

largely on personal judgment as to probabilities suggested by experience.

The estimates made by Mr. Collins for improvement of Pearl River I have accepted as the best that can be made.

The estimates are for low-water navigation from Carthage to the mouth of West Pearl River, and are as follows:

1. From Carthage to Jackson, Miss., a distance by river of 105 miles, at \$200 per mile.....	\$21,000
2. From Jackson to a point 40 miles below, at \$200.....	8,000
3. From 40 miles below Jackson to a point 250 miles below, 210 miles, at \$150 per mile.....	31,500
4. From 250 miles below Jackson to a point 282 miles below, through Home Bayou, 32 miles, at \$1,000 per mile.....	32,000
5. In West Pearl River, a distance of 33 miles, at \$150 per mile.....	4,950
Making a total of.....	97,450
Add 20 per cent.....	19,490
Total.....	116,940

The amount that will be required to maintain the river in good navigable condition, after it shall have been placed in that condition, must, at this time, be very largely a matter of conjecture, therefore no figures for maintenance are attempted; they will come naturally after results of an effort to reopen the river to navigation become known.

If the work described in this report be assumed by the United States, I have to submit the opinion that it will be economy to *do it at once*, and not dribble appropriations through a decade with the probability of finding an unsatisfactory result at the end.

I therefore recommend that appropriation be made to the full amount of total estimate, or, if of less amount, that it be made to cover specified portions of the river.

I have not been able to obtain commercial statistics.

The work proposed is located, the greater part in the State of Mississippi, the lesser in the State of Louisiana, and the nearest light-house is on the Rigolets, opposite the mouth of West Pearl River.

## K 3.

## IMPROVEMENT OF BAYOU LAFOURCHE, LOUISIANA.

Survey of this bayou was authorized by act of Congress approved March 3, 1873, report of which, together with plan and estimates for improvement, was rendered with my annual reports for 1874. (See Report of Chief of Engineers for 1874, Appendix R 13, pages 765 to 771.)

Survey of a portion of the bayou extending from Donaldsonville, at its head, to Napoleonville, a distance of 16 miles, was made in 1873 under an act of Congress approved March 3, 1873, directing survey for continuous inland navigation between Donaldsonville, on the Mississippi River, and the Rio Grande River, Texas. In the report of this (see Report of Chief of Engineers for 1875, pages 877 to 880, Appendix S 5) somewhat detailed plans and estimates were submitted for the improvement of navigation in Upper Bayou Lafourche.

Under act of Congress approved June 18, 1878, appropriating \$10,000 for this work, a wrecking-flat was built at New Orleans with which to remove stumps, snags, &c., between Thibodeauxville and Parr's Canal.

The flat was completed, provided with outfit and crew, and dispatched to Donaldsonville September 24, 1878. At this point considerable delay

was occasioned by sickness among the crew; the work was also greatly delayed farther down the bayou on account of sand bars and blockades of flatboats.

The flat worked her way from Donaldsonville to Lafourche Crossing, removing in that distance 169 obstructions, consisting of logs, stumps, trees, and sunken flatboats, besides cutting of many trees, stumps, and roots projecting from the banks of the bayou and obstructing navigation. All obstructions to navigation of the nature noted were removed for the distance worked, except, perhaps, a few unimportant ones that may have escaped observation.

High water in the bayou preventing the continuance of work to advantage, the flat was laid up at Lafourche Crossing, December 28, 1878, and the crew discharged.

The continuance of high water prevented resumption of work during the remainder of the fiscal year.

By act of Congress approved March 3, 1879, \$10,000 were appropriated for this work, with which it is proposed to make an attempt to open a channel through the upper 10½ miles of the bayou (from the Mississippi River to Paincourville) of at least 4 feet in depth and from 40 to 60 feet in width, the work to be done by dredging and to be let out at contract. Through this portion of the bayou during the last low-water season there were several bars over which a skiff could not be rowed.

If after completion of the attempt projected there be any balance of the \$10,000 available, it is proposed to apply it, in connection with the balance of last appropriation, to the removal of snags, &c., below Lafourche crossing of the Morgan Louisiana and Texas Railroad, the latter work to be done by hired labor and purchase in open market, in order to utilize the wrecking-flat now on hand.

