

4768

Diag. Cht. No. 4115

Form 504  
 DEPARTMENT OF COMMERCE  
 U. S. COAST AND GEODETIC SURVEY

State: Hawaiian Is.

11-5613

DESCRIPTIVE REPORT.  
 Hydrographic Sheet No. 4768

LOCALITY:

West Coast of Hawaii

Kealakekua Bay

1928

CHIEF OF PARTY:

T.J. Maher

4768

G. & S. COMPANY  
APR 17 1928  
Acc. No.

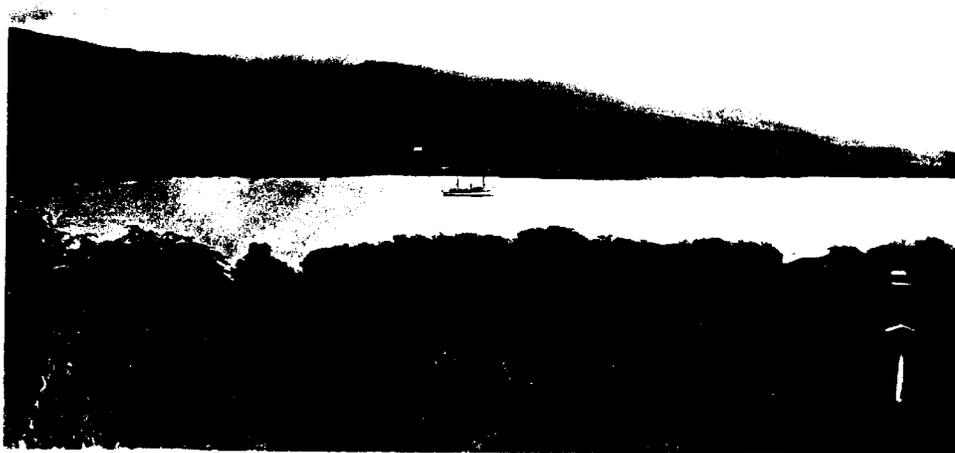
DESCRIPTIVE REPORT  
to accompany

HYDROGRAPHIC SHEET NO. 1  
Scale: 1:5,000

KEALAKEKUA BAY, ISLAND OF HAWAII, T.H.

Steamer GUIDE  
Thos. J. Maher  
Commanding

1928



DESCRIPTIVE REPORT  
to accompany

HYDROGRAPHIC SHEET NO. 1

Scale: 1:5,000

KEALAKEKUA BAY, ISLAND OF HAWAII, T.H. (Whaleboat).

AUTHORITY: Director's Instructions dated November 3, 1927.

GENERAL DESCRIPTION: Kealakekua Bay is a small bay about two miles wide at the entrance and about one mile deep. The shore line is rough and rugged, the north point of the bay Keawekaheka Point, is low and bare and is the end of a lava flow. Cook Point makes out into the bay south and east from Keawekaheka Point and is of similar formation. Napoopoo Light is on the southern extremity of this point. The high water line around these points to Kaawaloa Cove is literally a sea wall. Deep water can be found right up to the high water line. In Kaawaloa Cove the shore line is low between Cook Point and the high cliff to the southeast of the cove. Cook's Monument, a twenty-five foot concrete shaft, is in this cove. In all but southerly winds this small cove is very calm. Deep water can be found close up to the beach, but sunken rocks and rocks awash fringe the high water line.

The high cliff on the north side of the bay is the landmark for the bay. This cliff rises almost vertically to a height of from four to six hundred feet. Deep water can be found close up to this cliff, but as on the western side of the bay the high water line is fringed with rocks. The west side of the bay is low and flat, and with the exception of a small sand beach just south of the eastern end of the cliff the shoal line is very rugged and is the edge of an extensive lava flow.

The town of Napoopoo consists of a few scattered houses, a combination store and post office, at which limited supplies can be obtained. Fresh water is scarce here, the natives depending almost entirely upon rain water and shallow cisterns. A small concrete dock, which is more of a sea wall than a dock, is a few hundred yards south of the southern end of the sand beach. There is generally somewhat of a swell running on this side of the bay and it is difficult to make a landing, even with small boats, at this dock. It is often more advisable to make a surf landing on the sand beach rather than attempt to land at the

dock. There are many sunken rocks and rocks awash in the vicinity of this dock and care must be taken in bringing a boat of any size to the dock. There are only two or three feet of water alongside this dock. ✓

The shore from Napoopoo around to Palemano Point is low and rough, fringed with rocks. ✓

There is quite an extensive coral reef around Palemano Point and the limits of this reef are well defined by the breakers. \* ✓

