

## RAPIDS OF THE MISSISSIPPI.

[To accompany bill H. R. No. 93.]

APRIL 22, 1856.

Mr. E. B. WASHBURN, from the Committee on Commerce, made the following

### REPORT.

*The Committee on Commerce, to whom were referred the bills making appropriations for continuing the improvement of the Des Moines and Rock Island rapids, in the Mississippi river, beg leave to report :*

That the Mississippi river has the greatest length of comparatively uninterrupted navigation of any river in the world. Taking its rise in the lakes in the northern part of the Territory of Minnesota, it flows south through twenty degrees of latitude, till it finds an outlet in the Gulf of Mexico. The enormous extent of country which it drains, known as the Valley of the Mississippi, combines all those elements which make a country distinguished for prosperity, wealth, and greatness. It is the great dividing-line between States. The borders of nine sovereign States and one Territory are washed by it. A commerce of eleven hundred millions now floats annually upon its waters and those of its tributaries, and it is increasing with a rapidity almost without parallel in the history of the country. The wise statesmen of the early days of the republic did not fail to see and appreciate the importance of such a river as a great national highway, even at a period anterior to the application of steam as a propelling power. Their vision, prophetic as it was, and stretching far into the prospective, could not reveal what all now behold in the wealth, power, population, and greatness, of the vast valley of the Mississippi. The great importance to our country that we should control the outlet of such a stream, was the leading cause that impelled to the negotiation which secured to us Louisiana. The products of the whole valley could then only find a market by following that great channel to the Gulf of Mexico, and, in return, importations from foreign countries were received by the same highway of commerce.

The collection district, for which now New Orleans is the only port of entry, embraces an area of territory equal to nearly one-half of the whole territory of the United States. As early as 1824 the attention of Congress was directed to the necessity and propriety of looking after the navigation of the Mississippi river. In 1829, a small appropriation was made for improving the mouth of the river, and in the same, as in the two preceding years, indeed, a general appropriation was made for improving its navigation and the navigation of the Ohio.

The whole amount that has, up to this time, been expended upon the Mississippi alone, is not easy to ascertain, as the appropriations for that river have also embraced some of its tributaries, as will be seen from the following table of the amounts appropriated since the first appropriation of 1824, inclusive.

*Appropriations for the Mississippi.*

1824. For improving navigation of Mississippi and Ohio	\$75,000
1627. ....do.....do.....do.....do.....do.....	30,000
1828. ....do.....do.....do.....do.....do.....	50,000
1829. ....do.....do.....do.....do.....do.....	50,000
1829. For survey of the Passes at the mouth of the Mississippi.....	500
1830. For improving navigation of Mississippi and Ohio	50,000
1832. ....do.....do.....do.....do.....do.....	50,000
1833. For improving navigation of the Mississippi, Ohio, and Missouri.....	50,000
1834. ....do.....do.....do.....do.....do.....	50,000
1835. ....do.....do.....do.....do.....do.....	50,000
1836. ....do.....do.....do.....do.....do.....	60,000
1836. ....do.....do.....do.....do.....do.....	40,000
1836. ....do.....do.....do.....do.....do.....	17,800
1836. For deepening mouth of the Mississippi.....	75,000
1837. ....do.....do.....do.....do.....do.....	210,000
1837. For improving navigation of Mississippi and Ohio,	60,000
1837. For improving navigation of Mississippi, Ohio, and Missouri.....	40,000
1837. ....do.....do.....do.....do.....do.....	23,000
1838. For improving navigation of Mississippi and Ohio, and for replacing snag-boats.....	70,000
1838. For improving navigation of Mississippi, Ohio, and Missouri, and for replacing snag-boats...	20,000
1842. For improving navigation of Mississippi, Ohio, and Missouri, and for repairing boats.....	100,000
1844. For improving navigation of Mississippi, Ohio, Missouri, and Arkansas.....	180,000
1852. For improving navigation of Mississippi below rapids.....	90,000
1852. For improving navigation of Mississippi, Rock River and Des Moines rapids.....	100,000
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	1,541,300
For pier near, and harbor of, St. Louis, in 1836, \$15,000; in 1837, \$50,000; in 1844, \$25,000.....	\$90,000
For dredge-boats, snag-boats, &c., in 1852...	150,000
For harbor of Dubuque, (Iowa,) in 1844, \$7,500; in 1852, \$15,000.....	22,500
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	262,500
	<hr/>
	1,803,800
	<hr/>

Though these rapids have always been the principal obstructions to the navigation of the Mississippi river, no specific appropriations for removing them were made until 1852. Under the appropriation in the law of March 3, 1837, for the improvement of "the Mississippi above the mouth of the Ohio, and the Missouri river," General Charles Gratiot, who was then at the head of the Bureau of Topographical Engineers, directed the first survey to be made of the Des Moines and Rock Island rapids, as appears by the following correspondence:

BUREAU OF TOPOGRAPHICAL ENGINEERS,  
*Washington, March 10, 1856.*

SIR: I have the honor to acknowledge your direction to report upon a letter of the 5th instant, from the honorable E. B. Washburne, of the House of Representatives.

The letter desires to be informed under what law, and also under what instructions, the survey of the Rock River and Des Moines rapids was made by Lieutenant (now Colonel) R. E. Lee, whose report is dated the 27th January, 1838. (December 6, 1837.)

There was no positive direction of law, that I can find, directing the survey to be made. But it is ascertained that the survey was made by order of General Gratiot, dated the 6th April, 1837.

Under the appropriation in the law of March 3, 1837, "for the improvement of the Mississippi river above the mouth of the Ohio, and of the Missouri river," the accounts for the survey were settled and paid out of that appropriation.

In the report from Lieutenant Lee, dated 6th December, 1837, and printed as Senate document No. 139, 2d session 25th Congress, Lieutenant Lee speaks of these rapids as "the only serious obstacles to the navigation of the Mississippi from the mouth of the Ohio to the Falls of St. Anthony," which obstacles (Rock River and Des Moines rapids) he describes in that report: "And as these, in my opinion, form the first objects of attention, surveys have been made of each." The survey and maps are parts of this document.

A copy of the instructions under which Lieutenant (now Colonel) Lee acted is herewith submitted.

Respectfully, sir, your obedient servant,

J. J. ABERT,  
*Col. Corps T. E.*

Hon. JEFFERSON DAVIS,  
*Secretary of War.*

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ENGINEER DEPARTMENT,  
*Washington, April 6, 1837.*

SIR: You are assigned to the superintendence of the improvement of the Mississippi river above the mouth of the Ohio, and of the Missouri river, and of the works for the improvement of the harbor of St. Louis. For these objects Congress, at its late session, appropriated forty thousand dollars for the first, and fifty thousand dollars for the

second, which, with the unexpended balances of former appropriations, are now applicable to them. You will be relieved from duty in this office so soon as your services can be dispensed with, which will be on my return to this city from a western tour. You will then repair to the scene of your contemplated operations, and make the necessary arrangements for pushing them with vigor upon the plan that may be determined on. It is desirable that they should be carried on at three different points simultaneously, viz: in the harbor of St. Louis, at the Des Moines rapids, and at the Rock River rapids, which you will endeavor to accomplish. You will locate yourself at St. Louis, or such other point as may be most advantageous to your operations, and be allowed in commutation of fuel and quarters one dollar per diem. To meet the expenses incident to your extended command, you will also be allowed the equivalent for fuel and quarters granted by the Secretary of War on the 16th July last, viz: \$1 50 per day—both allowances to be paid out of the appropriations for the service on which you are placed. You will make a requisition for such instruments as you may require at once, in order that no time may be lost in procuring them.

I have the honor to be, very respectfully, your most obedient,  
C. GRATIOT.

Lieutenant R. E. LEE,  
*Corps of Engineers, Washington, D. C.*

ENGINEER DEPARTMENT,  
*Washington, July 1, 1837.*

SIR: You are relieved from duty in this department, and will now proceed to execute the orders with which you were furnished on the 6th of April last.

You will first repair to Brownsville, and if you find it necessary will proceed to Pittsburg, to examine the boats and machinery there constructing; you will descend the Ohio to Louisville, and examine what preparations have been made by Captain Shreve for the objects with which you are charged, and what further may be necessary. After this, you will take the first boat to St. Louis.

I am, very respectfully, sir, your most obedient,  
C. GRATIOT.

Lieutenant R. E. LEE,  
*Corps of Engineers, Washington, D. C.*

Lieutenant Lee, having completed his survey of both of the rapids, in compliance with a resolution of the Senate, made a report, from which the committee select the following extracts:

“ST. LOUIS, *December 6, 1837.*

“SIR: Upon my arrival here in August last, in obedience to your orders, assigning to my superintendence the application of the appro-



priations made by Congress for the improvement of the Mississippi river above the mouth of the Ohio, and of the Missouri river, and for the erection of the contemplated works in this harbor, I proceeded to make such an examination as would enable me to submit to your approval the necessary plans; a report of which I now lay before you.

“1. *Mississippi river*.—The only serious obstacles to the navigation of the Mississippi river, from the mouth of the Ohio to the Falls of St. Anthony, a distance of about 1,200 miles, are the Des Moines and Rock River rapids; and as these, in my opinion, form the first objects of attention, surveys have been made of each, the result of which, with my views as to the best mode of their improvement, will be stated under each head.

“*Des Moines rapids*.—These rapids, situated about 200 miles above St. Louis, commence just below the Des Moines garrison, and terminate about three-quarters of a mile above the village of Keokuk, and four miles above the mouth of the Des Moines river. Between these points the Mississippi flows, with great velocity, over an irregular bed of blue limestone, reaching from shore to shore, at all times covered with water, and through which many crooked channels have been worn by the action of the current. Its longitudinal slope not being uniform, but raised at several places above its general elevation, divides the whole distance into as many pools or sections. The passage over these reefs becomes, during low stages of the river, very difficult, in consequence of the shoalness of the water, its great fall and velocity, and the narrow and winding channels through them: as the river rises, its surface becomes nearer and nearer parallel to a plane tangent to the highest of these points, its extreme fall is diminished, and the only impediment consists in the rapidity of the current. The navigation being only impeded during the low stages of the river, which is limited generally from this cause to not more than three months in the year, and the obstructions being of a character to admit of removal, I shall refer only to the improvement of its natural bed, as being not only more practicable, but, in my opinion, preferable to any other.

“The construction of an artificial channel along the Wisconsin shore, proposed by Captain Shreve, in his report of 1836, has many advantages; but, from the information derived from the survey, it is found that it would require an excavation of more than three times the quantity of stone than would be necessary to make the natural channel double as wide, and of an equal depth. To make it the same width, viz: 200 feet wide and five feet deep, would require an excavation of more than a million cubic yards. This, with other considerations, has led me to prefer the improvement of one of the natural channels; and I have selected that which, while it would require no more labor, promises, when completed, to afford the easiest and safest route.

“By improving the most difficult passes first, immediate benefit will be obtained. The meeting of boats will not be attended with the same danger as if they were confined to a continuous channel, as advantage may be taken of the pools before alluded to, where the

navigation is comparatively good. The present length of the channel being but little diminished, the descent will not be much increased, and, though rendered more uniform, the velocity of the current not sensibly augmented. The increased area of the channel will be so small, in comparison with the width of the river, that the supply of water will not be perceptibly lessened. Besides, by obstructing some of the minor channels with the stone excavated from that to be improved, its passage may be so far retarded as to leave no room for apprehension on this head.

“The distance from the head to the foot of the rapids is 11.005 miles, and the entire fall of the river at the time of making the survey was 24.015 feet. The descent is not uniform, being greater over the reefs and less in the pools, is different in every section, and varies at every stage of the river. Having no certain marks to which I could refer, the height of the river could only be compared with extreme low water, by the relative quantity of water on the shoalest parts, and which was 10 or 12 inches more than is said can be found at its lowest stages. I have, therefore, assumed it to be one foot above low-water level, and all the soundings are referred to this plane. \* \* \* \*

“*Rock River rapids.*—The upper, or Rock River rapids, distant about 150 miles from the Des Moines, commence 14 miles above Rock island, and extend to its foot. Within this distance, the Mississippi falls 25.740 feet, descending over a rocky bed, broken by reefs, which at some points reach entirely across the river, affording at low water a shallow channel, and projecting at others from opposite sides, interlock, and form a difficult, winding, and dangerous passage. The fall of the river is not regular, but, like that at the lower rapids, is greater over the reefs, and less in the intermediate pools formed in like manner by them. The velocity of the current, varying with the descent, and continually checked by the rough bed of the river, the winding of the channel, and the projection of the reefs, though not as great as the fall would indicate, is still rapid, and in many places difficult to stem.