The work cannot be considered as susceptible of permanent completion so far as that portion contemplating a dredged channel through the upper portion of the bayou is concerned. Should it be possible with the \$10,000 appropriated to procure the dredged channel required (and I do not believe that ten times the amount would suffice), it is certain that such channel would be obliterated by the flood in the Mississippi River next following its completion.

The amount estimated for year ending June 30, 1881, is exclusively for completion of removal of obstructions in the lower bayou, to improve navigation and prevent obstructive overflows.

The work is located in the collection-district of New Orleans.

The nearest light-houses are those at the mouth of the Mississippi and at the entrance to Atchafalaya Bay.

Original estimated cost.....	\$100,100 00
Amount appropriated.....	20,000 00
Amount expended.....	6,182 19

## Money statement.

July 1, 1878, amount available.....	\$10,000 00	
Amount appropriated by act approved March 3, 1879.....	10,000 00	\$20,000 00
July 1, 1879, amount expended during fiscal year.....	5,998 19	
July 1, 1879, outstanding liabilities.....	184 00	
		6,182 19
July 1, 1879, amount available.....		13,817 81
* Amount (estimated) required for completion of existing project.....	\$10,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	10,000 00	

\* Removing snags lower bayou.



## K 4.

## IMPROVEMENT OF SABINE PASS, TEXAS.

An examination of this pass was made during the fiscal year ending June 30, 1873, report of which was forwarded to the Chief of Engineers with my annual reports for that year.

In compliance with instructions from the Chief of Engineers, dated January 20 and 23, 1875, I submitted February 4, 1875, report with plan and estimates "for the improvement of the navigation of the harbor and bar at Sabine Pass, Texas." (See Report of Chief of Engineers for 1875, Appendix S 10, pages 945 to 947.)

In the act of Congress approved March 3, 1875, \$20,000 were appropriated for the work, which was let out at contract, but the contractors failed in their agreement and the contract was annulled.

Under act of Congress approved August 14, 1876, appropriating \$38,000 and balance of the appropriation for 1875, the work was again advertised for contract, but as it was estimated that the lowest responsible bid received would not complete a channel of the specified depth of 12 feet, all bids were rejected and the United States dredgeboat *Essayons*, lying idle at New Orleans, was sent to perform the work.

The *Essayons*, after about half completing a channel through the bar ranging from 12 to 15 feet in depth, became disabled by the unexpected failure of her boilers, and was ordered to New Orleans for repairs.

The disastrous result attending an attempt to substitute the *McAlester* is reported in my annual report of last year. (See Report of Chief of Engineers for 1878, Appendix J 4, pages 609 and 610.)

Repairs to the boilers of the United States dredgeboat *Essayons*, reported in progress in my last annual report, were completed and the vessel sailed for Sabine Pass August 7, 1878, to continue the work of dredging—

1st. In deepening and widening the channel across the outer bar, and then

2d. Excavating a channel across the reef that separated the harbor of Sabine City from the roadstead inside of the outer bar.

The work was continued until February 7, 1879, when operations were suspended and the *Essayons* ordered to New Orleans. The following are the reasons why suspension at this time was considered necessary:

1st. To provide for a sufficient balance of appropriation available to care for the valuable property belonging to the work, without counting the contingency of appropriation for the next fiscal year.

2d. Because in working a channel through the shell reef above referred to it was presumed that a considerable amount of the copper sheathing of the vessel had been torn off, so as to make it dangerous to leave the *Essayons* in the pass after commencement of the season in which the teredo becomes most active. This season begins in February or early in March. The *Essayons* was accordingly laid up in the fresh water of the Mississippi to await repair and further appropriation.

At the time of suspension of work the condition of the channel, as reported to me, was as follows:

A good 12-foot channel from the Gulf to Sabine Harbor and a 15-foot channel, well buoyed, practicable for steam-vessels throughout its entire length.

The entire length of channel dredged was about 18,000 feet and the

average depth before dredging was between 6 and 7 feet. At time of suspension of dredging the least width of 12-foot channel (mean low tide) was 75 feet, and the greatest 140 feet, while the width of practicable 15-foot channel for steam-vessels of that draught was sufficient for passage of such vessels.

The work, besides providing the channel above specified, also deepened the bar on either side, for a distance of 100 feet or more, an average of about 1 foot—due probably to washing and to sloughing in.

