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APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS.

(CONTINUED.)

APPENDIX L.

ANNUAL REPORT OF MAJOR W. H. H. BENYAURD, CORPS
OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE
30, 1879.UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., July 1, 1879.

GENERAL: I have the honor to transmit herewith annual reports upon the works under my charge for the fiscal year ending June 30, 1879.

On account of the prevalence of the yellow fever throughout the greater part of my district during the summer and fall months of last year, I was unable to continue operations at the various works (except upon Red River and Tone's Bayou) during that period. This constituted the best part of the working season (being low-water) and therefore but little work was done upon most of the important improvements contemplated. The various reports, however, will show the extent of those operations.

Very respectfully, your obedient servant,
W. H. H. BENYAURD,
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers U. S. A.

L I.

REMOVING RAFT IN RED RIVER AND CLOSING TONE'S BAYOU, LOUISIANA.

1. REMOVAL OF RAFT IN RED RIVER, LOUISIANA.

In 1872 work was commenced by Lieutenant Woodruff, under direction of Captain Howell, upon the removal of the great Red River Raft. A channel entirely through the obstruction was made, which has since been somewhat widened, sufficient to accommodate all navigation interests of Upper Red River.

OPERATIONS OF THE YEAR ENDING JUNE 30, 1879.

During the fiscal year the raft region has been very clear from jams, owing to the low stage of water in Red River. In the latter part of April last a very sudden and heavy rise occurred, carrying away two spans of the railroad bridge at Fulton, Arkansas, and bringing down the greatest amount of drift since the raft was opened. A number of jams were immediately formed, having a total length of 5 miles. The United States steamer Florence was ordered to remove the jams, and left Shreveport April 30 for the work, and returned May 13, reporting the river open to Fulton.

The following extracts taken from the log of the steamer Florence,

George White, master, will show the amount of work done during that period.

The first jam was met near the Worthy plantation, being 600 yards long; 170 trees were cut and the jam pulled out and cleared.

The second jam was near Cottonwood Bayou, 1,000 yards long; 86 trees were cut and the jam cleared, but reformed again about 18 miles below, near Shady Grove. The *Florence* and crew immediately returned, but, being above the jam, could not render any assistance in pulling it out; the crew, however, by going below and cutting up 570 trees, the jam, 900 yards long, was again cleared.

The next jam was met at Briarfield, 1,900 yards long; 132 trees were cut and the others pulled by the *Florence*.

Another jam had again reformed above, at Cottonwood Bayou, 725 yards long; 93 trees were cut and the jam cleared, which immediately formed again below, but this was also soon cleared. At Mr. Abraham's Landing another jam 1,100 yards long was found, which was removed; and still another at Soda Fount Landing, 1,200 yards long was cleared out, and the *Florence* returned to Shreveport May 13 for stores and repairs.

The *Florence* left again for the raft region May 15, found two small jams which were readily removed, run through to the head of the raft and found the channel open, no drift running, and the water falling. Upon returning to Shreveport the *Florence* was laid up in charge of watchmen and the crew discharged.

Total length of jams removed 5 miles.
Total number of trees cut, 1,528.

The *Florence* is an iron-hull steamboat, constructed for the special purpose of keeping the channel in the raft region open, and has been found well adapted for the purpose. She is now nearly four years old, and during that time has never been docked nor had any extensive repairs. A great number of the iron plates have recently become loose, and she has been ordered to Saint Louis to be docked and repaired.

The United States steamer *Aid*, used in opening the raft, became worn-out in service, and was grounded in front of Shreveport in March, 1878. Since then her engines and part of her machinery have been taken out and shipped to Saint Louis, to be used in the construction of a new boat for the White and Saint Francis Rivers. The hull, cabin, boilers, &c., were sold at public auction at Shreveport.

The United States craneboat, No. 1, used in opening the raft, became worn-out in service, and has been ordered to be dismantled.

The boats now remaining to keep open the raft are the United States steamer *Florence* and two flatboats.

Since the raft was opened not much caving of the banks has taken place, with the exception of the bends in the river, but the bed of the river has scoured greatly, increasing the depth and considerably reducing the level of the water during the high-water season. A great quantity of valuable land above the raft has been reclaimed, and is now under cultivation.

