

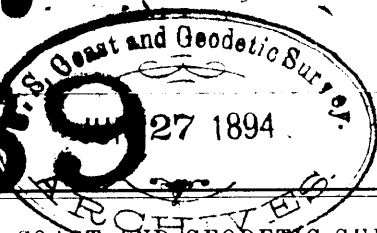
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Diag. Cht. No. 1239-1

U. S. COAST AND GEODETIC SURVEY.

T. C. Mendenhall, Superintendent.

State: *South Carolina.*

DESCRIPTIVE REPORT.

*Hydrographic Sheets Nos. 2187,
2188, 2189 + 2190.*

LOCALITY:

*Ashley, Cooper &
Wando Rivers.*

1894.

CHIEF OF PARTY:

Lieut. Robert G. Peck, U.S.N.

2188

U.S. AND G. SURVEY
LIBRARY AND ARCHIVES

Diag. Ch't. No. 1239-1
Acc. No.

83
SHA
2188
1894

Department of Commerce and Labor
COAST AND GEODETIC SURVEY

J. C. Mendenhall
Superintendent.

State: South Carolina

DESCRIPTIVE REPORT.

Hyd. Sheet No. 2188

LOCALITY:

Ashley, Cooper and
Wando Rivers
Sec. S. H. A. 2187

1894
~~190~~

CHIEF OF PARTY:

R. G. Peck, U.S.N.

2188

2189

U.S. COAST AND GEODETIC SURVEY
LIBRARY AND ARCHIVES

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Diag. Cht. No. 1239-1

83
SHA
2189
1894

Department of Commerce and Labor
COAST AND GEODETIC SURVEY

J. C. Mendenhall,
Superintendent.

State: *South Carolina*

DESCRIPTIVE REPORT.

Hyd. C. Sheet No. 2189

LOCALITY:

Ashley, Cooper and

Wando Rivers

See SHA 2187

1894
~~190~~

CHIEF OF PARTY:

P. G. Peck 2157

2189

2190

COAST AND GEODETIC SURVEY
LIBRARY AND ARCHIVES

83
SHA
2190
1894

Diag. Cht. No. 1239-1 *Acc No.*

Department of Commerce and Labor
COAST AND GEODETIC SURVEY

J C Mendenhall
Superintendent

State *South Carolina*

DESCRIPTIVE REPORT.

Hyd C Sheet No *2190*

LOCALITY:

Ashley, Cooper and

Wando Rivers

See SHA 2187

~~1894~~
~~190~~

CHIEF OF PARTY:

R. S. Peck

2190
2190

Write me at: *Go. Quintard Iron Works, foot of East 12th St.,*
New York City

Telegraph me at:

My Express Office is:

U. S. Coast and Geodetic Survey *Str. "Bache",*

JUN. 26. 1894. 008110

New York,

Assistant in Charge
A. B.

June 22, 1894.

Descriptive Report.

Dr. J. C. Mendenhall,
Superintendent,

U. S. Coast and Geodetic Survey,
Washington, D. C.

Sir:-

I have the honor to submit the following descriptive report to accompany hydrographic sheets 1, 2, 3 and 4 of the survey of the Ashley, Cooper and Wando Rivers, S. C., which work was executed between the dates January 30 and May 8 under your instructions of January 6 and the detailed instructions of the Hydrographic Inspector of January 12, 1894. The following statistics are herewith appended:- four reference tables - one for each sheet; and table showing the number of days on station, and how employed, and statistics of signals.

Shore Line.

The ground of the survey was covered by four projections on a scale of $\frac{1}{10,000}$, sent from the office, of which nos. 1 and 2 were for The Ashley, no. 3 for The Cooper and no. 4 for The Wando. The shore line and other topographical details were obtained from the sheets of Assistants John W. Down and C. H. Boyd, whose topographical survey of the locality was cotemporary with the work of The "Bache". Owing to the distortion of the sheets in consequence of which those of the topographers differed from each other and from those of the ship as well, much difficulty was experienced in transferring the shore line, and it was finally accomplished only with much labor by using small squares.

In some cases where the shore line of the creeks had been put in by sextant, it was found not to agree with our positions determined while sounding in the creeks. In such cases a more correct shore line is put in with dotted line by reference to our lines of soundings.

In that part of The Wando River above \triangle Venning,

it will be seen that our lines are ended a considerable distance beyond the topographical shore line. This is due to the fact that while the shore line was made to correspond with the grass line, our sounding lines, having been run at extreme high water, were carried to a considerable distance beyond. The part of the river included in this large bay or widening of the river is all very shoal, and much of the work here could be done only at high water.

Scheme of Lines.

In the execution of the hydrography one system of lines was planned perpendicular to the axis of the stream, and this system was intersected at right angles by a second or check system following its general direction. In the broader parts of the rivers the normals were spaced at intervals of 150 metres, but this interval was much reduced in the narrower parts, and wherever the presence of shoals made a special development necessary or desirable. The intervals between the lines of the longitudinal system varied with the varying widths of the rivers.

There were always at least three lines in this system, and the intervals never exceeded 200 metres, being generally much less.

In the hydrography of the creeks, most of which are quite unimportant, the general plan adopted was a series of traverses or zigzags, in which the alternate courses were normal to the stream, together with one mid-channel line. Where the creek was small the latter alone was deemed sufficient, and in a few cases, while on the sheets apparently of some size, creeks were so shallow and so unimportant in their meanderings through the marsh, leading nowhere, that no attempt was made to force the boats through them to obtain soundings — work which would have been possible only at high water and practically valueless when accomplished.

Tides

There is at Fort Sumter an automatic tide gauge belonging to the office, but which has been operated for a number of years by the U.S. Engineers. This gauge is used by them for their tidal reductions in the quarterly surveys of the area included between the jetties, and its central position in the harbor would seem to make it desirable for determining the plane of reference for the entire chart of this locality. I therefore determined, as suggested by the office, to connect all my gauges with the Sumter gauge, and carry the Sumter plane of reference along successively to these gauges. Inasmuch as it is believed that the impounding of the waters due to the construction of the jetties has caused a change in the mean low water level, the plane of reference assumed for the Sumter gauge is that obtained from the observations of the past two years only.

The following table will explain the locations of the several gauges used for the reduction of soundings, their positions

in the chain from Sumter, and between what points on the different sheets each gauge was used :-

Gauge No.	Location.	El. of zero referred to zero of Gauge No.	Between what points used for Reduction of Soundings -
1.	Ashley River - "New Bridge"	Sumter	Sheet No. 1 - "New Bridge" to Ashepoo Wharf.
2.	Ashley River - Royal Fert. Co's Wharf.	1.	Sheet No. 1 - Ashepoo Wharf to limit of sheet.
3.	Ashley River - Fetteressa Wharf of Ch. M. & M. Co.	2.	Sheet No. 2 Throughout. (Intermediate station to connect Gauge No. 5 with Sumter.
4.	Custom House Slip, City.	Sumter	
5.	Cooper River - Near Δ Daniel	4.	Sheet No. 3 - From beginning to Hyd. signal No. 6, left bank.
6.	Cooper River - Read Fertilizer Co's Wharf -	5.	Sheet No. 3 - From Hyd. signal No. 6 to upper limit, together with Sander's Creek.
7.	Clauter's Creek - 500 metres from Δ Margin.	5.	Sheet No. 3 - From Hyd. signal "Pog" to upper mouth of Clauter's Creek.
8.	Wando River - Near Δ Mitchell.	4.	Sheet No. 4 - Throughout.

