do.	2d	–	136,978 00	
Do.	3d	–	150,840 20	
Do.	4th	–	194,453 03	
Do.	5th	–	161,066 28	
Do.	6th	–	162,425 13	
Do.	7th	–	137,191 13	
La Plaisance bay				
River Raisin	–	$74,281 52	..	Including a modification by board of inspection at a cost of $8,031.
River Raisin harbor	–	–	15,327 50	To render the harbor permanent.
Do.	–	–	23,986 60	To render the piers permanent.
Do.	–	–	95,890 30	Do. do.
Do.	–	–	81,952 20	Do. do.
Do.	–	–	120,959 63	Do. do.

In addition to the foregoing estimates, the following appropriations are recommended for the present year. They are for objects deemed very essential, and are believed to include every cent necessary for those objects.

Ashtabula harbor.

For removing the remainder of the rock bar - - - - - $9,080 50

Conneaut harbor.

Completing the winding basin - - - - - - - - 3,000 00

Cunningham creek.

Payment of arrearages, and for protection of public property - - - 800 00

To complete the work on the present plan, if such be the intentions per estimate of local agents - - - - - - - - - 22,061 00

La Plaisance bay.

To repair present work now falling to decay - - - - - 3,000 00

Statement showing the number of inhabitants in 1830, *and* 1839, *in the several counties of the State of Ohio, supposed to be more directly affected by the improvement of the harbors on the southern coast of Lake Erie, viz., in* 1830, *according to the census of that year, and in* 1839, *by estimation.*

Counties.	Census, 1830.	Estimated, 1839.	Remarks.
Ashtabula	14,584	24,000	Conneaut and Ashtabula harbors.
Geauga	15,813	32,000	Grand river and Cunningham harbors.
Trumbull	26,153	39,000	
Portage	18,826	38,000	
Cuyahoga	10,373	36,000	Cleveland harbor.
Medina	7,560	21,000	
Lorain	5,696	18,000	Black river harbor.
Huron and Erie	13,341	33,500	Huron and Vermillion harbors.
Sandusky	2,851	11,000	
Seneca	5,159	14,000	
Crawford	4,791	10,000	Constituted 1820, organized 1826.
Wood	1,102	6,000	
Lucas	–	7,000	Recently organized.
Stark	26,588	35,000	
Columbiana	35,592	37,000	
Wayne	23,330	33,000	
Richland	24,006	36,000	
Holmes	9,135	15,000	
Tuscarawas	14,298	20,000	
Coshoctin	11,161	18,500	
Licking	20,869	34,500	
Knox	17,085	28,000	
Marion	6,551	17,000	
Delaware	11,505	22,000	
Franklin	14,741	28,000	
Union	3,192	7,000	
Hancock	813	8,000	
Hardin	210	3,500	
Henry	262	2,500	
Putnam	230	4,000	
Allen	578	7,500	
Williams and Paulding	387	3,500	
Vanwert	–	1,000	Recently organized.
Mercer	1,110	4,500	
	347,892	655,000	

A statement exhibiting the rise of taxable property in the different counties included in the State of Ohio, from 1826 *up to* 1839, *from the assessors' returns.*

Names of counties.	1826.	1829.	1833.	1838.
Adams	$598,296	$609,803	$832,565	$903,215
Allen	2,737	–	51,214	298,204
Ashtabula	970,479	994,332	1,247,900	1,743,070
Athens	416,331	292,656	481,579	553,999
Belmont	895,049	938,370	1,591,716	1,850,947
Brown	993,960	995,668	1,358,944	1,692,143
Butler	1,575,477	1,613,927	2,504,007	2,896,571
Champaign	528,707	549,319	908,571	1,444,075
Clark	624,096	760,016	1,114,995	1,737,705
Clermont	1,053,469	1,074,142	1,542,627	2,054,610
Clinton	496,174	486,977	785,770	1,114,754

STATEMENT—Continued.

Names of counties.	1826.	1829.	1833.	1838.
Columbiana	–	$1,001,965	$1,491,099	$2,585,574
Coshocton	$569,035	571,585	850,708	1,114,754
Cuyahoga	1,032,494	1,076,047	1,401,599	4,089,767
Dark	134,259	123,804	260,259	1,454,469
Delaware	194,959	603,223	831,093	1,310,803
Fairfield	1,283,563	2,030,031	1,992,697	2,454,969
Fayette	320,312	346,442	544,539	653,919
Franklin	–	1,224,429	1,663,315	3,684,564
Gallia	254,967	246,593	427,962	483,384
Geauga	1,050,233	1,087,099	1,427,869	1,810,579
Greene	877,263	839,898	1,441,907	1,786,668
Guernsey	488,104	513,403	908,109	1,100,619
Hancock	–	8,358	50,929	257,849
Hamilton	33,224	4,666,247	7,726,091	9,854,909
Hardin	110,473	–	118,425	225,222
Harrison	576,545	611,446	1,025,210	1,123,132
Henry	–	–	–	81,652
Highland	674,608	691,077	1,055,863	1,386,005
Hocking	122,702	123,820	215,272	222,174
Holmes	293,694	306,574	557,060	794,161
Huron*	1,162,576	1,182,815	1,512,665	2,187,616
Jackson	65,322	66,516	197,932	222,634
Jefferson	1,085,995	1,114,827	1,885,064	2,074,704
Knox	836,397	855,443	1,252,294	1,565,556
Lawrence	136,703	136,180	241,782	317,662
Licking	1,396,883	1,462,072	2,110,491	2,769,654
Logan	315,659	434,254	519,622	1,142,845
Lorain	576,614	763,523	889,552	1,533,241
Madison	336,419	351,179	600,578	289,658
Marion	110,878	171,536	390,602	766,027
Medina	939,385	728,750	931,599	1,309,672
Meigs	252,146	268,957	380,172	347,989
Mercer	12,047	20,408	54,118	161,592
Miami	577,561	606,749	1,000,748	1,643,580
Monroe	119,871	134,937	280,572	416,743
Montgomery	1,324,849	1,428,038	2,293,419	2,231,886
Morgan	142,022	217,769	452,991	696,411
Muskingum	1,436,018	1,114,669	2,362,617	2,782,110
Perry	415,121	432,376	729,241	805,935
Pickaway	1,217,356	1,251,187	1,790,665	2,267,366
Pike	382,244	391,576	521,108	510,974
Paulding				
Portage	1,380,559	1,471,795	2,019,029	3,161,791
Putnam	–	–	–	805,935
Preble	587,458	608,896	1,086,322	1,409,064
Richland	–	762,973	1,354,189	2,356,247
Ross	2,101,200	2,115,550	2,897,605	3,495,640
Sandusky	49,502	136,571	275,992	595,735
Scioto	374,436	595,266	963,883	1,024,709
Seneca	2,724	168,662	302,089	950,141
Shelly	99,233	105,703	194,468	378,472
Stark	1,139,993	1,253,620	1,854,957	2,669,380
Trumbull	1,484,583	1,167,752	1,807,792	2,573,365
Tuscarawas	668,425	688,726	902,778	1,284,341
Union	302,272	318,592	380,535	
Vanwert	–	–	–	15,052
Warren	1,449,319	1,475,038	1,143,065	2,303,237
Washington	397,697	419,329	681,301	747,535
Wayne	–	893,204	1,451,996	1,999,369
Wood	68,489	70,762	1,207,562	431,018
Williams and Paulding	131	–	90,066	205,360
	39,719,257	49,767,511	75,421,355	105,214,712

* In 1838, Erie county was taken from Huron.

Note referred to at page 153.

We have remarked that the channels by which the trade of the upper lakes now connects with the seaboard and with the valley of the Mississippi, are the Welland canal and the Erie and Ohio canals. We have had recourse, therefore, to the returns made annually respecting the business of these canals for such facts as we supposed calculated to exhibit the value of the general commerce of the lakes. These will be found annexed to this note in the form of tabular statements. That for the Welland canal is for the years 1837 and 1838. We have also the quantities of some of the staple articles passing through it in the years 1832, 1833, and 1834, as follows:

WELLAND CANAL.

	In 1832.	In 1833.	In 1834.
Cubic feet of square timber			
Number of West India staves	146,136	161,792	392,055
Barrels of pork	5,422	9,611	23,422½
Barrels of salt	75,922	30,942	94,380
Bushels of wheat	155,170	229,675	264,919*
Tons of merchandise	1,032	1,323	1,880
Tons of mineral coal	–	–	400
Tonnage	–	–	37,917
Number of schooners	240	433	570
Number of boats and scows	175	287	334

ERIE CANAL.

Staple articles arriving at Buffalo, and passing east by the Erie Canal, during the following years:

Years.	Flour and wheat.	Pork, &c.	Tobacco.	Butter & lard.	Ashes.	Lumber.	Corn.	Property passing east from other States.
	Tons.	Bbls.	Tons.	Tons.	Tons.	Feet.	Barrels.	Tons.
1829	577½	4,754	32	70	1,705	311,256		
1830	12,384½	6,675	62	174	2,713	136,499		
1831	3,435½	5,668	222	205	2,502	184,639		
1832	5,391½	5,159	386	394	2,110	251,504		
1833	11,926	4,273	535	449	2,118	331,140		
1834	12,421	14,590	1,009	119	1,655	439,643		
1835	15,935½	8,160	1,765½	503	1,694	2,087,024	12,193	22,124
1836	24,159	7,385	1,897½	626	1,752½	–	–	36,273
1837	27,205½	24,414	608	550	2,080	1,499,348	–	42,299
1838	57,979	–	–	–	–	–	–	68,187

* Of this quantity of wheat, only 1,800 bushels British, and 2,200 bushels American, went to Montreal; the rest went to Oswego for the New York market.

We annex for the years 1834 and 1835 a fuller statement:

		1834.	1835.
Wheat	bushels	111,798	168,012
Corn	do.	–	12,193
Flour	barrels	79,324	100,833
Provisions, beef and pork	do.	14,590	8,160
Oil	do.	221	
Fish	do.	346	732
Whiskey	do.	1,347	614
Ashes	tons	1,655	7,304
Tobacco	do.	1,008	1,765
Pig-iron	do.	1,128	997
Casting	do.	689	768
Household furniture	do.	145	355
Furs	do.	154	136
Butter and lard	do.	119	503
Cheese	do.	138	34
Wool	do.	73	93
Deer skins and raw hides	do.	141	207
Grindstones	do.	126	135
Sundries	do.	–	242
Timber	feet	–	61,430
Lumber	do.	439,643	2,087,024
Shingles	M.	–	74,062
Staves	do.	2,400	2,694

Statement of property arriving at Buffalo from the east, on the Erie canal, during the following named years.

Years.	Merchandise for the State of New York.	Merchandise destined out of the State.	Furniture and tools.	Foreign hides.	Sundries.	Salt.
	Tons.	Tons.	Tons.	Tons.	Tons.	Barrels.
1829	2,270	4,881	935	–	470	65,431
1830	2,972	6,061	1,832	–	389	75,370
1831	4,620	9,435	2,849	–	275	74,064
1832	4,351	8,780	2,918	163	251	61,335
1833	6,451	14,341	4,257	180	536	70,929
1834	6,628	17,401	4,149	–	860	84,101
1835	11,239	18,460	5,434	–	–	79,385
1836	–	30,874				
1837	7,771	22,236	5,962	–	–	105,528
1838	–	32,087				

In 1837 there was received at Buffalo by the Erie canal, and shipped to other States:

Merchandise	44,459,329	pounds
Furniture	10,675,844	do.
Iron ware	570,407	do.
Stone coal	8,345	do.
Other articles	181,735	do.
Salt	79,146	barrels.

Note.—We have not the reports of the commissioners of the New York canals for 1836 and 1837, and cannot therefore make these statements as perfect as we could wish. The States to which merchandise is destined are enumerated in the body of our report.

OHIO CANAL.

We have given statements of the business of the Ohio canal at Cleveland for the years 1830, 1836, 1837, and 1838, as also at Portsmouth, on the Ohio river, and we have remarked the proportion of the business of the canal which seeks a market by the lake route. The following statement, which we copy from a western publication, and which we have verified by a comparison of its details with official statements, is inserted for the purpose of sustaining what we have said on this point.