With a view of ascertaining the change in the river since the raft was opened, I sent a small survey party under Mr. W. C. Melvin, assistant engineer, to make an examination of the river and make a comparison of sections with those made by Lieutenant Woodruff. I desired to make an examination of the entire raft region (such as was recommended by the Chief of Engineers in House Ex. Doc. No. 39, Forty-fifth Congress, third session), but the funds at my disposal did not admit of the expense. I was therefore confined in my examinations to the river and connecting bayous. One hundred and fifty cross-sections of the river and bayous were made and compared with those obtained by Woodruff's survey. The result shows that the high-water line has been reduced to a level generally within the banks, while a great depth of water has

everywhere been gained, with an enlarged section of channel-way, while in low-water stages very little water is diverted from the river proper. The report of Mr. Melvin, annexed, contains all the information derived from the examination.

Operations in the raft region have hitherto been chiefly confined to removing jams in high-water; at a low stage of water the bed of the river is full of snags and trees imbedded in the sand; by cutting these down to low-water it would be a great improvement to navigation and would allow the water to increase the scour which is now so much improving the channel.

An appropriation of \$10,000 was made by act of Congress approved March 3, 1879, for the improvement of the river from Head of Raft to Fulton. As the old plant used in the removal of the raft, including the steamer *Aid*, the crane-boats Nos. 1 and 2, and the shear-boat *Essay*, were all worn out in service, condemned, and sold, I especially recommend that appropriation be made to supply Upper Red River with a boat to take the place of the outfit worn out and disposed of. Such a boat I estimate will cost about \$30,000.

2. CLOSING TONE'S BAYOU, LOUISIANA.

Work at Tone's Bayou was commenced in October, 1876. A dam has been constructed entirely across the bayou reaching nearly up to low-water mark, and at each end for some distance out from the bank it is built up to within about 12 feet of high-water mark. The dam has been constructed by making large mattresses of willow brush, loading them with stone, and barrels and bags filled with clay, to sink and keep them in place.

OPERATIONS OF THE YEAR ENDING JUNE 30, 1879.

Work was continued upon the brush dam in the bayou, the top of which had been injured by the vast amount of drift that passes over it during the flood stages. This was unavoidable, as the appropriation was not sufficient to carry the dam up to the high-water line, consequently a volume of water found its way over the dam, carrying along with it the drift from Upper Red River. Had the appropriation in the first place been sufficient to carry up the dam to the full height intended, the yearly expenditure on account of repairs, &c., would not have been needed.

The work of completing the dam is now being carried on with an allotment from the appropriation of March 3, last. It is intended to carry up the brush work as far as the money will allow (it is hoped that this will reach the high-water mark), and then place upon the top a heavy layer of stone.

It is recommended to enlarge the cut-off in Red River, and thus allow that stream to carry off a great portion of the water which now goes out through the various bayous, and also to drive a row of piles across the head of Tone's Bayou to prevent the entrance of drift from Red River. Estimates for these operations are submitted below.

I append herewith the report of Mr. Joseph Burney, assistant engineer, upon the operations of last season.

COMMERCIAL STATISTICS.

Shreveport is the principal distributing city for Red River, and during the twelve months ending May, 1879, received 103,660 bales of cotton,

16,040 of which were received from above the raft; 65,025 bales of cotton were shipped by Red River to New Orleans, and the balance by rail to the various markets.

There was during the same time 126 landings made at Shreveport by steamboats from New Orleans, and 24 from above the raft.

The total amount of merchandise carried to Shreveport by steamboats during the twelve months was 50,400 tons, and about the same amount delivered at points along the river below.

The above works are situated in the third collection-district of Louisiana. There is no light-house near them. The nearest port of entry is New Orleans, La.

The original detailed estimate for the removal of the raft (see my report for fiscal year ending June 30, 1876, also previous reports of Captain Howell) was \$259,014, with additional items for keeping open the channel for fiscal year, \$50,000; and for subsequent years it was estimated that from \$10,000 to \$25,000 would be required.

The amounts appropriated heretofore are as follows:

By act approved June 10, 1872.....	\$150,000
By act approved March 3, 1873.....	80,000
By act approved June 23, 1874.....	50,000
By act approved March 3, 1875.....	20,000
By act approved August 14, 1876, for removing raft and closing Tones Bayou.....	35,000
By allotment August 27, 1877, for closing Tones Bayou.....	4,500
By act approved February 7, 1878, for removing raft.....	6,000
By act approved June 18, 1878, for removing raft and closing Tones Bayou.....	24,000
By act approved March 3, 1879, for removing raft and closing Tones Bayou.....	15,000

Money statement.

