



In addition to the gauging of the river, your instructions comprised the taking of soundings over the shoals at the bar; the measurement of the surface and bottom currents in the channel through the bar; borings on the probable site of jetties; a survey of the shore-line on the Mayport side of the river; and the running of a line of levels to determine the fall between Mayport and General's Mound.

The soundings on the bar were made in the intervals between the series of ebb-current measurements, and were finished about December 1, 1878, at which time the only channel open was well to the southward, passing close under the shore, there being east of General's Mound 27 feet water, where, in 1868, was the high-water line. Pelican Shoal had shifted to the southward, and occupied a position where, in 1868, there had been 27 feet of water. These soundings also showed a channel breaking out on the north side of Pelican Bank, with as much water on its bar as there was in the main channel. It was, at its seaward end, very narrow and crooked. These soundings show that no feature of the bar in 1868 remained in the same place in December, 1878, the bar channel itself being 3,000 feet to the south. The soundings also showed washing of the south face of Fort George Beach, and a corresponding wash on the north side of the river channel.

The current-observations in the channel through the bar were made in January, 1879. By this time the channel working out on the north side of Pelican Bank, as found by the soundings of November, 1878, had so improved and straightened that it had become the ship-channel, and was exclusively used.

Four stations were occupied, and the results are shown on sheet E. Three of the stations were on the inner and one on the outer slope of the bar. Station A, the furthest inshore, was about 3,200 feet inside the bar; station B about 2,000, and station C about 600. Station D, on the outer slope, was about 800 feet beyond. Some idea may be formed of the changes that had taken place between December 1 and the middle of January from the statement that the bar had advanced into deep water about 600 feet. At current-station C there was 11 feet water where in November, 1878, had been  $6\frac{1}{2}$  feet, or what was, in fact, the then bar, and station D had shoaled from 15 feet to 16. The velocities at the inshore stations were found to be considerable, being about 4 feet per second at the surface and  $3\frac{1}{4}$  near the bottom at station A;  $4\frac{1}{2}$  at the surface and 4 near the bottom at station B, and  $3\frac{1}{2}$  at the surface and 3 near the bottom at station C. At station D, on the outer slope, the surface decreased to 2 and the bottom velocity to  $1\frac{1}{2}$  feet per second.

Owing to the uncertainty of finding it smooth enough to take observations, only half a tide was observed at each station, viz, the first half at one and the latter half at the next. A mistake was made at station B in anchoring too near the south side of the channel, and having done so, it was too risky, in the strength of the tide and with heavy breakers near, to undertake shifting. The fact of being on the south side of the channel may account for the velocity there being found greater than at station A, although I may have vacated A prematurely; for, whilst boring, it was noticed that the current seemed to attain its maximum velocity after the shoals to the north and south of the channel-way had become bare, or nearly so.

Owing to the shoalness of the water, borings could be only made in a few places from a floating object. It was intended that the borings should be made, 1st, on Fort George Beach; 2d, in the old north channel near the Lizzie Baker wreck; 3d, in the present channel near the bar; 4th, in the channel of December, 1878, near its bar; and 5th, on the Mayport shore near General's Mound. The first three were made as near the required spots as practicable. The pipe was run down by a passing vessel, and consequently lost whilst making the third boring. Sufficient had been done, however, to show that from 25 to 28 feet below low-water nothing was to be found but sand and shell. The washing and making of the shoals on the harbor side proved that for at least 25 feet below low-water there was nothing but sand, and wells dug on Mayport shore showed the same.

Under these circumstances further borings were discontinued by your orders.