“By an examination of map No. 2, you will see that the main channel, worn by the action of the water, is so distinctly marked that there can be no doubt as to the best mode of improving it. The depth of water is generally sufficient, and the difficulty consists in the short turns and narrow passes between the reefs, which oblige the boats to cross the current obliquely, and incur the danger of being forced on the rocks. \* \* \* \*

“In making the improvements herein proposed, the department is so well aware of the importance of commencing with the lower or Des Moines rapids, and the advantages of this course are so apparent, that it can need no further recommendation. Their accomplishment will afford an uninterrupted channel through both rapids, sufficient, at all stages of the river, for the class of boats that can ascend the Upper Mississippi. In calm weather its course would be distinctly marked by the appearance of the water, and the ripples produced by its action against the rocks. These marks are destroyed by the wind, and of course can only be distinguished by daylight. Captain Shreve, in

treating of this subject, says, that buoys, however securely anchored, could not withstand the violence of the running ice; and his experiment at the Grand chain in the Ohio would seem to be conclusive.

"I should still recommend their trial, they being formed so as to offer the least possible resistance, securely anchored in the rock under the protection of a prominent reef, and a hole excavated in the bed of the river to receive them and allow the passage of the ice above. Should it be found impossible to secure them, other expedients must be resorted to, either by spindles, beacons, or buoys, every spring, in order that the full benefit of the operations may be obtained.

"The removal of the obstructions in both rapids, at the several points named, will require an excavation of 172,000 cubic yards through the solid rock. The difficulty attending such an operation under water, which must be performed by blasting, is much increased by the rapid current of the Mississippi, the unexpected rises to which it is subject, and the short season for operations.

"Nothing can be attempted till after the spring freshet, which generally subsides in June, and a rainy or cold fall may suspend the work in October. Men will have to be collected and transported from a distance; and, perhaps, when every thing is prepared, a sudden flood may arrest all operations for weeks, and the whole working season prove unfavorable. So much depends upon circumstances that can neither be foreseen nor controlled, that the estimate presented of the probable cost of the work must only be considered conjectural. Whatever may be the true amount, there can be no doubt but that the benefits that would result would more than authorize ten times the sum, and that the whole community at large would be repaid a hundred-fold. It will open the whole country above to the Falls of St. Anthony, remarkable for its beauty, fertility, and health; abounding in minerals, and whose population is daily increasing by a constant stream of immigration. There are now twenty steamboats, over 120 tons burden each, employed in its commerce, and numerous villages are springing up along the banks of the Mississippi, some of which have already attained a respectable size and importance.

"The annexed tabular statement will show the quantity of excavation required at the points named in each rapids, the average fall per mile over the chains, and the probable cost.

*Tabular statement of the quantity of excavation required to make a channel 200 feet wide and 5 feet deep, through the rapids of the Mississippi river, showing the length of the chains, the average fall, points to be improved, and probable cost of each.*

## 1.—LOWER OR DES MOINES RAPIDS.

Name of chain.	Length in miles.	Average fall per mile.	Points to be improved.	Quantity of excavation.	
				Cubic yards.	Probable cost.
Lower chain -----	2. 000	<i>Feet.</i> 2. 9	A B C D	17, 200	
				11, 000	
				2, 500	
				30, 700	
* Pool between Lower and English chains.	1. 225	2. 0			\$61, 400
English chain -----	0. 800	2. 37	E F	14, 500	29, 000
Lamelles chain -----	3. 180	3. 18	G H J K L	1, 111	
				1, 500	
				1, 000	
				31, 000	
				34, 611	69, 222
Upper chain -----	3. 800	0. 96	M	15, 000	30, 000
	11. 005			94, 811	189, 622

## 2.—UPPER OR ROCK RIVER RAPIDS.

Sycamore chain -----	3. 75		A B C D E	2, 750	
				4, 500	
				4, 740	
				4, 444	
				11, 851	
				28, 285	\$56, 570
† Pool -----	2. 0				
Campbell's Island chain	1. 5		F G	8, 900	
				4, 444	
				13, 344	
					26, 688
Duck Creek shoal -----	4. 0		L M	10, 000	
				1, 700	
				11, 700	
					23, 400
Rock Island chain -----	3. 0	2. 12	U P	23, 000	
				1, 000	
				24, 000	
					48, 000
Total -----	14. 25			77, 329	154, 658

\* Requiring no improvement.

† Pool between Sycamore and Campbell's Island chain requiring no improvement.

Mr. Nicollet, in his report of 1845 to Colonel Abert, chief of the Bureau of Topographical Engineers, "intended to illustrate a map of the hydrographical basin of the Upper Mississippi river," thus speaks of these rapids:

"*The Lower or Des Moines rapids*, on ascending the Mississippi, are two hundred and four miles above St. Louis, and beyond the mouth of the Des Moines, whence they derive their name, which was given to them by the first French settlers who opened the fur-trade in this part of the Mississippi, long before it was known that the Des Moines had any places in its course that could be considered as rapids.

"The spot at which the first difficulties in the navigation of the rapids are encountered, is about three-quarters of a mile beyond Keokuk, and four miles above the mouth of the Des Moines; thence the rapids ascend nearly up to Montrose, where but a few years back was situated Fort Des Moines, and opposite to which is Commerce, which has but lately changed its name to Nauvoo, and become a Mormon settlement.

"In January, 1838, Congress ordered a survey of the rapids, which was intrusted to Captain R. E. Lee, of the corps of engineers. By his estimate, the length of the rapids is eleven miles, with a fall of twenty-four feet. Here the Mississippi tumbles over ledges of a blue limestone, at all times covered with more or less water, and through which many crooked channels have been worn by the action of the current. During low stages of the water, the passage of the rapids is very difficult, as well in consequence of the shallowness of the water as the narrowness and tortuousness of the channel; so that the time of practicable steamboat navigation is shortened by nearly three months in the year, which is about the duration of low water in the river.

"Captain Lee had commenced a system of improvements that has, unfortunately, been suspended, to the great detriment of the country; for without the completion of such improvements as had been so judiciously devised and commenced, the immense resources of the beautiful region of country north of the rapids, in Illinois, Wisconsin, and Iowa, will remain unavailable. In the winter of 1836-'37 I was a witness that \$15 were paid for flour, and \$25 for barrelled pork at St. Peter's, which at St. Louis had probably respectively cost but \$5 and \$8, because the steamers loaded with winter provision had not been able to cross the rapids during the preceding fall. \* \* \* \* \*

"*The Upper or Rock River rapids*, so named from their proximity to Rock river, above the mouth of which they are. On approaching these rapids, in the ascent of the Mississippi, there is presented to the view as beautiful a prospect as can be met with in the whole West.

"Rock Island comes into view covered with a most luxuriant vegetation, and made picturesque by the ruins of an old fort; whilst the town of Stephenson [now Rock Island] and that of Davenport, with the beautiful range of sloping hills in the rear of it, help to form so winning a landscape, as alone to account for the rapidity with which settlements multiply in this portion of the Mississippi. Other more substantial inducements, however, are offered to the immigrant in the



fertile lands that extend to a considerable distance back on both shores of the river.

“The length of the rapids is from fourteen to fifteen miles from Rock Island, to a little below Port Byron on the left side of the river, and Parkhurst on the right side. According to the surveys of Captain R. E. Lee, the fall of the Mississippi from the head to the foot of the rapids, is 25.74 feet. The waters roll over a bed of limestone rocks, the ledges of which sometimes reach quite across, so as at low water to be very shallow, or projecting and interlocking from opposite sides, afford nothing but winding, difficult, and dangerous channels.

“The fall of the river is not regular, but, like that over the lower rapids, is, as might be expected, greater over the reefs and less in the channels, so that the velocity of the current, varying with the descent, and being continually checked by the rocky bed of the river, its tortuousness, occasioned by the projecting ledges above referred to, though not so great as the natural fall would predicate, is still rapid and difficult to overcome. The difficulty consists mainly, however, in the short turns and narrowness of the passes between the reefs, which oblige boats to cross the current in an oblique direction, running the risk of being dashed against the rocks. As a matter of course, the descending boats, being swept along by the current, run the greatest risk. But Captain Lee has shown that it is practicable to remove these obstacles so as to afford a safe passage up and down both of the rapids.

“The general government is certainly interested in hastening these projected improvements, having annually considerable supplies to send to the already established military posts of Prairie du Chien, the St. Peter's, and others that will probably soon be required, as well as to facilitate future transactions with the Indians, which the onward march of events so plainly indicates must, of necessity, take place before long.” \* \* \* \* \*

The plan of Colonel Lee for removing the obstructions afforded by these rapids is the only feasible one, in the opinion of persons most competent to judge. The plan is being substantially followed out in the present prosecution of the work by Major Floyd, under the appropriation of 1852. The following letters on the subject, from experienced boatmen and others having a knowledge of the subject, afford ample evidence to the committee of the highly beneficial results to be realized from a prosecution of that mode of improvement:

GALENA, ILLINOIS, *December 1, 1854.*

SIR: Permit us, the undersigned owners, masters, and pilots of steamboats engaged in the navigation of the Upper Mississippi, at this the close of a low-water season, to express our appreciation of the benefits rendered to our commerce by the results of your present season's work upon the rapids of the Mississippi. Working, as you have done, under many disadvantages, the amount of labor you have been enabled to perform has been of incalculable benefit to the navigation of the rapids. Most if not all of us have cause to remember the centre rock, (removed this season,) which has been the immediate or remote cause of the destruction of an amount of property larger than that of

the entire appropriation. We speak within bounds when we assert that not less than three hundred thousand dollars have been lost by destruction and detention of boats and cargoes upon this chain, which is now perfectly safe, and having over it as great a depth of water as can be found in the channel, over the sand-bars, either above or below the Upper rapids. The improvements also made in the "English" and "Montebello" chains are of a no less beneficial character. These well-known points of danger and delay have, as part of the results of this year's operations, been rendered as safe and easy to navigate as any other part of the "Pools" in the Des Moines rapids. Contrasting both rapids now with what they were at the opening of navigation last spring, we cannot but hope that our representatives in Congress will insist upon the "material aid" for the prosecution of this (to us) important work to completion. Iowa, Wisconsin, Illinois, and the whole country to the Falls of St. Anthony, are deeply interested in this improvement. A single glance at a map of this portion of our valley should convince any one of its "nationality." Petty party disputes we hope may be laid aside; and a united delegation from this portion of the neglected West insist upon this work being prosecuted until we have a free and safe outlet for our products from the "Falls" to the mouth of the Missouri. It may not be improper for us to express our opinion, founded upon practical experience in navigating the rapids, of the mode now being prosecuted by you in removing the obstructions on them. We will briefly state, that we have regarded Major Lee's plan (the one you are now operating upon) as the only one that will prove to be permanent, effectual, and as enduring as the stream that now flows over the rapids of the Upper Mississippi.

Yours, respectfully,

Henry Corwith,	M. Kennett,
D. B. Morehouse,	Edward H. Beebe,
R. Blakeley,	J. M. Harris,
Orrin Smith,	R. S. Harris,
Hiram Bersic,	James Carter,
D. S. Harris,	H. F. McCluskey,
George W. Campbell,	B. H. Campbell.

Major JOHN G. FLOYD,

*Superintendent of the improvement of the Mississippi rapids.*

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GALENA, *March 13, 1856.*

DEAR SIR: In answer to your inquiries in relation to the best mode of improving the Rock Island and Des Moines rapids of the Mississippi river, I can only state that I know of no better mode than that recommended by Lieutenant Lee to the 25th Congress, 2d session, on 29th January, 1838, Senate document No. 139, to which I respectfully refer as embracing all, in my opinion, that would make a safe and permanent channel on this now dangerous and difficult part of our river.

Yours, truly,

D. S. HARRIS.

Hon. E. B. WASHBURNE, *Washington.*

CINCINNATI, *March* 10, 1856.