July 1, 1878, amount available.....	\$26,445 94
Amount appropriated by act approved March 3, 1879.....	15,000 00
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July 1, 1879, amount expended during fiscal year.....	\$41,445 94
	28,038 33
	<hr/>
July 1, 1879, amount available.....	13,407 61
	<hr/>
Amount (estimated) required for completion of existing project.....	122,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, for closing Tones Bayou.....	30,000 00
For removing raft in Red River.....	15,000 00
For building one iron-hull steamboat to replace steamer Aid and crane-boats condemned and disposed of.....	30,000 00

RAFT IN RED RIVER, LOUISIANA.

REPORT OF MR. W. C. MELVIN, ASSISTANT ENGINEER.

SHREVEPORT, LA., June 13, 1879.

MAJOR: I have the honor to report to you that I have completed an examination of the river portion of the "Red River Raft Region."

I regret that I could not at the same time obtain cross-sections of all the sloughs and bayous leading from the river into the lakes west of it. This was impossible on account of drift accumulation in the mouths of nearly all of them. It was impossible to obtain a satisfactory cross-section of any of them. Should you deem the further examination of these outlets advisable, they must be reached with skiffs through Red, Dooley, and Shiftail bayous, and the old Sale and Murphy Canal route.

The result of examinations shows considerable change in the river-bed and lowering of high-water lines, with increased depth of water at all the points measured. One important result of opening a channel through the raft is, that in low stages of water very little of it is diverted from the natural channel, but flows with an even volume to Shreveport over the bed of the river proper.

Another result is that the high-water line has been reduced to a level generally

within the banks, while a greater depth of water is everywhere found and an enlarged section of channel-way. These results are notably found from section 1 (Blanton's Bluff) to 424, near Carolina Bluff. From this point down a gradual improvement is noted, though not so marked as above.

By comparing sections of the river last made with the sections of outlets it is found that with an average channel depth of 11 feet in the river nearly all the sloughs will be dry. The exceptions are Bee Slough and Cottonwood Bayou.

Stanton's Slough above Diggs's Bluff cannot be considered as within the raft region, although with a section of discharge equal to one-third the volume of water of the river, carrying it into Postern Lake east of the river, and returning it through Albin Canal No. 1, Postern Bayou, and Dutch John Slough near Coushatta Bluff. We find it left the river where the area of the section is 9,581 feet, and after returning to it at Coushatta Bluff we find the river with a section of 5,346 feet, more than 4,000 feet less than at the point of departure, which deficit must be drawn off through the sloughs and bayous between the two places for the supply of the western lakes. Below Coushatta Bluff we find a further loss to the river of 1,904 feet of its section before reaching Willow Chute, where the area of section is 3,442 feet, full capacity.

After leaving Willow Chute the river loses nothing more by outlets. That which is lost between there and Shreveport must be by absorption and evaporation. At station 585 we have a full section of discharge of 2,163 feet, the smallest we find in the river.

From Benoit's Bayou to Hotchkiss Cut-off the water is gradually making for itself a larger channel, and will finally succeed. Like all other parts of the river where the channel has gradually become reduced, it has a bottom lining of a putty-like consistency and tenacity that almost defies the power of water to wear it, and it is only in places that this coating has been broken through by other forces than the water flow that caving banks occur. This is the case in many places, and the cause is found in falling timber along the banks in a majority of instances.

After reviewing the survey of 1874, and comparing with that just made, the conclusions reached are, that the river is deepening and the flood-line correspondingly lower. A volume of water equal to that of high-water of 1874 will not now cause an overflow anywhere below Red Bayou, and will barely fill the banks above that bayou. Lands that prior to the opening of the raft were annually inundated will not now be subject to overflow.

The general tendency of that part of the river from Hurricane Bluff to Shreveport is to enlarge its channel from there to its junction with Twelve-Mile Bayou, the gradual filling up of the outleaving bayous and sloughs on the west bank. All the water lost from the river below the mouth of Sulphur River to Hurricane Bluff goes to supply Shiftail and Sodo lakes with water enough for navigation when there is more than enough for the navigation in Red River.

In connection with this it will not be amiss to note the fact that a levee from Red River along the south bank of Irishman's Bayou to Shiftail Lake, thence to the bank of Twelve-Mile Bayou, would be of more service to navigation of the lakes, and to lower part of Red River (raft region), than any work that could be done with the same expenditure of money.