The last few days' work (which was quite accurately measured) resulted in showing an average removed from channel of 2,915 cubic yards per hour's actual dredging, which may be taken as a measure of the capacity of the dredge under the most favorable circumstances. In its progress the work developed the fact that the outer bar is composed of ridges of clay running across the axis of the pass and filled in between with a quite soft deposit.

This observation, and those made further west on the coast of Texas, leads to the inference that a large portion, if not all, of this coast is underlaid, at various depths, by the blue clay found in the mud lumps at the mouth of the Mississippi and in the deeper portions of that river's bed.

The following repairs have been made to the *Essayons*, viz: Hull entirely recoppered to the water-line; entirely replaced shaft-casing and sleeve-linings; patched boilers, and replaced tubes where needed, besides important repairs to bearing brasses and machinery. These repairs have placed the vessel in first-class working order. The act of Congress approved March 3, 1879, appropriated \$25,000 (\$100,000 was asked for) for this work. A portion of this was used for repairs, the balance will not warrant resumption of work. It is therefore proposed to await further appropriation, in the mean time using the amount available for care of property during the current year.

By authority from the Chief of Engineers, dated June 2, 1879, the *Essayons* was loaned to Capt. M. R. Brown, Corps of Engineers, for the purpose of making an off-shore survey at South Pass, Mississippi River. The vessel was engaged on this duty about two weeks in June. On completion of this duty the *Essayons* was returned to New Orleans and laid up in good condition. Experience has already shown that a dredged channel across this bar cannot be considered as permanent. This has been heretofore reported as probable; it is now considered certain.

A dredged channel protected by lateral works to prevent filling may be made a permanent work.

A survey, which I intend to ask authority for making this winter, will show what portion of the dredged channel requires lateral protection and form the basis for a special report and estimate. If in the mean time appropriation be made for continuance of dredging, as here estimated for, I would respectfully recommend that it be made so as to cover probable works for protection as well as for dredging, and made so as to be applicable to one or both, at discretion of the officer charged with the work.

The work is located in the collection-district to Galveston, near the light-house at the entrance to Sabine Pass.

No commercial statistics received during the year.

Original estimated cost.....	\$390,317 00
Amount appropriated .....	113,000 00
Amount expended.....	94,590 77



*Money statement.*

July 1, 1878, amount available.....	\$42,852 20	
Amount appropriated by act approved March 3, 1879.....	25,000 00	\$67,852 20
July 1, 1879, amount expended during fiscal year.....	49,131 60	
July 1, 1879, outstanding liabilities.....	311 37	49,442 97
July 1, 1879, amount available.....		18,409 23
Amount (estimated) required for completion of existing project (20-foot channel).....	277,317 00	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	100,000 00	

## K 5.

## IMPROVEMENT OF SABINE RIVER, TEXAS.

Survey of the mouth of this river was made under my direction in 1871, and report and estimates for improvements submitted to the Chief of Engineers April 28, 1871.

The act of Congress approved June 10, 1872, provided for survey of "the bar at the mouth of Sabine River, in Sabine Lake, and to extend up the main channel of said river to the town of Belzoria, Tex."

The survey was made in 1873, and report with estimates for improvement rendered to the Chief of Engineers with my annual reports for that year.

As in the case of the Neches River, a re-examination was made at the mouth of this river previous to advertising for proposals for dredging on the bar at its mouth, provided for in the river and harbor act approved June 18, 1878, appropriating \$10,000.

The three works, Sabine, Neches, and Trinity rivers, were advertised together, in order, as stated in my last annual report for Trinity River, to attract bidders, the appropriations being so small as not to warrant contractors bidding on one work alone, unless at an exorbitant rate per cubic yard.

The contract was accordingly awarded to Messrs. Brott & Norris, as in the case of the Neches River, and on their failure to comply with their agreement the work on second advertisement was let to Mr. S. N. Kimball, of Mobile, Ala.

The work has for its object the dredging of a channel 5 feet deep across the bar at the mouth of the river to a depth of 5 feet in Sabine Lake at mean low-tide, with a width of 100 feet or more, or so much thereof as the appropriation will permit.

In the river and harbor act approved March 3, 1879, \$6,000 is appropriated "for improving narrows of Sabine River above Orange, Tex., and to deepen the channel at the mouth of the Sabine River."