DEAR SIR: Your note of the 5th instant is before me; and, in answer to the questions you ask relative to my opinion as to the best method of improving the Rock Island and Des Moines rapids, I would beg leave to say, that my opinion is now, and always has been for the past twenty years, that the fastest, easiest, and cheapest, and by far the most successful method is blasting and excavating the rocks on the high chains; this can be done with great ease and facility. Much good has already been the result, and navigation greatly aided by what little has already been done; and I should look upon it as a great public calamity to have the work stopped. You are aware the commerce on the Mississippi is almost doubling annually, and it is discreditable to this progressive age that a noble river like our Mississippi should thus remain obstructed.

Most respectfully, yours,

ORRIN SMITH.

Mr. E. B. WASHBURNE.

GALENA, ILLINOIS, *December* 12, 1853.

SIR: In answer to your inquiries in relation to the improvement of the rapids of the Mississippi, I can only say that I know of no feasible plan other than that reported by Lieutenant (now Major) R. E. Lee, to General Gratiot, Chief Engineer United States army, in 1838. It is comprised in a report of the Secretary of War, Senate document No. 139, of the 25th Congress, second session. Five years' constant employment, in all stages of water, over this part of our river, has confirmed me in the opinion that it is the only mode by which efficient and permanent improvements can be made. There is not a single change from the plans submitted by Major Lee that I could suggest. The channel requires the same work now as it did then. There has been no change, or likely to be for the next fifty years, as in both rapids the river flows over a bed of limestone cut up into pools. No better idea or description of the nature of these obstructions, or what work is necessary to remove them, can be found than in Major Lee's details and maps. The improvements, if made as he has suggested, would place as great depth of water over the channel as has been over many of the sand-bars above and below them this season—say four feet. The surveys made this year are generally looked upon as being as useless as a re-survey of the Capitol would be, in order that members might ascertain its location. Time and money both wasted: *cui bono?* It has always seemed to me that the plan of operating on both rapids at the same time was injudicious. The character of the work, submarine blasting, removing the debris, boulders, &c. being the same, similar boat's tools, materials, &c., are required: consequently double the expense would be required in thus operating; and the ultimate loss to the government or contractor, after the completion of the work, (which, if prosecuted in accordance with Lee's plan, would be permanent, requiring no repairs or alterations,) would be

in the sale or disposal of two sets of boats, &c., instead of one. And should the department persist in its present course, and attempt to operate by contract, it would, as you will readily perceive, greatly increase the expense. We cannot expect to see much greater progress made than has been effected in the past two seasons. Unless the department determines to take the work in hand, and place it under charge of some efficient officer of engineers, or some competent civilian, I do not believe much more will be done than what has already been accomplished—defining the position of rocks and chains, the locality of which we are perfectly familiar with. If Major Lee, for instance, could be placed in charge of these improvements, I believe they would be more effectually and economically prosecuted than by adopting any other course. I name Major Lee (having no personal acquaintance with him) as, in my opinion, far better acquainted with the character of the obstructions, and the requisite means to be taken to remove them, than any other officer. It has ever been my opinion that operations should be commenced on the upper or Rock Island rapids, for the following reasons: it will require a much shorter time to improve them; “the chains” are shorter, and the average of water deeper—there being generally twelve inches more water in the upper than in the lower rapids.

From this state of things arises the fact, that there are no facilities, other than those used by the steamboat and belonging to her, used in transporting freight; consequently any steamboat freighting from a port above them can only transport the quantity of cargo in her hull and barges as will permit her safely to cross them. But so soon as she arrives at Rock Island or Davenport, she can then commence taking in additional cargo, and frequently to a much larger amount than all she could cross the rapids with; and after taking in a *full* load, proceed to Montrose, on the head of the lower rapids, the master being well assured that he will find a sufficient number of “rapids lighters” to transport his whole cargo to Keokuk. Should the water be so low, or the “rocks so high” as to prevent him crossing with his steamboat, he can re-ship his freight, and send forward his passengers to St. Louis on boats that are engaged in the “Keokuk trade.” Now apply this state of facts to freight destined for ports above St. Clair, (head of upper rapids,) say a large part of Illinois, Iowa, Wisconsin, and all of Minnesota; and what is the result? A steamboat cannot take in, for any port in the section above named, a larger quantity of freight than she is enabled to cross the upper rapids with, although this may not be one-fourth of her actual capacity; while on the lower rapids, from facilities there offered, she has passed over to her all she can swim under, and which she may transport to the foot of the Rock Island rapids. Here, if she has more freight for ports above than she is enabled to go over with, she must either “double trip” it, or store her freight. The removing of the obstructions on the upper rapids would open up for us uninterrupted navigation from Montrose to St. Anthony, a distance of 600 miles; whereas, now, a boat can transport her full tonnage but one hundred and fifty miles—say from Montrose to Davenport; and from thence to St. Anthony, four hundred and

fifty miles, she can only transport the quantity she can go over the "upper rapids" with. You are, however, too familiar with all these facts for me to enlarge upon them, and give in detail all the inconveniences that we who reside above the rapids are subjected to. Any person familiar with the commercial usages of the country above the rapids, is aware that "I have as much freight as I can cross the rapids with" is a sufficient and valid reason for not taking freight, although it might be in a situation where it would be totally lost or destroyed, were it not shipped upon the boat then "refusing" it for this sole reason. It is estimated (and I think it not too high) that no less than \$15,000 has been lost during the present season by the sinking, grounding, and detention of boats. On the upper rapids, last year, I should think \$20,000 would not more than cover the losses. When I assure you that thirty dollars per ton has been paid on merchandise from St. Louis to Galena this fall, which, had the rapids been improved, would have been transported for from eight to ten dollars, you can readily understand that it is a matter of some importance to the whole country above the rapids to see this work progressing, the obstructions removed, and a free highway opened up to a southern market for our products, at a cost for transportation of something less than its full market value.

Yours, respectfully,

E. H. BEEBEE.

Hon. E. B. WASHBURN,  
*Washington City.*

As to what has been done in regard to the improvement of these rapids since the appropriation of 1852, the committee refer to the following reports made, since that time, by various officers having the work in charge.

KEOKUK, *March 13, 1856.*

SIR: Your letter of the 29th of February has just been received. You make some inquiry respecting the improvement of the Mississippi rapids, which I will endeavor to answer. I refer you to this extract from my report of November, 1854, the end of the first season's work: "I propose, for the next year's work," &c., "to commence the work at the first low water of spring. In such a season as this, two months could be had before the rise; then, to divide the twenty-fours into three 'shifts' of eight hours each, to work night and day; to work at least two parties at each 'chain,' thoroughly organized, with boats and tools of every description complete. I would thus work at about twenty points continuously throughout the season, and thus double the ordinary season in length. I could thus expend advantageously \$200,000 in the season."

This estimate was predicated upon the use of the old-fashioned *hand-drill*—the only one heretofore used upon this work. Now, the contractor employs a steam-drill of great capacity for work, drilling three or four feet per hour, and sinking a hole to any depth required, and of six inches diameter. The canister of powder is full five inches



in diameter, and the blast of ten times the effect of the old plan. This plan is capable of being extended to almost any amount of work, provided the money is on hand to pay the contractor when the work is done.

It is manifest that any contractor would willingly increase his force and preparations to the largest possible extent, to save time; for time is money, he being compelled by his contract to lay out of 20 per cent. of the work actually done until the contract is completed. I am willing to believe that the present contractor will increase his preparations, both in extent and in improved machinery, adequate to meet any amount of appropriation that might be made, and to execute the work to the best advantage and with the greatest possible rapidity.

One thing is most certain, that exigencies of commerce require these obstructions to be speedily removed; and another, equally certain, it cannot be done without adequate appropriations.

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

JOHN G. FLOYD.

Hon. S. M. KENNETT.

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LOUISVILLE, *February 20, 1854.*

SIR: Your letter of the 13th instant, enclosing a communication from the honorable B. Henn, of Iowa, was received on Saturday, the 18th instant.

In accordance with your instructions, I have the honor to submit the following report on the letter in question:

Two years will have elapsed since the approval of the appropriation for the improvement of the rapids of the upper Mississippi on the 30th of August next—six months hence. The expenditures under this appropriation were committed to my charge on the 27th of April last—less than eleven months prior to this date.

Instructions, explaining and defining the manner of executing the requisite preliminary surveys, and the agents by whom the surveys were to be made, were issued by me under date of June 1, 1853, and a copy of the same was reported in due time to the Topographical bureau. These surveys, and the delineations required in explanation thereof, were indispensable as a means of defining the nature and extent of the work that must be done at the several points at which improvements were required.

The working drawings executed under the direction of Col. Lee, in 1839, could nowhere be found, and of course new surveys and drawings were essential to the resumption of the work fourteen years afterwards.

It is accordingly manifest that the work of improvement could not be commenced till the surveys should be made and the explanatory drawings should be prepared, which have contributed to delay the works to the time when I was relieved from the superintendency of western river improvements by Colonel Johnston.

Numerous reports have been submitted by me to the Topographical bureau, in which a clear exposition has been made of all operations affecting the improvement of the rapids under my superintendency.

To these reports, and especially to my eleventh annual report, with its appended documents, of the 1st of September last, and to my inspection report, dated on the 20th December last, I take leave to refer for various useful details in relation to the subjects of the inquiry instituted in the letter of the honorable member of Congress from Iowa. Without a laborious examination of the office records of western river improvements, all of which have been transferred to the custody of Colonel Johnston, I cannot now furnish the details asked for by the honorable gentleman.

With regard to the queries predicated on a clause of my report to the Board of Engineers, dated at Washington on the 23d of February, 1853, and in relation to certain "modes of improvement informally proposed," I take leave to offer the following remarks, viz :

Within a period of thirty-six years, I have had occasion to visit the upper Mississippi repeatedly in the discharge of official duties. On such occasions the improvement of the rapids has been a topic of conversation between myself and numerous individuals who took a deep interest in the accomplishment of this object. Each individual, as might naturally be supposed, entertained favorite views in reference to the best method of improvement. The methods thus "informally proposed" consisted for the most part of the modes contemplated in my report above cited. But with respect to the contingents, "*where, when, and by whom*" the several methods were discussed or proposed, I cannot define with accuracy. It may suffice to remark, that at one time I was in favor of a lateral canal, with locks, on the Illinois side of the river, especially at the Des Moines rapids; subsequently, I inclined to the opinion that the Iowa side of the river was better adapted as the site of a similar canal; and on more mature deliberation, I came to the conclusion that the method proposed and recommended in my report of 23d February, just before cited, and for the reasons therein stated—the method by sluice navigation—was preferable to that by lateral canals on either side of the river, and especially to that by slack-water navigation, effected by means of locks and dams across the river. I claim not the credit of having originated either of the methods alluded to; and at the same time disclaim, as I usually have done, the application of any method of improvement that would have a tendency to destroy or even impair the natural navigation of the river in which improvements may be required.

In conclusion, I can assure you that nothing has been done, and no expenses or delays have been incurred, except in so far as relates to the discovery of the most favorable localities for the opening of channels best adapted to sluice navigation within the low-water margins of the river at both of the rapids.

Very respectfully, sir, your obedient servant,  
S. H. LONG,

*Lieut. Col. Top. Engs., late Supt. W. R. Improvements.*  
Colonel J. J. ABERT,  
*Chief Top. Engineers, Washington, D. C.*

DR.

*Lieutenant Colonel S. H. Long in account with Lieutenant Col. J. E. Johnston.*

CR.

H. Rep. 69—2

1853.			1853.		
Nov. 1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of western rivers.....	\$8,565 55	Oct. 8	By amount of H. Fendren's receipt transferred ----	\$500 00
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Mississippi river.....	7,921 25	8	By amount of Thomas Riddle's receipt transferred..	500 00
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Arkansas river.....	3,641 68	14	By amount of N. M. Ferguson's receipt transferred..	500 00
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Missouri river.....	3,573 85	14	By amount of H. R. Day's receipt transferred.....	500 00
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Illinois river.....	439 55	15	By amount of H. R. Day's order in favor of T. S. Brown .....	28 00
			29	By amount of Col. Johnston's receipt transferred ..	12,000 00
			Dec. 3	By cash advanced snag-boat No. 1 .....	500 00
				By amount overpaid on account of improvement of rapids of upper Mississippi, per abstract and vouchers transferred .....	1,365 47
				By Lieut. Col. S. H. Long's transportation allowance, per voucher.....	187 10
				By Lieut. Col. S. H. Long's com. quarters and fare, per voucher.....	138 00
				By Lieut. Col. S. H. Long's office rent and fuel, per voucher .....	77 60
				By amount paid C. Basham, jr., per voucher .....	2 25
			24	By cash advanced snag-boat No. 4 .....	500 00
			24	By cash advanced snag-boat No. 3 .....	
				By balance delivered Col. Johnston in cash, as per receipt .....	6,843 46
		24,141 88			24,141 88

I certify that the above account current is correct in all respects, and the balances of the appropriations therein exhibited are correctly stated, and they cover the entire amount drawn by me under each appropriation, and the respective balances still remaining in my possession; also the final balance to be transferred to Lieut. Col. J. E. Johnston, superintendent of western river improvements, in conformity to orders from the War Department, dated October, 1853, is \$6,843 46.