The following observations were taken for determining the differences in the elevations of the zeros of the several gauges used :-

Comparison of Tide Gauges
for
Difference of Elevation of Zeros.

Date	Gauge No. 1 - "New Bridge"			Gauge No. - Fort Sumter			Diff. of Times		Diff. of Readings		Diff. of Elevation of Zeros	
	Tide	Time	Readg Range Stand	Time	Readg Range Stand	H.W.	L.W.	H.W.	L.W.			
March 5	L.W.	1-30 P.M.	3.55	30	12-04 P.M.	-05	32	9	3.60	} 3.70		
" 5	H.W.	7-00	8.50	4.95	36	6-37	4.70	4.75	38		23	3.80
" 6	H.W.	7-25 A.M.	9.075	60	7-16 A.M.	5.30	50	9	3.775	} 3.64		
" 6	L.W.	1-40 P.M.	3.35	5.725	20	1-19 P.M.	-.15	5.45	-		21	3.50
" 6	H.W.	7-20	8.90	5.55	20	7-07	5.04	5.19	35	13	3.86	} 3.665
" 7	L.W.	1-50 A.M.	3.15	5.75	40	1-05 A.M.	-.32	5.36	33	15	3.47	
" 7	H.W.	8-00	9.05	5.90	40	7-37	5.25	5.57	25	23	3.80	} 3.62
" 7	L.W.	2-05 P.M.	3.00	6.05	30	1-47 P.M.	-.43	5.68	45	18	3.43	
" 8	H.W.	8-30 A.M.	8.45	60	8-28 A.M.	5.14	50	2	3.76	} 3.665		
" 8	L.W.	3-00 P.M.	3.00	5.45	40	2-47 P.M.	-.55	5.74	30		13	3.55
" 9	H.W.	9-20 A.M.	9.05	60	9-01 A.M.	5.29	40	19	3.76	} 3.625		
" 9	L.W.	3-25 P.M.	3.00	6.05	30	3-20 P.M.	-.44	5.78	40		5	3.44
" 10	H.W.	9-55 A.M.	8.80	50	9-40 A.M.	4.99	40	15	3.81	} 3.655		
" 10	L.W.	3-55 P.M.	2.90	5.90	30	3-30 P.M.	-.60	5.59	50		25	3.50

Average = 3.65

The Zero of Gauge No. 1 is below the Zero of Sumter Gauge 3.65 feet.

" " " Sumter Gauge is (by observation of past two years) at M.L.W.

" " " Gauge No. 1 is below M.L.W. of Sumter Gauge 3.65 feet.

Correction of P. of R. for diff. of range of tide (.20 ft. for average tides) .10 "

The Plane of Reference reads on Gauge No. 1 3.55 "

Gauge No. 1 - Bench Marks.

B.M. No. 1. - eleven (11) copper nails in horizontal row, driven into second pile of first row of piles to W'd of boat landing on North side of "New Bridge," foot of Spring St., Charleston, S.C., at 11 ft. mark on gauge.

B.M. No. 2 is a cross (+) on cap-sill of first row of piles to W'd of boat landing platform. A copper nail is driven at the intersection and one at end of each arm of cross. The center nail is 16 ft. 1 inch above zero of gauge and is 12.53 ft. above M.L.W.

Comparison of Tide Gauges
for
Difference of Elevation of Zeros.

Date	Tide	Gauge No. 2 - Royal F. Co. Wh. Stand				Gauge No. 1 - New Bridge				Diff. of Times		Diff. of Readings		Diff. of Elevation of Zeros
		Time	Ready	Range	Stand	Time	Ready	Range	Stand	H.W.	L.W.	H.W.	L.W.	
March 9	H.W.	9.30 A.M.	7.30		60	9.20 A.M.	9.05		60	+10			1.75	1.90
" 9	L.W.	3.30 P.M.	0.95	6.35	30	3.25 P.M.	3.00	6.05	30		+5		2.05	
" 13	H.W.	12-10	6.72		50	12.10	8.50		80	0			1.78	1.87
" 13	L.W.	6-10	1.85	4.87		6.05	3.80	4.70	40		+5		1.95	

Average = 1.88

The zero of Gauge No. 2 is above the zero of Gauge No. 1 1.88 feet.
 " " " " " 1 " below M. L. W. 3.55 " "
 " " " " " 2 " " " of Gauge No. 1 1.67 " "
 " Correction of plane of reference for diff. of range of tide (.17 ft. for average tides) .08 " "
 " Plane " Reference reads on Gauge No. 2 1.59 " "

Gauge No. 2 - Bench Marks -

B.M. No. 1, consists of eleven copper nails driven in horizontal row into pile, at S.E. corner of Wharf at Royal Fertilizer Works, at 11 ft. mark (top) of gauge, and is 9.41 ft. above M. L. W.

B.M. No. 2, is the center of a cross cut in the longitudinal stringer of wharf near S.E. corner and nearly over B.M. No. 1. A copper nail marks the intersection and the end of each arm. B.M. No. 2 is 12.83 ft. above M. L. W.

Comparison of Tide Gauges
for

Difference of Elevation of Zeros.

Date,	Gauge No. 3. Petteressa Wharf.				Gauge No. 2. Royal F. Co's Wharf.				Diff. of Times -		Diff. of Readings		Diff. of Elevation of Zeros.	
	Tide.	Time	Read'g	Range.	Stand. m.	Time	Read'g	Range.	Stand. m.	H.W.	L.W.	H.W.		L.W.
March 15	L.W.	9.00 P.M.	1.75		40	8.40 P.M.	1.80	4.50	50		20		-.05	.050
"	H.W.	3-20 A.M.	7.35	5.60	40	3.00 A.M.	7.20	5.40	60	+20		+15		
"	L.W.	10.00 "	1.65	5.70	55	9.45 "	1.70	5.50	50		+15		-.05	.075
"	H.W.	3.35 P.M.	6.05	4.40	60	3.15 P.M.	5.85	4.15	50	+20		+20		
"	L.W.	9.55 "	0.85	5.20	45	9.35 "	0.85	5.00	30		+20		.00	.075
"	H.W.	4.40 A.M.	7.30	6.45	40	4.20 A.M.	7.15	6.30	40	+20		+15		
"	L.W.	10.55 "	1.45	5.85	35	10.40 "	1.45	5.70	35		+15		.00	.100
"	H.W.	5.15 P.M.	6.80	5.35	65	5.00 P.M.	6.60	5.15	70	+15		+20		

Average = .075

The Zero of Gauge No. 3 is below The Zero of Gauge No. 2 +.075 feet.
 " " " " " 2 " " M.L.W. 1.59 " "
 " " " " " 3 " " " of Gauge No. 2 1.66 " "
 " Correction of Plane of Reference for diff. of range of tide (20 ft. for average tides) .10 " "
 The " " " reads on Gauge No. 3 1.56 " "

Gauge No. 3 - Bench Marks -

B.M. No. 1 was made by driving eleven copper nails in pile at 11 ft. mark (top) of gauge. It is 9.44 ft. above M.L.W.