CURRENTS. There is very little current inside the bay in the lee of either point, outside the current seems to be governed by the wind. ✓

ANCHORAGE. Good anchorage in from fifteen to twenty fathoms may be found in all but souwesterly weather inside the bay. The bottom is coral and sand, and is fair holding ground. In heavy weather it would not be advisable to anchor in the bay. ✓

METHOD. A U.S. Navy, twenty-four foot whaleboat was used for the inshore section of the survey. Manned with two and three coarsmen, one leadsman, one recorder, one officer on right angles and plotting, one officer left angles and coxswain. The lines were run twenty-five meters apart, and soundings spaced as close as possible. The lines were run normal to the beach. Inside the bay the lines were run right up to the beach, but around Palemano Point it was dangerous to approach closer than is shown on the sheet due to the heavy breakers on the reef. On two occasions the boat swamped, but fortunately no member of the party was hurt or no records or equipment lost. In all cases the soundings were run as close to the beach as was possible and safe. ✓

H. C. Warwick,  
Jr. H & G Engineer,  
C & G Survey.

The area between the twenty fathom and one hundred fathom curves was surveyed by a launch party in charge of Ensign V. M. Gibbens; the motorsailer being used for that purpose. All of the work proceeded very slowly on account of the depths and the necessity for spacing soundings as closely as called for in the instructions. ✓

The offshore work, at the approaches, was done from the Steamer GUIDE by means of the fathometer. The results were not satisfactory so a number of up and down soundings, in excess of what usually would be required, was taken. Only the up and

\* The notation "coral reef" on the sheet has been changed to "lava reef" on recommendation of E. R. Hand.

down soundings were plotted. All fathometer soundings were reduced for tides, salinity, temperature and fathometer rate. During 1927, Lieutenant Bond devised an ingenious method of obtaining slope corrections. Attention is called to the report submitted by him which was forwarded on March 31st. The method employed is, I believe, more rapid than the graph correction method devised by the office. The principle underlying each is the same but results are obtained in different forms. An examination of each method indicated that each is correct and both are applicable. Where the slope is uniform for considerable distances, with a minimum limitation of distance between soundings equal to depth X Sin slope. This is slightly inexact, as the assumption is made that the slope distance and horizontal distance between soundings are the same. Soundings may be taken close together, the bottom may be very irregular, there may be an excessive or unusual drop between two adjacent soundings. If the difference in depth between these two soundings is used, by a method of slope corrections, the slope line extended will meet the perpendicular from the ship's position somewhere in the water where there is no reflecting surface. Slope correction methods assume that the reflection takes place from this surface, and that the echo depth comes from it; the results so obtained are incorrect. Slope correction methods apply in general - but here there is an entire country where slopes are beyond the limits of the graph furnished by the office. That is immaterial as the graphs can be readily extended. However, I do not believe that the results so obtained are correct under conditions which exist as shown on the sheet.

It appears to me that sound waves in water have been treated too much like light waves. For slope corrections it is assumed that the reflection comes from a surface perpendicular to the normal from the ship. All of this is true to a certain extent. Sound waves are very long; they will round turns and bends and experience teaches that sound can be heard when not in a direct line with the source and when not in the direct line of any reflected wave.

In the accompanying sketch a steep slope is shown. Treated by the method of slopes, the results obtained would be derived from a point of reflection at A area, giving a corrected depth which would be too great.

The area B is not sharp. Except in artificial constructions the surface of the earth, where there are varying slopes, consists of a great number of very irregular or curved surfaces. The surface B is curved. This curved surface may be considered as the points of a series of tangents, some one of which will be perpendicular to the line from the ship. From this tangent, the echo, I believe, is most likely to emanate. The surface of reflection then is not the plane of the slope. The office graph may take all of this into consideration. The results obtained

however by it's use do not give corrected depths which agree with vertical casts. A sufficient number of up and down soundings were taken to enable the office to show on the chart actual depths, free from all theoretical considerations. More have been taken on an overlapping sheet, but those given are sufficient for this chart. Fathometer soundings have not been plotted. All of the work in connection with correcting these soundings has been done. A similar condition existed off the Coast of Washington in a small area.

This section will furnish information for a study in slopes. For that reason vertical casts, where slopes were unusual, were taken very close together. Numerous water temperatures and samples for salinity were obtained. A tide guage was maintained in operation at Napoopoo;

Various theories are advanced relative to the formation of these islands, some claiming subsidence of a large area, others claiming volcanic action, others a combination of both. A determination of this will undoubtedly entail an examination of underwater areas, with checking of soundings. These should therefore be given without uncertainty on our charts. Vertical casts have therefore only been plotted.