S. H. LONG,

*Lieut. Col. Top. Eng., late Superintendent of Western River Improvements.*

Received, Louisville, January 6, of Lieut. Col. S. H. Long, late superintendent western river improvements, six thousand eight hundred and forty-three dollars and forty-six cents (\$6,843 46) in full of above balance, and of all accounts relating to the improvement of western rivers.

J. E. JOHNSTON, *Supt. W. R. I.*

OFFICE WESTERN RIVER IMPROVEMENTS,  
Louisville, Kentucky, April 6, 1854.

SIR: Having completed the drawings of the rapids of the Mississippi, constructed from surveys made by order of Lieutenant Colonel S. H. Long, topographical engineers, I have the honor to submit this report on the subject.

The instructions required such surveys at the *lower rapids* (Des Moines rapids) and at the *upper rapids* (Rock River rapids) as were necessary to determine the best and most economical route along the bed of the river for forming a continuous navigable channel, 200 feet wide and 4 feet deep at the lowest stages. It is hardly necessary to state that this required an entirely new survey; the maps made in 1837 by Lieutenant (now Brevet Colonel) Lee, of the engineer corps, being on too small a scale to exhibit the character and extent of the channels and their obstructions.

The time was too limited, with the means at hand, for a thorough survey of the river-bed, and it was determined, after a careful examination and consultation with some of the ablest pilots, to confine the more accurate survey to the vicinity of the channel now navigated. This channel is undoubtedly the most practicable one for improvement. The general flow and direction of the current is here, being obstructed in other parts by broad shoal reefs.

The soundings on the drawings are, therefore, confined mainly to the vicinity of the present channel, with a confidence that where they have not been made, the prospect for improvement is by far less favorable.

Angles were taken on the position of *each* sounding by two theodolites, and special care was taken to determine the edges of the channels and reefs wherever they were crossed by the lines of soundings. Every attention was paid to secure accuracy; and in order to exhibit the channels and reefs distinctly, the drawings were constructed on a scale of 32 inches to one mile. The line of four feet low water is delineated, and lines drawn to show the parts necessary to be removed. In the improvement thus designated, all short turns and cross-currents are avoided as far as is consistent with a due regard for economy.

### *Lower Rapids.*

The foot of these rapids, beginning at Keokuk, about half a mile above the depot of the St. Louis Packet Company, extends up the river  $10\frac{1}{2}$  miles. There are four principal chains, known as the Lower, English, Lamallee's, and Upper. The first three are nearly contiguous, and are divided into other reefs variously named. The Upper Chain is distant from Lamallee's by  $2\frac{1}{2}$  miles, and this interval is comparatively unobstructed.

The rock composing the reefs is a compact stratified limestone, in which are flint and geodes, and interstratified with blue clay a few inches in thickness. The limestone strata are nearly horizontal, and vary in thickness from a few inches to three and four feet. A few large granite boulders are found on the rapids and along the shore. The width of the river is about one mile.

To connect the stations used in sounding, a survey was made of 6 miles of the left bank, and  $12\frac{1}{4}$  miles of the right bank. The levels taken along the latter show the fall, at low water, to be 21 feet from the head to the foot of the *obstructions*, and the average slope two feet per mile. This slope is, however, not uniform, the maximum being six feet per mile, and the minimum about two-tenths of a foot per mile.

The maximum range of the water-surface at the head of the rapids is  $11\frac{3}{4}$  feet, and at the foot 21 feet. Hence, high-water fall  $13\frac{1}{4}$  feet, and average fall 1.12 foot, per mile.

The velocity at low water nowhere reaches five miles per hour. At high water, though the total fall is less, it is more uniform, and the friction along the bottom is so much less in proportion to the volume of water, that the velocity is greatly increased, and must reach seven miles per hour.

At present, steamboats of the least tonnage, drawing two feet, cannot pass at low water without imminent danger of getting fast on the rocks, and the navigation is entirely suspended, or performed only with lighters at a cost of from 75 cents to \$1 25 per ton. At this same stage there is three feet water on the bars above and below the rapids. As the river rises, the water increases on these bars more than on the rapids, owing to the greater width and slope of the latter.

The ratio is nearly expressed in the following table, supposing the channel on the rapids deepened to 4 feet at low water:

With 3 feet on the bars, there would be 4 feet on the rapids.

4 do.	do.	do.	do.	4 feet 3 inches on the rapids.
5 do.	do.	do.	do.	4 feet 7 inches on the rapids.
6 do.	do.	do.	do.	5 feet on the rapids.
7 do.	do.	do.	do.	5 feet 8 inches on the rapids.
8 do.	do.	do.	do.	6 feet 6 inches on the rapids.

I endeavored to furnish a table showing the duration of each of these stages during several years, but could not obtain the data. It might be important to aid in deciding upon the maximum depth to be given to the improved channel, in order to adequately accommodate the commerce of the river at mean stages. This, however, has less importance at this time, as the improvement, unlike a canal constructed with adequate dimensions, may be extended at any future period without more expense and inconvenience than now.

The operations of Captain Lee, in removing the obstructions, were confined to the Lower and English Chains. Pilots say that he enabled steamboats to pass them drawing from nine to twelve inches more water than they could before. In addition to this, his examinations at Lamallee's Chain resulted in discovering the channel now used through the upper part of it, known as Spanish chute.

The effect of his operations at the "Omega Patch," (Lower Chain) was, besides deepening the water in the neighborhood, to make the current draw more forcibly upon it. The patch itself would all have been removed by him had the improvement been continued.

This locality, four-tenths of a mile from the foot of the rapids, and 870 yards from the Iowa shore, is the most difficult to pass of any, owing to swift cross-currents, and boats grounded on it have great difficulty in getting off. It should be the first improved. The chan-



nel crosses over to the Illinois shore at Montebello, one mile from foot of rapids. As we ascend, the next difficult pass (marked E'') is at the foot of English Chain, two miles from foot of rapids, and 170 yards from Illinois shore. The next (marked B'') is near the head of English Chain, about three miles from foot of rapids, and 200 yards from Illinois shore.

The next are on Lamallee's Chain, at place marked R,  $5\frac{3}{4}$  miles from foot of rapids, 500 yards from Illinois shore; at place marked I and J,  $6\frac{1}{2}$  miles from foot, 600 yards from Illinois shore; and at place marked G and F, head of Lamallee's Chain,  $6\frac{3}{4}$  miles from foot, and 600 yards from Illinois shore. Above this the channel crosses over to the Iowa shore. The next pass is the Upper Chain, and here a continuous cut of about 800 feet will be required.

The improvement of the Upper Chain would immediately lessen the distance for lightering about four miles; this would not, however, much diminish the expense, which is mainly incurred in unloading and lading.

At the Upper Chain, and at the "Omega Patch," there is no four-foot channel, and a cut will be necessary. At the other passes named above, the channel is divided by narrow ledges, the removal of which will be comparatively easy.

The lower reefs of the rapids are materially affected by back-water from floods in the Des Moines river, four miles below. Owing to this, pilots, by trusting their marks at the foot of the rapids, venture up them, drawing more water than is found above. Sand-bars, acting as dams, also affect the water on the lowest reef, which becomes the most impassable obstruction when long continued low water has removed the sand.

An accurate idea of the present channel can be had by inspecting the drawings, and renders further description unnecessary; and but a glance will be required to convince one of the facility with which it can be improved and made adequate to meet the wants of commerce.

Captain Shreve, in his report in 1836, urgently recommends that these rapids be improved by excavating a channel 90 feet wide, five feet deep, along the Iowa shore, from Keokuk to Nashville, and through the Upper Chain, near the foot of Montrose island.

He states, "by pursuing this plan, the navigator will have the shore for his guide, and cannot miss the channel at any stage of water. Consequently, it will not be necessary to excavate a channel more than 90 feet wide, which width can be more easily navigated than a channel 300 feet wide, following the meanderings of the natural channel that now exists between the reefs." Captain S. thinks the expense of excavating rock near the shore will be ten per cent. less than near the natural channel.

This mode of improvement has still many friends among river men, on account of the ease with which such a channel could be navigated under all circumstances; the objection to a perfect navigation of the natural channel improved, being its distance from the shore.

The survey was extended to embrace this shore channel. It is used wholly in towing lighters up the rapids. In its present condition it is at the shoalest places, in low water, from 10 to 12 inches deep. It has never been improved, and the depth could be easily increased to 18 inches.

To make a channel four feet deep, we must begin at the foot of the rapids, and excavate from 6 inches to  $2\frac{1}{2}$  feet, almost continuously to the landing at Nashville, a distance of  $7\frac{1}{2}$  miles. The total fall is 18 feet, average slope  $2\frac{4}{10}$  feet per mile. The greatest slope the improvement would have, need not at any point exceed four feet per mile. Above Nashville the improvement should be made as indicated on the drawings.

This plan is more economical, and for the purposes of navigation preferable in every respect to that of a canal and locks.

A fatal objection to both is, that all the labor bestowed upon them would be worthless till the whole was completed; and the great oppression which these rapids cause to commerce requires that *immediate relief*, which can only be applied by improving the natural channel, beginning at the worst passes first. This should be done, no matter what may be the improvement finally required, and no attempt should be made to widen any portion beyond 100 feet till the whole is made of this capacity.

The channel marked out on the drawings will be, when improved, nearly straight, crossing the river but twice, and then in *pools*, where the current is moderate. Any estimate of the amount of rock that will require removing in order to effect this, must at best be a very rough one. Former experience shows, that to remove a portion of a stratum we must remove the whole of it; that is, if in deepening a part now having three feet water, we should come on a stratum two feet thick, we must remove it all, and make five feet water. How much this may increase the quantity to be removed, can only be known by experience.

Even more unreliable must be an estimate of the cost of removing a given amount. The work can only be carried on during a limited portion of the year—three months at most, (August, September, and October;) and after every preparation has been made, an unfavorable condition of the river may almost, if not entirely, prevent operations, and all the expense will have been of no avail.

Captain Lee was not able, owing to continued high water and early fall, to work more than twenty days in 1838. He reports the amount of excavation at about 318 cubic yards. He had a most favorable season in 1839, of about three months. In his report of this year, it is stated that the amount of stone removed is something more than 2,000 tons, about 1,027 cubic yards; total for both years, 1,345 cubic yards.

The actual expense of removing this amount of rock was, in 1838, \$29,028 32; and in 1839, \$18,924 98—total, \$47,953 20. The average cost, then, was \$35 72 per cubic yard; or, for the favorable season, \$18 42 per cubic yard.

From the more settled condition of the country, and the facilities it affords, together with the advantage of former experience, we might now expect to remove the rock at \$10 per cubic yard.