B.M. No. 2 is The center of cross cut in longitudinal stringer of wharf nearly over B.M. No. 1. A copper nail was driven at intersection and at end of each arm of cross. B.M. No. 2 is 10.40 ft. above M.L.W.

Comparison of Tide Gauges for Difference of Elevation of Zeros.

Date	Gauge No. 4 - Custom House				Fort Sumter Gauge				Diff. of Times		Diff. of Readings		Diff. of Elevation of Zeros	
	Tide	Time	Read'g	Range	Stand. m.	Time	Read'g	Range	Stand. m.	H.W. m.	L.W. m.	H.W. m.		L.W. m.
March 5	L.W.	1.05 P.M.	2.68		50	12.54 P.M.	-.05		32		11	2.73		2.79
" 5	H.W.	6.55 "	7.55	4.87	30	6.37 "	4.70	4.75	35	18		2.85		
" 9	H.W.	9-10 A.M.	8.10		30	9-01 A.M.	5.29		40	9		2.81		2.725
" 9	L.W.	3-15 P.M.	2.15	5.95	30	3.20 P.M.	-.49	5.78	40		-5	2.64		
" 10	H.W.	9.45 A.M.	7.80		40	9.40 A.M.	4.99		40	5		2.81		2.73
" 10	L.W.	3.45 P.M.	2.05	5.75	30	3.30 P.M.	-.60	5.59	50		15	2.65		
April 9	H.W.	10-10 A.M.	7.45		40	9-55 A.M.	4.70		40	15		2.75		2.70
" 9	L.W.	4.05 P.M.	2.45	5.00	35	4.00 P.M.	-.20	4.90	40		5	2.65		
" 9	H.W.	10.45 "	9.05		70	10.35 "	6.30		45	10		2.75		2.70
" 10	L.W.	5-10 A.M.	3.45	5.60	40	5-00 A.M.	+.80	5.50	40		10	2.65		
" 10	H.W.	11.00 "	7.75		60	11-10 "	4.90		30	-10		2.85		2.75
" 10	L.W.	5.00 P.M.	2.75	5.00	40	4-50 P.M.	+.10	4.80	40		10	2.65		
" 10	H.W.	11-10 "	8.28		68	11-00 "	5.60		45	10		2.68		2.64
" 11	L.W.	5.20 A.M.	3.20	5.08	60	5-00 A.M.	+.60	5.00	50		20	2.60		
" 11	H.W.	11.45 "	7.40		60	11.35 "	4.70		40	10		2.70		2.64
" 11	L.W.	5.45 P.M.	2.97	4.43	45	5.35 P.M.	+.40	4.30	40		10	2.57		
" 12	L.W.	7.00 A.M.	3.30		40	6.45 A.M.	+.70		40		15	2.60		2.65
" 12	H.W.	1-10 P.M.	7.70	4.40	60	1-05 P.M.	5.00	4.30	30	5		2.70		

Average, 2.70

The Zero of Gauge No. 4 is below the Zero of Sumter Gauge 2.70 ft.
 " " " Sumter Gauge (by observations of past two years) is at M.L.W.
 " " " Gauge No. 4 is below M.L.W. of Sumter Gauge 2.70 ft.
 Correction of Plane of Reference for diff. of range of tide (.10 ft. for average tides) .05 "
 Plane of Reference reads on Gauge No. 4 2.65 "

Gauge No. 4 - Bench Marks -

B.M. No. 1 :- About midway of Custom House Slip, on N. side, is a flight of landing steps. Gauge was secured to second pile from these steps towards open end of slip. B.M. No. 1 is made by eleven copper nails driven into pile at 11 ft. mark on gauge and is 8.35 ft. above M.L.W. ($30\frac{15}{16}$ inches below top surface of pier).

B.M. No. 2 is the center of cross, nearly over B.M. No. 1, cut with cold chisel into side of top granite block of slip, $4\frac{15}{16}$ inches below upper surface of block. It is 10.52 ft. above M.L.W.

Comparison of Tide Gauges for Difference of Elevation of Zeros.

Date	Gauge No. 5 - Δ Daniel				Gauge No. 4 - Custom House				Diff. of Times			Diff. of Readings			Diff. of Elevation of Zeros
	Tide	Time	Readg	Range	Stand	Time	Readg	Range	Stand	H.W.	L.W.	H.W.	L.W.	H.W.	
March 24	H.W.	10.05 A.M.	7.78		50	9.45 A.M.	7.80		35	20				.02	} .085
" 24	L.W.	4.05 P.M.	2.60	5.18	25	3.50 P.M.	2.75	5.05	20		15			.15	
" 25	H.W.	10.45 A.M.	7.82		50	10.25 A.M.	7.85		60	20				.03	} .105
" 25	L.W.	4.47 P.M.	2.72	5.10	27	4.30 P.M.	2.90	4.95	20		17			.18	
April 11	L.W.	5.55 "	2.70		30	5.45 "	2.97		45		10			.27	} .185
" 12	H.W.	12.35 A.M.	7.95	5.25	30	12.20 A.M.	8.05	5.08	60	15				.10	
" 12	L.W.	7.20 "	3.00		40	7.00 "	3.30		40		20			.30	} .20
" 12	H.W.	1.35 P.M.	7.60	4.60	50	1.10 P.M.	7.70	4.40	60	25				.10	

Average .14

The Zero of Gauge No. 5 is above The Zero of Gauge No. 4 .14 ft.
 " " " " " 4 " below M.L.W. 2.65 " "
 " " " " " 5 " " " of Gauge No. 4 2.51 " "
 Correction of Plane of Reference for diff. of range of tide (.16 ft. for average tides) .08 " "
 The " " " reads on Gauge No. 5 2.43 " "

Gauge No. 5 - Bench Marks -

The Bench Mark is The upper surface of buried flat stone which marks The Δ Daniel and is 6.14 ft. above M.L.W., as obtained by Level No. 10, U.S.C. and G. Survey.

Comparison of Tide Gauges for Difference of Elevation of Zeros.

Date	Gauge No. 6 - Beach Pier, Cal. City				Gauge No. 5 - A. Daniel				Diff. of Times		Diff. of Readings		Diff. of Elevation of Zeros
	Tide	Time	Readg.	Range	Time	Readg.	Range	Stand.	H.W.	L.W.	H.W.	L.W.	
March 24	H.W.	10.20 A.M.	8.88		65	10.05 A.M.	7.78	50	15		1.10		1.15
" 24	L.W.	4.22 P.M.	3.80	5.08	30	4.05 P.M.	2.60	5.18	25	17	1.20		
" 30	L.W.	2.55 P.M.	3.90		25	8.40 A.M.	2.85	40	15		1.05		1.185
" 30	H.W.	3.00 P.M.	7.50	3.60		2.45 P.M.	6.18	3.33	30	15	1.32		
April 11	L.W.	6.15	3.92		40	3.55	2.70	30		20	1.22		1.16
" 12	H.W.	12.58 A.M.	9.05	5.18	60	12.35 P.M.	7.95	5.25	30	20	1.10		
" 12	L.W.	7.30	4.20		45	7.20	3.00	40		10	1.20		1.21
" 12	H.W.	1.50 P.M.	8.82	4.62	56	1.35 P.M.	7.60	4.60	50	15	1.22		
											Average	1.17	

The Zero of Gauge No. 6 is below The Zero of Gauge No. 5 1.17 ft.