The method used to determine slope corrections was as follows:- The graph furnished by the office was employed. The results so obtained were then checked by the method devised by Lieutenant Bond. A template used for this purpose will be forwarded. The office can use it or not or construct another.

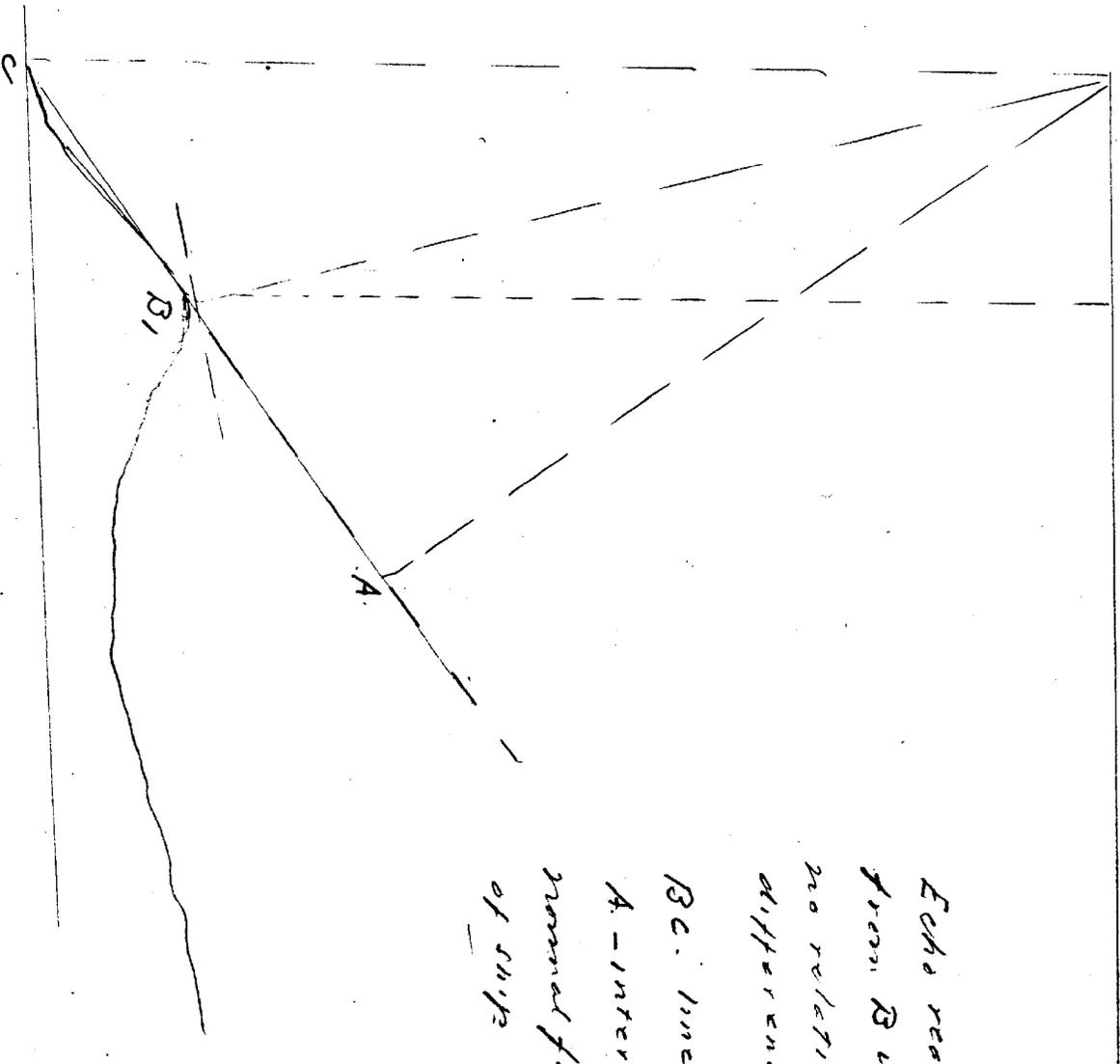
KEALAKEKUA BAY - HARBOR FACILITIES. Seas wash in heavily in the vicinity of Napoopoo. In that section there is usually a swell. The logical place for a wharf (\*) would be in the vicinity of Cook's Monument where the water is usually smooth. No information is available regarding this section during southwest weather.