The shore-line of the Mayport side of the river was surveyed from the village itself as far as Burnside House (which is in the neighborhood of a wreck of that name), a distance of 17,000 feet. This line shows that from the village eastward 5,000 feet, to within 1,000 feet of the old light tower, the shore-line is much the same as that of 1868. From 1,000 feet west of the old light tower for a distance of 2,500 feet easterly the shore-line has receded; at one spot near the old tower fully 250 feet. For the next 1,500 feet to South Run the shore-line is much the same. From South Run, easterly for 4,000 feet there has been considerable washing, it amounting at General's Mound to 500 feet. This point is where the shore-line turns and runs south. From here it has made out from 200 to 400 feet for a distance of 3,500 down to Burnside House and probably farther. A line of levels was run from the tide-gauge at Mayport to one at General's Mound, the distance between these points being 10,800 feet measured on shore. The low-water level was found to be 0.8 lower at General's Mound than at Mayport, and the high-water level 0.15 lower. A tidal range of 4.10 at Mayport corresponds to one of 4.75 at General's Mound, an increase at the later of

0'.65. This would make a mean tide of 4'.30 at Mayport correspond to 5' at the Mound. The tide commenced to rise on the Mayport gauge when it had risen 0'.35 at General's Mound, showing a slope seaward at that time of 0'.45, and this seaward slope seems to have continued during the entire flood but gradually lessening toward high-water. With open gauges the times at Mayport and the Mound are practically the same, nor did a buoy near Pelican Bank set up with the current quite so soon as the schooners anchored off Mayport.

The following drawings referred to in this report are forwarded:  
 Horizontal curves of velocities at station 3, marked A.  
 Vertical curves constructed from the above, marked B (2 parts).  
 Horizontal curves of velocities at station 3, marked C.  
 Vertical curve constructed from the above, marked D (2 parts).  
 Curves of the currents in the channel through the bar, marked E.  
 Cross-sections of the river at Mayport, marked F.  
 Curves of ebb-current discharges, marked G (4 parts).  
 Curves of flood-current discharges, marked H (2 parts).  
 Curves showing ratio of discharge, marked K.  
 Very respectfully, your obedient servant,

GEORGE DAUBENEY,  
*Assistant Engineer.*

General Q. A. GILLMORE,  
*Lieutenant-Colonel Corps of Engineers, U. S. A.*

## I 8.

PROJECT FOR DEEPENING, BY MEANS OF LOW JETTIES, THE ENTRANCE INTO CUMBERLAND SOUND, BETWEEN THE STATES OF GEORGIA AND FLORIDA.

UNITED STATES ENGINEER OFFICE,  
*New York, June 30, 1879.*

GENERAL: I have the honor to submit below a brief description, with estimates of the cost of a project for deepening the entrance into Cumberland Sound, between the States of Georgia and Florida, by means of low-jetties. This harbor is generally known as Fernandina Harbor.

The plan of improvement, in all its essential features, is similar to the one prepared for deepening the channel over the bar at the mouth of the Saint John's River, Florida, and the two projects are forwarded together, in the belief that should it be determined by Congress to improve one of these entrances, but not both of them, the information would be useful in making the selection, by furnishing data for a fair and discriminating comparison between the two.

The draught of water that can be carried over the Fernandina bar varies from 11 to 12½ feet at mean low tide, with exceptional depths 1 foot greater, and a mean rise and fall of about 6 feet.

The anchorage inside is safe and very capacious, and with a good channel of entrance would constitute an excellent harbor of refuge.

The estimate of cost applies to works of the following description:

The north jetty, springing from Cumberland Island near its south end, would run along the north shoal, curving gradually to the eastward. Its sea-end would rest in about 16 feet low water sounding, and a chord joining its two ends would have a direction about east 10 degrees south. Its length would be a little more than 18,000 feet.

The south jetty would start from a point near the north end of Amelia Island, curving gradually to the southward, so that with a length of a little more than 12,000 feet it would reach the outer 16-foot curve. A straight line joining its two extremities would bear about east 15 degrees north.

The width of gap between the outer ends of the jetties would probably be from 3,000 to 3,500 feet.

The jetties are to be constructed mainly of a superstructure of riprap

stone, with flat side slopes, resting on a foundation mattress of logs overlaid with brush. A mattress hearting would be introduced into the body of the work whenever admissible.