Before applying this amount, it is proposed to first make a resurvey of the river, as provided for in the second section of the above-cited act, when it can be decided whether it may be best to expend the money at the narrows or on the bar at the mouth of the river.

Abstracts of proposals and contracts are given in my report for the Neches River.

The work is not susceptible of permanent completion.

The work is located in the collection-district of Galveston. The nearest light-house is at Sabine Pass.

The work is not considered permanent, because it appears quite certain that the cut through the bar will gradually fill; but there is no basis for estimate as to the length of time it will remain sufficiently open for navigation, or as to cost of maintaining its navigability.

Original estimated cost.....	\$56,000 00
Amount appropriated.....	16,000 00
Amount expended.....	453 19

*Money statement.*

July 1, 1878, amount available.....	\$10,000 00	
*Amount appropriated by act approved March 3, 1879.....	6,000 00	\$16,000 00
July 1, 1879, amount expended during fiscal year.....		453 19
July 1, 1879, amount available.....		15,546 81
Amount (estimated) required for completion of existing project.....	40,000 00	
*Amount that can be profitably expended in fiscal year ending June 30, 1881.	40,000 00	

## K 6.

## IMPROVEMENT OF NECHES RIVER, TEXAS.

Survey of this river from Boonville to its mouth, provided for by act of Congress approved June 10, 1872, was made, under my direction, in 1872-'73, report of which, with plans and estimates, was submitted to the Chief of Engineers December 30, 1873.

Previous to advertising for proposals for dredging on the bar at the mouth of the river, under act of Congress approved June 18, 1878, appropriating \$8,000, re-examination was made to ascertain what changes, if any, had taken place since last survey.

The work was advertised August 1, 1878, and the bids received opened September 9, 1878.

\*To be applied to improving narrows of Sabine River, above Orange, Texas, or to improvement of the bar at the mouth, or both, as may appear most to the interest of commerce, after the survey of the river authorized by act of Congress approved March 3, 1879.



*Abstract of bids received for improvement of the bars at the mouths of the Trinity, Neches, and Sabine rivers, Texas, as provided for by act of Congress approved June 13, 1878.*

Number.	Bidder.	Residence.	Guarantors.	Bidder furnishing dredges, tug boats, scows, and labor, and providing for agent.	For excavation carried off on scows, per cubic yard.	Time of commencing work.	Remarks: Number of dredges, tug boats, scows, &c., to be furnished.
1	Brott & Norris.....	Washington, D. C.....	U. E. Fisher, G. L. McDonald.....	17 cents.....	17 cents.....	Oct. 15, 1878	One dredge, two scows, one tug boat.
2	William H. Brainard.....	do.....	G. W. Dwenger, C. P. Crandell.....	22 cents.....	22 cents.....	Oct. 23, 1878	Three dredges, six scows, three tug boats.
3	George D. Rice.....	Mobile, Ala.....	J. C. Chamberlain, J. R. Edwards.....	23 1/2 cents.....	23 1/2 cents.....	Dec. 30, 1878	One dredge, two scows, one tug boat.
4	James E. Slaughter.....	do.....	D. R. Dunlap, L. Seranton.....	25 cents.....	25 cents.....	Nov. 30, 1878	One dredge, two scows, one tug boat.

Messrs. Brott & Norris, of Washington, D. C., being the lowest bidders, the contract was awarded to them, and articles of agreement entered into October 3, 1878.

ABSTRACT OF CONTRACT.

Names of contractors: Brott & Norris.  
 Residence: Washington, D. C.  
 Bondsmen: William H. Gleason and George E. Kirk, of Washington, D. C.  
 Price per cubic yard of excavations carried off on scows: 17 cents.  
 Time of commencing work: on or before October 15, 1878.  
 Date of contract: October 3, 1878.

The agreement specified that the work should be commenced on or before October 15, 1878, but owing to the prevalence of yellow fever in New Orleans (at which point the contractors proposed to procure a portion of their plant) and consequent quarantine on the Texas coast, the contractors could not reasonably be expected to comply with the terms of their agreement as to time of commencement, and therefore were not pressed to do so.