Profiles will be found in field-book accompanying this of various sections of the river, nearly all of which were made at known Δ stations and B. M. Care has been taken to make the sections for comparison with those on map at the same point. On these profiles the original lines from the map are drawn in red and blue lines, and new profile in black lines.

The effect of the removal of the raft on the lakes must be to deprive them of a supply of water from Red River during low-water. At times when an average channel depth of 10 feet exists through the original raft there will be no water supplied to the lakes that will benefit navigation in them.

Very respectfully,

W. C. MELVIN,
Assistant Engineer.

Maj. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

CLOSING TONE'S BAYOU, LOUISIANA.

REPORT OF MR. JAMES BURNEY, ASSISTANT ENGINEER.

MEMPHIS, TENN., June 28, 1879.

MAJOR: Having been placed in charge of the work of closing Tone's Bayou, Louisiana, on account of the death of Capt. J. S. Tennyson, who was formerly in charge, I have the honor to submit the following report upon the operations of the fiscal year ending June 30, 1879.

An examination of the dam was made after the high-water of 1878, and it was found that a large portion of the upper center had been carried over into deep water below by the heavy driftwood from the raft region, which all passes down Tone's Bayou instead of going down Red River.

In July, 1878, preliminary operations were commenced under charge of Capt. J. S. Tennyson; 1,000 cubic yards of stone was obtained and deposited near the dam, the mattress ways were repaired, and new quarters for the workmen erected. In September active operations were commenced; 19 mattresses were constructed and sunk, averaging 50' x 30' x 2'.9, which brought up the center of the dam to low-water mark, having a width across of 60 feet. The willow brush was then placed on top of the dam in layers of 2 feet in thickness; over that was placed cottonwood saplings 4 feet apart across the dam, and then recrossed lengthwise, forming 4 feet squares. At each intersection of the cottonwood saplings a 1/4-inch ash pin was driven; then behind each square a stake 5 feet long was driven to connect with the lower work.

Stone being too expensive to use for ballast throughout, a barrel filled with clay and properly headed up was placed in the squares together with a slight ballasting of stone. Fine brush was then placed around the barrels and packed tight; then a layer of willows and saplings, as described before, until the dam arrived at high-water mark. Over the whole of this was placed about 500 cubic yards of stone and 400 cubic yards of earth; this had a weight of about 1,800 tons, and under the pressure the dam settled 5 feet. Work was then suspended in December, 1878.

In the work of construction last season there was used 2,850 cords of willows, 5,200 cottonwood poles, 1,272 barrels, 1,000 cubic yards of stone, 750 cubic yards of earth, and 2,700 stakes.

The whole of the water was forced back into Red River, the dam being 7 feet above low-water when pressed down, and the difference of level between the water above and below the dam being 3'.3.

In April, 1879, after the water began to fall, it was found that the dam had stood the high water with very little injury, but the east bank being in danger of caving around, a small working party was employed and the end soon secured, using 48 cubic yards of stone, 120 barrels filled with clay, 220 cords of brush, and 300 cottonwood saplings.

Directly after this work was finished, a very heavy rise occurred in the month of May, bringing down over 5 miles of solid heavy drift, and, after the water fell, the dam was found to have been injured by the drift. A working party in charge of Mr. George R. Wilson is now engaged in repairing and strengthening the dam, and in low water there will be no discharge down Tone's Bayou.

From measurements taken before work was commenced in September, 1876, the low-water area of Red River in the cut-off below Tone's Bayou was 1,160 square feet, and of Tone's Bayou it was 3,100 square feet. The steamboats could not cross the bars below the bayou, and navigation was partially suspended during the busiest season of the year. In 1878 the river was at about the lowest stage or record, yet there was sufficient water for all light-draft steamboats to ascend to Shreveport, showing that the construction of the dam had greatly improved the navigation of Red River.

From examinations made during the low-water of 1878, great changes were found to have occurred. The sand-bar in the cut-off which was fast increasing before the work commenced, and which threatened to destroy navigation entirely, showed considerable scour, while the mouth of Tone's Bayou showed considerable filling up, and at one point where the depth was 28 feet in 1876, in 1878 a sand-bar had formed which was up to the low-water level.

The reason why navigation was nearly destroyed above Tone's Bayou, cutting off over 500 miles of valuable river trade, was the making a cut-off by the State of Louisiana across a narrow neck of land, through stiff blue clay not susceptible of the slightest scour, and constructing a dam on that portion of Red River which was the main channel before the cut-off was made. This either forced the water through the new cut-off, which had not a water area of 1/2 the size required, or down Tone's Bayou, which was then a very small stream running through a sandy, alluvial soil, and connecting with Red River below by a route 70 miles shorter than the old channel in Red River.