The following table shows the amount of rock to be removed in making the natural channel four feet deep:

Locality.	Present width of 4-foot channel.	Amount to be re- moved to make it 100 feet wide.	Amount to be re- moved to make it 200 feet wide.
<i>Upper Chain.</i>	<i>Feet.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
Cut A, (800 feet long,) only 2½ feet water-----	-----	2,970	8,900
Point B-----	30	730	4,040
Point D, (Baptiste's reef)-----	200	10	1,130
Total *-----	-----	3,710	14,070
Nashville crossing, (only 3 feet water)-----	-----	1,288	2,777
<i>Lamallee's Chain.</i>			
Reef G, } "Spanish chute"-----	{ 25	2,666	2,666
Reef F, }	{ 25	-----	4,000
Point H-----	140	-----	830
Reef I, } "Lime-kiln patch"-----	{ 50	1,360	2,250
Reef J, }	{ 50	600	600
Point K-----	100	-----	700
Point L-----	100	-----	500
Point M-----	90	-----	680
Point N-----	90	-----	218
Reefs O, P, Q, } Hole in Wall-----	{ 50	250	500
Reef R, }	{ 70	100	333
Reef S-----	35	200	2,222
Reef T-----	55	666	2,266
Reefs U, V, W-----	65	-----	9,425
Reef X-----	100	-----	370
Reef Y-----	40	222	222
Reef Z-----	100	-----	50
Reef A'-----	100	-----	45
Point B'-----	100	-----	1,666
Point D', }	{ 60	-----	666
Reef E', } Stud-horse chute-----	{ 60	1,923	1,928
Point F', }	{ 69	-----	760
Total-----	-----	7,927	32,897
<i>English Chain.</i>			
Point G'-----	150	-----	20
Point H', (a single rock)-----	120	1	1
Reef A'-----	80	666	666
Reefs B' and C', (Centre patch)-----	30	888	888
Reef D'', (partly removed by Lee)-----	50	22	22
Reef E'', (Brown's patch)-----	25	2,666	2,666
Reef J'-----	200	-----	132
Reefs F'', G'', H'', and I'-----	80	-----	17,770
Total-----	-----	4,243	21,165
<i>Lower Chain.</i>			
Point K'' } Montebello crossing-----	{ 150	-----	40
Cut N'' }	{ -----	868	1,736
Rock O''-----	200	-----	1
Reef P''-----	75	-----	5,370

\* This work is also a part of the shore improvement.

Locality.	Present width of 4-foot channel.	Amount to be removed to make it 100 feet wide.	Amount to be removed to make it 200 feet wide.
<i>Lower Chain—Continued.</i>	<i>Feet.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
Cut Q", (partly removed by Lee) -----		1,333	2,666
Reef S", (Omega patch) -----	25	1,000	4,000
Point R" -----	25		296
Point T" -----	30	814	814
Point U" -----	30		800
Patches V" -----	150		555
Point X" -----	65	148	866
Reef Y" -----	15	650	1,300
Total -----		4,813	18,444

From the foregoing we obtain the following as the cost of improving the natural channel at the lower rapids:

1. *For channel 100 feet wide and 4 feet deep.*

Upper Chain -----	3,710 cubic yards, at \$10, \$37,100	
Nashville Crossing -----	1,288 do do 12,880	
Lamallee's Chain -----	7,927 do do 79,270	
English Chain -----	4,243 do do 42,430	
Lower Chain -----	4,813 do do 48,130	
Total -----	21,981	219,810

2. *For channel 200 feet wide.*

Upper Chain -----	14,070 cubic yards, at \$10, \$140,700	
Nashville Crossing -----	2,777 do do 27,770	
Lamallee's Chain -----	32,897 do do 328,970	
English Chain -----	21,165 do do 211,650	
Lower Chain -----	18,444 do do 184,440	
Total -----	89,353	893,530

To make the shore channel four feet deep, we must excavate for a width of 100 feet:

From foot of rapids to the Nashville landing ---	225,300 cubic yards, at \$9, \$2,027,700	
Upper Chain -----	3,710 do at 10, 37,100	
Total -----	229,010	2,064,800

*For a width of 200 feet.*

From foot of rapids to the Nashville landing ---	450,600 cubic yards, at \$9, \$4,055,400	
Upper Chain -----	14,070 do at 10, 140,070	
Total -----	464,670	4,195,470

*Upper Rapids.*

These, beginning at half a mile above the Lower end of Rock island, extend 13 miles up the river. The principal reefs are known as Lower Chain, (at foot of rapids,) Rock Island Chain, (two miles from foot,) Duck Creek Chain, ( $4\frac{1}{2}$  miles from foot,) Campbell's Chain, ( $7\frac{1}{2}$  miles from foot,) St. Louis Chain, (10 miles from foot,) Sycamore Chain, (12 miles from foot,) and Upper Chain.

Unobstructed spaces intervene between these chains, the greatest being two miles, between Campbell's and St. Louis Chains.

Much of the rock is a very friable limestone, and, when quarried, breaks up in the smallest pieces. A very soft yellow sandstone is also common, and a little slate. Large granite boulders are found in many places.

Owing to the softness of the rocks composing the reefs, they have been much more worn away and dislocated by the ice and currents than at the lower rapids, and do not form as great an obstruction. Small steamboats, drawing  $2\frac{1}{2}$  feet water, pass them at the lowest stages, towing their barges. The navigation, however, is attended with great risk, and every year that has low water sees several steamboats sunk, and others seriously injured.

Duck Creek and Campbell's Chains are particularly dangerous. The current is moderate at both, (about three miles per hour;) but the boat, to avoid the prominent rocks, is required to make such sudden turns as cannot often be performed, especially by stern-wheel boats. These two obstructions claim the earliest attention. Sycamore and Upper Chains should have the next.

Rock Island Chain is a continuous flat reef across the river-bed, with a low-water depth of  $2\frac{1}{2}$  feet. To make four feet, a cut through it 600 feet long will be required. The water was raised here about 10 inches, by building the dams connecting the islands with the Illinois shore. The width of the river was thus considerably reduced. In the narrowest part it is but 400 yards wide. The average width of the rapids is about half a mile.

In connecting the stations used in sounding, four miles of the right bank were surveyed, and  $14\frac{8}{10}$  miles of the left bank. A line of levels gave the fall from head to foot at lowest water 22 feet; average slope,  $1\frac{7}{10}$  foot per mile. The greatest slopes of surface are at Upper, Sycamore, and Rock Island Chains, the current being between four and five miles an hour. The range from low to high water at the head of the rapids is 13 feet, and at the foot 23 feet, making the high-water fall 12 feet, or  $\frac{1}{13}$  foot per mile. The relation between the rise on the chains, and on the sand-bars above and below these rapids, is not well known.

The chutes behind Campbell's and Fulton's islands are not navigable, and could not be made so as easily as the channel now used. But slight benefit would result from closing them. The only method of improving the upper rapids is to remove the rocks that now obstruct the channel, and close some of the side chutes whose tendency is to produce cross-currents.

The following table shows the amount of rock to be removed to make the present channel four feet deep :



Localities.	Present width.	Amount to be re-moved to make it 100 feet wide.	Amount to be re-moved to make it 200 feet wide.
<i>Upper Chain.</i>			
	<i>Feet.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
Point A.....	130	-----	625
Point B.....	150	-----	350
Point C.....	175	-----	200
Cut D*.....	-----	740	1,480
Cut E*.....	-----	2,220	4,440
Total.....	-----	2,960	7,095
<i>Sycamore Chain.</i>			
Point A.....	100	-----	1,330
Point B.....	180	-----	270
Point C.....	200	-----	170
Patch D.....	75	20	20
Points E and F.....	70	33	1,500
Points G and I.....	70	-----	1,690
Point J.....	70	432	1,330
Point K.....	-----	74	700
Point L.....	200	-----	90
Points M and O.....	150	-----	669
Rock N.....	75	1	1
Total.....	-----	560	7,770
<i>Crab Island.</i>			
Patches A and B.....	180	-----	800
Points C and C'.....	150	-----	500
Total.....	-----	-----	1,300
<i>St. Louis Chain.</i>			
Point D.....	60	160	155
Patch E, (St. Louis rock).....	60	-----	160
Point G.....	80	115	250
Point H.....	80	-----	800
Points I and J.....	170	-----	175
Total.....	-----	275	1,540
<i>Campbell's Chain.</i>			
Point A.....	170	-----	} 123
Point B.....	150	-----	
Rock C.....	60	10	10
Rock D.....	100	-----	57
Rock E.....	100	-----	} 140
Rock F.....	100	140	
Cut G, (very difficult to pass).....	-----	1,670	8,900
Point H.....	80	20	} 195
Point I.....	195	-----	
Patch J.....	80	10	10
Patch K.....	200	-----	130
Patch L.....	80	260	265
Total.....	-----	2,110	9,380

\* These cuts are made near the present channel (70 feet wide) to avoid cross currents.

Localities.	Present width.	Amount to be re- moved to make it 100 feet wide.	Amount to be re- moved to make it 200 feet wide.
<i>Winnebago Island.</i>			
Patches A, B, C, D, and E, (lying in channels)-----	<i>Feet.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>
		180	180
<i>Duck Creek Chain.</i>			
Patch A-----	200		1
Patch B-----	200	1	1
Cut C, } Dangerous {-----		840	2,500
Rock D, }		1	1
Patch E-----	100	113	113
Points F and G-----	25	1,033	1,033
Points H and I-----	200		166
Total-----		1,988	3,815
<i>Rock Island Chain.</i>			
Point A-----	150		200
Cut B-----		3,890	7,775
Point C-----	100		150
Patch D-----	120		10
Patch F-----	150		65
Total-----		3,890	8,200
<i>Lower Chain.</i>			
Points A and B-----	200		4,500
Points C and D-----	70	400	1,230
Rock E-----	200		5
Total-----		400	5,735

From the above we obtain the following as the cost to improve the natural channel at the upper rapids:

*For a channel 100 feet wide and 4 feet deep.*

Upper Chain-----	2,960 cubic yards, at \$10,	\$29,600
Sycamore Chain-----	560 do do	5,600
St. Louis Chain-----	275 do do	2,750
Campbell's Chain-----	2,110 do do	21,100
Winnebago island-----	180 do do	1,800
Duck Creek Chain-----	1,988 do do	19,880
Rock Island Chain-----	3,890 do do	38,900
Lower Chain-----	400 do do	4,000
Total-----	12,362	123,620

*For a channel 200 feet wide and 4 feet deep.*

Upper Chain .....	7,095 cubic yards, at \$10, \$70,950	
Sycamore Chain .....	7,770.....do.....do.....	77,700
Crab's island .....	1,300.....do.....do.....	13,000
St. Louis Chain .....	1,540.....do.....do.....	15,400
Campbell's Chain .....	9,380.....do.....do.....	93,800
Winnebago island.....	180.....do.....do.....	1,800
Duck Creek Chain.....	3,815.....do.....do.....	38,150
Rock Island Chain .....	8,200.....do.....do.....	82,000
Lower Chain .....	5,735.....do.....do.....	57,350
Total.....	45,015	450,150

#### CONCLUSION.

The practicability of improving the channel by removing the rocks in the bed of the stream, has been proved beyond question by the result of former operations; and a careful examination of the obstructions themselves is sufficient to convince any one without further demonstration. All the rapids pilots I have heard on the subject are unanimously of this opinion. No apprehension need be felt that, by enlarging the narrow passes, we shall lower the water in the pools above, and cause new obstructions. The effect of a sluice-way two hundred feet wide cannot sensibly affect the pools with the whole river for their supply; and even if so, it can be remedied by depositing the excavated rock in the numerous small chutes. Sharp edges will, in most cases, be avoided at the sides of the channel, as the improvement will be effected by removing narrow ledges that at present divide the channel, and the sides will remain as before. A little care will avoid danger to boats where it has been necessary to cut off a point.

The method pursued by Captain Lee, was to drill holes by means of iron tripods standing in the water, with platforms on them for the workmen, and for guides to the drill. The holes were made about one and three-quarters inch in diameter, through two-thirds of the stratum—it having been found impracticable to remove more than one stratum at a time. The charge of powder used was about half a pound; it was placed in a tin tube, which was then filled with sand. The tube being prepared, was placed in the hole immediately on removing the drill; the tube rose above the water, and was supported by the tripod. The effect of the explosion was merely to "split the rock," pieces seldom being thrown out of the water.

The blasting was thus effected as rapidly and economically as if on the shore. The great difficulty is in removing the detached pieces. Captain Lee states that it must keep pace with the blasting, and cannot be done advantageously where the water is more than five feet deep. Men were employed expressly to work in the water, whose duty it was to place the tripods, pry out the rock, and fasten to it. Crane-boats were used to raise the stone and deposite it in scows, and these, by means of a "veering-boat," (flying-bridge,) were swung to the deep holes, and the material was there deposited.

The crane-boats should be constructed double, with a recess suffi-

ciently large to enable the men to fasten to the stone and raise it between the boats. If hoisted from the side, there is much labor lost in careening the boat before she attains sufficient bearing to raise the stone.