The side slopes on the outer faces of the jetties, and also on the inner faces for a distance of 1 mile from the sea-ends, would be 1 upon 4, and for the rest of the inner slope 1 upon 1½ and 1 upon 2.

The crests of the outer ends of the jetties, for a length of about ½ of a mile, are to be finished at the level of half tide, and for all the rest of the works at the level of mean low tide.

Perhaps it would be found best to carry the low portions of the north jetty a little above mean low tide and make the south jetty correspondingly lower; a question which could be determined at the time of construction.

The crown of the jetties will be about 20 feet wide where they terminate at mean low tide, and about 30 feet wide on the sea-ends where the height is carried to half-tide.

## ESTIMATE OF COST.

<i>North jetty, 18,390 feet long.</i>	
2,735,000 cubic feet mattress, at 6 cents per foot.....	\$164,100
130,000 cubic yards stone, at \$4.25 per yard.....	552,500
	716,600
<i>South jetty, 12,260 feet long.</i>	
3,440,000 cubic feet mattress, at 6 cents per foot.....	\$206,400
223,800 cubic yards stone, at \$4.25 per yard.....	951,150
	1,157,550
Total cost of both jetties .....	1,874,150
Deduct difference between cost of stone and riprap where mattress hearting may be used.....	133,220
	1,740,930
Add for piling and trammings for both jetties .....	156,000
	1,896,930
For superintendence and contingencies, 10 per cent. on \$1,740,930 .....	174,093
	2,071,023

Work upon the scale indicated should give a low-water depth in the new channel of 20 to 21 feet, available on the flood tide for vessels drawing 23 to 24 feet.

With a single jetty carried out along the north shoal to the 15-foot curve, and a spur jetty projected from the north end of Amelia Island, a low-water depth on the bar of 16 to 17 feet could probably be established and maintained.

The cost of these works, if completed in three or four years, would not exceed \$1,000,000.

In the execution of either of the foregoing projects, the sum of \$400,000 can be profitably expended within twelve months after it is made available.

A discussion of the general question of the application of jetties to the entrance into Cumberland Sound was made in a communication to the Chief of Engineers dated April 15, 1876, and published in his report for the year 1876, Appendix H 6.

Very respectfully, your obedient servant,

Q. A. GILLMORE,

*Lieut. Col. of Engineers, Bvt. Maj. Gen. U. S. A.*

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

LETTER OF HON. D. L. YULEE.

FERNANDINA, July 5, 1879.

DEAR SIR: As the Cumberland Sound entrance, for a survey of which an appropriation was made at a late session of Congress, is within the district of works directed by you, I beg leave to say that an improvement which would afford a depth over the bar of 17 or 18 feet of water at low tide would answer the immediate commercial requirements of that entrance to the port of Fernandina, and, besides costing less, would be more speedily done. At the same time it would, of course, be desirable to have an estimate of the additional expense which would be required to produce a depth of 21 feet at low-water.

When I refer to the present commercial requirements, I have in mind the requirements for the European and other foreign trade, such as Brazil, &c. The transatlantic line of steamships from Fernandina, which commenced last winter, is re-enforced by recent arrangements made by Mr. Lawtey (a merchant of this State), now in England, who has secured four steamers for the service, and the class of sailing-ships required for the naval store and lumber shipments to Europe and South America is also of deep draught.

The size and character of the steamers, as of the sailing-vessels, used in this commerce is limited by the water at the entrance, which at present does not allow the use of vessels of economical character as to capacity, and thus reduce the usefulness of the port as an Atlantic outlet for productions of the Gulf States over the Florida transit route. While, therefore, a depth of 21 feet at low tide would be very desirable, it would be eminently useful to provide at an early day for a depth of 17 or 18 feet at low tide.