	At Portsmouth.	At Cleveland.
Wheat in 1835	1,154 bushels	387,232 bushels
1836	No return.	464,756 bushels
1837	735 bushels	548,697 bushels
1838	2,368 bushels	1,229,002 bushels
Corn in 1835	40,510 bushels	53,373 bushels
1836	No return.	392,281 bushels
1837	3,199 bushels	280,374 bushels
1838	8,768 bushels	107,514 bushels
Flour in 1836	No return.	167,539 barrels
1837	13,546 barrels	207,593 barrels
1838	13,898 barrels	287,465 barrels
Pork in 1835	No return.	No return.
1836	No return.	13,496 barrels
1837	13,372 barrels	43,513 barrels
1837	308,740 pounds	2,808,766 pounds
1838	12,463 barrels	39,055 barrels
1838	276,843 pounds	1,542,532 pounds
Lard in 1835	No return.	522,498 pounds
1836	No return.	636,409 pounds
1837	222,800 pounds	1,555,536 pounds
1838	987,122 pounds	1,157,109 pounds
Butter in 1835	807,875 pounds	490,989 pounds
1836	No return.	900,419 pounds
1837	4,600 pounds	773,642 pounds
1838	1,689 pounds	606,844 pounds

Statement of merchandise passing from the Erie canal, through Buffalo, destined for the following-named States:

	In the year 1835.	In the year 1837.
Virginia	2,763	–
Missouri	58,846	29,566
Tennessee	333,766	46,542
Alabama	59,831	2,487
Upper Canada	95,768	36,026
Pennsylvania	1,392,319	1,609,174
Michigan	13,254,209	16,677,244
Indiana	3,254,986	2,195,302
Illinois	3,320,718	3,828,162
Ohio	14,239,879	19,183,693
Kentucky	918,915	119,978
Wisconsin	–	731,155

The property from other States, passing into the Erie canal, at Buffalo, during the following years, was

In 1835	22,124 tons
1836	36,273 "
1837	42,229 "
1838	68,187 "

And the merchandise passing to the west, was

In 1835	18,466 tons
1836	30,874 "
1837	22,236 "
1838	32,087 "

Showing a great diminution of trade westward, in the year 1837, attributable to the general depression of business, characteristic of that year.

Statement of the amount of most of the different kinds of property which arrived at, or was cleared from, Cleveland, by way of the Ohio canal, during the years 1830, 1836, 1837, *and* 1838.

Articles.	Arrived.				Cleared.			
	1830.	1836.	1837.	1838.	1830.	1836.	1837.	1838.
Flour, barrels	32,988	167,539	203,691	287,465				
Pork, do.	873	13,496	42,057	39,055				
Whiskey, do.	2,442	7,257	11,886	10,859				
Salt, do.	–	–	–	–	23,404	22,334	62,977	63,465
Fish, do.	–	–	–	–	4,482	4,082	6,026	7,504
Linseed oil, do.	–	336	130	82				
Wheat, bushels	176,689	464,756	549,141	1,229,012				
Flaxseed, do.	–	11,562	8,036	6,071				
Corn, do.	–	392,281	280,234	107,514				
Oats, do.	–	–	87,895	22,088				
Mineral coal, do.	5,100	84,924	183,484	73,292				
Pork and bacon, in bulk, pounds	–	–	2,812,009	1,542,532				
Butter, do.	–	900,419	753,294	606,844				
Lard, do.	–	636,409	1,527,610	1,157,109				
Cheese, do.	–	74,880	35,500	12,638				
Pig iron, do.	–	1,031,568	1,017,847	1,000,784				
Gypsum, do.	–	–	–	–	190,400	1,548,289	1,552,083	1,975,373
Pot and pearl ashes do.	–	34,829	102,220	68,955				
Merchandise, including iron nails, furniture, and extra baggage, pounds	–	–	–	–	3,272,640	14,708,361	10,757,386	18,875,286
Rough stone, perch	–	6,816	3,875	441				
Lumber, feet	–	1,235,186	757,076	65,376	–	294,652	1,723,532	1,944,802
Shingles, number	–	–	–	–	–	1,351,000	2,541,000	3,448,250
Tobacco, hogsheads	–	3,851	1,445	357				
Millstones, pairs	–	–	–	–	–	28½	26	47

A statement of the amount of most of the different kinds of property which arrived at, or was cleared from, Portsmouth, by way of the Ohio canal, during the years 1830, 1836, 1837, *and* 1838.

Articles.	Arrived.				Cleared.			
	1830.	1836.	1837.	1838.	1830.	1836.	1837.	1838.
Flour, barrels	–	–	13,546	13,898	–	–	1,559	1,186
Pork, do.	–	–	13,372	12,463	–	–	1,867	1,928
Whiskey, do.	–	–	2,621	3,556	–	–	–	493
Salt, do.	–	–	154	898	–	–	6,457	3,236
Wheat, bushels	–	–	735	2,368	–	–	–	589
Corn, do.	–	–	3,197	8,768	–	–	6,703	2,981
Oats, do.	–	–	–	–	–	–	420	
Mineral coal, do.	–	–	–	–	–	–	15,543	16,892
Bran and shorts, do.	–	–	4,010					
Pork and bacon, in bulk, pounds	–	–	308,740	276,843	–	–	441,726	
Butter, do.	–	–	4,650	1,689				
Lard, do.	–	–	222,800	987,122	–	–	16,500	1,763
Cheese, do.	–	–	–	7,864	–	–	–	9,800
Tallow and candles, do.	–	–	–	–	–	–	16,799	
Dried fruit, do.	–	–	–	789				
Pig iron, do.	–	–	–	–	–	–	878,158	1,087,851
Castings, do.	–	–	2,458	–	–	–	31,151	48,834
Blooms, do.	–	–	16,614	–	–	–	73,699	
Pot and pearl ashes, do.	–	–	–	1,896				
Merchandise, do.	–	–	–	4,855,609	–	–	3,487,271	3,763,398
Iron and nails, do.	–	–	–	–	–	–	585,186	2,768,761
Feathers, do.	–	–	1,441	984				
Cotton yarn, do.	–	–	–	–	–	–	7,911	10,896
Furs and peltries, do.	–	–	–	–	–	–	4,475	1,798
Hides and skins, do.	–	–	–	–	–	–	140,805	190,706
Lumber, feet	–	–	31,043	8,944	–	–	421,646	17,647
Shingles, number	–	–	–	–	–	–	478,000	1,847,000
Tobacco, hogsheads	–	–	–	–	–	–	–	283

Statement of the principal articles passing on the Welland canal during the years 1837 *and* 1838.

Articles.	1837.	1838.
Boards, feet	3,343,510	1,228,780
Square timber, cubic feet	106,335	232,147
Pipe staves, number of	665,825	452,522
West India staves, do.	704,648	1,158,461
Flour, barrels	6,869½	49,082
Pork, do.	10,395½	8,760½
Salt, do.	101,260	101,807½
Lard, do.	288	572
Whiskey, do.	260	274
Ashes, do.	200	255
Wheat, bushels	208,242½	414,919
Corn, do.	47,517	24,566
Barley, do.	524	730
Potatoes, do.	18,663	
Merchandise, tons	2,697.14.1	2,779. 4
Furniture and baggage, do.	216.10	137.11
Coal, do.	755.15	843.15
Iron, do.	112	174
Gypsum and plaster, do.	580	737. 8
Tobacco, do.	110. 6	
Tonnage, amount	80,697	95,397

Statement showing the number of steamboats on Lakes Erie, Michigan, and Superior, together with their amount of tonnage, and value.

	Names.	Tons. 95ths.	Value.	To what port belonging.
Steamboat	Cleveland	579.68	$80,000	Cleveland.
"	Cincinnati	159.18	12,000	"
"	Star	–	21,000	"
"	New York	325.32	20,000	"
"	United States	366.80	30,000	"
"	Bunker Hill	457.39	40,000	"
"	Rochester	472.41	40,000	"
"	North America	361.45	30,000	"
"	Lexington	363.53	30,000	"
"	James Madison	630.43	75,000	"
"	Fair Pert	259.00	18,000	"
"	Constitution	443.52	47,000	"
"	Robert Fulton	368.43	20,000	"
"	Constellation	483.60	60,000	"
"	Columbus	391.58	40,000	"
"	Pennsylvania	305.24	20,000	"
"	Chesapeake	418.00	40,000	"
"	W. F. P. Tailor	95.36	10,000	Buffalo.
"	Governor Marcy	161.80	12,000	"
"	Daniel Webster	358.10	40,000	"
"	Ohio	187.87	10,000	"
"	Charles Townsend	312.58	12,000	"
"	Red Jacket	200.00	15,000	"
"	Mazeppa	50.54	5,000	"
"	De Witt Clinton	413.00	35,000	"
"	Victory	87.67	5,000	"
"	Wisconsin	500.00	65,000	"
"	Milwaukie	550.00	50,000	"
"	Buffalo	600.00	80,000	"
"	Chatauque	340.00	22,000	"
"	Erie	500.00	80,000	Presque Isle.
"	Thomas Jefferson	428.68	50,000	"
"	William Peacock	120.00	5,000	"
"	Andrew Jackson	49.35	3,000	"

STATEMENT—Continued.

	Names.	Tons. 95ths.	Value.	To what port belonging.
Steamboat	Oliver Neuberry	170.12	$6,000	Miami.
"	Oliver H. Perry	352.25	35,000	"
"	Governor Vance	60.00	5,000	"
"	Commercial	58.00	8,000	"
"	Sandusky	377.12	50,000	Sandusky.
"	Great Western	800.00	100,000	"
"	Michigan	472.75	60,000	Detroit.
"	Monroe	341.27	35,000	"
"	Uncle Sam	220.74	18,000	"
"	Chicago	186.00	12,000	"
"	Niagara	216.00	15,000	"
"	Detroit	137.66	13,000	"
"	Erie	149.35	20,000	"
"	General Brady	65.09	8,000	"
"	General Gratiot	62.64	5,500	"
"	Don Quixote	51.27	5,000	"
"	United	30.48	3,000	"
"	Lady of the Lakes	26.16	3,000	"
"	Water Witch	16.59	2,000	"
"	Cincinnati	16.60	2,000	"
"	Argo	8.79	1,000	"
"	Mazeppa	50.58	6,000	"
"	Vermillion	400.00	40,000	"
"	Illinois	800.00	120,000	"
"	Macomb	186.00	12,500	"
"	General Scott	324.00	22,000	"
"	John Marshall	60.00	7,200	Maumee.
		17,324.92	1,741,200	

There are two or three small steamboats not included in this list.

Statement showing the number of ships, brigs, and schooners on Lakes Erie, Michigan, and Superior, together with their amount of tonnage and value.

Ships, brigs, schooners, &c.	No.	Tons. 95ths.	Value.	To what port belonging.
Ships	1	260.16	$8,000	Cleveland.
Brigs	2	261.92	13,000	"
Schooners	51	4,207.12	150,000	"
Ships	3	685.85	36,000	Buffalo.
Brigs	3	677.93	27,000	"
Barks	1	245.41	8,000	"
Schooners	52	4,368.11	168,000	"
Schooners	9	652.29	38,000	Presque Isle.
Schooners	5	356.42	10,400	Miami.
Brigs	3	559.68	23,000	Detroit.
Schooners and sloops	80	4,730.73	120,000	"
Schooners and sloops	15	792.75	58,000	Sandusky.
Total ships, brigs, sch'rs and sloops	225	17,988.67	658,400	
Do. steamboats	61	17,324.92	1,741,200	

SANDUSKY BAY.

SANDUSKY, *July* 14, 1839.

GENTLEMEN: We have ventured to lay before you the following view of our position and business, with the hope of drawing your favorable attention to the present state of our bay and harbor.

The advantageous position of Sandusky bay, with reference to an intercourse with the interior of the country, may be seen at a glance by looking on the map. Affording the only natural harbor on the southern shore of Lake Erie from Buffalo to Detroit river, (unless indeed we except Maumee bay and river,) capable, without artificial aids, of accommodating the navigation of the lake, it early attracted the attention of the business public, as being the nearest connecting point between the lake country and the great Mississippi valley at Cincinnati.

The position of the latter town, situated on the most northern bend of the Ohio river, at the head of steamboat navigation during the summer months, gave to Sandusky an early notoriety in the commerce of the lakes. It threw into her harbors almost the entire transportation and travel between New York and the western States. This advantage, amounting in effect to a monopoly, she continued to enjoy until the completion of the Ohio canal, and the consequent improvement of the harbor at the mouth of Cuyahoga creek. This directed her trade into other channels, and deprived her of the enjoyment of the advantages of her position. These discouragements, however, have not been sufficient to repress the energies of her citizens, nor to cast entirely into the shade her superior position for commerce, for shipbuilding, and interior communication; for the reason, that the points brought into notice, and the work constructed, did not fully answer the expectations and wants of the business community.

As a consequence, we see the citizens of the south pledging their credit for the construction of work intended to remedy these defects; and the citizens of the north, backed by the legislative voice joining in a common effort to correct the errors committed. The River and Lake Erie railroad (now in a course of construction) will reach from Sandusky to Dayton, on the Miami canal, 65 miles above Cincinnati, affording a communication, free of river obstructions, directly into the heart of the city. The city of Cincinnati, in addition, has lent her credit largely to a company now actively engaged in the construction of a railroad up the valley of the little Maumee river, to intersect the Mad river and Lake Erie railroad at Springfield, on the national road, a distance of 85 miles; making the whole distance from Cincinnati to Sandusky, by this route, 211 miles. The route by way of Dayton and the Miami canal, is 216 miles; while the distance from Cleveland to Cincinnati, by way of the Ohio canal, is 412 miles.