Nothing, however, was done by them toward carrying out their contract up to March 11, 1879, when by direction of the acting Chief of Engineers the contract was annulled and the work readvertised March 26, 1879, and the bids received opened April 30, 1879.



Abstract of bids received for improvement of the Trinity, Neches, and Sabine rivers, Texas, as provided for by act of Congress, approved June 15, 1878.

Number.	Bidder.	Residence.	Guarantors.	Bidder furnishing dredges, tug-boats, scows, and labor, and providing for agent.	For excavation carried off on scows, per cubic yard.	Time of commencing work.	Remarks: Number of dredges, tug boats, scows, &c., to be furnished.
1	James E. Slaughter	Mobile, Ala.	N. D. Wallace, L. G. Aldrich	24 1/2 cents	24 1/2 cents	Sept. 1, 1879	One dredge, two scows, and one tug boat.
2	Edward P. Doherty	New Orleans, La.	P. Harman, William H. Wilder	22 1/2 cents	22 1/2 cents	July 1, 1879	One dredge, two scows, and one tug boat.
3	Daniel C. Hays	Joliet, Ill.	Henry A. Sanger, George H. Munroe	35 cents	35 cents	July 1, 1879	One dredge, two scows, and one tug boat.
4	S. N. Kimball	Mobile, Ala.	L. Scranton, William H. Barney	22 3/4 cents	22 3/4 cents	Aug. 31, 1879	One dredge, two scows, one tug boat. Plant is in Mississippi River near New Orleans.

Mr. S. N. Kimball, of Mobile, Ala., was awarded contract under the second advertisement, and entered into articles of agreement, which provide that the work shall be commenced on or before August 31, 1879.

ABSTRACT OF CONTRACT.

Name of contractor: Seth N. Kimball, of Mobile, Ala.  
 Bondsmen: D. R. Dunlap and L. Scranton, of Mobile, Ala.  
 Price per cubic yard of excavation carried off on scows: 22.25 cents.  
 Time of commencing work: on or before August 31, 1879.  
 Date of contract: June 10, 1879.

The work has for its object the procurement of a channel across the bar at the mouth of the river 5 feet in depth at mean low tide, with a width of 40 feet, or so much thereof, or a channel of such greater width as the amount available will permit.

In the act of Congress approved March 3, 1879, \$5,000 is appropriated for improving the mouth of this river, which amount it is proposed to apply in further widening and deepening the channel over the bar which shall have been made by the present contractor, under the appropriation of 1878, the work to be advertised for contract.

The work of dredging channels across the bars at the mouths of the Sabine and Trinity rivers, Texas, was let in connection with this work, and in reports for them reference will be made to this report for items equally pertaining to the three works.

The work is not susceptible of permanent completion.

The work is located in the collection-district of Galveston. The nearest light-house is at Sabine Pass.

The work is not considered permanent, because it appears quite certain that the cut through the bar will gradually fill, but there is no basis for estimate as to the length of time it will remain sufficiently open for navigation or as to cost of maintaining its navigability.

Original estimated cost.....	\$26,318 05
Amount appropriated.....	13,000 00
Amount expended.....	337 92

Money statement.

July 1, 1878, amount available .....	\$8,000 00
Amount appropriated by act approved March 3, 1879.....	5,000 00
	<hr/>
July 1, 1879, amount expended during the fiscal year .....	\$13,000 00
	337 92
	<hr/>
July 1, 1879, amount available .....	12,662 08
	<hr/>
Amount (estimated) required for completion of existing project .....	13,318 05
Amount that can be profitably expended in fiscal year ending June 30, 1881.	13,318 05

K 7.

IMPROVEMENT OF ENTRANCE TO GALVESTON HARBOR, TEXAS.

A survey of this harbor and its entrance from the Gulf was made under the direction of the late Bvt. Brig. Gen. M. D. McAlester, Major Corps of Engineers, and report rendered by him under date of June 9, 1868. (See Report of Chief of Engineers for 1868, Appendix I 4, pages 497 to 517.)



Before this no reports or surveys, looking to improvement of the harbor and its entrance, of any value, had been made. General McAlester in his report only looked to the attainment across the inner bar, obstructing entrance to the harbor, of a channel equal in depth to that across the outer bar as maintained by natural causes.