It may not be improper to call your attention to the considerations that the harbor of Fernandina is capacious and perfectly land-locked; that the anchorage in the harbor is only three miles from the outer sea-buoy; that the surf does not break upon the bar, so that all the water gained can, in general, be utilized; that it is the only Atlantic harbor in the State which can be advantageously used for the European trade; that it is a fortified harbor, and that it is the terminus of the shortest possible transit between the Gulf and Atlantic seas, thus offering to the Gulf States an additional facility of trade with the Eastern markets in the United States and Europe.

Very respectfully, your obedient servant,

General Q. A. GILLMORE,  
Lieut. Col. of Engineers, U. S. A.

D. L. YULEE.

## COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Fernandina, Fla., in the years 1877 and 1878.

## VESSELS ARRIVED.

Year.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1877.....	150	100,581	3,343	32	8,088	217	40	12,541	404	222	122,200	3,782
1878.....	185	120,865	3,909	16	3,985	101	42	8,294	215	223	133,144	4,225
Aggregate...	335	221,446	7,252	48	12,073	318	82	20,835	619	445	255,344	8,007

## VESSELS CLEARED.

Year.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1877.....	165	106,638	3,580	24	6,340	166	42	13,641	412	231	126,619	4,168
1878.....	195	124,883	4,086	19	4,911	123	25	9,080	236	239	138,874	4,445
Aggregate...	360	231,521	7,676	43	11,251	289	67	22,721	648	470	265,493	8,613

Year.	Value of exports.	Value of imports.	Duties collected.
1877.....	\$315,446	\$19,639	\$2,376
1878.....	258,184	11,862	2,090
Total.....	573,630	31,501	4,466

## I 9.

SURVEY OF SAINT JOHN'S RIVER, FLORIDA, BETWEEN LAKE GEORGE AND LAKE MONROE, AND ESTIMATES OF COST OF DEEPENING VOLUSIA BAR AND STRAIGHTENING THE RIVER BY CUT-OFFS.

UNITED STATES ENGINEER OFFICE,  
New York, July 16, 1878.

GENERAL: The act of Congress approved June 18, provided "for survey of the Saint John's River, Florida, between Lake George and Lake Monroe, and estimates of cost of deepening the Volusia Bar and straightening the river by cut-offs."

This work was assigned to me under date July 8, 1878, and the sum of \$1,700 was subsequently allotted for the purpose.

In order that I might form a judgment with respect to the general scope of the survey and the degree of detail with which it should be conducted, I visited the locality in February last. There had been an exceptionally high freshet on the Upper Saint John's during the previous autumn, raising the level of the water 8 or 9 feet and flooding a large tract of country. Strong downward currents were produced in the stream, and a large deposit of sand was made on Volusia Bar where the stream enters Lake George. The water subsided more rapidly than the crest of the bar was lowered by scour, seriously interfering with, and for a time entirely stopping, the steamboat traffic between the points above and the points below Volusia. I found the water slowly deepening on the bar, with 4 feet to 4½ feet soundings through the channel. At the time of the survey in March the depth was full 4½ feet. The normal depth on the Volusia Bar is about 5 feet, subject to variations produced by the wind.

The serious shoalings to which the bar is subjected are caused entirely by freshets, and more than an ordinary freshet is necessary to render the bar an interruption to steamboat traffic. After the freshets, the previous depths on the bar are gradually restored.

It is believed that two jetties carried out beyond the bar into 5½ or 6 feet water, with their outer ends 200 to 250 feet apart, and their crests no higher than the level of low-water, would keep this channel open. A single jetty on the west side might suffice, and should be tried before the expense of two jetties is incurred.

Above the Volusia Bar, and between it and Lake Monroe, a distance of about 40 miles by river, the stream, although very crooked, is of ample depth for any kind of vessels adapted to the navigation of the Upper Saint John's. The steamboats have very little trouble in rounding the bends, a simple "slowing-down" being all the precaution needed. The only gain to be secured by cut-off is strictly in distance, and therefore in time. Cut-offs at the four most prominent bends would measure about 1,160 yards in aggregate length, and would shorten the channel 3,700 yards.