If your attention has never been drawn to these facts, you will be able, on reflection, fully to understand the reasons which have guided the southern portion of the State, as indicated above. Cincinnati being the focal point for the whole commerce of the valley attached to the Ohio river, it is not enough that a connexion from the north is formed with the river; the head of the market must be reached, at least the head of navigation for steamboats, on the river should be aimed at.

In addition to these improvements, there is a survey for a canal now in progress, from this point to Columbus. And there is already in operation a railroad from Sandusky to Monroeville, 15 miles, reaching the great east and west road between Cleveland and Detroit.

A separate charter has been promised for the extension of this road to Mansfield, in Richland county, with a prospect of its construction and further extension to Columbus or Newark, on the Ohio canal.

These artificial facilities, a bay and river navigation of 36 miles into the interior, to lower Sandusky, will give you some idea of our expectations, and of the claim we may reasonably set up for the aid of the General Government in securing to us our harbor facilities.

The unexampled high water in the great northern lakes for the last few years, has made sensible encroachment on the natural defences of our harbor. Its chops are formed, as you are aware, by cedar points putting out from the main land, and peninsula points extending southeasterly from the peninsula which forms the northern shore of our bay. During the past year several breaches have been made through the defences, by the action of the water, similar to that made through the peninsula at the head of Erie harbor. In our opinion, these breaches should be closed, to prevent the filling up of the bay by the influx of sand during heavy gales, which, in time, might sensibly affect the entrance channel. There can be no doubt that a contraction of the mouth of the harbor, to the width of its navigable channel, might be of service in deepening its waters; although, at present, no difficulty is experienced from this source. This, however, is a matter which we refer to your superior knowledge.

For a national depot in case of war, for shipbuilding and repairs, or for the establishment of a marine hospital, in our judgment, no point on the lakes offers greater inducements. For the latter object Bull's island, embracing a surface of about 300 acres, situated opposite the town, within the bay, possesses the requisites for such an establishment, in a degree unequalled on the whole southern shore. The main land in and about the town being situated upon an elevated limestone plain, airy and healthy, makes it a point of great desirableness and beauty for public establishments. The shores of the bay and river are studded with the finest oak timber in the west for ship building, inexhaustible in quantity, and unsurpassed in quality, according to the uniform testimony of builders, inferior only to the live-oak of the more southern regions. For defence against a hostile attack the facilities are abundant and easily available. The interior navigation afforded by Sandusky bay and river, it will be perceived, adds much to them. This is a subject, however, on which we need not dwell.

In case of war, with the completion of the improvement already mentioned, striking the Ohio river at its highest navigable point at all seasons; opening, by means of the Ohio, Mississippi, and Missouri rivers, and their numerous tributaries, a rapid and uninterrupted communication with the remotest points of the whole country, the peculiar advantages of Sandusky for a grand depot of military stores cannot but forcibly arrest your attention.

When to the works already mentioned we add the Charleston (South Carolina) railroad, reaching Cincinnati at the north, direct, or by a junction with the Tennessee river below the Muscle shoals, enough has been said to enable you to determine this branch of inquiry for yourselves, without further illustration from us.

In the suggestions we have ventured to make on the subject of harbor improvements, our limited knowledge of the extent of the works needed, and the ordinary cost of erection, render it quite impossible for us to state the probable cost of such improvements. For materials, however, the ex-

pense will fall much below what it would be at any other point on the lake. Abundance of timber can be obtained close at hand, and brought prepared for the works entirely by water. Of stone, the supplies for building purposes for almost the whole lake shore, are obtained at this point, and may be had for the public use at prices which would hardly cover the expense paid for quarrying at other places. With these general facts, your critical knowledge will enable you to form quite satisfactory estimates.

The population and local trade of Sandusky are of course subjects of interest in inquiries of this nature. The former may be stated in round numbers (although believed to exceed it) at 200 souls.

Its local trade does not differ in kind from that of other towns, except that it embraces in its aggregate large quantities of prepared stone for canal locks and housebuilding, and a rich supply of gypsum of an excellent quality, obtained on the peninsula opposite this town. The fisheries of the bay yield, annually, from ten to twelve hundred barrels, the average market price of which is about eight dollars. So various is this trade, that its amount cannot, with much certainty, be estimated. A bank with a capital of $100,000 is found wholly inadequate to furnish the requisite exchanges and other facilities for carrying it on. The three items last referred to, have alone yielded for the last year an amount not less than $125,000.

The sales of salt, pork, whiskey, flour, and steamboat wood, for domestic consumption in 1832, was very limited. The business of Sandusky at this time began to feel sensibly the effects of the canal improvements of the State.

In 1837 these items, from an examination of the books of the principal dealers, are estimated at $45,300. In 1838, at $91,000.

We subjoin a comparative statement of the principal exports and imports of Sandusky for the years 1832, 1837, and 1838.

These years are selected as affording the best exhibits of the business of the town, under the new influences brought into existence by the operations of the canal system of the State.

Exports.

Year.	Whiskey.	Pork.	Grass seed.	Flour.	Ashes.	Peltries.	Cranberrys	Wheat.	Butter.	Lard.
	Bbls.	Bbls.	Bbls.	Bbls.	Casks.	Packs	Bbls.	Bushels.	Kegs.	Kegs.
1832	331	1,995	321	598	498	27	75	5,000	700	350
1837	398	4,881	47	1,298	508	169	377	24,500	820	782
1839	1,023	8,452	360	3,158	670	510	264	139,120	2,582	1,620

This table might be extended by adding thereto a variety of articles, such as wool, leather, beeswax, bacon, &c., &c. But on a comparison of the different years, it appears that the aggregate did not vary materially, and may be estimated at a value of about $10,000 each year.

Imports.

Year.	Merchandise.	Castings, mill stones.	Household furniture and sundries.	Salt.
	Tons.	Tons.	Tons.	Barrels.
1832 - - -	608	80	58	4,300
1837 - - -	1,214	260	270	5,664
1838 - - -	2,790	310	407	10,915

An attempt to estimate the exports and imports presents some difficulties. The question suggests itself whether it would be proper to embrace business that enters our bay, or confine ourselves to the town of Sandusky. The manufacture of flour is extensively carried on at Lower Sandusky, and at Venice. From the latter place especially, large shipments are annually made, and the exports from Lower Sandusky embrace not only flour, but large quantities of wheat, corn, ashes, and staves. The capital employed at these points in the purchase of wheat alone cannot be less than $130,000. At both places the imports are highly respectable, intended for the supply of a rich and thriving region. Our harbor improvements would be alike for their accommodation as well as for our own. In presenting this hasty and imperfect view of the present and prospective conditions of Sandusky, we are aware that the exhibits of the business now transacted in our town must compare unfavorably with several ports on the lake. A comparative statement ten years back, however, would place us quite at the head of the list. We look forward to the time when our improvements shall be completed, when a like comparison will restore us to our former relative condition.

It is with the greatest confidence, therefore, that we bespeak a favorable consideration at your hands on behalf of the Government in advising future improvements on the lake shore.

We are, gentlemen, with considerations of high respect, your obedient servants, &c.,

O. FOLLETT,
HOLLISTER & BOALT,
CASWELL & MILLS,
JOHN G. CAMP.

Lieut. Col. JAS. KEARNEY,
Maj. HENRY SMITH, Maj. JOHN R. BOWES,
Commissioners under the act of Congress, providing for the examinations of harbors of Lake Erie.

BREST HARBOR.

BREST, MICHIGAN, *July* 1, 1839.

GENTLEMEN: The undersigned, residents and proprietors of the village of Brest, in the county of Monroe and State of Michigan, learning that you

are in session by order of the proper department at Washington, among other duties for the purpose of investigating the relative merits of the harbors of Lake Erie, respectfully beg leave to state:

That the village of Brest is situated on both sides of Stony creek, at its junction with Lake Erie, (and at the head of the same,) on a dry and sufficiently elevated table of land to render it pleasant and healthy. The bay or harbor of Brest is formed by Stony and Raisin point.

Stony point is a bold and high promontory, projecting nearly three miles into the lake, and protecting it securely from north and northeasterly winds, (the latter of which is the only wind which creates a heavy sea or swell at this end of the lake,) while the Raisin point, on the southwest, protects it from the west and southwesterly winds, and with Stony point, forms an inland bay of nearly three miles in depth with soundings from ten to twenty feet water, and accessible at all points from the lake. On the west, north, and south, it is surrounded by a section of country not surpassed in richness or fertility of soil in the State; when connected with the two important thoroughfares through the State (the central and southern railroads) by a road which is now building a distance of about thirty miles to connect with both, it will much shorten the distance in the great line of commercial communication between New York and the far west, and obviate the hazard of those delays which often occur from the head winds in ascending the Detroit river. The proprietors of the town of Brest have already expended about $30,000 in the building of a pier and warehouse, which are nearly completed; making it already accessible for the largest boats and vessels sailing the lakes.

But to make this harbor perfect and one of the largest and best on the lake, it requires another pier of less length and expense, together with some excavation of earth between the piers, to admit vessels into the mouth of the creek. The village now contains about fifty good frame buildings, one and a half, two, and some three stories high—nearly all of said improvements have been made in the short space of two years. And to explain the cause of so long a delay in the commencement of business at such an important point, we would briefly state: That agreeably to the French history of this section of country, this bay was selected by the first French pioneers who located upon rivers and borders of the lake, as the only point for a good and convenient harbor (directly on the waters of the lake) between Maumee bay and Detroit river, and accordingly commenced the building of a town, which, previous to the last war, was a place of considerable trade and commerce; but, during the war, was entirely destroyed by fire. After which period unavoidable obstacles prevented its resuscitation until the present time. We deem it unnecessary to go into further particulars, presuming the knowledge you have of the geography of the country, particularly that of the lake coast, is sufficient to satisfy you of the great importance to Government of a good harbor at this end of the lake, in case of war with Great Britain, as well as to facilitate the trade and commerce from the far west, it being sufficiently spacious to receive a large fleet with safety, and a convenient distance from our boundary line with the upper province of Canada.

With this brief statement of facts we submit the subject to your honorable body, trusting you will give it that attention its merits and importance require.

In behalf of the citizens and proprietors we subscribe ourselves your obedient servants,

H. S. PLATT,	A. LAPELL,
THOS. WHELPLEY,	P. PHILLIPS,
DANIEL GOODNOW,	J. H. BENEDIT,
H. BLAKELY,	LEONARD STODDART.

To the BOARD OF INSPECTORS *of lake harbors at Detroit.*

N. B. In addition to the above, we are authorized to state, relative to the railroad forming the connecting link of the southern and central roads with Lake Erie, that part of the road between Brest and the city of Monroe (a distance of about five miles) which, as a continuation or branch of the southern road, is now under contract to be completed on or before the first day of September next.

A.

Statement showing the amount applicable to expenditure, and the amount expended in the service of the Topographical Bureau during the year ending September 30, 1839.