The result was that Tone's Bayou, having a fall per mile of twice that in Red River, rapidly scoured out, and in 1876 discharged three-fourths of the water from Red River, spreading out through various lakes and bayous, which could not be made navigable except at a very great outlay of money.

The work of closing Tone's Bayou is exceedingly difficult; the dam is compelled to be constructed upon a foundation of nearly pure sand, the slightest current readily scouring out and burying the dam in it. Many attempts before 1876 had been made to close the bayou, but after each high-water scarcely a trace of the work remained. The mattress work has been the only plan adopted that has met with any success. It has stood 3 high-water seasons, and each low-water has turned the whole of the water into Red River, keeping the navigation open. This, however, has only been done by

the utmost vigilance and perseverance, repairing and strengthening the dam at the proper time, as the water would readily cut a new channel around, leaving the dam entirely on one side.

Should the dam be carried to high-water mark and stand the immense pressure, the result would be, the cut-off would not scour and enlarge, but the water would be backed up above, raising the high-water mark until it scoured out some of the numerous bayous above, and the first to enlarge would be Bayou Pierre.

The planters in the vicinity would be greatly alarmed at the entire closing of Tone's Bayou, for should the opinion above be correct, it would destroy some of the best plantations on Red River for many years.

The difficulty is in the cut-off not being large enough to discharge the water from Red River above it. I would therefore respectfully recommend that the water area in the cut-off be made to equal the water area in Red River above. This would require the cut-off to be increased to at least twice its present dimensions, which can be done in either high or low water by the United States dredge-boat Lone Star, now engaged under your orders at the mouth of Red River. The dam could then be gradually closed in without danger to the planters.

In order to protect the dam from drift-logs I would respectfully recommend that two rows of piling be driven at the mouth of Tone's Bayou, which would force all the drift down Red River.

ESTIMATE.

Widening the cut-off.....	\$10,000
Driving piling, and repairing and building up dam.....	20,000
	<hr/>
	30,000

I have the honor to remain, very respectfully,

JOSEPH BURNEY.

Maj. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

L 2.

IMPROVEMENT OF CYPRESS BAYOU, TEXAS AND LOUISIANA.

Work upon the improvement of the bayou has been chiefly confined to dredging operations and to the removal of cypress stumps and other obstructions to low-water navigation. In 1871 the city of Jefferson built a dredge-boat, which was used under the direction of the city authorities for a short time in improving the channel. In 1873, appropriations having been made by Congress, the work was continued with the dredge which was loaned to the government for that purpose. Up to the beginning of last year's operations 6 cut-offs have been made, straightening and greatly improving the channel. These are at the following points:

1. Potato Bend.
2. Little Cypress.
3. Middle Cypress.
4. Sisco Island.
5. Upper Benton.
6. Lower Benton.

For detailed information see previous reports.

OPERATIONS FOR THE YEAR ENDING JUNE 30, 1879.

In January, 1876, the hull of the dredge-boat was worn out in active service, and not having the convenience nor the funds to dock her, she sunk in shallow water and remained in that condition until May, 1877, when a new hull was constructed and the machinery transferred to it. The funds becoming again exhausted, work was suspended from November, 1877, until July, 1878, when the machinery was placed in thorough

working order, and a plain but convenient cabin built on the boiler-deck for quarters for the workmen.

The new boat is a powerful shovel dredge-boat, fitted up with every convenience and capable of excavating 750 cubic yards per day. The machinery has lately been purchased, and the new dredge-boat now belongs entirely to the government.

The dredge-boat commenced work under charge of Capt. M. B. Lydon, October 22, 1878, widening Dougherty's Defeat Cut-off, and dug 3,000 cubic yards of earth, and pulled 6 stumps, when, on account of low water, work was suspended on the dredge-boat and the crew engaged in cutting stumps, logs, and snags from Jefferson to the lakes. Eighteen hanging trees were removed, 239 stumps cut to low-water mark, 285 logs sawed off, and 67 snags removed.

On December 9, 1878, work was resumed on the dredge-boat and Dougherty's Defeat Cut-off was finished, removing 1,837 cubic yards of earth and pulling 20 stumps.

The boat was then moved to Sisco Island Cut-off February 1, 1879, where it dug 600 cubic yards of earth and pulled 10 cypress stumps.