" " " " " 5 " " M.L.W. 2.43 "

" " " " " 6 " " " 3.60 "

The Plane of Reference reads on Gauge No. 6 3.60 "

Gauge No. 6 - Bench Marks.

B.M. No. 1 - eleven (11) copper nails driven into pile at 11 ft. mark (top) of gauge. It is 7.40 ft. above M.L.W.

B.M. No. 2 - On the face towards water of the brick chimney of boiler house, about 15 metres back from bulkhead of wharf, a cross and letters B M (B + M) were cut with cold chisel in fifth brick from S. E. corner, about 5 ft. above the ground. B.M. No. 2 is the center of cross, and is 14.70 ft. above M.L.W.

Comparison of Tide Gauges
for
Difference of Elevation of Zeros.

Date,	Gauge No. 7 - Clauter's Creek				Gauge No. 5 - Δ Daniel.				Diff. of Times.		Diff. of Readings.		Diff. of Elevation of Zeros.	
	Tide	Time	Readg	Range	Stand	Time	Readg	Range	Stand	H.W.	L.W.	H.W.		L.W.
1894	L.W.	9-05 A.M.	3.40		25	8-40 A.M.	2.85		40		25		.55	}.68
" 30	H.W.	3-00 P.M.	7.00	3.60	25	2-45 P.M.	6.18	3.33	30	15		.82		
													Average	.68

The Zero of Gauge No. 7 is below The Zero of Gauge No. 5	.68 ft.
" " " " " 5. " M.L.W.	2.43 "
" " " " " 7. " "	3.11 "
The Plane of Reference reads on Gauge No. 7	3.11 "

Gauge No. 7 - Bench Mark -

Bench Mark - Three large iron nails driven into scantling, at N.W. corner of wharf, at 11 ft. mark of gauge, 7.89 ft. above M.L.W.

Comparison of Tide Gauges
for

Difference of Elevation of Zeros.

Date	Gauge No. 8 - A Mitchell.			Gauge No. 4 - Custom House.			Diff. of Times		Diff. of Readings		Diff. of Elevation of Zeros.	
	Tide	Time	Read'g	Range	Stand.	Time	Read'g	Range	Stand.	H.W.		L.W.
April 9	H.W.	10.25 A.M.	8.95		50	10.10 A.M.	7.45		40	15	1.50	} 1.30
" 9	L.W.	4.20 P.M.	3.55	5.40	40	4.05 P.M.	2.45	5.00	35	15	1.10	
" 9	H.W.	11.05 "	10.45		50	10.45 "	9.05		70	20	1.40	} 1.25
" 10	L.W.	5.25 A.M.	4.55	5.90	30	5.10 A.M.	3.45	5.60	40	15	1.10	
" 10	H.W.	11.05 "	9.20		50	10.50 "	7.75		60	15	1.45	} 1.275
" 10	L.W.	5.20 P.M.	3.85	5.35	20	5.00 P.M.	2.75	5.00	40	20	1.10	
" 10	H.W.	11.47 "	9.73		25	11-10 "	8.28		68	37	1.45	} 1.30
" 11	L.W.	5.30 A.M.	4.35	5.38	44	5.20 A.M.	3.20	5.08	60	10	1.15	

Average 1.28

The Zero of Gauge No. 8 is below the Zero of Gauge No. 4	1.28 ft.
" " " " " 4 " " M.L.W.	2.65 "
" " " " " 8 " " " of Gauge No. 4	3.93 "
Correction of Plane of Reference for diff. of range of tide (.30 ft. for average tides)	.15 "
The Zero of Gauge No. 8 is below M.L.W.	3.78 "
" Plane of Reference reads on Gauge No. 8	3.78 "
Gauge No. 8 - Bench Mark.	

The Bench Mark is the upper surface of flat stone, with small, round, vertical hole in top, which marks the Δ Mitchell. It is 10.025 ft. above M.L.W. as obtained by Level No. 10, U. S. C. & G. Survey.

The plane of reference for each successive gauge was corrected for the difference in the range of the tide at the two points compared by applying half this difference of range for average tides.

In the correction of all soundings a time allowance was used, and this was obtained by laying off quarter mile intervals above and below each gauge, and for the zones thus marked off, the gauge being at the center of one zone, allowing one minute for each quarter mile of distance from the zone of the gauge. The rate at which the tide travels (15 miles per hour) on which this allowance was based was found by observation, and this rate agrees closely with the result obtained theoretically by Airy's rule.

Navigation of the Ashley. "New Bridge" to Lamb. Owing to the narrowness and irregularity of many parts of the channel, it would be difficult to give close sailing directions, such as would insure the best water possible throughout, without marking the channel by a considerable number of buoys or beacons. The following will be sufficient for taking a draft of 10 ft. up the river at mean low water as far as the White House Shoal, or 8 ft. as far as Lamb. At ordinary high water 5 ft. can be added to these drafts.

After passing through draw keep along west bank until about .3 mile beyond mouth of Old Town Creek which is about one mile above the bridge; then haul over for Pacific wharf on east bank and follow along line of wharves until off the Chicora wharf. The names of the different phosphate works to which wharves belong are painted on them and can be read with ease. In order of passing they are as follows:— Pacific, Ashpoos, Atlantic, Chicora, Stone, Imperial, Wando and Royal. The first wharves on the river above the bridge are two

belonging to the West Shore Terminal R. R.
 After passing the Chicora wharf, head over for
 black buoy no. 1, leaving it on port hand, and
 then head for the first red pile beacon, situated
 off point of marsh island to left of Accabee
 Creek. Leave this beacon on starboard hand,
 150 yards away, and haul to W'd so as to bring
 the second red pile beacon, marking the "Sisters",
 a little on port bow. After passing first bea-
 con bring this in range with point of woods
 near upper or northern side of Woods Mills
 (second, back from beacon), but do not pass ^{the} range.
 When something less than half the distance from
 first to second beacon, bring ^{the} latter on ^{the} starboard
 bow and head so as to pass it 100 yards ^{distant} away.
 From this beacon head so as to pass red buoy no. 2
 about 60 yards on starboard hand. After
 passing red buoy, haul gradually to N'd and W'd
 round the third red pile beacon for point of
 west bank distant about 6 miles, and in round-
 ing give this point a berth of about 100 yards.
 Then keep along west bank about same distance
 off (100 yards) for 500 yards, until small creek on

west bank is opened; then haul in to west bank and keep close along edge of marsh until range stakes come on; follow range across the river until abreast of Wando Mining Co's wharf (abandoned mill), and as soon as reach on port hand is opened head over and follow along port hand bank until bridge is opened; then haul gradually towards it.