The estimates I have given may be thought too great; but, from careful examination, I am convinced that they are not. It must be considered that the work has to be done at a distance from the shore, in a swift current, and liable to frequent interruptions from boats and rafts, and that after all the preparations have been made, the season may prove unfavorable. Still the value of these improvements far outweighs the expense of making them, as the detriment which the two rapids now occasion to commerce is estimated "between five and six hundred thousand dollars annually." (Mr. O'Sullivan, civil engineer—report on Warsaw and Port Byrne railroad.)

The drawings of the upper rapids, and preliminary report, were furnished Col. Long September 20, 1853; and of the Lower and English Chains of the lower rapids, October 20, 1853. The other duties I have been required to perform have occasioned the delay in presenting this.

My instructions from Col. Long directed me to co-operate in the surveys with Mr. J. Barney, United States agent for the upper, and Mr. J. G. Floyd, United States agent for the lower rapids. I was deprived of this, on the part of the former, by the requirements of his agency at Dubuque, and of the latter by his ill health.

I am, however, indebted to them, as well as to Captain Leroy Dodge, Captain Bersie, Captain Hines, Captain Hugh White, Captain Hall, Captain Waggonner, and other river-men, for their counsel and advice. Captain Waggonner and Captain Hall aided me in the surveys.

Very respectfully, sir, your obedient servant,

G. K. WARREN,

*Lieut. Topographical Engineers, U. S. A.*

Brevet Lt. Col. J. E. JOHNSTON,

*Corps Topographical Engineers,*

*Sup't W. R. Improvements, Louisville, Ky.*

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OFFICE BOARD OF ENGINEERS,

LAKE HARBORS AND WESTERN RIVERS,

*Washington, August 26, 1854.*

SIR: The board having duly considered the letter of the bureau of the 10th instant, I am instructed to submit the following report upon that part of it which relates to the rapids of the Mississippi.

On a former occasion the attention of the board was directed to this subject, and a report thereon was submitted under date of February 23, 1853.

For want of the requisite details of the surveys that had been made previously to that date, and in the absence of any plans, sections, &c., indicating with the requisite precision the true character and condition of the channel to be improved, except in so far as relates to a general

chart of Des Moines and Rock Island rapids, respectively, on a scale too small to indicate the nature and extent of the obstructions contemplated to be removed, the board was constrained to supply numerous deficiencies by assumptions instead of accurate data, and to present its opinions in regard to the quantity and cost of the work required on premises of a character somewhat questionable. Accordingly, they assumed equal quantities of rock excavation for both of the rapids above mentioned, viz: 100,000 cubic yards for each; and equal prices per cubic yard, viz: \$2 50, including all expenses incident to the execution of the work on each of the rapids, and giving for the aggregate quantity and cost of improving both rapids 200,000 cubic yards at \$2 50—\$500,000.

In a subsequent report of the board, submitted under date of February 7, 1854, on the amounts required for the completion of the improvement of both rapids, is the following remark, viz:

“The estimated cost of completing these works (viz: in the aggregate \$464,000) is founded on the reports of Captain Lee, corps of engineers, dated December 6, 1837. Recently a more minute examination of the ground and the consideration of the enhanced prices of labor and materials led to the opinion that the ultimate cost of these works will greatly exceed the amount stated. These remarks apply to the Rock Island and Des Moines rapids improvements, the estimates for which are about to be revised.”

The examination alluded to in the foregoing extract has been made, and a report thereon has been rendered by Lieutenant G. K. Warren, under date of the 6th of April last, who was charged with the surveys and investigations deemed necessary to a full and clear understanding of the localities, nature, and extent of the work required to be done, in order to effect the desired improvement of both of the rapids.

The probable cost of the work, as reported by Lieutenant (now Colonel) Lee in 1837, and by Lieutenant Warren in 1854, differ materially. The board are not, however, sufficiently informed as to the nature of the work, and of the circumstances under which it must be performed, to give a decided opinion upon this point. They feel constrained, therefore, to exhibit the estimates of those two officers, and to adopt a mean between them for the cost, as the nearest approximation to the actual cost at which they are now able to arrive.

In Colonel Lee's estimate of December 6, 1837, as based on surveys and examinations made under his direction, and with the view of opening a continued low-water channel 200 feet wide and 5 feet deep throughout, are embraced the following summary items, viz:

Excavation of the entire channel from the head to the foot of the Des Moines rapids, 11,005 miles, 94,811 cubic yards, at \$2 .....	\$189,622 00
Excavation of the entire channel from the head to the foot of Rock Island rapids, 14 miles, 77,329 cubic yards, at \$2.....	154,658 00
Total for both rapids, 172,140 cubic yards.....	<u>344,280 00</u>



In Lieutenant Warren's estimate of April 6, 1854, as based on surveys and examinations made by him, with a view to the formation of a continued low-water channel 200 feet wide and 4 feet deep throughout, are embraced the following summary items, viz:

Excavations of the entire channel, from the head to the foot of the Des Moines rapids, 10½ miles, 89,353 cubic yards, at \$10 per cubic yard.....	\$893,530 00
Excavation of the entire channel from the head to the foot of Rock Island rapids, 13 miles, 45,015 cubic yards, at \$10 per cubic yard.....	450,150 00
Total for both rapids, 134,368 cubic yards, at \$10...	1,343,680 00

It should be observed that the difference between the quantities of excavation estimated by Colonel Lee and Lieutenant Warren, respectively, may be accounted for in part by the fact that about 2,000 cubic yards of stone were removed from the Des Moines rapids, under the direction of Colonel Lee, subsequently to the date of his report of 1837, and more especially by the difference in the depths of the channels contemplated in the estimates of those officers—that of Colonel Lee being five feet, and that of Lieutenant Warren being only four feet. Moreover, the price in the estimate of Colonel Lee is only \$2 per cubic yard, no allowance being made for superintendence and contingencies; whereas the estimate of Lieutenant Warren provides for a cost of \$10 per cubic yard, which is intended no doubt to cover all expenditures incurred on account of the improvements, except perhaps charge for superintendence.

They would further take leave to remark, that a mean between the prices per cubic yard, as estimated by Colonel Lee and Lieutenant Warren, viz: \$6, accords very nearly with the price stipulated to be paid, viz: \$5 85, for the improvement of both rapids, under contracts made in February last.

By taking the quantity of excavation as reported by Lieutenant Warren, and the mean of the prices as estimated by Colonel Lee and Lieutenant Warren, viz: \$6, the estimate will stand as follows, viz:

For the Des Moines rapids, 89,353 cubic yards, at \$6 per cubic yard.....	\$536,118 00
For the Rock Island rapids, 45,015 cubic yards, at \$6 per cubic yard.....	270,090 00
Total for both rapids, 134,368 cubic yards, at \$6 per cubic yard.....	806,208 00

Agreeably to returns made to the bureau of topographical engineers, it appears that of the appropriation made for the improvement of the rapids of the Mississippi in August, 1853, viz: \$10,000, a balance of \$90,263 remains unexpended. The board is of opinion that the expenditure of this balance should be confined to the improvement of the rapids at the "Lower chain and English chain" of the Des Moines rapids. The estimated quantity of rock to be blasted and

removed on these two chains, and the probable cost thereof, are as follows, viz :

For the Lower chain, 4,813 cubic yards, at \$6.....	\$28,878 00
For the English chain, 4,243 cubic yards, at \$6.....	25,458 00
Amount for both chains, 9,056 cubic yards, at \$6.....	<u>54,336 00</u>

This amount deducted from the balance above stated, viz : \$90,263, will leave for superintendence and contingencies, and for operation on other portions of the Des Moines rapids, \$35,927, which may be expended with convenience and to advantage in the partial improvement of Lamallee's chain, which is the next above the English chain.

The reasons of the opinion of the board, as above signified, are briefly as follows, viz :

1st. The improvement of the Des Moines rapids, and of the Rock Island rapids, are provided for by separate contracts, and may with propriety, and with far greater convenience to the contractor, and with equal benefit to the public, be carried on separately.

2d. The improvement of the Des Moines rapids, commencing at their foot and proceeding upward, is likely to subserve the public interests more effectually than a very partial improvement on both rapids.

3d. The distance from the Des Moines to Rock Island rapids is about 140 miles, which will render necessary two distinct sets of apparatus, each including all varieties of water craft, machinery, tools, &c., in order to prosecute the improvement of both rapids at the same time. In view of the limited means now applicable to these branches of the service, compared with the amount of the estimated cost of improving both rapids, it would seem onerous, if not ruinous, to compel the contractor to carry on both improvements simultaneously.

4th. The expenditure of the entire balance (\$90,263) on the improvements of the Des Moines rapids, would not be likely to produce greater facilities for the navigation of these rapids than those now existing on the Rock Island rapids, without any additional improvements.

In conclusion, the board takes leave to observe in reference to the sufficiency of the river, in its lowest stage, to fill a channel 200 feet wide and 4 feet deep, in which the current may in the same stage have a velocity of five miles per hour : Lieut. Warren has informed the board that, in accordance with estimates, from observations made by him at sundry points in a very low stage, the entire volume of the river passing both rapids is sufficient to fill a channel 600 feet wide and 4 feet deep, with a current of six miles per hour, as signified by the following statement in his own words, viz : " I have no hesitation in saying that the amount of water passing at the lowest stage is capable of maintaining a velocity of six miles per hour in a channel four feet deep and 600 feet wide, the quantity required to accomplish this being 21,120 cubic feet per second.

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

*Lieut. Col. Top. Eng., Pres. Board.*

Col. J. J. ABERT,

*Bureau of Topographical Engineers.*

OFFICE WESTERN RIVER IMPROVEMENTS,  
*Keokuk, September 9, 1854.*

SIR: Your letter of August 1st, calling my attention to the annual report to be made, was duly received. I have been somewhat delayed in obtaining certain information called for by you, and I have now the honor to submit the following report:

In the month of April, 1853, I was appointed by the Secretary of War, United States agent for the improvement of the Des Moines rapids of the Mississippi.

I reported for duty immediately to Lieut. Col. Long, who, by order of the 1st of June, directed me to co-operate with Captain J. Barney, United States agent, and Lieutenant G. K. Warren, topographical engineers, in the survey of the Des Moines and Rock River rapids, in order to determine the best and the most economical channel of improvement.

In consequence of ill health and other reasons, I did not participate to any considerable extent in execution of the surveys, and they were completed, and the maps, drawings, and report, were submitted by Lieutenant Warren.

I concur generally in the views of the work as expressed by Lieutenant Warren; but my experience in the work already shows that his estimated quantity of excavation is not sufficient, for the reason assigned by him—the necessity of removing the whole of each stratum of stone, when only a portion might suffice for the required depth. One-third might be fairly added to his estimates of quantity.

As soon as Lieutenant Warren had completed the surveys and maps of the “Lower and English chains” of the Des Moines rapids, to which the appropriation confined the expenditure of money, I advertised thirty days for bids to contract for the execution of the work.

Upon opening the bids on the 20th day of November, no satisfactory bids were found, and they were accordingly declined.

On the first day of February you ordered me to repair to Louisville to effect a contract, if possible, with parties offering to do the work.

A very favorable contract was obtained with Messrs. Robert Swan & Co., of Alleghany city; they having agreed to remove all the obstructions to navigation which might be required, for the sum of \$5 85 per cubic yard of rock removed.

They were delayed in their preparations for the work, and about two months in the spring of very low water was lost.

They, however, completed their arrangements and commenced the work at the first low water of August, and have prosecuted it with energy and success, but they have not employed as many hands nor worked on as many points as I intended.

The effect already produced by the work on Campbell's chain places the efficacy and practicability of the plan beyond a question of a doubt.

I will now proceed to answer your inquiries in the order they are put, as near as practicable.

1. Estimate of the entire cost of the channels through the rapids..... \$1,500,000 00

2. The amount that can be expended profitably next year..... \$200,000 00
3. Nearest port of entry at which any revenue is collected is St. Louis. Amount of revenue collected to January 1st..... 289,260 44  
Amount collected for the month, August, 1854..... 102,648 60
4. Amount of work done up to this date, about 850 cubic yards.
5. Amount of commerce and navigation to be benefitted :  
A low estimate of the value of produce and merchandise passing over the rapids annually ..... 35,000,000 00  
Extent of navigation to be benefited, 2,000 miles.

There are about forty steamboats employed in the trade over the rapids. They will average about two hundred tons freight to the trip, and they make about fifteen trips per year.