Names of appropriations.	Balance undrawn from the Treasury September 30, 1838.	Balance in the hands of disbursing agents at that date.	Additional sum appropriated during the ensuing session of Congress.	Amount added by sales and rents of public property.	Total amount under each head of appropriation applicable to expenditure in this bureau.
Construction of a harbor at Michigan City, Indiana	$41,897 59	$5,714 01		-	$47,611 60
Construction of a breakwater at the mouth of the river St. Joseph, Michigan	32,329 00	2,148 18		$318 00	34,795 18
Improvement of the harbor at the mouth of Black river, New York	15,270 00	275 26		37 00	15,582 26
Improvement of the harbor of Whitehall, New York	12,500 00	810 10		-	13,310 10
Improvement of the harbor at the mouth of Vermillion river, Ohio	16,126 57	107 97		143 75	16,378 29
Improvement of the harbor of Portland, Lake Erie, New York	23,219 00	-		19 00	23,238 00
Improvement of the harbor at Cattaraugus creek, New York	20,369 00	-		-	20,369 00
Improvement of the harbor of Salmon river, Lake Ontario, New York	21,919 00	4,860 32		-	26,779 32
Construction of a breakwater at Plattsburg, New York	18,363 00	1,595 73		-	19,958 73
Construction of a breakwater at Burlington, Vermont	37,000 00	-		-	37,000 00
Deepening the channel between the north and south Hero islands, Vermont	7,250 00	636 79		-	7,886 79
Roads and canals	600 85	1,661 14		-	2,261 99
Surveys of a military character	9,281 61	1,622 76		-	10,904 37
Improvement of the harbor of Presque Isle, Pennsylvania	21,400 00	-		126 82	21,526 82
Improvement of Dunkirk harbor, New York	3,500 00	215 81		57 50	3,773 31
Deepening the channel of the river Thames, Connecticut	5,500 00	284 59		322 67	6,107 26
Improving the harbor of Westport, Connecticut	5,816 00	120 70		-	5,936 70
Continuing the works at Buffalo harbor, New York	10,250 00	-		-	10,250 00
Sea-wall, separating Lake Erie from Buffalo creek	33,000 00	4,843 32		-	37,843 32
Sea-wall for the preservation of Fairweather island	16,550 00	267 37		-	16,817 37
Improving the harbor of New Bedford, Massachusetts	7,191 37	404 71		-	7,596 08
Improving the harbor of Saybrook, Connecticut	15,710 00	-		-	15,710 00
Improvement of the harbor of Chicago, Illinois	21,000 00	-		-	21,000 00
Removing obstructions at Grand river, Ohio	2,852 00	2,800 00		-	5,652 00

Removing obstructions at Cunningham creek, Ohio	-	250 71	-	-	250 71
Placing buoys in the vicinity of the monument on Steele's ledge, Maine	-	630 78	-	-	630 78
Continuing the pier at Kennebunk, Maine	5,575 00	300 92	-	32 50	5,908 42
Constructing a breakwater on Stamford's ledge, Portland harbor, Maine	21,368 00	5,520 55	-	-	26,888 55
Breakwater at the mouth of Merrimac river, Massachusetts	-	3,750 47	-	-	3,750 47
Breakwater at Sandy bay, Massachusetts	15,000 00	192 24	-	-	15,192 24
Preservation of Plymouth beach, Massachusetts	1,200 00	-	-	-	1,200 00
Preservation of the point of land leading to the fort and light-house at the gurnet in Duxbury, Massachusetts	500 00	1,597 24	-	-	2,097 24
Preservation of the beach at Provincetown harbor, Massachusetts	4,500 00	91 09	-	-	4,591 09
Improvement of the harbor at the mouth of Bass river, Massachusetts	8,580 00	237 93	-	-	8,817 93
Breakwater at Hyannis harbor, Massachusetts	8,764 00	-	-	-	8,764 00
Breakwater at Church's cove, Rhode Island	17,400 00	40 91	-	-	17,440 91
Improving the harbor of New Brunswick, New Jersey	-	2,672 80	-	-	2,672 80
Improving Little Egg harbor	10,000 00	-	-	-	10,000 00
Repairs at the harbor of Chester, Pennsylvania	-	110 98	-	-	110 98
Improving the harbor of New Castle, Delaware	4,573 00	4,680 69	-	-	9,253 69
Improving the harbor of Wilmington, Delaware	11,356 00	460 34	-	-	11,816 34
Deepening the harbor of Baltimore, Maryland	13,989 00	559 38	-	-	14,548 38
Improving the natural channels at the northern and southern entrances of the Dismal Swamp canal	11,276 54	2,406 39	-	-	13,682 93
Removing a sand-shoal in Pamlico river, below Wilmington, North Carolina	4,000 00	1,168 65	-	-	5,168 65
Opening a passage between the town of Beaufort and Pamlico sound, and improving New river	12,500 00	-	-	511 53	13,011 53
Improvement of Cape Fear river below Wilmington, North Carolina	19,000 00	1,615 11	-	154 62	20,805 73
Improving the navigation of Savannah river, Georgia	15,000 00	2,509 12	-	27 75	17,536 87
Improving the inland channel between St. Marys and St. Johns, Florida	27,601 07	2,949 29	-	3 60	30,553 96
Improving the harbor of Mobile, Alabama	94,500 00	23,189 37	-	-	117,689 37
Removing a mud-shoal in the east pass to Appalachicola, Florida	-	-	$9,900 00	-	9,900 00
Deepening the channel of Pascagoula river, Florida	-	182 45	-	-	182 45
Increasing the depth of water at the mouths of the Mississippi	34,950 00	32,559 81	-	1,023 56	68,538 37
Improving the navigation of the Cumberland river	22,500 00	8,093 99	-	1,020 20	31,614 19
Continuing the pier and mole at Oswego, New York	35,411 67	-	-	-	35,411 67
Works at the mouth of Genesee river, New York	16,500 00	3,515 03	-	-	20,015 03
Improvement of the harbor at the mouth of Oak Orchard creek	-	3,533 72	-	-	3,533 72
Works at the harbor near the mouth of the river Raisin	7,500 00	9,025 10	-	-	16,525 10
Piers at La Plaisance bay	-	82 12	-	-	82 12
Removing obstructions at Black river, Ohio	1,340 00	2,129 16	-	45 97	3,515 13
Improvement at the mouth of Huron river, Ohio	3,750 00	-	-	-	3,750 00
Removing obstructions at Conneaut creek, Ohio	4,500 00	270 74	-	-	4,770 74
Removing obstructions at Ashtabula creek, Ohio	4,630 00	575 60	-	63 45	5,269 05
Improving the harbor of Cleveland, Ohio	26,866 00	12,642 62	-	-	39,508 62

A—Continued.

Names of appropriations.	Balance undrawn from the Treasury September 30, 1838.	Balance in hands of disbursing agents at that date.	Additional sum appropriated during the ensuing session of Congress.	Amount added by sales and rents of public property.	Total amount under each head of appropriation applicable to expenditure in this bureau.
Road from opposite Memphis to the St. Francis river, Arkansas	- - -	$4,180 13	- - -	- - -	$4,180 13
Road from Detroit to Saganaw bay, Michigan	- - -	1,303 19	- - -	- - -	1,303 19
Road from Detroit towards Chicago	- - -	332 23	- - -	- - -	332 23
Road from Clinton to the rapids of Grand river	- - -	458 70	- - -	- - -	458 70
Road between Sheldons and the mouth of St. Joseph river	- - -	328 43	- - -	- - -	328 43
Road between Niles and the mouth of St. Joseph river	- - -	523 07	- - -	- - -	523 07
Road from Detroit to Fort Gratiot	- - -	31 88	- - -	- - -	31 88
Road from Detroit to Grand river	- - -	624 20	- - -	- - -	624 20
Road from the northern boundary of Florida to Appalachicola	$1,461 04	2,001 08	- - -	- - -	3,462 12
Road from Tallahassee to Iola, on the river Appalachicola	10,000 00	- - -	- - -	- - -	10,000 00
Road from St. Augustine to Picolata	17,300 00	- - -	- - -	- - -	17,300 00
Road from Jacksonville, by the Mineral Springs, to Tallahassee	10,000 00	- - -	- - -	- - -	10,000 00
Road from Fort Howard, at Green Bay, by Milwaukie and Racine, to the northern line of the State of Illinois	15,000 00	- - -	- - -	- - -	15,000 00
Road from Milwaukie, on Lake Michigan, to a point opposite the town of Dubuque, on the Mississippi river	10,000 00	- - -	- - -	- - -	10,000 00
Road from the northern line of Missouri to the Mississippi	10,000 00	- - -	- - -	- - -	10,000 00
Road from Fort Crawford to Fort Howard, at Green Bay	5,000 00	124 86	- - -	- - -	5,124 86
Road from Dubuque to the northern boundary of Missouri	- - -	- - -	$20,000 00	- - -	20,000 00
Road from Burlington, towards the Indian agency, on the Des Moines	- - -	- - -	5,000 00	- - -	5,000 00
Road from Racine, by Janesville, to Sinipee, on the Mississippi	- - -	- - -	10,000 00	- - -	10,000 00
Road from Sauk harbor to Dekorree, on Wisconsin river	- - -	- - -	5,000 00	- - -	5,000 00
Road from Fond du Lac, by Fox lake, to Wisconsin river	- - -	- - -	5,000 00	- - -	5,000 00
Road from Jacksonville to Newmansville, Florida	- - -	- - -	5,000 00	- - -	5,000 00
Road from Jacksonville to St. Marys	- - -	- - -	7,500 00	- - -	7,500 00
Road from Burlington, Iowa, to De Hagues, in Illinois	- - -	- - -	2,500 00	- - -	2,500 00
Survey from the southern debouche of the Dismal Swamp canal to Winyaw bay, S. C.	- - -	4 03	- - -	- - -	4 03

Survey of Crow shoal, in Delaware bay	-	415 63	-	-	415 63
Survey of a route for a railroad from Milwaukie to Dubuque, Wisconsin Territory	-	1,141 85	-	-	1,141 85
Survey of Rock river and the haven of said river	1,000 00	-	-	-	1,000 00
Survey of Des Moines and Iowa rivers	1,000 00	-	-	-	1,000 00
Survey and improvement of the Suwanee river, Florida	-	-	15,000 00	-	15,000 00
Survey of Yellow river, Florida	-	-	500 00	-	500 00
Survey of Red Cedar river, Iowa	-	-	1,500 00	-	1,500 00
Light-house on the Brandywine shoal in Delaware bay	28,950 00	12,490 35	-	-	41,440 35
Protection of the northern frontier of the United States	-	3,759 77	-	-	3,759 77
Survey of the Neenah and Wisconsin rivers	-	-	2,000 00	-	2,000 00
Surveying and marking the boundaries between the Indian tribes west of the Mississippi	-	-	10,000 00	-	10,000 00
Pier at the northern extremity of Winnebago lake, Wisconsin	-	-	500 00	-	500 00
Placing buoys at the mouth of Neenah river	-	-	500 00	-	500 00
Continuing the Delaware breakwater	81,000 00	8,871 16	-	8 00	89,879 16
Maps showing the position of the lands of each Indian tribe in amity with the United States	-	-	1,000 00	-	1,000 00
Total	1,054,236 31	192,504 62	100,900 00	3,920 92	1,351,561 85

A.—Continued.

Names of appropriations.	Amount disbursed in 4th quarter of 1838.		Amount disbursed in 1st quarter of 1839.	
	By disbursing agents.	By accounting officers, in payment of claims presented to, and first liquidated by, them.	By disbursing agents.	By accounting officers, in payment of claims presented to, and first liquidated by, them.
Construction of a harbor at Michigan City, Indiana	$14,881 80	-	$12,868 03	
Construction of a breakwater at the mouth of the river St. Joseph, Michigan	13,724 46	-	8,748 65	
Improvement of the harbor at the mouth of Black river, New York	4,285 27			
Improvement of the harbor of Whitehall, New York	3,285 75	-	462 62	
Improvement of the harbor at the mouth of Vermillion river, Ohio	4,312 53	-	1,635 80	
Improvement of the harbor of Portland, Lake Erie, New York	4,550 61	-	11,402 12	
Improvement of the harbor at Cattaraugus creek, New York	3,629 98	-	5,835 55	
Improvement of the harbor of Salmon river, Lake Ontario, New York	4,586 66	-	322 00	
Construction of a breakwater at Plattsburg, New York	6,896 09	-	11,841 78	
Construction of a breakwater at Burlington, Vermont	7,988 96	-	357 16	
Deepening the channel between the north and south Hero islands, Vermont	393 77	-	270 00	
Roads and canals				
Surveys of a military character	6,232 87	$1,910 31	2,189 92	$525 50
Improvement of the harbor of Presque Isle, Pennsylvania	6,115 11	-	513 69	
Improvement of Dunkirk harbor, New York	2,826 32	-	328 56	
Deepening the channel of the river Thames, Connecticut	4,953 52	-	819 33	
Improving the harbor of Westport, Connecticut	1,026 82			
Continuing the works at Buffalo harbor, New York	87 36			
Sea-wall separating Lake Erie from Buffalo creek	5,999 91	-	336 66	
Sea-wall for the preservation of Fairweather island	5,176 43	-	736 00	
Improving the harbor of New Bedford, Massachusetts	1,716 78	-	1,538 10	
Improving the harbor of Saybrook, Connecticut				
Improvement of the harbor of Chicago, Illinois	5,360 04	-	3,500 11	