Care must be exercised in approaching the draw against the ebb tide which sets across it and runs very strongly. The draw is opened promptly on signal from approaching vessels. The eastern draw is preferable as it gives a fairer approach. It is used almost entirely.

After passing bridge keep about mid river, favoring west bank, until reach above on port hand is opened; then follow this bank until reach on east bank is opened; then haul over to east bank and follow along until the great sand pile at Lamb is in range with low cedar tree on east bank about .3 mile above small white house also on east bank. Range comes on about .3 mile below white house.

Follow range until near point of west bank; then haul across for east bank so as to give point a wider berth. Follow along east bank until abreast trees on left bank; then take mid river until off Magnolia Gardens; then west bank to Lambs.

Above Lambs the navigation becomes more difficult, though it is said that at high water about the same draft (13 ft.) can be carried as far as the Ashley Phos. Works, $3\frac{1}{2}$ miles from Lambs, and 8 ft. to Greggs, $3\frac{1}{2}$ miles beyond the latter point. From Greggs to Dorchester the river is navigable only for light draft river steamers.

Navigation of the Cooper and Wando Rivers.

As far as the survey of the Bache extended in these two rivers, a distance from the City of 12 and 8 miles respectively, they are practically free from dangers detached from shore, and as a rule may be navigated safely by following the ebb tide reaches.

There are no artificial aids to navigation.

Jetties and Channel depths.

Owing to the great improvement in the Swash Channel which has been produced by the jetties, this channel is now almost entirely used by deep draught vessels. The jetties are expected ultimately to establish and maintain a channel across the bar not less than 21 feet deep at low water, where the low water depth has heretofore not exceeded 12 feet. Their action is to be assisted by dredging.

The estimated cost for jetties up to low water was \$4,380,500. and up to 3 feet above mean low water \$5,334,500. A considerable part of the jetties has now been raised to high water.

The present channel across the bar and from deep water inside, for nearly the entire length of the jetties, was made by a dredged cut on the range given by St. Philip's Church steeple and the light house on Fort Sumter. This is expected to be the permanent channel and the dredging is mostly limited to this range. The ultimate low water depth of 21 feet expected has already been obtained for a considerable part of the way.

The range is a most excellent one - so sensitive that a variation of 15 feet on either side can be noticed either by day or night. The range is very easily taken up from outside, both the church tower and Fort Sumter being easily identified in the day time, even by a stranger, and the lights still more easily at night.

The recent removal of the Rattlesnake Shoal Light-ship to a position on the prolongation of the range line makes its identification additionally easy.

On the crest of the bar between the jetties a mean low water depth of 16 feet existed at the time of the "Bache's" recent departure from Charleston. The shoalest part is between the extreme outer ends of the jetties and is only a narrow strip. Owing to a slight shifting of the channel it is at present necessary to haul to the southward of the St. Philip's range for a short distance near the outer ends of the jetties. The channel will doubtless be restored on the St. Philip's range by dredging.

On the crest of the bar the bottom is hard

and vessels cannot bump on it safely. For this reason the pilots do not attempt to bring in vessels unless the soundings actually show sufficient water and the state of the sea is such as not to endanger striking.

At the present time the draught of vessels crossing the bar may be stated about as follows:—coastwise schooners draw about 15 to 16 feet; foreign sailing vessels draw from $16\frac{1}{2}$ to 18; Tramp Steamers draw from $16\frac{1}{2}$ to 19. Up to the time of the "Bache's" departure the deepest draught that had been taken across the bar was 20 feet.

In the Ashley River 15 feet can be carried as far as the White House Shoal, 13 feet to Lamb's, 12 feet to Middleton's, 8 feet to Gregg's, and to Dorchester the river is navigable only for light draft river steamers.

In the Cooper River all vessels that can cross the bar can go above the Read Fertilizer Works, and 15 feet can be carried at high water to Strawberry Ferry, some 30 miles above the city. Above Strawberry Ferry the river becomes narrower and the bends sharper, and there are many shoals.

It is said that 7 feet can be carried to Mulberry Bluff, and 5 feet to Wadboo Bridge.

There was formerly a shallow canal connecting the head-waters of the Cooper with the Santee. A few years ago an engineering commission made an examination of this canal, but reported it unworthy of improvement.

Pilots.

At the present time there are three pilot boats for Charleston Harbor, two of which are constantly outside the bar. One lies near the bar and the other cruises from 5 to 10 miles in the offing. Pilot ground extends 30 miles from the bar.

Soundings on the bar are taken by the inshore boat whenever there are vessels to enter, and these soundings are signaled to the pilots of incoming vessels for every change of depth of 3 inches.

Vessels generally heave to for pilot. In case of delay a good anchorage may be selected to the northward of the new position of the light ship, where a vessel will be convenient to the bar.

The State law makes pilotage compulsory

for all vessels, provided vessel is spoken. This could be avoided with difficulty, as a bright lookout is kept by the pilots.

All the pilots are in one association, and there are in all 32, of whom 27 are full branch, 4 12-foot, and 1 10-foot branch. The following are the rates of pilotage now in force:-

For 6 feet, or under	\$15.00
" 7 " " "	16.50
" 8 " " "	18.50
" 9 " " "	21.00
" 10 " " "	23.50
" 11 " " "	33.00
" 12 " " "	40.00
" 12½ " " "	44.00
" 13 " " "	45.00
" 13½ " " "	50.00
" 14 " " "	54.00
" 14½ " " "	60.00
" 15 " " "	66.00
" 15½ " " "	69.00
" 16 " " "	84.00
" 16½ " " "	100.00
" 17 " " "	120.00
" 17½ " " "	150.00
" 18 " " "	180.00

Each additional 6 inches over 18 feet, 10.00

Outward bound vessels are required by law to give twenty-four hours notice to pilot.

Tugs.

Tugs are generally used by vessels entering the harbor, but with a fair wind sailing vessels frequently cross the bar and enter the harbor under sail. Tugs can be almost always obtained outside the bar as well as at the different wharves in the city. They can be ordered at offices of different tug-boat companies and also at pilot headquarters. All sea-going sailing vessels tow up and down the rivers.

Anchorage.

The usual anchorages for vessels are; Rebellion Roads; in the Ashley River off the mouth of Wappoo Creek; and off the city to the southward of Southern wharves and to the northward of Merchant's wharf. Between these limits, comprising all that part of the harbor lying off the central part of the city, vessels are forbidden by the harbor regulations to anchor.

The bottom is generally soft and the holding ground excellent. The protection against sea is, as a rule, sufficient in any part of the harbor. Rebellion Roads and lower city anchorage would

be exposed to south-east winds. The upper city anchorage has the additional protection of Shutes' Folly Island. Still safer anchorages can be found by running farther up into the Cooper and Wando Rivers, and in anticipation of a hurricane such as occasionally visits this port, one can scarcely make his vessel too secure. During the cyclone of August, 1893, which caused such devastation in this section, the Revenue Cutter Morrill left the Custom House dock and ran up to a point just inside the Wando River, off the mouth of Hobcaw Creek, where with two anchors down she safely rode out the storm. Owing to the great height of the tide and clean sweep of the wind from the south-east, there was a heavy sea in the harbor off the city. The buoys of the Light House department on the Custom House dock were carried far up into the city, and the tender lying at the dock was damaged and very nearly wrecked.