There are also about thirty "lighters" employed in transporting freight over the Des Moines rapids, and each trip of the lighter will cost the steamboat about fifty dollars.

Thus the additional cost on freight over the rapids, including the cost of delays and damages to steamboats, may fairly be set down at five hundred thousand dollars per annum.

It will require at least six of the most favorable seasons to accomplish the whole of the work contemplated.

The labor will be applied at the most difficult points first, so as to relieve the navigation as much as possible until completed.

From the facts I have stated, no one can fail to see the commercial importance of improving the rapids of the Mississippi, flowing through a country unequalled in fertility; unequalled in the rapidity of population; unsurpassed in the energy, industry, and productiveness of the population. It would be difficult indeed to calculate the increased commerce and the increased importance of the work twenty years hence.

Very respectfully, your obedient servant,

JOHN G. FLOYD, *U. S. Agent.*

Lieut. Col. J. E. JOHNSTON,

*Top. Eng., Sup't W. R. Improvements.*

KEOKUK, August 25, 1855.

SIR: I herewith submit a report of work and operations upon the improvement of the Rock River and Des Moines rapids of the Mississippi, during the fiscal year ending 30th June, 1855. No work has been done since last November, and my report of that month embraces all the operations of the season, and consequently my report now is but a summary of last season's work.

The contractors, Swan & Co., made their preparations, beginning in February, 1854, and begun work on the rapids in August following. As I have already stated, their preparations were not commensurate

with the necessities and extent of the work they were engaged upon. And it was not in my power to control them in this respect, either in the amount of preparatory expenditures, or in the number of hands employed, nor yet in the number of points worked upon.

There are objections and defects in the contract system, especially when Congress refuses to make adequate appropriations. It is no argument that there is an unexpended balance, because, if the contractor were assured of continued appropriations, or saw a sufficient amount at once appropriated, he would feel justified in making his preparations of proper magnitude and extent, and fully adequate to *complete* the work. But of all things, the appropriations by Congress are the most uncertain.

The work upon the upper rapids was confined to two chains—Campbell's chain and Sycamore chain. The former was considered the most dangerous to navigation. The work done has, so far, relieved the danger and difficulty there. No boat this season has sustained any damage upon that chain, that I have heard of, and none have stuck where the work was done. The work upon Sycamore chain was not sufficient in amount to have made any perceptible difference to the boats.

At the lower rapids, the obstructions, as heretofore described, consist of reefs of rocks extending across the channel at various points, which require continuous blasting and removal. This will always render the work slower, more difficult and costly, than upon the upper rapids. The appropriation bill confined the expenditure of money upon the lower rapids to two chains—the English chain and the Lower chain; and the operations were confined to two points of the English chain, leaving from five to six feet depth, at low-water, upon the points worked. About 5,800 cubic yards of stone were removed during this season. The contractors, Swan & Co., have thought proper to relinquish their contract, and on the 8th of March last I received a letter dated Washington city, February 19th, 1855, they declining to prosecute the work any further, but saying they were willing to continue the work at a "living price,"—not saying what that price was. I immediately forwarded their letter to Lieutenant Colonel J. E. Johnston, then in charge of the Western river improvements, recommending him to give the preference to Swan & Co. at the same price that another contractor would do the work for.

They, however, made a proposition to the War Department to do the work for ten dollars per cubic yard. The Secretary of War declined their proposal, and ordered the contract to be thrown open to public competition. Proposals for the execution of the work were accordingly invited through the newspapers and otherwise.

On the 25th of May, the bids were opened, and the proposals were found to run from nine to fourteen dollars per cubic yard of stone removed. There were three bids of nine dollars, one of which was accepted, and the contractor is now actively preparing for work, and will commence about the 1st of September. He designs to execute all his work by steam machinery, which promises the best results. The following will embrace the answer to your inquiries, in order :



1. Estimate of entire cost of improving both rapids according to the plan.....	\$1,500,000 00
2. Amount that can be expended profitably in next year.....	200,000 00
3. Nearest port of entry, Keokuk, Iowa. Revenue collected for the fiscal year ending 30th June, 1855....	753 30
4. Amount, in value, of commerce passing both rapids annually.....	50,000,000 00
5. Extent of navigation to be benefited from St. Paul to New Orleans.....	2,000 miles.
Balance of appropriation unexpended June 30, 1855....	\$55,550 57

I cannot conclude this report without adverting to the great importance of knowing, as early as possible, whether the appropriations for the work will be continued.

If the money asked for should be granted by Congress, the contractor must have time to make preparations adequate to the work to be done; otherwise a whole season will be lost, and thus the work will be delayed from year to year.

JOHN G. FLOYD, *U. S. Agent.*

Lieut. Col. LONG,  
*Sup't Western River Improvements.*

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The following extract from the memorial of the Chamber of Commerce of the city of St. Louis presents the necessity and propriety of the proposed improvements in a strong light, and appeals forcibly to the action of Congress:

“The Mississippi, being under the immediate control and jurisdiction of Congress, is a great national highway, and therefore, we believe, is entitled to the fostering care of the general government. Its free and unobstructed navigation, the former guaranteed by solemn compact, is of the highest importance, not only to the contiguous States, but to all the territory in its wide and extended valley—to our common country. It is eminently a national interest. Every improvement desired is for the benefit of all, and would conduce to the development of commerce. Hence, it richly merits protection and assistance, equal, at least, to that granted to the Atlantic sea-board. Nine States and one Territory border on its banks, and five other States and two other Territories are situated on or traversed by its tributaries; making *fourteen States and three Territories* directly interested in the safety and economy of its navigation. Not only the cities and country of the upper river from St. Paul to St. Louis and Cairo, a distance of about nine hundred miles, are injured by the existence of these natural obstructions, but Pittsburg, Wheeling, Cincinnati, Louisville, Nashville, Memphis, Little Rock, Vicksburg, Natchez, and New Orleans, proportionably share the expenses and losses they occasion.

“The delays, difficulties, and dangers of navigating the rapids involve extra risks, outlays, advanced premiums of insurance, and frequent loss of boats and cargoes. The losses thus incurred are absolute and total. Neither the carrier, factor, merchant, nor producer is benefited. All fare alike. These great expenses and losses absorb the apparent advantage of high prices to the carrier, and the farmer and manufacturer keenly feel the blighting effects upon the profits of their industry and capital. The working men, the great masses of agriculturists and mechanics, are the greatest sufferers.

“To illustrate more particularly the injurious effects of the rapids upon the property of the country lying upon the Upper Mississippi and its tributaries, we will add a few facts from reliable statistics. From St. Louis to the Lower rapids, a distance of two hundred miles, freights are from ten to fifteen cents per hundred pounds. For the succeeding one hundred miles, to the Upper rapids, they are from 50 to 75 cents, and not unfrequently advance to \$1 50, or more, per 100 pounds. These enormous rates are unavoidable in the present unimproved state of the rapids. They constitute a tax upon the business of the country that almost amounts to a prohibition of shipments. The costs of transportation sometimes exceed the original value of the produce.

“Were safe and permanent channels cut through or around the rapids, the same transportation could be effected for 25 to 30 cents per 100 pounds—a variation of one hundred to six hundred per cent. The article of wheat alone would be carried at 6 to 10 cents, instead of 20 to 30 cents per bushel. A single glance should suffice to show the beneficial influence of this change alone on the property of an agricultural country. Large numbers of emigrants are annually deterred from locating their new homes in any part of a country where the cost of sending away what they produce for exportation, or bringing home what they require from abroad, is so uncertain and often so ruinous.

“Notwithstanding the construction, finished or in contemplation, of numerous railroads, these high freights lessen very materially the demand for public lands, of which, were the rapids improved, large bodies would soon find eager purchasers, and become to a great extent settled and cultivated. National capital, thus appropriated and expended, would, from the stimulated sale of government lands, soon return with interest to the public coffers.

“There are sixty-two steamboats, of an average burden of two hundred and sixty-five tons, employed on the Mississippi above St. Louis. There are also forty-five barges, averaging one hundred and fifty tons each, engaged in the same trade. The aggregate tonnage of these boats and barges is 20,630 tons, and as they average three trips per month, the aggregate capacity per month is 185,070 tons. Transient boats from the Ohio and other rivers are also constantly ascending and descending the Upper Mississippi. They add to the volume of business of that branch of western navigation, and show the danger and disadvantages of its difficult portions.

“Several railroads extend their iron bands to the Mississippi, and others are projected; but notwithstanding their cars groan under the weight of agricultural and mineral production, seeking an eastern

market, or of merchandise and other commodities destined to the West, their construction, instead of relieving the navigation of the Mississippi, adds indefinitely to its business. The railroads of the valley of the Upper Mississippi, by their effects upon the development of the latent resources and wealth of the country, create far more transportation than can be accomplished by them. So that an increase of miles of railroads results in a demand for a proportionate increase of tonnage on the river. The points at which railroads reach the river become the most important for shipping. The great mass of the surplus productions of the country demand cheap transportation to a cash home market for consumption, or to the sea-board for transportation. By the natural and national highway of the valley of the Mississippi, this surplus can be conveyed at one-fourth of railroad rates, and yet yield remunerating prices to the carrying trade.

"No rapids should be permitted to interpose their rocky barriers to such universal national interest. The Mississippi should pursue its noble course, and commerce float along its bosom, both free and unobstructed. From the Falls of St. Anthony, the Mississippi flows through countries unsurpassed for fertility of soil and capacity for producing the cereals, of world-renowned mineral resources, of rich and extensive forests. Its valley is traversed and irrigated by noble streams, all contributing not only their redundant waters to swell the mighty river, but bearing the surplus productions of their respective regions to swell the tide of its commerce, and add to the wealth of the nation.

"The first permanent obstructions are at Rock island, about five hundred miles below the falls; and one hundred miles further south are those of the Des Moines. From thence to the Gulf of Mexico, following its meanderings, the Mississippi is uninterrupted by other than temporary obstructions.

"The improvement of the rapids has often been urged upon Congress. It has been prayed for as a necessity, recommended as a measure of enlightened national policy, demanded as an imperative duty and act of justice to the people of the whole valley, the business of which is now estimated at not less than \$500,000,000 per annum. The appropriations heretofore granted by Congress have proved inadequate to an object so important, but they were sufficient to demonstrate the practicability of the undertaking.

"The surveys and reports of Lieutenant Lee, made in 1837 and 1838, and various statistical documents in relation to the subject, presented at different periods to Congress, are on file in the proper department at Washington. Conflicting views may be entertained respecting the details, but cannot affect the general proposition; and your petitioners can perceive no constitutional objection to an appropriation from Congress to secure this important work. It may be considered a question of expediency, but not of constitutionality. We can only regard it as one of enlightened policy and justice. It would seem that the most casual observer would be impressed with the magnitude of the subject, and that every citizen of the great valley would join us in asserting the justice of our claim upon the general government, to remove every obstruction from the main artery of the most

extensive and important inland navigation on the globe—the great channel of the commerce of sovereign States and Territories, extending over and embracing an area of two thousand miles from north to south, and nearly an equal distance from east to west; of a country inexhaustibly rich in mineral and agricultural resources, which, although in the infancy of development, already enjoys an extensive interior trade, and furnishes most important and considerable contributions to the commerce of the world.”

The entire amount of appropriations, and the portion expended, will be seen from the following letter from the head of the Bureau of Topographical Engineers:

BUREAU OF TOPOGRAPHICAL ENGINEERS,  
Washington, *March 22, 1856.*

SIR: The following report is submitted in reply to the letter of the honorable Mr. Washburne, of the 20th instant:

Amount expended upon the rapids of the Des Moines and Rock river of the Mississippi, \$47,953 30. This amount was expended in 1838 and 1839.

No appropriation in relation to this improvement from 1838, before that of the law of August, 1852, when \$100,000 were appropriated, of which about one-half has been expended; therefore, the whole amount expended may be stated as follows:

In 1838 and 1839.....	\$47,953
In 1853, and 1854, and 1855, about.....	50,000
Total.....	<u>97,953</u>

Respectfully, sir, your obedient servant,

J. J. ABERT,  
*Colonel Corps T. E.*

Hon. JEFFERSON DAVIS,  
*Secretary of War.*

Another important document, giving the amount of revenue collected at the several ports of entry and delivery in the collection district of New Orleans, since 1837, inclusive, and the tonnage of registered and enrolled vessels at the same ports, and for the same period, is also annexed:

TREASURY DEPARTMENT, *April 12, 1856.*

SIR: In compliance with a resolution of the Committee on Commerce, transmitted in your letter of the 7th instant, I enclose herewith a statement, from the office of the Register of the Treasury, to

whom it was referred, exhibiting the amounts of revenue collected at the several ports of entry and delivery in the collection district of New Orleans, since 1837, inclusive, and the tonnage of registered and enrolled vessels at the same ports, and for the same period.