The report of Civil Assistant George Daubeney, who made this survey, is herewith submitted. He makes the following estimates of cost:

FOR DEEPENING VOLUSIA BAR.	
East jetty .....	\$7,763
West jetty .....	4,757
Cost of two jetties .....	12,520
FOR CUT-OFFS TO SHORTEN THE CHANNEL 3,700 YARDS.	
Excavation .....	\$26,000
Grubbing, &c .....	240
Cutting of wood .....	80
Superintendence and contingencies .....	2,680
Total .....	29,000

I think both of Mr. Daubeney's estimates are rather low. I would amend them as follows:

The improvement of Volusia Bar .....	\$15,000
For cut-offs between Lake George and Lake Monroe .....	35,000

The improvement of the Volusia Bar seems to be desirable.

I have not been able to procure any statistics of the commerce and trade on the Upper Saint John's.

Very respectfully, your obedient servant,

Q. A. GILLMORE,

Lieut. Col. of Engineers, Bvt. Maj. Gen., U. S. A.

Brig. Gen. H. G. WRIGHT,

Chief of Engineers U. S. A.

REPORT OF GEORGE DAUBENEY, ASSISTANT ENGINEER.

NEW YORK, June 15, 1879.

GENERAL: In compliance with your instructions to make a survey of Volusia Bar, on the Upper Saint John's River, and also whatever bends on the river between Lakes George and Monroe interfered with the navigation of the same, I have to report as follows:

Volusia Bar is situated at the south end of Lake George; which lake, 12 miles long and 7 wide, receives the waters of the narrow portion of the river connecting it with Lake Monroe. This narrow portion varies in width from 200 to 400 feet. The bar proper is about 1,800 feet, out in a northwesterly direction from the extreme down-stream point of the narrow river. The shoal on the east side of the channel is, on its crest, nearly bare at average low water. This crest is slightly outside the general line of the lake shore, sloping gradually lakeward for 1,000 feet before striking 4 feet water, which deepens to 6 feet in the next 200.

The shoal on the west side does not seem to have any defined crest, but has a gradual slope from shore, running out 2,000 feet before meeting 4 feet water, which deepens, however, almost immediately to 6 feet. The general direction of this outer 6-foot curve is nearly east and west, and about parallel to the shore-line. The general direction of the channel through the bar is nearly northwest. The present channel, after leaving the extreme down-stream point of the narrow river, runs N. 49° W. (true) for a distance of 1,700 feet, having a water-way 200 feet wide, and shoaling from a normal depth of 12 to 6½ feet in that distance. The course then changes to N. 35° W., and so runs for 300 feet, until well past the beacon, when it again changes to N. 6° E., 450 feet on this course bringing 1 to 6 feet water. The narrowest and shoalest part of the channel lay near the last point of change of direction, 250 feet outside the beacon, there being at the time of the survey a width only of from 35 to 40 feet, with a depth of 4½. The water-level was then stated to be about a foot above that of very low river. The distance in this channel-way between the inner and outer 6-foot curves is 1,050 feet and between the 5-foot curves 750. The bar seems to be composed of sand, that being the bottom found when sounding, until in 6 or 7 feet water, when