Vessels rarely enter Charleston Harbor for shelter only. The times when shelter would ^{be} needed would be generally unfavorable for crossing the

bar. The holding ground outside is so good that a vessel obliged to anchor in the vicinity would probably, with a long scope, ride out an ordinary gale in safety.

Fidal Currents and Set.

It is said by the pilots that off the bar the flood current sets for three hours to the southward and westward, then to the westward, and the last hour to the northward and westward; the ebb sets first three hours strong to northward and eastward, then East, and last hour south-east-straight out. Within the harbor the currents as a rule follow the channels tolerably closely, but at turning points, as for instance at Sumter Shoal buoy (black, no. 11), and at upper middle ground buoy (red, no. 12), the set is athwart the course of a ship and will naturally be guarded against, especially at night when the effect of currents is not as quickly perceived as in the day time.

While the ebb current is considerably stronger than the flood in all parts of the harbor, within the jetties the ratio of the ebb current to that of

the flood has been increased by their action to the proportion of 1.6 to 1. The strength of the currents in the rivers does not differ materially from that found in the harbor.

Both in the harbor and in the rivers the flood current continues to run from a half hour to an hour after high water, and the ebb current about the same length of time after low water. Although I took a great many observations to determine this point, my results were too variable to admit of closer statement.

Prevailing Winds, etc.

From April to November the prevailing wind is from south-west. During winter the most frequent wind is from north-east, and least frequent from south-east. The heaviest gales are from north-east and south-east, the latter being most dangerous and creating oftentimes a considerable sea in the harbor. As on the northern coasts, the cold, clear northwester is not uncommon. It is only during summer - the N. I. hurricane months - that gales are dangerous to

vessels in the harbor. At such times especial precautions are advisable.

Fogs.

Fogs are not very frequent or troublesome and when they do occur, generally last but a short time. They occur most frequently in January and February. They are brought in by the winds from sea and are dissipated by those from shore.

Freshets.

Freshets occur, but are not dangerous to life. The chief damage caused by them is to the rice fields. They are said to occur most frequently in August.

Quarantine Regulations and Boarding Station.

The Quarantine establishment and boarding station are at Fort Johnson, and the quarantine buoys moored off the Fort mark the point where vessels must wait until they have been boarded and have received pratique. There are at the Quarantine station very complete arrangements for fumigation and disinfection, steam heat at high temperature being used for germicidal purposes in an efficient modern plant. Owing to Charleston's

proximity to West India ports and the frequency and closeness of the communication with them, the disease chiefly dreaded is yellow fever.

Wharves.

Many of the wharves of the city are in a very bad condition, having been in many cases completely wrecked by the summer cyclone of 1893. Some have been repaired, but others remain in their dilapidated and unserviceable condition. The depths alongside the wharves are quite variable and depend upon dredging, as the slips gradually fill up with mud. Vessels generally rest in the mud at low water, but without injury. In the Custom House slip there are at the present time 6 to 7 feet at low water for two-thirds of length of slip.

Public Landing.

The only public landing in the city is at the Custom House slip, about midway of east front of the city, where there are four flights of granite steps made in the granite walls of the pier.

Hospitals.

The "City," the "Roper" and the "St. Francis Xavier" comprise the hospitals of the city, the two latter being private institutions. The former can accommodate 200 beds. The Marine Hospital Service is given out by contract, and at the present time is at the St. Francis Xavier, situated on Calhoun St., near Rutledge Avenue. The charge per diem is \$1.00.

Supplies - Water, Coal, Provisions, etc.

Fresh water can be obtained at many of the wharves of the city by connecting hose to the hydrants of the City Water works, the charge being 75¢ per 1000 gallons. There are also several water boats from which water can be obtained at short notice and in any quantities desired, at a charge of $\frac{1}{2}$ to $\frac{3}{4}$ ¢ per gallon.

There are several large coal dealers and generally an abundant supply of both anthracite and bituminous coals on hand. Vessels generally coal at the wharves, but lighters

can be had if desired. The price made to the "Bache" was for anthracite \$5.35, and for New River Coal (considered equal to Pocahontas) \$3.70 per ton of 2240 pounds.

Provisions of all kinds can be procured in any amount and at reasonable prices. There is a fine market near the water front, a short distance from the Custom House. Here meats of all kinds, as well as poultry and fish are to be found.

Facilities for Docking and Repairs.

There is at present no dock in Charleston, the only one, Pregel's, having been wrecked in cyclone of August, 1893.

Pregel's Marine Railway, the only one in the city, can haul vessels of 600 tons and 160 feet on keel. The charge for sailing vessels is 20 ¢. per ton of registered tonnage; for steamers, according to size. For a steamer 100 feet long and 10 ft. draft the charge would be \$50. Prices are made on application.

There are good facilities for repairs. A ship yard is connected with railway for re-

pairs to wooden vessels).

The crews of vessels on the railway are allowed to work on them, but no outside labor is permitted in competition with that furnished by the proprietors of the dock.

There are iron works in the vicinity, and it is said that repairs to iron vessels can be made efficiently and at reasonable cost.

It is contemplated by Mr. Pugnall to build a new Marine Railway capable of hauling the largest vessels that can enter the port—length to be 450 feet.

The docking facilities seem at present quite inadequate to the needs of a city of the commercial importance of Charleston.

Weather Service and Time.

The office of the weather observer in Charleston is in the Carolina Savings Bank Building, corner of East Bay and Broad Sts. and opposite the Post Office. On this building the weather signals are displayed. The morning weather report is received from Washington at about 9.30 A.M.

There is no time ball, but the Washington Naval Observatory time can be obtained every noon at the Western Union telegraph office on East Bay St. There is no Branch Hydrographic Office located here, nor station for reporting vessels. The former would doubtless be appreciated and would have a large field of usefulness.

Trade.

The following table exhibits the principal articles and the money value of the trade of Charleston during the fiscal year ending August 31, 1893, and for the previous year :-

	1891-92	1892-93
Cotton, uplands	\$ 17,570,000	\$ 12,025,000
" , sea uplands	555,000	583,000
Rice	1,244,000	1,132,000
Turpentine	390,000	271,000
Resin	255,000	228,000
Phosphate Rock	2,230,000	1,741,000
Fertilizers	3,001,000	4,884,000
Cotton Goods, domestics, etc.	4,706,000	3,831,000
Lumber and Cross-ties	759,000	829,000
Fruits and Vegetables	2,480,000	2,911,000
Manufactures exclusive of Fertilizers	11,159,000	11,725,000
Wholesale & retail trade	<u>39,526,000</u>	<u>34,481,000</u>
Total	\$ 83,000,000	\$ 75,000,000

The value of exports at the port of Charleston since 1880 has varied from \$ 26,646,000. in 1881 to \$ 9,286,000. in 1893. The value of the imports during the same period has varied between \$ 201,000. in

1880 and \$1,057,000 in 1891.