A lava road, unsurfaced, runs from Cook's Monument to the road on the ridge. There is no beach road from Cook's Monument to Napoopoo, as the cliff or Pali shown on the sheet is steep to, to the waters edge. The chart is the best guide to an anchorage. In general, this bay affords good anchorage.

*Thos. J. Maher*

Thos. J. Maher,  
Commanding,  
Steamer GUIDE.

[\*) Considering hydrographic features only.



Echo really comes  
 from B which has  
 no relation to slope  
 difference.  
 BC. line of slope  
 A - intersection with  
 normal from position  
 of ship

KEALAKEKUA BAY, HAWAII, T.H.

STATISTICS, Sheet No. 1, Steamer GUIDE, 1928.

Date, 1928	Letter	Vol.	Positions	SOUNDINGS	Statute	Vessel
				V.C. Fath	Miles	
March 19	A	1	40	4	35	6.3 ship
" 20	B	1	66		127	9.0 "
" 21	C	1	78	14	136	15.5 "
" 22	D	1	9	8	8	1.3 "
" 23	E	1	10	10	10	4.0 "
March 1	a	1	122	122		4.5 motorsailer
" 2	b	1	143	143		4.5 "
" 3	c	1	79	79		2.3 "
" 5	d	1	168	168		5.1 "
" 6	e	1	177	177		6.1 "
" 6	e	2	24	24		2.0 "
" 7	f	2	150	150		5.9 "
" 8	g	2	85	85		4.2 "
" 9	h	2	108	108		4.2 "
" 14	j	3	85	85		4.6 "
" 15	k	3	78	78		4.5 "
" 16	l	3	77	77		4.8 "
" 17	m	3	53	53		3.0 "
" 24	n	3	25	25		0.6 "
Febr. 27	a	1	61	128		2.2 whaleboat
" 28	b	1	101	190		3.0 "
March 1	c	1	105	324		5.2 "
" 2	d	1	146	477		5.4 "
" 3	e	2	78	297		3.2 "
" 5	f	2	131	429		6.3 "
" 6	g	2	151	524		5.9 "
" 7	h	2	28	103		1.3 "
" 7	h	3	95	269		3.3 "
" 8	k j	3	117	306		3.4 "
" 14	k	4	45	183		1.6 "
TOTAL	28	8	2,635	4,640	316	133.2

## LIST OF PLANE TABLE POSITIONS SCALED FROM SHEET #A, (LIEUTENANT HAND, 1928).

Page 1.

OBJECT	LATITUDE		LONGITUDE		DESCRIPTION		
	°	'	°	'			
ULTA	19	27	1080.86 (764.0)	155.55	1042.5 (707.6)	Whitewash on vertical stone.	
DO	19	27	1439.86 (405.0)	155	55	1292.4 (457.7)	Whitewash
AR	19	27	1541.56 (303.3)	155	55	1161.7 (588.4)	Front gable, ruins
Bo1	19	27	1716.86 (128.0)	155	55	1091.0 (659.0)	Whitewash on coco palm
HOP	19	28	3.5 (1841.36)	155	55	1013.3 (736.7)	Whitewash
BUT	19	28	115.06 (1729.80)	155	55	936.0 (814.0)	Big whitewash on rock.
WA	19	28	242.5 (1602.36)	155	55	893.3 (856.7)	Whitewash on end of stone wall
LMT	19	28	324.05 (1520.81)	155	55	874.62 (875.38)	Small whitewash
PA	19	28	416.0 (1428.86)	155	55	790.5 (957.5)	Coco palm
SHA	19	28	459.42 (1385.44)	155	55	802.2 (947.8)	Shack
MEET	1928		576.12 (1268.74)	155	55	817.5 (932.5)	Whitewash on cairn
MAS	19	28	658.20 (1186.66)	155	55	723.4 (1026.6)	House
AB	19	28	729.9 (1114.96)	155	55	859.82 (890.18)	Whitewash
AC	19	28	781.4 (1063.46)	155	55	884.9 (865.1)	Whitewash and flag on cairn.
CO	19	28	868.80 (976.06)	155	55	752.2 (997.8)	Whitewash on coco palm
OLD	19	28	861.98 (982.88)	155	55	651.65 (1098.34)	Center of large old house, has 4 porch posts
AD	19	28	942.08 (902.78)	155	55	542.75 (1207.25)	Whitewash
AL	19	28	1074.2 (770.66)	155	55	501 (1249)	Whitewash
POP	19	28	1100.2 (744.66)	155	55	569 (1181)	Whitewash
RUD	19	28	1215.86 (629. )	155	55	592.2 (1157.8)	Whitewash(?) setting on sea wall over a cross
TAB	19	28	1332.84 (512.02)	155	55	586.8 (1163.2)	Stone tablet at Keiau.
PO	19	28	1449.56 (395.3)	155	55	593.2 (1156.8)	Rag on post
SIM	19	28	1576.26 (258.60)	155	55	679.53 (1070.47)	Whitewash and symbol on top of rock.
TY	19	28	1650.08 (194.78)	155	55	747.3 (1002.7)	Whitewash high up.
DA	19	28	1705.91 (138.95)	155	55	810.6 (939.4)	Whitewash
DOF	19	28	1749.30 ( 95.56)	155	55	922.4 (827.6)	Whitewash
FUS	19	29	10.5 (1834.37)	155	55	1110.2 (639.6)	?
SLY	19	29	115 (1729.87)	155	55	1288.7 (460.1)	Whitewash triangle
QUA	19	29	194 (1650.87)	155	55	1410 (339.8)	Large whitewash, wormlike ridge.
BOY	19	29	240.5 (1604.37)	155	55	1533.5 (216.3)	Two spots of whitewash
POC	1929		266 (1578.87)	155	55	1648.1 (101.6)	Many spots
COR	19	29	285.5 (1559.37)	155	56	24.8 (1725 )	Whitewash
SPUR	19	29	226 (1618.87)	155	56	134.8 (1615 )	Top of slant <del>shaped</del> rock over arch shaped point.
IN	19	29	270 (1574.87)	155	56	156.1 (1593.7)	Whitewash