I am, very respectfully,

JAMES GUTHRIE,  
*Secretary of the Treasury.*

Hon. E. B. WASHBURNE,  
*Chairman Committee on Commerce, H. R.*



Statement exhibiting the amount of revenue collected annually at the several ports of entry and delivery in the collection district of New Orleans since 1837, inclusive; also, the tonnage of registered and enrolled vessels for the said several ports of entry and delivery for the years aforesaid.

Districts.	REVENUE COLLECTED.									
	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.
New Orleans, La.....	\$1,362,367 63	\$1,588,158 58	\$1,619,672 01	\$1,212,122 26	\$1,643,645 18	\$840,602 50	\$253,979 51	\$1,687,095 55	\$1,769,821 33	\$1,360,862 82
Tuscumbia, Ala.....										
St. Louis, Mo.....	1,304 34	8,096 57	12,250 79	2,843 44	11,150 16	6,535 11	3,139 97	9,391 50	20,952 57	26,465 74
Nashville, Tenn.....	7,129 04	275 47	41 58	6,551 13	1,803 68	1,008 61	89 31	275 14	2,304 21	1,231 91
Knoxville, Tenn.....										
Memphis, Tenn.....										
Louisville, Ky.....	3,956 37	2,275 90	2,999 19	2,641 03	1,487 36	3,654 55	2,828 06	6,817 06	6,463 48	10,936 16
Paducah, Ky.....										
Cincinnati, Ohio.....	482 92	999 01	1,013 81	1,899 56	2,074 43	2,145 73	2,113 40	10,518 71	28,681 63	30,575 47
Pittsburg, Pa.....	5,812 40	1,564 80	3,049 05	1,414 60	1,563 85	1,886 85	2,014 45	1,096 11	1,862 29	1,095 24
Evansville, Ind.....										
New Albany, Ind.....										
Alton, Ill.....										
Galena, Ill.....										
Quincy, Ill.....										
Cairo, Ill.....										
Burlington, Iowa.....										
Keokuk, Iowa.....										
Dubuque, Iowa.....										
Wheeling, Va.....	751 82	31 17	92 79	621 76	74 88	141 05	82 48	296 89	147 00	274 45
Total.....	1,381,804 52	1,601,400 90	1,639,119 22	1,228,093 78	1,661,799 54	855,974 40	264,247 18	1,715,490 96	1,830,232 51	1,431,441 79

# STATEMENT—Continued.

Districts.	REVENUE COLLECTED.								
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.
New Orleans, La.....	\$1,621,357 08	\$1,714,880 43	\$1,594,742 27	\$1,924,698 41	\$2,249,540 64	\$2,149,931 97	\$2,566,568 66	\$2,581,292 76	\$2,142,677 82
Tuscumbia, Ala.....									8,476 20
St. Louis, Mo.....	52,757 69	60,618 38	54,334 04	122,914 91	213,831 77	283,056 23	290,520 10	391,753 19	658,869 07
Nashville, Tenn.....	330 44	3,209 19	4,643 16	8,479 80	20,621 30	76,245 60	30,348 80	15,814 80	39,055 85
Knoxville, Tenn.....									72 58
Memphis, Tenn.....						11,183 40	46,567 25	30,606 59	48,533 65
Louisville, Ky.....	8,752 98	8,648 81	26,663 26	59,901 00	66,572 67	57,422 60	57,673 00	44,965 02	38,029 68
Paducah, Ky.....									10,730 70
Cincinnati, Ohio.....	31,793 04	56,871 79	43,399 89	133,838 76	212,904 43	172,096 60	259,532 30	292,946 04	98,043 91
Pittsburg, Pa.....	1,531 06	2,017 17	2,715 53	1,778 74	8,723 62	20,318 41	7,584 70	3,872 20	16,788 20
Evansville, Ind.....						2,105 60	2,482 75	3,402 80	8,405 40
New Albany, Ind.....					526 20	31,404 40	75,947 40	27,253 00	3,566 60
Alton, Ill.....								67,907 27	32,499 30
Galena, Ill.....								144 30	767 64
Quincy, Ill.....								49,847 40	51,845 26
Cairo, Ill.....									
Burlington, Iowa.....									807 90
Keokuk, Iowa.....									355 50
Dubuque, Iowa.....									
Wheeling, Va.....	400 76	824 20	1,222 03	260 05	1,884 29	1,432 14	2,131 19	1,946 01	9,215 57
Total.....	1,716,923 05	1,847,069 97	1,727,720 18	2,251,871 67	2,774,604 92	2,805,196 95	3,339,356 15	3,511,823 96	3,200,182 94

## STATEMENT—Continued.

42

Districts.	TONNAGE.									
	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.
	Tons and 95ths.									
New Orleans, La.....	92,375 89	104,426 11	109,076 36	126,612 75	145,114 63	143,624 29	149,409 60	161,042 92	169,771 60	180,504 81
Tuscumbia, Ala.....	3,668 92	9,373 00	8,735 00	11,259 00	11,370 00	14,726 80	13,589 38	16,664 53	18,905 69	22,425 92
St. Louis, Mo.....	5,193 64	5,481 36	4,240 94	4,733 46	3,521 65	3,810 82	4,813 08	5,666 78	2,809 23	2,809 23
Nashville, Tenn.....										
Knoxville, Tenn.....										
Memphis, Tenn.....										
Louisville, Ky.....	1,714 00	7,734 00	8,125 87	1,591 86	8,359 73	4,618 64	5,093 18	7,114 44	8,751 02	8,132 25
Paducah, Ky.....										
Cincinnati, Ohio.....	9,321 21	10,376 36	9,159 47	12,052 27	10,188 76	12,025 01	11,675 13	13,139 44	14,403 21	15,512 86
Pittsburg, Pa.....	12,652 11	11,864 71	11,864 71	12,000 00	10,342 77	10,017 13	4,942 69	9,232 71	13,283 47	17,162 94
Evansville, Ind.....										
New Albany, Ind.....										
Alton, Ill.....										
Galena, Ill.....										
Quincy, Ill.....										
Cairo, Ill.....										
Burlington, Iowa.....										
Keokuk, Iowa.....										
Dubuque, Iowa.....										
Wheeling, Va.....		305 34	2,268 74	2,460 40	1,417 81	1,212 73	1,212 34	1,340 18	1,487 91	2,660 76
	124,925 87	149,560 93	154,471 29	170,709 84	190,295 55	190,035 57	190,735 50	214,201 20	230,412 28	249,209 02

RAPIDS OF THE MISSISSIPPI.

# STATEMENT—Continued.

Districts.	TONNAGE.								
	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.
	Tons and 95ths.								
New Orleans, La.....	212,697 80	225,680 52	240,206 24	248,709 09	251,900 14	266,013 02	153,184 88	183,818 41	200,836 93
Tuscumbia, Ala.....	31,635 86	36,312 61	32,355 08	28,907 47	34,065 46	37,861 87	45,441 03	48,475 51	60,592 10
St. Louis, Mo.....	2,707 46	2,445 68	2,910 77	3,776 05	3,587 67	4,082 90	3,414 33	5,726 73	6,269 91
Nashville, Tenn.....									
Knoxville, Tenn.....									
Memphis, Tenn.....						550 77	1,404 19	1,894 84	2,133 63
Louisville, Ky.....	10,388 36	8,822 39	13,954 91	14,820 19	12,937 90	11,818 80	14,166 32	20,122 89	22,680 14
Paducah, Ky.....									
Cincinnati, Ohio.....	17,801 12	21,350 70	16,897 74	17,188 80	14,187 18	11,781 30	10,191 42	23,842 73	28,713 51
Pittsburg, Pa.....	25,390 38	30,970 35	35,770 63	44,571 30	53,731 34	64,156 24	79,361 75	84,870 68	93,691 63
Evansville, Ind.....									
New Albany, Ind.....									
Alton, Ill.....							3,842 69	2,952 31	3,698 01
Galena, Ill.....								309 23	309 23
Quincy, Ill.....								334 40	2,515 48
Cairo, Ill.....									
Burlington, Iowa.....									
Keokuk, Iowa.....									
Dubuque, Iowa.....									
Wheeling, Va.....	2,660 76	2,660 76	2,660 76	5,933 70	3,933 89	4,280 58	9,429 79	4,127 89	5,487 42
	303,281 89	328,243 21	344,756 33	363,906 70	374,333 73	400,545 68	320,437 60	276,475 92	426,928 24

F. BIGGER, Register.

TREASURY DEPARTMENT, Register's Office, April 11, 1856.

The following are some of the towns and cities and the tables of distances between them from Galena to St. Louis, and Galena to St. Paul:

*Distances from Galena to St. Louis.*

From GALENA to—	Miles.	
Bellevue.....	12	
Savanna.....	18	30
Sabula.....	2	32
Fulton City and Lyons.....	18	50
Albany.....	10	60
Camanche.....	2	62
Le Clair and Port Byron.....	18	80
Hampton.....	6	86
Rock Island and Davenport.....	12	98
Muscatine.....	30	128
New Boston.....	30	158
Keithsburg.....	8	166
Oquawka.....	12	178
Burlington.....	15	193
Fort Madison.....	23	216
Montrose and Nauvoo.....	12	228
Keokuk.....	12	240
Quincy.....	45	285
Clarksville.....	62	347
Alton.....	80	427
Mouth of Missouri.....	5	432
St. Louis.....	20	452

*Distances from Galena to St. Paul.*

From GALENA to—		
Mouth of river.....	7	
Dubuque.....	22	29
Dunleith.....	1	30
Potosi Landing.....	14	44
Waupaton.....	10	54
Buena Vista.....	4	58
Cassville.....	5	63
Guttenberg.....	10	73
Clayton.....	12	85
Wyalusing.....	5	90
McGregor's Landing.....	6	96
Prairie du Chien.....	4	100
Red House.....	5	105
Johnson's Landing.....	2	107
Gordon's Landing.....	30	137
Columbus.....	2	139
Lansing.....	1	140



Miles.

De Soto.....	6	146
Victory.....	10	156
Warner's.....	15	171
Brownsville.....	10	181
La Crosse.....	12	193
Mouth of Black river.....	16	209
Fortune's Landing.....	4	213
Montoville.....	5	218
Minneowah.....	10	228
Winona.....	5	233
Wild's Landing.....	5	238
Fountain City.....	6	241
Mount Vernon.....	14	258
Wabashaw.....	30	288
Nelson's Landing.....	2	290
Reed's Landing.....	2	292
Maiden Rock.....	14	306
Wacouta.....	13	319
Red Wing.....	5	324
Diamond Bluff.....	15	339
Prescott.....	13	352
Point Douglass.....	1	353
Hastings.....	3	356
Red Rock.....	30	386
Kaposia.....	3	389
St. Paul.....	5	394
Mendota.....	6	400
Fort Snelling.....	1	401

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In view of all these facts in relation to these obstructions, taken in connexion with the demands of commerce in the Mississippi valley, and the estimates and recommendations of the proper officers of the government, running through a series of years, the committee report a bill, appropriating two hundred thousand dollars for the improvement of the Des Moines rapids, and also a bill appropriating one hundred thousand dollars for the improvement of the Rock Island rapids.

The following table shows the results of the survey conducted in the year 1900. The table is divided into two main sections: the first section shows the results of the survey conducted in the year 1900, and the second section shows the results of the survey conducted in the year 1901. The table is divided into two main sections: the first section shows the results of the survey conducted in the year 1900, and the second section shows the results of the survey conducted in the year 1901.

In view of all these facts it seems to me that the

The following table shows the results of the survey conducted in the year 1900. The table is divided into two main sections: the first section shows the results of the survey conducted in the year 1900, and the second section shows the results of the survey conducted in the year 1901. The table is divided into two main sections: the first section shows the results of the survey conducted in the year 1900, and the second section shows the results of the survey conducted in the year 1901.