Dredging of the inner bar was recommended, and by acts of Congress approved July 11, 1870, and March 3, 1871, a total of \$45,000 was appropriated for this work, all of which was necessarily expended in procuring plant for the work, in repairing the pile breakwater built by the city, and in making a thorough survey of the harbor and its approaches.

Under date of December 3, 1873, report of this survey was made and plans and estimates submitted for a general improvement. These plans were approved as worthy of trial, and work was commenced on the inner bar, and on a very small scale, in September, 1874. In September, 1875, a cyclone swept away the greater portion of the plant and material then on hand to the value of about \$50,000.

Several months following were consumed in again getting ready for work, and at the end of that time, appropriation being nearly exhausted and appropriation for year ending June 30, 1877, being withheld, the work was totally suspended until the middle of September, 1876, a portion of the appropriation for the year then being released. With this portion work was continued until January, 1877, when suspension for a few weeks was made necessary for lack of money. In February, the balance of appropriation being released, work was resumed, and the work for the inner bar completed as far as it was deemed desirable before securing a channel over the outer bar equal in depth to that afforded over the inner bar.

April 14, 1877, work on the outer bar was commenced and continued to November 30, 1877, when the appropriation becoming exhausted, it was suspended and not resumed until June 15, 1878.

During the fiscal year ending June 30, 1879, this work was prosecuted as heretofore by hired labor and purchase in open market.

The channel across the inner bar having kept its good condition as reported last year, work was mainly confined to the extension of the Bolivar Point gabionnade, to manufacture and to keeping the plant of the work in good condition.

The results of the year's work have not been such as those obtained by the inner bar work led me to anticipate. It is now evident that the method of construction so successfully employed on the inner bar requires modification in its application to the outer bar.

Modification is now being considered by a Board of Engineers. I therefore only give a synopsis of the work of the year.

The condition of the inner bar channel at various dates, as ascertained from careful surveys, is shown in the following table, viz:

	Feet.
June, 1878 .....	20½
July, 1878 .....	22
December, 1878 .....	20
April, 1879 .....	20½

The progress made in extension of the Bolivar Point gabionnade during the year is shown by the following table, viz:

Date.	No. of gabions.	Length.	Total length.
July, 1878 .....	18	<i>Feet.*</i>	<i>Feet.</i>
August, 1878 .....	108	216	4, 176
September, 1878 .....	11	1, 307	5, 483
February, 1879 .....	11	141	5, 624
March, 1879 .....	11	137	5, 761
April, 1879 .....	20	252	6, 013
May, 1879 .....	25	314	6, 327
June, 1879 .....	36	*435	6, 762
June, 1879 .....	47	*570	7, 332
Total .....	276	3, 372	.....

\* Approximate.

At the close of the year the total length of Bolivar Point (outer bar) gabionnade was 7,332 feet.

The total number of gabions placed in the gabionnade during the year is 354, a portion of them being placed without mats underneath, the water being so shoal that it was considered desirable to have the gabions sink into the sand.

At the close of the year it was ascertained that gabions with mats had sunk as much as those without, but not so rapidly.

The amount of sinking ranged from 3 to 7 feet, and, contrary to expectation, the gabions did not become covered with sand, but remained standing in a trench and entirely uncovered.

At the close of the year there remained in the manufacturing yard, and ready for use, 605 gabions, a large number of mats, piles, and other material required on the work.

At the beginning of the year work was resumed after a suspension of about six months.

The plant of the work was very considerably deteriorated by lying up for such a length of time, and the placing it in condition involved both expense and injurious delay during that season esteemed most advantageous for prosecution of work on the outer bar.

The manufactured material on hand also deteriorated, a portion of it to such extent as to render it unfit for use.

The deterioration of gabions in yard was not discovered until after a large number of them had been placed in position on the outer bar and it had been discovered that many had been broken up and swept away by the waves. The total number so lost during the year is reported as 121.

This item alone represents a very large loss in money value, which cannot now be definitely stated. The cause of loss was found to be dry-rot of stakes of gabions which had been accumulated in yard under the supposition that work would be continuous.

#### SURVEYS.

During the year the following surveys were made, viz:

- Three of the inner bar.
- Five of the outer bar.
- Five of the outer gabionnade and its immediate vicinity.

The outer bar surveys did not show any change that could be attributed to the influence of the gabionnade, nor was it anticipated that the