LIST OF PLANE TABLE POSITIONS SCALED FROM SHEET #A, (LIEUTENANT HAND, 1928).

Page 2.

OBJECT	LATITUDE		D.M. METERS		LONGITUDE		D.P. METERS		DESCRIPTION
	°	'	0	"	0	'	"		
JMI	19	29	233.05	(1611.37)	155	56	273.4	(1476.4)	Whitewash on post
INS	19	29	23.5	(1821.37)	155	56	337.6	(1412.2)	Whitewash on wall
HOD	19	28	1799.83	(45.03)	155	56	351.7	(1398.3)	House
DUB	19	28	1698.12	(146.74)	155	56	471.5	(1278.5)	Double banner
DO	19	29	23.50	(1821.37)	155	56	767.1	(982.7)	Flag and whitewash
PI	19	29	95	(1749.87)	155	56	876.4	(873.4)	Flag in pipe, faint
Coc	19	29	237.5	(1607.37)	155	56	973.7	(776.1)	Coco palm, northernmost
GO	19	29	349	(1495.87)	155	56	1000.7	(749.1)	Banner
THE	19	29	398	(1446.87)	155	56	1182.6	(567.2)	Algeroba tree in green clump.
HI	19	29	450	(1394.87)	155	56	1313.6	(436.2)	Flag and whitewash
HA	19	29	393	(1451.87)	155	56	1506.7	(243.1)	Two whitewash spots.
IT	19	29	430	(1414.87)	155	56	1627.5	(122.3)	Large whitewash
FA	19	29	594	(1250.87)	155	57	171.5	(1578.3)	Whitewash, very faint
LBS	19	29	794.5	(1050.37)	155	57	290	(1459.8)	Whitewash on slant rock high.
MA	19	29	912	(932.87)	155	57	259	(1490.8)	Whitewash on sand, small
BLT	19	29	1125	(719.87)	155	57	248	(1501.8)	Dogear whitewash

TRIANGULATION STATIONS

	°	'	"	0	'	"	0	'	"
PALEMANO (Hand, 1928)	19	27	43.581	1340.02 (504.85)	155	55	481.633	1418.5 (331.6)	
COOK (Hand, 1928)	19	29	04.155	127.75 (1717.12)	155	56	09.691	282.6 (1467.2)	
NAPOOPOO LIGHT (Hand, 1928)	19	28	56.607	1740.53 (104.33)	155	56	20.988	612.2 (1137.8)	
KEAWEKAHEKA 1891	19	29	05.189	471.2	155	57	03.189	93.0	

Tabulation of Temperatures.  
 Thermometer No. 41299.

Sheet No. 1. Vol. No. 1.