Removing obstructions at Grand river, Ohio	2,320 36		554 88
Removing obstructions at Cunningham creek, Ohio			
Placing buoys in the vicinity of the monument on Steele's ledge, Maine	164 78		
Continuing the pier at Kennebunk, Maine	3,992 17		1,033 38
Constructing a breakwater on Stamford's ledge, Portland harbor, Maine	4,014 49		943 33
Breakwater at the mouth of Merrimac river, Massachusetts			
Breakwater at Sandy bay, Massachusetts	4,869 40		9,019 86
Preservation of Plymouth beach, Massachusetts	810 73		
Preservation of the point of land leading to the fort and light-house at the gurnet in Duxbury, Massachusetts	1,534 37		
Preservation of the beach at Provincetown harbor, Massachusetts			
Improvement of the harbor at the mouth of Bass river, Massachusetts	464 74		
Breakwater at Hyannis harbor, Massachusetts			
Breakwater at Church's cove, Rhode Island	994 91		1,015 23
Improving the harbor of New Brunswick, New Jersey			
Improving Little Egg harbor	2,323 97		
Repairs at the harbor of Chester, Pennsylvania			
Improving the harbor of New Castle, Delaware	5,563 05		
Improving the harbor of Wilmington, Delaware	1,195 18		488 09
Deepening the harbor of Baltimore, Maryland	4,299 87		
Improving the natural channels at the northern and southern entrances of the Dismal Swamp canal	2,018 17		5,307 48
Removing a sand-shoal in Pamlico river, below Wilmington, North Carolina	2,867 04		1,756 44
Opening a passage between the town of Beaufort and Pamlico sound, and improving New river			13,218 03
Improvement of Cape Fear river, below Wilmington, North Carolina	2,813 95		7,503 96
Improving the navigation of Savannah river, Georgia	2,505 47		4,698 62
Improving the inland channel between St. Marys and St. Johns, Florida	2,915 27		2,007 87
Improving the harbor of Mobile, Alabama	28,196 12		4,296 00
Removing a mud-shoal in the east pass to Appalachicola, Florida			
Deepening the channel of Pascagoula river, Florida			
Increasing the depth of water at the mouths of the Mississippi	21,969 88		38,623 95
Improving the navigation of the Cumberland river	5,831 39		6,850 10
Continuing the pier and mole at Oswego, New York	7,514 39		2,055 79
Works at the mouth of Genesee river, New York	7,054 92		3,787 52
Improvement of the harbor at the mouth of Oak Orchard creek	2,964 44		229 46
Works at the harbor near the mouth of the river Raisin	12,915 76		3,336 68
Piers at La Plaisance bay			
Removing obstructions at Black river, Ohio	3,072 47		52 23
Improvement at the mouth of Huron river, Ohio	2,755 47		397 72
Removing obstructions at Conneaut creek, Ohio	2,858 91		88 57
Removing obstructions at Ashtabula creek, Ohio	1,068 18		498 82

A—Continued.

Names of appropriations.	Amount disbursed in the 4th quarter of 1838.		Amount disbursed in the 1st quarter of 1839.	
	By disbursing agents.	By accounting officers.	By disbursing agents.	By accounting officers.
Improving the harbor of Cleveland, Ohio	$8,222 18	-	$2,237 43	
Road from opposite Memphis to the St. Francis river, Arkansas	2,525 96			
Road from Detroit to Saganaw bay, Michigan				
Road from Detroit towards Chicago				
Road from Clinton to the rapids of Grand river				
Road between Sheldon and the mouth of St. Joseph river				
Road between Niles and the mouth of St. Joseph river				
Road from Detroit to Fort Gratiot				
Road from Detroit to Grand river				
Road from the northern boundary of Florida to Appalachicola	366 50	-	131 88	
Road from Tallahassee to Iola, on the river Appalachicola				
Road from St. Augustine to Picolata	24 00	-	56 00	
Road from Jacksonville, by the Mineral Springs, to Tallahassee				
Road from Fort Howard, at Green Bay, by Milwaukie and Racine, to the northern line of the State of Illinois	-	-	4,586 10	
Road from Milwaukie, on Lake Michigan, to a point opposite the town of Dubuque, on the Mississippi river				
Road from the northern line of Missouri to the Mississippi				
Road from Fort Crawford to Fort Howard, at Green Bay				
Road from Dubuque to the northern boundary of Missouri				
Road from Burlington, towards the Indian agency, on the Des Moines				
Road from Racine, by Janesville, to Sinipee, on the Mississippi				
Road from Sauk Harbor to Dekorree, on Wisconsin river				

Road from Fond du Lac, by Fox lake, to Wisconsin river				
Road from Jacksonville to Newmansville, Florida				
Road from Jacksonville to St. Marys				
Road from Burlington, Iowa, to De Hagues in Illinois				
Survey from the southern debouche of the Dismal Swamp canal, to Winyaw bay, S. C.				
Survey of Crow shoal, in Delaware bay				
Survey of a route for a railroad from Milwaukie to Dubuque, Wisconsin Territory	584 87			
Survey of Rock river and the haven of said river				
Survey of Des Moines and Iowa rivers				
Survey and improvement of the Suwanee river, Florida				
Survey of Yellow river, Florida				
Survey of Red Cedar river, Iowa				
Light-house on the Brandywine shoal in Delaware bay	3,919 17		4,270 72	
Protection of the northern frontier of the United States	6 50	-		
Survey of the Neenah and Wisconsin rivers				
Surveying and marking the boundaries between the Indian tribes west of the Mississippi				
Pier at the northern extremity of Winnebago lake, Wisconsin				
Placing buoys at the mouth of Neenah river				
Continuing the Delaware breakwater	6,742 01	-	2,085 51	
Maps showing the position of the lands of each Indian tribe in amity with the United States				
Total	$272,292 08	$1,910 31	184,837 73	$525 50

A—Continued.

Names of appropriations.	Amount disbursed in the 2d quarter of 1839.		Amount disbursed in the 3d quarter of 1839.	
	By disbursing agents.	By accounting officers.	By disbursing agents.	By accounting officers.
Construction of a harbor at Michigan City, Indiana	$4,122 03		$7,808 37	
Construction of a breakwater at the mouth of the river St. Joseph, Michigan	2,496 81		3,943 78	
Improvement of the harbor at the mouth of Black river, New York	–		10,455 18	
Improvement of the harbor of Whitehall, New York	3,825 34		3,549 13	
Improvement of the harbor at the mouth of Vermillion river, Ohio	2,495 72		6,344 26	
Improvement of the harbor of Portland, Lake Erie, New York	5,945 39		76 50	
Improvement of the harbor at Cattaraugus creek, New York	2,729 97		3,828 99	
Improvement of the harbor of Salmon river, Lake Ontario, New York	2,945 60		12,082 86	
Construction of a breakwater at Plattsburg, New York	879 07		324 68	
Construction of a breakwater at Burlington, Vermont	14,042 86		10,514 38	
Deepening the channel between the north and south Hero islands, Vermont	407 53		276 00	
Roads and canals	1,417 20	$707 98		
Surveys of a military character				
Improvement of the harbor of Presque Isle, Pennsylvania	4,370 69		9,221 67	
Improvement of Dunkirk harbor, New York	178 83			
Deepening the channel of the river Thames, Connecticut	211 39		28 85	
Improving the harbor of Westport, Connecticut	410 00		2,025 00	
Continuing the works at Buffalo harbor, New York	458 25		599 64	
Sea-wall separating Lake Erie from Buffalo creek	2,563 47		6,399 91	
Sea-wall for the preservation of Fairweather island	2,730 00		3,077 84	
Improving the harbor of New Bedford, Massachusetts	4,340 20			
Improving the harbor of Saybrook, Connecticut	814 71		3,932 89	
Improvement of the harbor of Chicago, Illinois	3,803 48		5,107 27	

Removing obstructions at Grand river, Ohio	1,250 09	-	$703 59
Removing obstructions at Cunningham creek, Ohio			
Placing buoys in the vicinity of the monument on Steele's ledge, Maine			
Continuing the pier at Kennebunk, Maine			
Constructing a breakwater on Stamford's ledge, Portland harbor, Maine	3,295 70	-	10,486 43
Breakwater at the mouth of Merrimac river, Massachusetts	31 00	-	680 51
Breakwater at Sandy bay, Massachusetts	274 11	-	257 50
Preservation of Plymouth beach, Massachusetts	45 68	-	52 50
Preservation of the point of land leading to the fort and light-house at the gurnet in Duxbury, Massachusetts	207 54		
Preservation of the beach at Provincetown harbor, Massachusetts	4,449 57		
Improvement of the harbor at the mouth of Bass river, Massachusetts	741 31	-	5,992 05
Breakwater at Hyannis harbor, Massachusetts	1,897 32	-	3,956 06
Breakwater at Church's cove, Rhode Island	510 21	-	5,669 03
Improving the harbor of New Brunswick, New Jersey	14 60		
Improving Little Egg harbor	15 60		
Repairs at the harbor of Chester, Pennsylvania	1 30		
Improving the harbor of New Castle, Delaware	428 25		
Improving the harbor of Wilmington, Delaware	1,329 24	-	1,362 51
Deepening the harbor of Baltimore, Maryland	4,416 46	-	5,824 56
Improving the natural channels at the northern and southern entrances of the Dismal Swamp canal	3,149 09	-	2,094 88
Removing a sand shoal in Pamlico river, below Wilmington, North Carolina			
Opening a passage between the town of Beaufort and Pamlico sound, and improving New river	184 00		
Improvement of Cape Fear river, below Wilmington, North Carolina	8,676 97	-	1,651 37
Improving the navigation of Savannah river, Georgia	3,867 58		
Improving the inland channel between St. Marys and St. Johns, Florida	2,195 75	-	1,856 41
Improving the harbor of Mobile, Alabama	11,895 80		
Removing a mud shoal in the east pass to Appalachicola, Florida	9,900 00		
Deepening the channel of Pascagoula river, Florida			
Increasing the depth of water at the mouths of the Mississippi	6,902 22	-	1,855 90
Improving the navigation of the Cumberland river	5,566 93		
Continuing the pier and mole at Oswego, New York	4,282 78	-	13,338 36
Works at the mouth of Genesee river, New York	1,959 61	-	3,913 09
Improvement of the harbor at the mouth of Oak Orchard creek	339 82		
Works at the harbor near the mouth of the river Raisin	74 88	-	101 00
Piers at La Plaisance bay			
Removing obstructions at Black river, Ohio			
Improvement at the mouth of Huron river, Ohio	596 81		
Removing obstructions at Cenneaut creek, Ohio	1,412 64	-	250 18
Removing obstructions at Ashtabula creek, Ohio	1,008 05	-	1,148 34

A—Continued.

Names of appropriations.	Amount disbursed in the 2d quarter of 1839.		Amount disbursed in the 3d quarter of 1839.	
	By disbursing agents.	By accounting officers.	By disbursing agents.	By accounting officers.
Improving the harbor of Cleveland, Ohio	$6,863 57	-	$10,199 44	
Road from opposite Memphis to the St. Francis river, Arkansas				
Road from Detroit to Saganaw bay, Michigan	28 99	-	30 88	
Road from Detroit towards Chicago	7 39	-	218 15	
Road from Clinton to the rapids of Grand river	10 20	-	10 87	
Road between Sheldons and the mouth of St. Joseph river	7 31	-	7 78	
Road between Niles and the mouth of St. Joseph river	-	-	12 68	
Road from Detroit to Fort Gratiot	71	-	75	
Road from Detroit to Grand river	13 89	-	14 80	
Road from the northern boundary of Florida to Appalachicola	59 75	-	43 80	
Road from Tallahassee to Iola, on the river Appalachicola		-		
Road from St. Augustine to Picolata	4,408 60			
Road from Jacksonville, by the Mineral Springs, to Tallahassee				
Road from Fort Howard, at Green Bay, by Milwaukie and Racine, to the northern line of the State of Illinois	-	-	2,067 64	
Road from Milwaukie, on Lake Michigan, to a point opposite the town of Dubuque, on the Mississippi river	3,983 94			
Road from the northern line of Missouri to the Mississippi				
Road from Fort Crawford to Fort Howard, at Green Bay	-	-	3,892 00	
Road from Dubuque to the northern boundary of Missouri	2,223 93	-	1,114 49	
Road from Burlington, towards the Indian agency, on the Des Moines	947 58	-	215 00	
Road from Racine, by Janesville, to Sinipee, on the Mississippi				
Road from Sauk harbor to Dekorree, on Wisconsin river	-	-	807 76	

Road from Fond du Lac, by Fox lake, to Wisconsin river	–	–	126 04	
Road from Jacksonville to Newmansville, Florida				
Road from Jacksonville to St. Marys				
Road from Burlington, Iowa, to De Hagues, in Illinois				
Survey from the southern debouche of the Dismal Swamp canal to Winyaw bay, S. C.				
Survey of Crow shoal, in Delaware bay				
Survey of a route for a railroad from Milwaukie to Dubuque, Wisconsin Territory				
Survey of Rock river and the haven of said river	–	–	150 00	
Survey of Des Moines and Iowa rivers				
Survey and improvement of the Suwanee river, Florida	554 73			
Survey of Yellow river, Florida				
Survey of Red Cedar river, Iowa	–	–	1,209 82	
Light-house on the Brandywine shoal in Delaware bay	4,159 43	–	698 95	
Protection of the northern frontier of the United States	872 58	–		
Survey of the Neenah and Wisconsin rivers				
Surveying and marking the boundaries between the Indian tribes west of the Mississippi	–	428 00	1,492 67	
Pier at the northern extremity of Winnebago lake, Wisconsin	–	–	90 21	
Placing buoys at the mouth of Neenah river				
Continuing the Delaware breakwater	2,833 86	–	71,343 93	
Maps showing the position of the lands of each Indian tribe in amity with the United States	–	–	151 00	
Total	169,085 91	1,135 98	244,663 15	

A—Continued.