The dredge-boat was then moved to Bois d'Arc Pass, where a new cut-off was made 2,312 yards long. Twenty-seven thousand six hundred and seventy-seven cubic yards of earth was excavated, 563 stumps pulled, and 546 stumps cut down to low-water mark.

On finishing the Bois d'Arc Cut-off the dredge-boat was moved to Shreveport, La., and from there taken to the mouth of Red River so as to have her in readiness for dredging operations at that place during the next low-water season.

There are a number of channels through the lakes connecting Red River with Cypress Bayou and Jefferson, called "cut-roads." These are passages cut through the cypress timber by various parties, so as to make navigable channels at low-water. In many instances, however, the work has been so imperfectly done that owing to the projecting stumps, navigation is exceedingly dangerous. In order to assist the steamboat interests, an examination of the various routes was made by Mr. Joseph Burney, assistant engineer, and the most favorable route was selected and staked out in such a manner as to be a guide to the pilots when navigating the lakes. The entire distance from Shreveport to Jefferson, some 65 miles, was accordingly so marked, and is now a well defined channel.

There are no more cut-offs that can be made to advantage, nor dredging to be done on the bayou, for when the steamboats can pass Sodo Lake, there is sufficient water in the channel above for all navigation purposes. In the lakes the dredge would be of no service.

It is proposed during the next low-water season to send a working party across the lakes, and cut down and remove all the cypress stumps and other obstructions in the channel already selected. When this work is executed, it will give good navigation to Jefferson at a time when there is sufficient water for that purpose, and will complete the project previously submitted. Any further improvement could only be made by extensive and expensive works to give low-water navigation, such as the plan recommended by Captain Howell. (See Report of Chief of Engineers for 1873-'74, p. 709, *et seq.*) The work already done has been of great benefit to all interests concerned. Steamboat captains, pilots, and others have testified to the good that has been accomplished. Where formerly it cost \$5 per bale to carry cotton from Jefferson to New Orleans, now where there is no steamboat competition, it is only \$1.75, or only 25 cents more than from Shreveport.

The former appropriations are as follows:

By act approved June 10, 1872	\$10,000
By act approved March 3, 1873	50,000
By act approved August 14, 1876	13,000
By act approved June 18, 1878	15,000
By act approved March 3, 1879	6,000

COMMERCIAL STATISTICS.

There is not much change in the business done on Cypress Bayou since my report for 1877-'78. Jefferson stands at the head of navigation, and contains about 5,000 inhabitants, and is the principal distributing point for Eastern Texas. It receives annually about 40,000 bales of cotton, about one-half of which is shipped by steamboat to New Orleans, and the balance by railroad to the various markets. The annual sales of groceries, dry goods, hardware, &c., are about \$2,500,000. The present year the city has completed the East Line Railroad to Sulphur Springs, a distance of 95 miles, and it is expected that the receipts of cotton and sale of goods will be greatly increased.

For collection-district and port of entry, see report on removal of raft in Red River and closing Tones Bayou, Louisiana.

Money statement.

July 1, 1878, amount available	\$15,046 41
Amount appropriated by act approved March 3, 1879	6,000 00
	<u>\$21,046 41</u>
July 1, 1879, amount expended during fiscal year	13,872 70
July 1, 1879, amount available	7,173 71

L 3.

IMPROVEMENT OF MOUTH OF RED RIVER, LOUISIANA.

TEMPORARY IMPROVEMENT.

For the purpose of keeping a channel through the outer and inner bars during the season of low-water navigation, I had recourse to the expedient adopted by the State engineers of Louisiana the season previous. This was to lash two tugs to a steamer, one on either side, and employ the tugs in working their screws and the steamer its wheel, so as to cut and work out a channel wide and deep enough for the boats to pass the obstructions.

The tugs Belle Darlington and Ida, and the steamer Clara S., were chartered in New Orleans and taken to the mouth of Red River. Work was commenced September 16, 1878, under the personal supervision of Capt. Ed. Flood. A channel was first cut through the outer bar and the plant then removed to the gut. Work was continued here until September 30, when, a rise occurring in the Mississippi, operations were suspended until October 6. Again commencing, the tugs and steamer worked, going backward and forward through the cut channel, until October 30, when, having obtained a passage through the obstruction 6½ feet deep and 70 feet wide, and staked out, which would be sufficient for all purposes until the spring rise, the boats were withdrawn and sent