mud appears. The working of the material of which the bar is composed seems to have some regularity about it. After high freshets, when the water has to some extent subsided, the channel-way seems to be filled up. As the falling of the water continues, the depth of the channel, although it may do so for a short time, instead of decreasing either keeps its depth or increases it, and, some greater or lesser length of time after the river has recovered its average level, resumes its normal depth, which is about 5 feet of water. This was illustrated last winter. An unusually rainy summer and fall had raised the river to a great height; soon after it had commenced subsiding, there was for some days an entire suspension of steamboat traffic, the two lightest-draught boats happening, however, to be laid up, after which, although the river continued falling, traffic was resumed. From this it seems as though the sand is brought down-stream during freshets. At the time of the survey the water-level was stated to be about that of average low river, and that at such time the currents in the lower reaches of the narrow river are sluggish. This was found to be the case during the time of making the survey, for a float put out in the lower reach could not carry the line of a log-reel, and a float set adrift at the lower points of the river, after running slowly down to the inshore pile shown on the chart, drifted on the shoal to the westward, declining to pass over the bar. These floats were subsurface. The prevailing breezes at this time were northerly. It is probable that northerly winds destroy and southerly winds create a current, and the northerly ones, strong enough to raise any sea, have, undoubtedly, a more or less injurious effect upon the channel. It seems probable that jetties carried up to low-water level would keep this channel open immediately after freshets, but whether it would do so against the action of the sea and of the northerly winds which destroy the current, remains to be proved. The length required for a westerly jetty, from the shore to the outer 6-foot curve, will be about 1,900 feet. This jetty might be straight, and possibly might alone keep the channel open. A jetty to the eastward would require a length of 3,100 feet, of which 1,700 would be in less than 2 feet of water. Two estimates are submitted: one for a continuous row of round piling driven as closely as possible; the other for a structure of main and sheet piling. The draught of boats plying between Pilatka and Lake Monroe is at present governed by the depth of little Lake George, which at low-water allows 6 feet to be carried up, and that, consequently, will be the depth required upon Volusia bar at a similar stage of the river. The traffic over the portions of the river surveyed consists during the winter months of two mail-boats, one making an up trip the other the down trip, daily; two regular freight-boats running from Jacksonville, each making two trips weekly, and two other boats running irregularly. The mail-boats, which, by the way, seem to be the chief sufferers on the bar, carry but little freight, and cease to run up river after April 15. Almost the entire freighting of the section of country between Lakes George and Monroe is carried on by the two regular freight-steamers above mentioned, viz: the Carrie and the George M. Bird. I called in person on and also wrote to the agents of these boats, requesting them to forward to you some description of information as to the amount of freights carried by them, also stating why they as interested parties should give it.

UPPER SAINT JOHN'S RIVER, BETWEEN LAKES GEORGE AND MONROE.

The following is a description of the bends surveyed in this portion of the river:  
I. A bend about ¾ of a mile above Old Town, otherwise called Saint Francis. A cut-off here would have a length of 410 feet, saving 2,800 feet of distance.

II. Two bends, about 2 miles below Manuel's Landing. These combined cut-offs would have a length of 2,100 feet, saving 5,700 feet of distance.

III. A bend at Manuel's Landing. A cut-off here would have a length of 1,000 feet, saving 2,600 feet of distance. The width of river at the bends is from 130 to 150 feet, and in the reaches connecting them from 150 to 200 feet. The shores are bold, with plenty of water in midstream. While working on these bends we were daily passed by one or more of the boats plying on that portion of the river, viz, the Water Lily, Pastime, Carrie, and George M. Bird. None of them appeared to have much trouble in rounding these bends beyond slowing down, and thereby losing a little time. Coming "down-stream" the Pastime was in the habit of running her nose in the bank, upstream of a bend, and, after the current had swung her stern, of backing off, leaving her as soon as she drifted round the point, heading straight down the next reach. This operation consumed about seven or eight minutes. Whenever trouble or delay is incurred it is in going downstream. None of the boats above mentioned run at night.

VOLUSIA BAR.

Estimates for jetties.

Length of East Jetty .....	3,120
Length of West Jetty .....	1,900
Total .....	5,020

*1st estimate, round piles, driven as close together as possible.*

5,020 piles, at \$0.75, averaging 15 feet in length .....	\$3,765
Driving piles, at \$1.50 each .....	7,530
Add 10 per cent., superintendence and contingencies .....	1,130
East Jetty, \$7,704; West Jetty, \$4,721; total .....	12,425