Names of appropriations.	Aggregate amount disbursed between September 30, 1838, and September 30, 1839.	Balance in the hands of agents, unexpended, September 30, 1839.	Balance undrawn from the Treasury, September 30, 1839.	Total amount unexpended September 30, 1839, and applicable to future expenditures or to be restored to the unappropriated moneys in the Treasury.
Construction of a harbor at Michigan City, Indiana	$39,680 23	$4,987 78	$2,943 59	$7,931 37
Construction of a breakwater at the mouth of the river St. Joseph, Michigan	28,913 71	1,910 97	3,970 50	5,881 47
Improvement of the harbor at the mouth of Black river, New York	14,740 45	841 81	–	841 81
Improvement of the harbor of Whitehall, New York	11,122 84	517 26	1,670 00	2,187 26
Improvement of the harbor at the mouth of Vermillion river, Ohio	14,788 31	486 41	1,103 57	1,589 98
Improvement of the harbor of Portland, Lake Erie, New York	21,974 62	82 38	1,181 00	1,263 38
Improvement of the harbor at Cattaraugus creek, New York	16,024 49	347 51	3,997 00	4,344 51
Improvement of the harbor of Salmon river, Lake Ontario, New York	19,939 12	4,820 87	2,021 33	6,842 20
Construction of a breakwater at Plattsburg, New York	19,941 63	17 10	–	17 10
Construction of a breakwater at Burlington, Vermont	32,903 36	116 64	3,980 00	4,096 64
Deepening the channel between the north and south Hero islands, Vermont	1,347 30	539 49	6,000 00	6,539 49
Roads and canals	2,125 18	20 94	115 87	136 81
Surveys of a military character	10,858 60	–	45 77	45 77
Improvement of the harbor of Presque Isle, Pennsylvania	20,221 16	259 66	1,046 00	1,305 66
Improvement of Dunkirk harbor, New York	3,333 71	–	500 00	500 00
Deepening the channel of the river Thames, Connecticut	6,013 09	94 17	–	94 17
Improving the harbor of Westport, Connecticut	3,461 82	248 88	2,226 00	2,474 88
Continuing the works at Buffalo harbor, New York	1,145 25	587 75	8,517 00	9,104 75
Sea-wall separating Lake Erie from Buffalo creek	15,299 95	4,862 37	17,681 00	22,543 37
Sea-wall for the preservation of Fairweather island	11,720 27	–	5,097 10	5,097 10
Improving the harbor of New Bedford, Massachusetts	7,595 08	1 00	–	1 00
Improving the harbor of Saybrook, Connecticut	4,947 60	1,712 40	9,250 00	10,962 40
Improvement of the harbor of Chicago, Illinois	17,770 90	3,229 10	–	3,229 10

Removing obstructions at Grand river, Ohio	4,828 92	823 08	-	823 08
Removing obstructions at Cunningham creek, Ohio	-	250 71	-	250 71
Placing buoys in the vicinity of the monument on Steele's ledge, Maine	164 78	466 00	-	466 00
Continuing the pier at Kennebunk, Maine	5,025 55	882 87	-	882 87
Constructing a breakwater on Stamford's ledge, Portland harbor, Maine	18,739 95	160 60	7,988 00	8,148 60
Breakwater at the mouth of Merrimac river, Massachusetts	711 51	3,038 96	-	3,038 96
Breakwater at Sandy bay, Massachusetts	14,393 87	798 37	-	798 37
Preservation of Plymouth beach, Massachusetts	908 91	291 09	-	291 09
Preservation of the point of land leading to the fort and light-house at the gurnet in Duxbury, Massachusetts	1,741 91	355 33	-	355 33
Preservation of the beach at Provincetown harbor, Massachusetts	4,449 57	-	141 52	141 52
Improvement of the harbor at the mouth of Bass river, Massachusetts	7,198 10	209 83	1,410 00	1,619 83
Breakwater at Hyannis harbor, Massachusetts	5,853 38	79 62	2,831 00	2,910 62
Breakwater at Church's cove, Rhode Island	8,189 38	-	9,389 00	9,389 00
Improving the harbor of New Brunswick, New Jersey	14 60	2,658 20	-	2,658 20
Improving Little Egg harbor	2,339 57	6,957 43	703 00	7,660 43
Repairs at the harbor of Chester, Pennsylvania	1 30	109 68	-	109 68
Improving the harbor of New Castle, Delaware	5,991 30	689 39	2,573 00	3,262 39
Improving the harbor of Wilmington, Delaware	4,375 02	85 32	7,356 00	7,441 32
Deepening the harbor of Baltimore, Maryland	14,540 90	7 48	-	7 48
Improving the natural channels at the northern and southern entrances of the Dismal Swamp canal	12,569 62	1,113 31	-	1,113 31
Removing a sand-shoal in Pamlico river, below Wilmington, North Carolina	4,623 48	545 17	-	545 17
Opening a passage between the town of Beaufort and Pamlico sound, and improving New river	13,402 03			
Improvement of Cape Fear river, below Wilmington, North Carolina	20,646 25	159 48	-	159 48
Improving the navigation of Savannah river, Georgia	11,071 67	1,600 20	4,865 00	6,465 20
Improving the inland channel between St. Marys and St. Johns, Florida	8,975 30	668 59	20,910 07	21,578 66
Improving the harbor of Mobile, Alabama	44,387 92	8,838 45	64,463 00	73,301 45
Removing a mud-shoal in the east pass to Appalachicola, Florida	9,900 00			
Deepening the channel of Pascagoula river, Florida	-	182 45	-	182 45
Increasing the depth of water at the mouths of the Mississippi	69,351 95			
Improving the navigation of the Cumberland river	18,248 42	1,865 77	11,500 00	13,365 77
Continuing the pier and mole at Oswego, New York	27,191 32	2,083 85	6,136 50	8,220 35
Works at the mouth of Genesee river, New York	16,715 14	1,009 89	2,290 00	3,299 89
Improvement of the harbor at the mouth of Oak Orchard creek	3,533 72			
Works at the harbor near the mouth of the river Raisin	16,428 32	96 78	-	96 78
Piers at La Plaisance bay	-	82 12	-	82 12
Removing obstructions at Black river, Ohio	3,124 70	390 43	-	390 43
Improvement at the mouth of Huron river, Ohio	3,750 00			
Removing obstructions at Conneaut creek, Ohio	4,610 30	160 44	-	160 44
Removing obstructions at Ashtabula creek, Ohio	3,723 89	1,115 66	430 00	1,545 66

A—Continued.

Names of appropriations.	Aggregate amount disbursed between September 30, 1838, and September 30, 1839.	Balance in the hands of agents, unexpended, September 30, 1839.	Balance undrawn from the Treasury, September 30, 1839.	Total amount unexpended September 30, 1839, and applicable to future expenditures or to be restored to the unappropriated moneys in the Treasury.
Improving the harbor of Cleveland, Ohio	$27,523 62	$1,120 29	$10,866 00	$11,986 29
Road from opposite Memphis to the St. Francis river, Arkansas	2,525 96	-	1,654 17	1,654 17
Road from Detroit to Saganaw bay, Michigan	59 87	1,243 31	-	1,243 31
Road from Detroit towards Chicago	225 54	106 69	-	106 69
Road from Clinton to the rapids of Grand river	21 07	437 63	-	437 63
Road between Sheldons and the mouth of St. Joseph river	15 09	313 34	-	313 34
Road between Niles and the mouth of St. Joseph river	12 68	510 39	-	510 39
Road from Detroit to Fort Gratiot	1 46	30 42	-	30 42
Road from Detroit to Grand river	28 69	595 51	-	595 51
Road from the northern boundary of Florida to Appalachicola	601 93	1,399 15	1,461 04	2,860 19
Road from Tallahassee to Iola, on the river Appalachicola	-	500 00	9,500 00	10,000 00
Road from St. Augustine to Picolata	4,488 60	4,334 40	8,477 00	12,811 40
Road from Jacksonville, by the Mineral Springs, to Tallahassee	-	500 00	9,500 00	10,000 00
Road from Fort Howard, at Green Bay, by Milwaukie and Racine, to the northern line of the State of Illinois	2,067 64	3,432 36	9,500 00	12,932 36
Road from Milwaukie, on Lake Michigan, to a point opposite the town of Dubuque, on the Mississippi river	8,570 04	1,429 96	-	1,429 96
Road from the northern line of Missouri to the Mississippi	-	10,000 00	-	10,000 00
Road from Fort Crawford to Fort Howard, at Green Bay	3,892 00	1,232 86	-	1,232 86
Road from Dubuque to the northern boundary of Missouri	3,338 42	16,661 58	-	16,661 58
Road from Burlington, towards the Indian agency, on the Des Moines	1,162 58	3,837 42	-	3,837 42
Road from Racine, by Janesville, to Sinipee, on the Mississippi	-	-	10,000 00	10,000 00
Road from Sauk harbor to Dekorree, on Wisconsin river	807 76	4,192 24	-	4,192 24

Road from Fond du Lac, by Fox lake, to Wisconsin river	126 04	4,873 96	-	4,873 96
Road from Jacksonville to Newmansville, Florida	-	-	5,000 00	5,000 00
Road from Jacksonville to St. Marys	-	-	7,500 00	7,500 00
Road from Burlington, Iowa, to De Hagues, in Illinois	-	2,500 00	-	2,500 00
Survey from the southern debouche of the Dismal Swamp canal to Winyaw bay, S. C.	-	4 03	-	4 03
Survey of Crow shoal, in Delaware bay	-	415 63	-	415 63
Survey of a route for a railroad from Milwaukie to Dubuque, Wisconsin Territory	584 87	556 98	-	556 98
Survey of Rock river and the haven of said river	150 00	850 00	-	850 00
Survey of Des Moines and Iowa rivers	-	-	1,000 00	1,000 00
Survey and improvement of the Suwanee river, Florida	554 73	3,945 27	10,500 00	14,445 27
Survey of Yellow river, Florida	-	500 00	-	500 00
Survey of Red Cedar river, Iowa	1,209 82	290 18	-	290 18
Light-house on the Brandywine shoal, in Delaware bay	12,349 32	6,688 03	22,403 00	29,091 03
Protection of the northern frontier of the United States	1,578 03	2,181 74	-	2,181 74
Survey of the Neenah and Wisconsin rivers	-	2,000 00	-	2,000 00
Surveying and marking the boundaries between the Indian tribes west of the Mississippi	1,920 67	2,007 33	6,072 00	8,079 33
Pier at the northern extremity of Winnebago lake, Wisconsin	90 21	409 79	-	409 79
Placing buoys at the mouth of Neenah river	-	-	500 00	500 00
Continuing the Delaware breakwater	83,005 31	4,873 85	2,000 00	6,873 85
Maps showing the position of the lands of each Indian tribe in amity with the United States	151 00	-	849 00	849 00
Total	874,450 66	147,425 38	331,114 03	478,539 41

TOPOGRAPHICAL BUREAU, *December* 30, 1839.

J. J. ABERT, *Colonel Topographical Engineers.*

B.

Statement, showing the amount remaining in the hands of each of the dis- 1st October, 1838; the amount remitted to each from the Treasury, or hands of each from sales of public property, rent of public buildings or of the first three quarters of 1839; the amount accounted and unac- expenditures, or by evidences of transfers to other agents, or of replace- of each quarter.