Steamship Lines, Rail Roads, etc.

The Clyde Line of Steamers maintains a tri-weekly service between New York and Jacksonville, Fla., calling each way at this port. The steamers are fine vessels with good accommodations for passengers. The freight rates are reasonable.

Regular communication by small steamers is carried on by the inside route with Beaufort, S.C., and other small places lying on these interior waters. Another line of small steamers runs outside to Georgetown. A few small steamers run up the Ashley, Cooper and Wando Rivers, chiefly for carrying freight.

There are three principal lines of Railway; the North-Eastern or Atlantic Coast to northern cities; the South Carolina to Columbia, Augusta and the West; and the Charleston and Savannah to Savannah and beyond. The service is said to be good on all these lines. From New York the time is about twenty-one hours).

Carrying Business of the Rivers.

The carrying business of the rivers connected with the phosphate industries is considerable. Vessels bring to them cargoes of pyrites, sulphur, kainit, coal, etc. The phosphate rock and the commercial fertilizers are shipped away from the different works both by vessel and by rail.

Except in the phosphate industries, the carrying business of the rivers is small and is mostly done by small schooners, sloops, sail boats and a few light draught river ~~steam~~ boats, all owned in the vicinity. Lighters with tugs are used to transport the phosphate rock from the mining and washing works to the fertilizer works which are nearly all in the lower reaches of the river. Where the phosphate rock is shipped away from the mining establishments, vessels generally load in part up the river and then drop down below the "New Bridge" and take in remainder of cargo from lighters.

The commerce of the Ashley River for

the year 1893 is reported by the Chief of Engineers as 465,000 tons.

Settlements on the Rivers.

On the Ashley River there is a small settlement called Old Town, on Old Town Creek, about two miles above the city. This was the first site of Charleston, but was occupied only a few months before removal to its present location. St. Andrews is another small settlement near the Bee's Ferry Bridge (Charleston and Savannah R. R. Bridge) about 10 miles above city. Lambs is likewise a small settlement about 13 miles above the city.

There are other small settlements near the different phosphate works, without importance, and generally without a name.

St. Andrews is situated on the Charleston and Savannah R. R., and Lambs on a branch of the South Carolina Rail Road.

On the Cooper River there are no towns or villages and few settlements. The country is sparsely occupied. There are small

settlements in the vicinity of the Etiwan, the Edisto and the Read Phosphate Works, distant respectively 3, 3½ and 10 miles from the city.

On the Wando River there is a small village called Cainhoj about 12 miles from city, and a small screw steamer makes daily trips between the two places.

Bridges.

"New Bridge" or "Ashley River Bridge" crosses the Ashley at the foot of Spring Street, city. It is used for teams and for foot passengers. This important bridge was completely wrecked by the cyclone of August, 1893, but was rebuilding during the "Bache's" stay in Charleston, and was to be completed June 1st of this year.

The widths of the draws are as follows:-

East draw, 62 feet 6 inches.

West " " 63 " 6 " .

The Charleston and Savannah Rail Road Bridge crosses the Ashley at what was formerly Bee's Ferry, about 10 miles above the city. Although built for a R. Road bridge, it is used

for teams and pedestrians as well, the horses going between, and the wheels of vehicles running close beside the rails.

The North draw has a width of 78 feet, and the South " " " " " 79 " 6 inches.

There is said to be also a wagon bridge across the Ashley at Dorchester about 20 miles above the city.

The Army engineer in charge of this district considers the channels covered by these bridges "reasonably free, easy and unobstructed," as required by the law of Congress relating to the obstruction of navigable waters. The draw of the Charleston and Savannah R. R. bridge should, however, be used with caution in going through against an ebb tide. This tide runs very strongly and sets across the end of the draw, while the bend in the river just below the bridge prevents a vessel of considerable length from approaching in such a manner as to allow for the set of the current. The northern draw gives the fairer approach and is used almost entirely.

For additional information regarding the port of Charleston, I beg to refer you to the following printed matter sent to the office under date of April 21, 1894:-

Reports for 1892 of Department of Health.

Maritime Sanitation - Quarantine Regulations).

" " - Germicidal value of Steam Heat.

" " - In use at Quar. Station, Charleston, S.C.

Report of Harbor Commissioners of 1882, containing State Laws in Relation to the Port and Harbor of Charleston, S.C., and the Regulations of the Board of H.C. relating to Pilotage.

Port Regulations).

Anchorage of Vessels.

Ordinance requiring use of Spark arresters).

Annual Report of Army Engineer Officer in charge of district for 1893.

Latest Survey of bar by Army Eng. Officer, March, 1894.

I have the honor to be,

Very respectfully,

Your obedient servant,

Robert G. Seck,

Lieut., U. S. A., Asst. C. & G. Survey,

Comdg. "Bache".

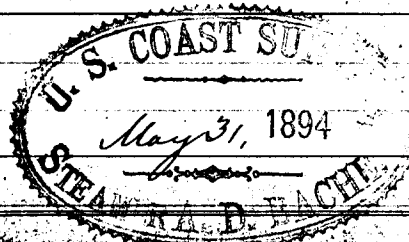
Hydrography: Ashley River, S. C. - Projection No. 1 - 1894.
 U.S. Coast and Geodetic Survey Steamer "A. D. Bache,"
 Lieut. Robert G. Peck, U.S. Navy, Assistant, Chief of Party.

Date, 1894.	Day letter.	Vol.	Number of -			Vessel.	Observers.
			Nautical miles.	Soundings.	Angles.		
<i>1st. Whale boat.</i>							
March 13	a	1	7.65	503	160	1st. W. b.	Lt. W. S. Benson and Ens. J. W. Oman, U.S.N.
" 14	b	1	8.00	408	156	"	" " " " " "
" 15	c	1	8.63	758	164	"	" " " " " "
" 21	d	1	1.75	338	44	"	" " " " " "
April 13	e	2	2.25	283	52	"	" " " " " "
Total - 1st. W. boat			28.28	2290	576	"	" " " " " "

<i>2nd. Whale boat.</i>							
March 6	a	1	4.50	417	134	2nd. W. b.	Ensigns G. W. Kline and J. W. Oman, U.S.N.
" 9	b	1	6.60	692	134	"	" " " " " "
" 10	c	1	1.90	149	28	"	" " " " " "
" 12	d	2	4.80	463	86	"	Ens. G. W. Kline and P. Geo. Thos. S. Martin, U.S.N.
" 13	e	2	5.30	554	102	"	" " " " " "
" 14	f	2	14.10	1426	272	"	" " " " " "
" 15	g	3	8.50	845	184	"	" " " " " "
" 17	h	3	.50	39	17	"	" " " " " "
" 21	i	3	1.55	260	38	"	" " " " " "
April 13	k	4	3.80	312	82	"	" " " " " "
Total - 2nd. W. boat			51.55	5157	1077	"	" " " " " "