*2d estimate, sheet-piling.*

504 main piles, including driving, at \$2.25 .....	\$1,134
200 M (board measure) sheet piling, at \$18 per M .....	3,600
36 $\frac{3}{4}$ M of waling pieces, at \$18 per M .....	672
Driving 5,020 sheet-piles, at 50 cents .....	2,510
Labor, say, 50 per cent. of cost of lumber .....	2,136
1,000 $\frac{1}{4}$ -inch bolts = 9,000 pounds } 12,500 pounds .....	1,250
2,000 $\frac{3}{8}$ -inch bolts = 3,500 pounds } .....	78
4,500 spikes, 1,300 pounds, at 6 cents .....	1,140
Add 10 per cent. for contingencies .....	1,140
East Jetty, \$7,763; West Jetty, \$4,757; total .....	12,520

*Estimate for cut-offs.*

Total linear feet of cut, 3,510.  
The estimate is based on a cut 100 feet wide, 10 feet deep, and side slopes of 1 to 1.  
The depth of 10 feet for the cut is derived as follows:

	Feet.
Average height of ground above water .....	2
Water likely to fall an additional .....	2
Draught required at low-water .....	6
	10

The entire site of cut is covered with wood-growth, which will also be required to be cleared back for 50 feet either side of cut.

3,510 linear feet of cut $\times$ 1,000 square feet area of cut .....	130,000 cubic yards.
130,000 cubic yards of excavation, at 20 cents .....	\$26,000
Grubbing and cutting 8 acres of wood, at \$30 per acre .....	240
Cutting 8 acres, at \$10 per acre .....	80
Superintendence, contingencies, &c .....	2,680
Total .....	29,000

I forward herewith two drawings, one a chart of Volusia Bar, the other a map of the bays referred to in this report.

Very respectfully, your obedient servant,

GEORGE DAUBENEY,  
*Civil Assistant.*

Gen. Q. A. GILLMORE,  
*Lieut. Col. Corps of Engineers, U. S. A.*

## APPENDIX J.

## ANNUAL REPORT OF CAPTAIN A. N. DAMRELL, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1879.

UNITED STATES ENGINEER OFFICE,  
*Mobile, Ala., August 28, 1879.*

GENERAL: I have the honor to transmit herewith annual reports, with financial statements, for the year 1877-'78, for the river and harbor improvements under my charge.

Very respectfully, your obedient servant,  
A. N. DAMRELL,  
*Captain of Engineers.*

The CHIEF OF ENGINEERS, U. S. A.

## J I.

## SURVEY FOR IMPROVEMENT OF THE HARBOR AT MOBILE, ALABAMA.

UNITED STATES ENGINEER OFFICE,  
*Mobile, Ala., January 7, 1879.*

GENERAL: I have the honor of submitting the following report of progress on the work of obtaining data to determine whether the present ship-channel leading from the lower anchorage in Mobile Bay can be deepened so as to admit of vessels drawing 22 feet or any less draught above 13 feet to the wharves of the city of Mobile, for which an appropriation of \$10,000 was made by act of Congress approved June 18, 1878.

Authority was received for the prosecution of this work on the 12th of July, 1878. The time from that date to the 15th of August, 1878, was consumed in making repairs to vessels to be employed and in general preparation.

On the 15th of August the work was commenced, and has been prosecuted steadily since with fair results, considering the extreme unhealthiness of the season, and more especially the prevalence of unfavorable weather, which has given but very few days in each month when the water was smooth enough for either borings or soundings.

The work accomplished is as follows:

Tide-gauges were established in Mobile River at Battery Gladden, near the upper end; at Battle's wharf, on the eastern shore; and at Fort Morgan, at the lower end of Mobile Bay.

Mobile River has been carefully sounded from Beauregard street, near the northern limit of the settled part of the city, to its mouth; soundings being taken across the river opposite each street.

The channel dredged, under Congressional appropriation, between the years 1871 and 1877, from the mouth of Mobile River through Choctaw and Dog River Bars, was sounded; the lines of soundings being run 100 feet apart longitudinally, and cross-sectioned every 10 feet.