Depth Fms.	Temp. C	Depth Fms.	Temp. C
150	23.5	480	4.8
266	24.0	s	24.1
200	22.5	602	4.3
175	22.8	s	24.1
333	6.7	349	6.4
545	4.8	s	24.9
s	24.4	343	6.7
528	5.0	s	24.1
s	23.8	257	8.8
71	22.7	s	24.4
s	24.0	153	15.0
215	9.7	s	24.0
s	23.6	251	8.8
389	5.8	s	24.1
s	24.6	166	13.5
215	9.7	s	24.0
s	23.6	150	15.3
78	22.2	s	24.0
s	24.1	250	8.8
265	7.8	s	24.0
s	24.0	197	11.8
248	6.1	s	24.3
s	24.0	195	11.7
315	6.3	s	24.3
s	25.1	198	11.9
220	9.3	s	24.0
s	25.1	193	12.4
281	7.8	s	23.8
s	24.0	152	17.7
81	23.0	s	24.0
s	24.0	262	8.5
71	23.3	s	23.7
s	24.0	184	13.6
230	10.1	s	23.8
s	24.5	239	9.7
		s	24.0

s - surface.

Tabulation of Temperatures.  
 Thermometer No. 41299.

Sheet No. 5. Vol. No. 1.

Depth Fms.	Temp. C	Depth Fms.	Temp. C.
1070	3.0	123	23.0
602	4.3	s	24.2
s	24.1	91	22.0
377	5.6	s	24.0
s	24.9	162	15.7
52	23.5	s	24.2
s	23.8	610	4.1
285	7.3	s	24.0
s	23.8	795	3.3
230	9.0	s	24.3
s	23.8	54	23.7
115	21.5	s	24.0
s	24.4	496	5.0
75	23.0	s	24.0
s	24.3	60	23.7
70	23.0	s	24.0
s	24.2	56	23.1
65	23.5	s	24.0
s	24.3	74	23.9
27	24.1	s	24.3
s	24.4	69	23.0
300	6.9	s	24.0
s	24.4	44	23.5
221	8.7	s	23.8
s	24.5	191	11.9
71	23.5	s	23.9
s	24.6	209	10.7
140	10.0	s	23.5
s	24.3	306	7.0
		s	23.7
		154	14.5
		s	24.6

S - Surface

Mean of 64 surface temperatures -- 24.1 C.

Surface temperature taken about 1 fathom below the surface.

FATHOMETER CORRECTIONS.

0 to 900 fathoms.

Depth Fms.	Layer Temp. C	Layer Velocity fms./sec	Mean Velocity fms./sec	Corr. Factor	Correction Increment	Total Corr. Fms.
100	17.0	822	822	1.0024	+ .0024	+ .24
300	7.3	809	815	0.9939	.0061	-1.8
500	4.8	808	813	0.9914	.0086	-4.3
700	3.7	810	812	0.9902	.0098	-6.86
900	3.3	812	812	0.9902	.0098	-8.82

Salinity - 33 parts per 1000.

Fathometer geared for a velocity of 820 fathoms per second.

Copy for Record Section file.

May 14, 1928.

Division of Hydrography and Topography:

Division of Charts:

Tide reducers are approved in  
8 volumes of sounding records for

HYDROGRAPHIC SHEET 4768

Locality: ISLAND OF HAWAII, T. H.

Chief of Party: T. J. Maher, 1928.

Plane of reference is M L & W  
1.1 ft. on tide staff at Napoos

Condition of records satisfactory except as checked below:

1. Locality and sublocality of survey omitted.
2. Month and day of month omitted.
3. Time meridian not given at beginning of day's work.
4. Time (whether A.M. or P.M.) not given at beginning of day's work.
5. Soundings (whether in feet or fathoms) not clearly shown in record.
6. Leadline correction entered in wrong column.
7. Field reductions entered in "Office" column.
8. Location of tide gauge not given at beginning of each day's work.
9. Leadline corrections not clearly stated.
10. Kind of sounding tube used not stated.
11. Sounding tube No. entered in column of "Soundings" instead of "Remarks".
12. Legibility of record could be improved.
13. Remarks.

*E. J. Maher*

Chief, Division of Tides and Currents.

**NOTE:- Reducers checked using plane of reference as determined by field party. Honolulu tide record for comparison not yet received in office.**

Form 537  
(1-1-1918)

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY

REG. NO.  
**4768**

**HYDROGRAPHIC TITLE SHEET**

The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. 1

REGISTER NO. **4768**

State Territory of Hawaiian Is.

General locality West coast of Hawaii

Locality Kaalakekua Bay

Scale 1:5,000 Date of survey Febr. 27-March 24, 1928

Vessel U.S.C. & G.S.S. GUIDE

Chief of Party Thos. J. Maher

Surveyed by T.J.M. (ship) V. M.G. (motor sailer) E.R.H. (whaleboat) H.C.W. (whaleboat)  
*ER Hand  
HC Warrick*

Protracted by H.C.W. F.B.Q. V.M.G?