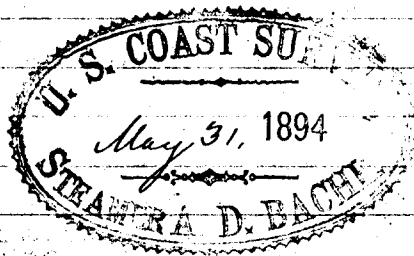
<i>Dinghy.</i>							
March 7	a	1	.75	168	38	Dinghy	Ensign J. W. Oman, U.S. Navy.
" 8	b	1	3.25	727	143	"	" " " " " "
" 12	c	1	2.40	470	93	"	" " " " " "
Total - Dinghy			6.40	1365	274	"	" " " " " "

<i>Recapitulation.</i>							
1st. Whale boat			28.28	2290	576		
2nd. "			51.55	5157	1077		
Dinghy			6.40	1365	274		
Total on Proj. No. 1			86.23	8,812	1927		



Hydrography: - Ashley River, S.S. - Projection No. 2 - 1894.
 U. S. Coast and Geodetic Survey Steamer "A. D. Bache";
 Lieut. Robert G. Peck, U. S. Navy, Assistant, Chief of Party.

Date, 1894.	Day letter.	Vol.	Number of -			Vessel.	Observers.
			Nautical miles.	Soundings.	Angles.		
<i>1st. Whale boat.</i>							
March 16	a	1	9.00	709	168	1st. W. boat	Lt. W. S. Benson and Ens. J. W. Oman, U.S.N.
" 19	b	1	3.12	476	92	"	" " " " " "
" 20	c	1	3.50	453	112	"	" " " " " "
April 13	d	2	1.75	252	96	"	" " " " " "
" 14	e	2	2.90	363	104	"	" " " " " "
Total - 1st. W. boat			20.27	2,253	572	"	"
<i>2nd. Whale boat.</i>							
March 16	a	1 & 2	7.50	804	210	2nd. W. boat	Ens. G. W. Kline & P. Yeo. Thos. S. Martin, U.S.N.
" 17	b	1	.70	49	14	"	" " " " " "
" 19	c	1	3.60	501	100	"	" " " " " "
" 20	d	1	5.00	552	128	"	" " " " " "
April 13	e	3	1.45	182	68	"	" " " " " "
" 14	f	3	4.10	412	114	"	" " " " " "
			22.35	2,500	634	"	"
<i>Recapitulation.</i>							
1st. Whale boat			20.27	2253	572		
2nd. " "			22.35	2500	634		
Total on Proj. No. 2			42.62	4,753	1,206		



Hydrography:— Cooper River, S.C.— Projection No. 3— 1894.
 U.S. Coast and Geodetic Survey Steamer "A. D. Bache,"
 Lieut. Robert G. Peck, U.S. Navy, Assistant, Chief of Party.

Date, 1894	Day Letter	Vol.	Number of—			Vessel.	Observers.
			Nautical miles	Soundings	Angles		
<i>1st. Whale boat.</i>							
March 22	a	1	6.50	590	138	1st. W. boat	Lt. W. S. Benson & Ens. J. W. Oman, U.S.N.
" 23	b	1	3.10	283	74	"	" " " " " "
" 27	c	1	8.50	600	148	"	" " " " " "
" 28	d	1	7.75	697	182	"	" " " " " "
" 29	e	2	3.90	248	94	"	" " " " " "
April 2	f	2	7.00	769	124	"	" " " " " "
" 3	g	2	5.25	549	122	"	" " " " " "
" 4	h	2	4.00	556	114	"	" " " " " "
Total— 1st. W. boat			46.00	4292	996		
<i>2nd. Whale boat.</i>							
March 22	a	1	5.85	504	110	2nd. W. boat	Ens. G. W. Kline & P. Ye. Thos. S. Martin, U.S.N.
" 23	b	1	5.70	474	128	"	" " " " " "
" 27	c	1	6.65	653	116	"	" " " " " "
" 28	d	2	16.80	1429	314	"	" " " " " "
" 29	e	2	4.40	409	94	"	" " " " " "
" 30	f	3	4.40	696	144	"	" " " " " "
April 2	g	3	6.45	534	130	"	" " " " " "
" 3	h	3	6.00	583	154	"	" " " " " "
" 4	i	3 & 4	5.60	885	162	"	" " " " " "
" 12	k	4	5.20	510	104	"	" " " " " "
Total— 2nd. W. b.			67.05	6677	1456		
<i>Dinghy.</i>							
March 30	a	1	3.90	691	146	Dinghy.	Lt. W. S. Benson & Ens. J. W. Oman, U.S.N.
Total— Dinghy			3.90	691	146		
<i>Recapitulation.</i>							
1st. Whale boat			46.00	4292	996		
2nd. " "			67.05	6677	1456		
Dinghy			3.90	691	146		
Total on Proj. No. 3			116.95	11,660	2,598		

U. S. COAST AND GEODETIC SURVEY
 May 31, 1894
 STEAMER A. D. BACHE

Hydrography: - Wando River, S. C. - Projection No. 4 - 1894 -
 U. S. Coast and Geodetic Survey Steamer "A. D. Bache",
 Lieut. Robert G. Peck, U. S. Navy, Assistant, Chief of Party.

Date, 1894.	Day Letter.	Vol.	Number of -			Vessel.	Observers.
			Nautical Miles.	Soundings	Angles.		
<i>1st. Whale boat.</i>							
April 5	a	1	11.25	949	212	1st. W. b.	Lt. W. S. Benson and Ens. J. W. Oman, U. S. N.
" 6	b	1	5.75	587	142	"	" " " " " "
" 9	c	1 & 2	6.25	595	132	"	" " " " " "
" 10	d	2	3.17	431	74	"	" " " " " "
" 12	e	2	3.00	454	78	"	" " " " " "
Total - 1st. W. boat			29.42	3,016	638	"	"

<i>2nd. Whale boat.</i>							
April 5	a	1	9.50	708	194	2nd. W. b.	Ens. G. W. Kline and P. Yeo. Thos. S. Martin, U. S. N.
" 6	b	1	4.20	336	108	"	" " " " " "
" 9	c	1	7.30	825	198	"	" " " " " "
" 10	d	2	4.50	543	138	"	" " " " " "
" 11	e	2	4.40	442	122	"	" " " " " "
Total - 2nd. W. boat			29.90	2,854	760	"	"

<i>Recapitulation.</i>							
1st. Whale boat			29.42	3,016	638	1st. W. b.	
2nd. " "			29.90	2,854	760	2nd. " "	
Total on Proj. No. 4			59.32	5,870	1,398		

<i>Recapitulation of Season's Work - by Boats.</i>							
1st. Whale Boat			123.97	11,851	2782		
2nd. " "			170.85	17,188	3927		
Dinghy			10.30	2,056	420		
Total for season			305.12	31,095	7129		

<i>Recapitulation - by Projections.</i>							
Projection No. 1			86.23	8,812	1927		
" " 2			42.62	4,753	1206		
" " 3			116.95	11,660	2598		
" " 4			59.32	5,870	1398		
Total for season			305.12	31,095	7129		