Names of agents.	For what quarter of the year.	Balance in hand, and unaccounted for from last quarter.	Amount remitted from the Treasury, and turned over by other agents.	Amount derived from sales, rents, and other sources.	Total in hand, to be accounted for.
Lt. Col. James Kearney	4th of 1838				
	1st 1839	$798 73	$374 00	$269 44	$1,442 17
	2d 1839				
	3d 1839				
Lt. Col. S. H. Long	4th 1838	72 64	-	-	72 64
	1st 1839				
	2d 1839	72 64	-	-	72 64
	3d 1839				
Major H. Bache	4th 1838	12,597 96	-	260 08	12,858 04
	1st 1839	8,938 87	-	47 94	8,986 81
	2d 1839	4,716 09	13,224 45	-	17,940 54
	3d 1839	13,321 36	4,197 00	-	17,518 36
Major J. D. Graham	4th 1838	4,655 61	-	-	4,655 61
	1st 1839	4,282 61	-	-	4,282 61
	2d 1839	4,150 73	500 00	-	4,650 73
	3d 1839	3,718 40	-	-	3,718 40
Capt. W. G. Williams	4th 1838	4,843 32	2,532 00	-	7,375 32
	1st 1839	1,375 41	-	-	1,375 41
	2d 1839	1,038 75	6,341 00	-	7,379 75
	3d 1839	4,270 67	8,337 88	-	12,608 55
Capt. A. Canfield	4th 1838	1,246 40	-	-	1,246 40
	1st 1839	369 12	1,000 00	-	1,369 12
	2d 1839	764 37	-	-	764 37
	3d 1839	308 13	1,000 00	-	1,308 13
Capt. C. Graham	1st 1839	-	20,443 25	-	20,443 25
	2d 1839	16,147 25	9,587 00	-	25,734 25
	3d 1839	13,283 72	5,200 00	-	18,483 72
Capt. W. B. Guion	3d 1839	-	1,000 00	-	1,000 00
Capt. G. W. Hughes	4th 1838	43 45	-	-	43 45
	1st 1839				
	2d 1839	43 45	-	-	43 45
	3d 1839				
Capt. T. J. Cram	3d 1839	-	23,624 86	-	23,624 86
Capt. J. McClellan	2d 1839	-	9,583 76	284 24	9,868 00
	3d 1839	2,115 47	-	79 62	2,195 09
Capt. W. Hood	3d 1839	-	3,500 00	-	3,500 00
Capt. J. Mackay	3d 1839	-	7,883 39	-	7,883 39
Lt. H. Stansbury	4th 1838	1,141 85	-	-	1,141 85
	1st 1839	556 98	5,000 00	-	5,556 98
	2d 1839	970 88	5,000 00	-	5,970 88
	3d 1839	1,986 94	-	-	1,986 94
Lt. T. B. Linnard	1st 1839	-	1,524 35	-	1,524 35
Lt. J. E. Johnston	4th 1838	275 26	4,069 50	-	4,344 76
	1st 1839	59 44	-	-	59 44
	2d 1839	59 44	-	-	59 44
	3d 1839	59 44	2,000 50	39 59	2,099 58

B.

bursing agents of the Topographical Bureau, and unaccounted for on the turned over to him by other agent or agents, and those which came into the grounds, or from other sources, during the last quarter of 1838, *and each counted for by each in each of those quarters, by accounts and vouchers of ments in the Treasury; and the balance unaccounted for by each at the end*

Amount expended.	Amount turned over to other agents, and replaced in the Treasury.	Total accounted for.	Balance unaccounted for.	Remarks.
$1,585 20	-	$1,585 20		
-	-	-	$72 64	
-	-	-	72 64	
3,919 17	-	3,919 17	8,938 87	
4,270 72	-	4,270 72	4,716 09	
4,619 18	-	4,619 18	13,321 36	
-	-	-	17,518 36	Accounts for 3d quarter not rendered.
373 00	-	373 00	4,282 61	
131 88	-	131 88	4,150 73	
932 33	-	932 33	3,718 40	
742 75	-	742 75	2,975 65	
5,999 91	-	5,999 91	1,375 41	
336 66	-	336 66	1,038 75	
3,109 08	-	3,109 08	4,270 67	
7,076 05	-	7,076 05	5,532 50	
877 28	-	877 28	369 12	
604 75	-	604 75	764 37	
456 24	-	456 24	308 13	
372 00	-	372 00	936 12	
4,296 00	-	4,296 00	16,147 25	
12,450 53	-	12,450 53	13,283 72	
-	-	-	18,483 72	Accounts for 3d quarter not rendered.
-	-	-	1,000 00	Accounts for 3d quarter not rendered.
-	-	-	43 45	
-	-	-	43 45	
6,633 65	-	6,633 65	16,991 21	
7,752 53	-	7,752 53	2,115 47	
1,651 37	-	1,651 37	543 72	
1,492 67	-	1,492 67	2,007 33	
-	-	-	7,883 39	
584 87	-	584 87	556 98	
4,586 10	-	4,586 10	970 88	
3,983 94	-	3,983 94	1,986 94	
-	-	-	1,986 94	Accounts for 3d quarter not rendered.
462 62	1,061 73	1,524 35		
4,285 27	-	4,285 27	59 44	
-	-	-	59 44	
-	-	-	59 44	
1,786 21	-	1,786 21	313 37	

B—Continued.

Names of agents.	For what quarter of the year.	Balance in hand, and unaccounted for from last quarter.	Amount remitted from the Treasury, and turned over by other agents.	Amount derived from sales, rents, and other sources.	Total in hand, to be accounted for.
Lt. A. A. Humphreys -	4th of 1838	-	6,000 00	-	6,000 00
	1st 1839	639 96	2,588 00	-	3,227 96
Lt. J. N. Macomb -	2d 1839	-	3,078 63	-	3,078 63
	3d 1839	3,010 14	523 07	-	3,533 21
Lt. W. H. Warner -	4th 1838	404 71	1,309 00	-	1,713 71
	1st 1839	-	1,640 00	-	1,640 00
	2d 1839	98 83	4,241 37	-	4,340 20
Lt. R. M. McLane -	4th 1838	-	1,500 00	-	1,500 00
	1st 1839	1,476 00	-	-	1,476 00
	2d 1839	1,420 00	5,323 00	-	6,743 00
	3d 1839	2,333 40	-	-	2,333 40
Lt. C. Fremont -	4th 1838	1,000 00	4,669 32	246 50	5,915 82
	1st 1839	-	2,500 00	-	2,500 00
Ezra Smith -	4th 1838	810 10	4,000 00	-	4,810 10
	1st 1839	1,524 35	-	-	1,524 35
Capt. J. K. F. Mansfield	1st 1839	-	5,115 65	3 60	5,119 25
	2d 1839	-	2,841 00	-	2,841 00
	3d 1839	575 00	1,281 41	-	1,856 41
Lt. J. H. Trapier -	1st 1839	-	4,948 65	15 00	4,963 65
	2d 1839	265 03	3,590 00	12 75	3,867 78
	3d 1839	20	-	-	20
Capt. A. J. Swift -	1st 1839	4,844 16	16,500 00	341 12	21,685 28
	2d 1839	-	1,000 00	-	1,000 00
Robert Harper -	4th 1838	250 71	-	-	250 71
	1st 1839	}			
	2d 1839	250 71	-	-	250 71
	3d 1839	}			
William McKnight -	4th 1838	8,093 19	3,000 00	100 00	11,193 19
	1st 1839	4,142 26	8,000 00	964 20	13,106 46
	2d 1839	6,256 36	-	1,176 34	7,432 70
	3d 1839	1,865 77	-	-	1,865 77
C. W. Rees -	4th 1838	3,533 72	-	-	3,533 72
	1st 1839	569 28	-	-	569 28
	2d 1839	339 82	2,500 00	46	2,840 28
	3d 1839	540 39	4,210 00	-	4,750 39
D. Lane -	4th 1838	630 78	-	-	630 78
	1st 1839	}			
	2d 1839	466 00	-	-	466 00
	3d 1839	}			
Moyamensing Bank -	4th 1838	8,871 16	6,000 00	-	14,871 16
	1st 1839	8,129 15	-	-	8,129 15
	2d 1839	6 043 64	-	-	6,043 64
	3d 1839	3,209 78	73,000 00	8 00	76,217 78
T. B. W. Stockton -	4th 1838	7,863 19	18,302 50	318 00	26,482 69
	1st 1839	-	25,258 00	-	25,258 00
	2d 1839	1,463 13	18,670 00	54 62	20,187 75
	3d 1839	13,568 91	2,824 00	-	16,392 91
R. C. Tilghman -	2d 1839	-	4,500 00	-	4,500 00
	3d 1839	1,328 49	34,500 00	-	35,828 49
John R. Bowes -	4th 1838	93 59	4,246 00	14 38	4,353 97
	1st 1839	41 44	1,578 00	-	1,619 44
	2d 1839		2,711 00	135 00	2,864 00
	3d 1839	351 92	6,470 00	8 75	6,830 67

B—Continued.

Amount expended.	Amount turned over to other agents and replaced in the Treasury.	Total accounted for.	Balance unaccounted for.	Remarks.
5,360 04	-	5,360 04	639 96	
3,500 11	-	3,500 11		
68 49	-	68 49	3,010 14	
295 91	-	295 91	3,237 30	
1,716 78	-	1,716 78		
1,541 17	-	1,541 17	98 83	
4,340 20	-	4,340 20		
24 00	-	24 00	1,476 00	
56 00	-	56 00	1,420 00	
4,409 60	-	4,409 60	2,333 40	
-	2,333 40	2,333 40		
6,232 87	-	6,232 87		
-	-	-	2,500 09	Accounts for 1st, 2d, and 3d quarters,
3,285 75	-	3,285 75	1,524 35	not rendered.
-	1,524 35	1,524 35		
2,623 85	2,565 65	5,189 50		
2,266 00	-	2,266 00	575 00	
1,856 41	-	1,856 41		
4,698 62	-	4,698 62	265 03	
3,867 58	-	3,867 58	20	
224 44	-	224 44		
22,517 26	545 17	23,062 43		
961 41	38 59	1,000 00		
-	-	-	250 71	
-	-	-	250 71	No accounts rendered.
7,050 93	-	7,050 93	4,142 26	
6,850 10	-	6,850 10	6,256 36	
5,566 93	-	5,566 93	1,865 77	
-	-	-	1,865 77	Accounts for 3d quarter not rendered.
2,964 44	-	2,964 44	569 28	
229 46	-	229 46	339 82	
2,299 89	-	2,299 89	540 39	
3,740 50	-	3,740 50	1,009 89	
164 78	-	164 78	466 00	
-	-	-	466 00	Accounts for 1st, 2d, and 3d quarters,
6,742 01	-	6,742 01	8,129 15	not rendered.
2,085 51	-	2,085 51	6,043 64	
2,833 86	-	2,833 86	3,209 78	
71,343 93	-	71,343 93	4,873 85	
28,660 88	-	28,660 88		
21,616 68	-	21,616 68	1,463 13	
6,618 84	-	6,618 84	13,568 91	
11,752 15	-	11,752 15	4,640 76	
3,171 51	-	3,171 51	1,328 49	
2,539 31	-	2,539 31	33,289 18	
4,312 53	-	4,312 53	41 44	
1,635 80	-	1,635 80		
2,495 72	-	2,495 72	351 92	
6,344 26	-	6,344 26	486 41	

B—Continued.

Names of agents.	For what quarter of the year.	Balance in hand, and unaccounted for from last quarter.	Amount remitted from the Treasury and turned over by other agents.	Amount derived from sales, rents, and other sources.	Total in hand, to be accounted for.
William H. Pettis -	4th of 1838	2,838 69	2,660 00	-	5,498 69
	1st 1839	910 44	-	-	910 44
	2d 1839	588 44	2,700 00	1 89	3,290 33
	3d 1839	344 73	16,559 00	-	16,903 73
P. S. V. Hamot -	4th 1838	-	6,400 00	-	6,400 00
	1st 1839	284 89	-	-	284 89
	2d 1839	-	5,002 00	19 32	5,021 32
	3d 1839	322 75	8,952 00	206 58	9,481 33
R. T. P. Allen -	4th 1838	-	7,082 00	-	7,082 00
	1st 1839	381 39	10,700 00	19 00	11,100 39
	2d 1839	-	4,852 00	-	4,852 00
R. P. Williams -	3d 1839	-	6,460 00	-	6,460 00
N. B. Haswell -	4th 1838	654 71	6,000 00	-	6,654 71
	1st 1839	-	3,250 00	-	3,250 00
	2d 1839	873 35	11,000 00	-	11,873 35
	3d 1839	-	14,020 00	2 02	14,022 02
Charles M. Watson -	4th 1838	1,595 72	4,613 00	-	6,208 72
	1st 1839	-	10,210 00	-	10,210 00
	2d 1839	-	3,540 00	-	3,540 00
	3d 1839	341 78	-	-	341 78
Thomas Forster -	4th 1838	215 81	3,000 00	40 16	3,256 27
	1st 1839	389 49	-	57 50	446 99
	2d 1839	118 43	-	-	118 43
S. Sampson -	4th 1838	-	1,200 00	-	1,200 00
	1st 1839	389 27	-	-	389 27
	2d 1839	389 27	-	-	389 27
	3d 1839	343 59	-	-	343 59
Asa S. Bowley -	4th 1838	91 09	-	-	91 09
	1st 1839	91 09	-	-	91 09
	2d 1839	91 09	4,358 48	-	4,449 57
. W. Judson -	4th 1838	-	10,311 17	-	10,311 17
	1st 1839	2,796 78	-	-	2,796 78
	2d 1839	740 85	4,482 00	-	5,220 00
	3d 1839	940 07	14,482 00	-	15,422 07
Henry Smith -	1st 1839	2,991 04	7,500 00	-	10,491 00
	2d 1839	2,732 80	-	-	2,732 80
	3d 1839	2,589 44	-	-	2,589 44
Thomas M. Clark -	4th 1838	3,750 47	-	-	3,750 47
	1st 1839	3,750 47	-	-	3,750 47
	2d 1839	3,750 47	-	-	3,750 47
	3d 1839	3,719 47	-	-	3,719 47
W. P. Eaton -	4th 1838	284 59	5,500 00	-	5,784 59
	1st 1839	831 07	-	-	831 07
	2d 1839	11 74	-	240 08	251 82
	3d 1839	40 43	-	82 59	123 02
T. S. Brown -	4th 1838	-	2,991 34	-	2,991 34
	1st 1839	534 02	5,482 00	-	6,016 02
	2d 1839	180 47	2,900 00	-	3,080 47
	3d 1839	350 50	3,826 00	-	4,176 50
. C. Loomis -	4th 1838	120 70	1,290 00	-	1,410 70
	1st 1839	383 88	-	-	383 88
	2d 1839	383 88	800 00	-	1,183 88
	3d 1839	773 88	1,500 00	-	2,273 88

B—Continued.