Soundings penciled by H C W

Soundings in fathoms xxx and fractions.

Plane of reference MLLW

Subdivision of wire dragged areas by

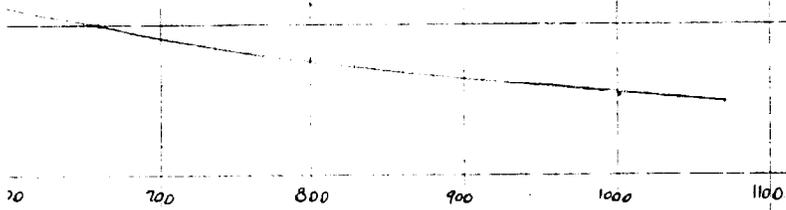
Inked by

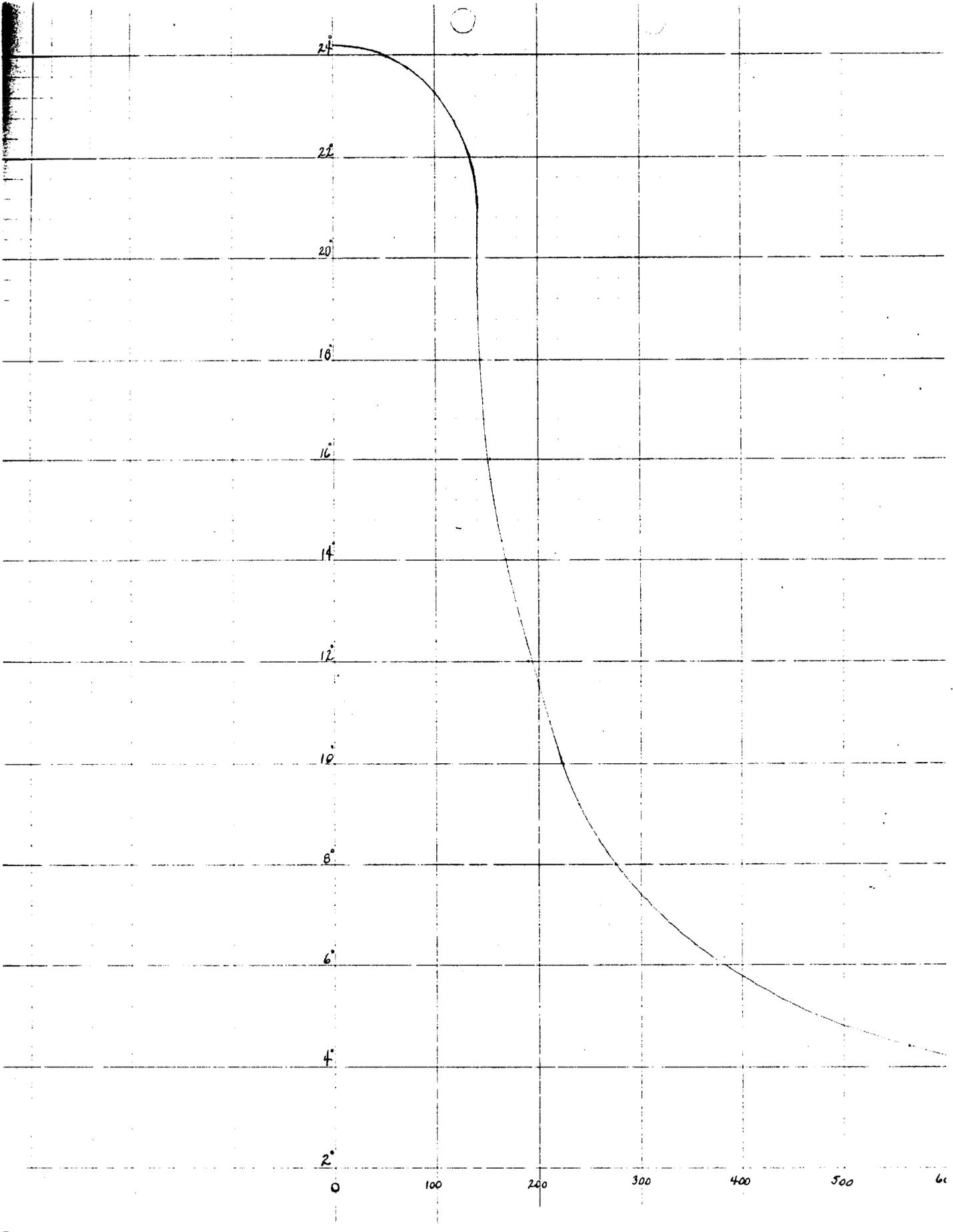
Verified by

Instructions dated November 3, 1928

Remarks: Work on this sheet included in 1 volume (ship) 3 vols. (motorsailer) 4 vols. (whaleboat); 3 marigrams Napoopoo guage, 1 descriptive report and reduction curves for fathometer, temperature tabulations; and 1 cahier tidal tabulations.  
G P O