Amount expended.	Amount turned over to other agents, and replaced in the Treasury.	Total accounted for.	Balance unaccounted for.	Remarks.
4,588 25		4,588 25	910 44	
322 00		322 00	588 44	
2,945 60		2,945 60	344 73	
12,082 86		12,082 86	4,820 87	
6,115 11		6,115 11	284 89	
513 69		513 69		
4,469 77		4,469 77	322 75	
9,221 67		9,221 67	259 66	
6,700 61		6,700 61	381 39	
11,402 12		11,402 12		
4,900 92		4,900 92		
4,747 61		4,747 61	1,712 39	
8,229 42		8,229 42		
2,376 65		2,376 65	873 35	
14,450 39		14,450 39		
13,367 32		13,367 42	654 60	
6,896 09		6,896 09		
11,841 78		11,841 78		
879 07		879 07	341 78	
324 68		324 68	17 10	
2,866 78		2,866 78	389 49	
328 56		328 56	118 43	
178 83		178 83		
810 73		810 73	389 27	
-		-	389 27	
45 68		45 68	343 59	
52 50		52 50	291 09	
-		-	91 09	
-		-	91 09	
4,449 57		4,449 57		
7,514 39		7,514 39	2,796 78	
2,055 93		2,055 93	740 85	
4,282 78		4,282 78	940 07	
13,338 22		13,338 22	2,083 85	
7,758 24		7,758 24	2,732 80	
143 36		143 36	2,589 44	
601 00		601 00	1,988 44	
-		-	3,740 47	
-		-	3,750 47	
31 00		31 00	3,719 47	
680 51		680 51	3,038 96	
4,953 52		4,953 52	831 07	
819 33		819 33	11 74	
211 39		211 39	40 43	
28 85		28 85	94 17	
2,457 32		2,457 32	534 02	
5,835 55		5,835 55	180 47	
2,729 97		2,729 97	350 50	
3,828 99		3,828 99	347 51	
1,026 82		1,026 82	383 88	
-		-	383 88	
410 00		410 00	773 88	
2,025 00		2,025 00	248 88	

B—Continued.

Names of agents.	For what quarter of the year.		Balance in hand, and unaccounted for from last quarter.	Amount remitted from the Treasury and turned over by other agents.	Amount derived from sales, rents, and other sources.	Total in hand, to be accounted for.
Seth Perry -	4th	1838	267 37	8,457 00	-	8,724 37
	1st	1839	3,547 94	-	-	3,547 94
	2d	1839	2,811 94	672 00	-	3,483 94
	3d	1839	753 94	2,323 90	-	3,077 84
Elijah Boynton -	2d	1839	-	4,019 72	-	4,019 72
	3d	1839	194 38	3,872 00	-	4,066 38
Major E. Kirby -	2d	1839	-	10,000 00	37 00	10,037 00
	3d	1839	10,037 00	-	-	10,037 00
John B. Wilbor -	4th	1838	-	3,000 00	-	3,000 00
	1st	1839	244 53	750 00	-	994 53
	2d	1839	596 81	-	-	596 81
Marshal Parks -	4th	1838	2,406 39	1,500 00	76 54	3,982 93
	1st	1839	1,964 76	1,500 00	-	3,464 76
	2d	1839	-	8,200 00	-	8,200 00
	3d	1839	3,208 19	-	-	3,208 19
Ezra Coe -	4th	1838	40 91	970 00	-	1,010 91
	1st	1839	16 00	1,450 00	-	1,466 00
	2d	1839	450 77	-	34	451 11
	3d	1839	-	5,591 00	-	5,591 00
G. B. Weston -	4th	1838	-	500 00	-	500 00
	Ist	1839	500 00	1,597 24	-	2,097 24
	2d	1839	562 87	-	-	562 87
	3d	1839	355 33	-	-	355 33
David K. Akin -	4th	1838	237 93	235 00	-	472 93
	1st	1839	8 19	325 00	-	333 19
	2d	1839	333 19	-	-	333 19
	3d	1839	-	6,610 00	-	6,610 00
Conrad Reid -	4th	1838	2,129 16	1,385 97	-	3,515 13
	1st	1839	442 66	-	-	442 66
	2d	1839	} 390 43	-	-	390 43
	3d	1839	}	-	-	
Thomas Young -	4th	1838	423 20	2,037 14	-	2,460 34
	1st	1839	1,265 16	-	-	1,265 16
	2d	1839	777 07	-	-	777 07
	3d	1839	-	2,000 00	-	2,000 00
Capt. W. Smith -	1st	1839	460 11	3,500 00	-	3,960 11
	2d	1839	172 59	-	-	172 59
	3d	1839	172 59	-	-	172 59
H. H. Dodge -	4th	1838	5,118 40	6,578 00	-	11,696 40
	1st	1839	4,207 53	530 90	-	4,738 43
	2d	1839	2,501 00	5,000 00	120 30	7,621 30
	3d	1839	757 73	10,562 00	-	11,319 78
Horace Hale -	1st	1839	-	6,000 50	-	6,000 50
	2d	1839	-	6,512 17	1,028 70	7,540 87
	3d	1839	1,263 87	-	-	1,263 87
J. A. Potter -	4th	1838	-	2,800 00	-	2,800 00
	1st	1839	479 64	1,872 00	-	2,351 64
	2d	1839	1,796 76	980 00	-	2,776 76
	3d	1839	1,526 67	-	-	1,526 67
Ashbel Dart -	4th	1838	270 74	2,400 00	-	2,670 74
	1st	1839	-	-	-	-
	2d	1839	-	1,500 00	-	1,500 00
	3d	1839	-	600 00	-	600 00

B—Continued.

Amount expended.	Amount turned over to other agents, and replaced in the Treasury.	Total accounted for.	Balance unaccounted for.	Remarks.
5,176 43	-	5,176 43	3,547 94	
736 00	-	736 00	2,811 94	
2,730 00	-	2,730 00	753 94	
3,077 84	-	3,077 84		
3,825 34	-	3,825 34	194 38	
3,549 13	-	3,549 13	517 25	
-	-	-	10,037 00	
9,508 56	-	9,508 56	528 44	
2,755 47	-	2,755 47	244 53	
397 72	-	379 72	596 81	
596 81	-	596 81		
2,018 17	-	2,018 17	1,964 76	
5,307 48	-	5,307 48		
4,991 81	-	4,991 81	3,208 19	
2,094 88	-	2,094 88	1,113 31	
994 91	-	994 91	16 00	
1,015 23	-	1,015 23	450 77	
510 21	-	510 21		
5,728 13	-	5,728 13		
-	-	-	500 00	
1,534 37	-	1,534 37	562 87	
207 54	-	207 54	355 33	
-	-	-	355 33	Accounts for 3d quarter not rendered.
464 74	-	464 74	8 19	
-	-	-	333 19	
741 30	-	741 30		
7,961 39	-	7,961 39		
3,072 47	-	3,072 47	442 66	
52 23	-	52 23	390 43	
-	-	-	390 43	Accounts for 2d and 3d quarters not rendered.
1,195 18	-	1,195 18	1,265 16	
488 09	-	488 09	777 07	
1,329 24	-	1,329 24		
1,914 68	-	1,914 68	85 32	
3,789 52	-	3,789 52	172 59	
-	-	-	172 59	
122 59	50 00	172 59		
7,488 87	-	7,488 87	4,207 53	
2,237 43	-	2,237 43	2,501 00	
6,863 57	-	6,863 57	757 73	
10,199 44	-	10,199 44	1,120 29	
6,024 69	-	6,024 69		
6,252 81	-	6,252 81	1,263 87	
1,855 90	-	1,855 90		
2,320 36	-	2,320 36	479 64	
554 88	-	554 88	1,776 76	
1,250 09	-	1,250 09	1,526 67	
703 59	-	703 59	823 08	
2,670 74	-	2,670 74		
276 72	-	276 72		
1,689 37	-	1,689 37		
479 64	-	479 64	160 44	

B—Continued

Names of agents.	For what quarter of the year.	Balance in hand, and unaccounted for from last quarter.	Amount remitted from the Treasury, and turned over by other agents.	Amount derived from sales, rents, and other sources.	Total in hand, to be accounted for.
M. Hubbard -	4th 1838	575 60	2,600 00	-	3,175 60
	1st 1839	2,107 42	-	-	2,107 42
	2d 1839	1,608 60	63 45	-	1,672 05
	3d 1839	664 00	1,600 00	-	2,264 00
Josiah Haskell -	4th 1838	192 24	5,000 00	-	5,192 24
	1st 1839	322 54	10,000 00	-	10,322 54
	2d 1839	1,302 68	-	-	1,302 68
	3d 1839	1,055 57	-	-	1,055 57
Joshua Herrick -	4th 1838	-	4,786 76	32 75	4,819 51
	1st 1839	698 25	1,218 00	-	1,916 25
	2d 1839	882 87	-	-	882 87
	3d 1839				
F. Bradford -	4th 1838	5,620 56	1,600 00	-	7,220 56
	1st 1839	3,206 07	-	-	3,206 07
	2d 1839	2,262 74	926 00	-	3,188 74
	3d 1839	-	10,754 00	-	10,754 00
William Robinson -	4th 1838	559 37	3,989 00	-	4,588 37
	1st 1839	248 50	-	-	248 50
	2d 1839	248 50	8,428 00	-	8,676 50
	3d 1839	4,260 04	1,572 00	-	5,832 04
A. Talcott -	4th 1838	18,867 66	30,000 00	258 29	49,125 95
	1st 1839	27,156 07	11,835 56	35 98	39,027 61
	2d 1839	427 85	-	-	427 85
J. H. Leavenworth -	2d 1839	-	3,000 00	-	3,000 00
	3d 1839	-	6,970 00	-	6,970 00
Freeman Marchant -	2d 1839	-	1,897 32	-	1,897 32
Daniel Basset -	3d 1839	-	4,733 00	-	4,733 00
D. B. Wood -	1st 1839	-	9,900 00	-	9,900 00
	2d 1839	9,900 00	-	-	9,900 00

TOPOGRAPHICAL BUREAU, *December* 30, 1839.

B—Continued.

Amount expended.	Amount turned over to other agents, and replaced in the Treasury.	Total accounted for.	Balance unaccounted for.	Remarks.
1,068 18	-	1,068 18	2,107 42	
498 82	-	498 82	1,608 60	
1,008 05	-	1,008 05	664 00	
1,148 34	-	1,148 34	1,115 66	
4,869 70	-	4,869 70	322 54	
9,019 86	-	9,019 86	1,302 68	
247 11	-	247 11	1,055 57	
257 50	-	257 50	798 07	
4,121 26	-	4,121 26	698 25	
1,033 38	-	1,033 38	882 87	
-	-	-	882 87	Accounts for 2d and 3d quarters not rendered.
4,014 49	-	4,014 49	3,206 07	
943 33	-	943 33	2,262 74	
3,295 70	-	3,295 70		
10,593 40	-	10,593 40	160 60	
4,299 87	-	4,299 87	248 50	
-	-	-	248 50	
4,416 46	-	4,416 46	4,260 04	
5,824 56	-	5,824 56	7 48	
21,969 88	-	21,969 88	27,156 07	
32,599 25	6,000 50	38,599 75	427 85	
649 41	-	649 41		
4,065 63	-	4,065 63		
6,172 90	-	6,172 90	797 10	
1,897 32	-	1,897 32		
4,653 38	-	4,653 38	79 62	
-	-	-	9,900 00	
9,900 00	-	9,900 00		

J. J. ABERT,
Colonel Topographical Engineers.