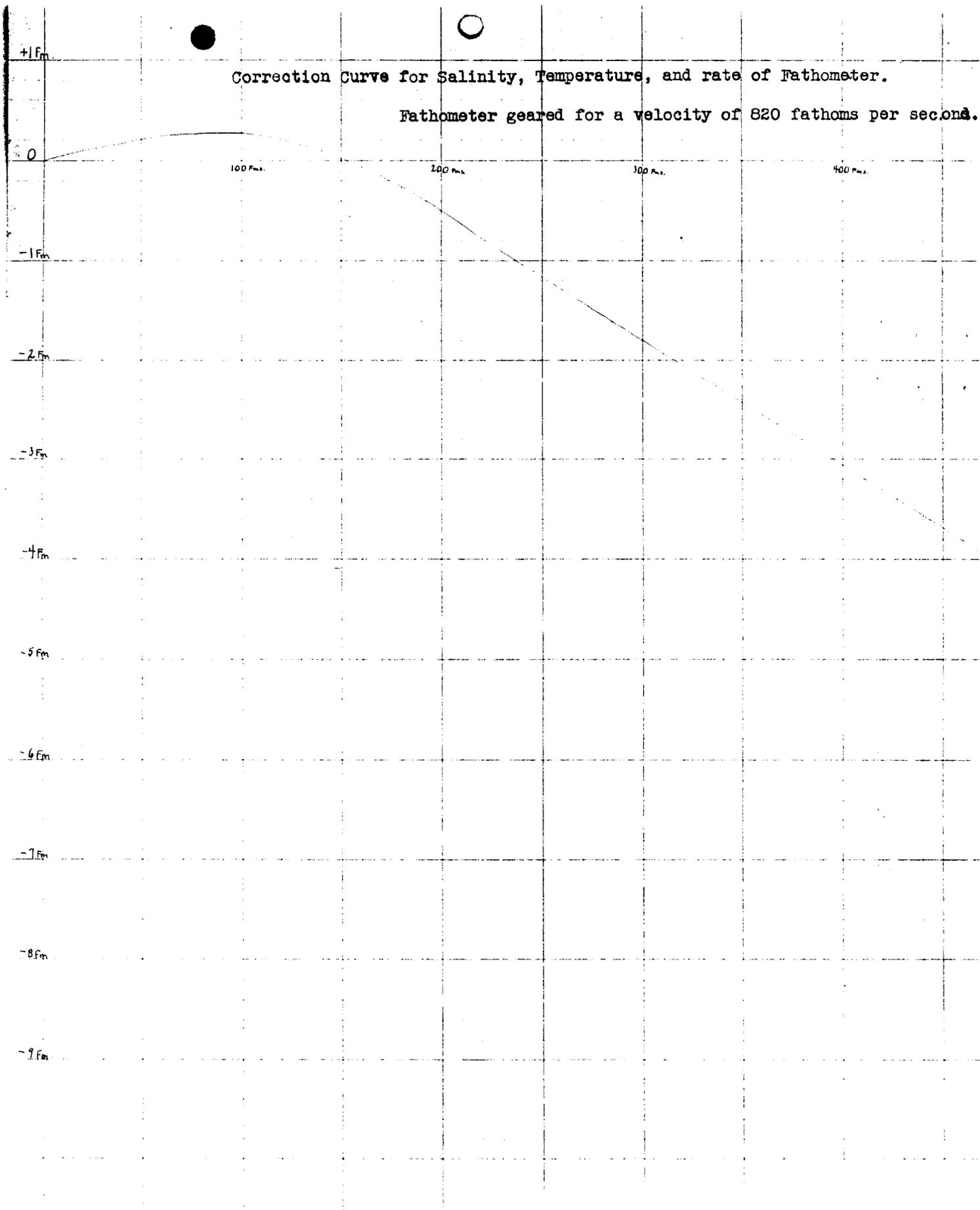
Temperature - Depth Curve.





Correction Curve for Salinity, Temperature, and rate of Fathometer.

Fathometer geared for a velocity of 820 fathoms per second.



3r second.

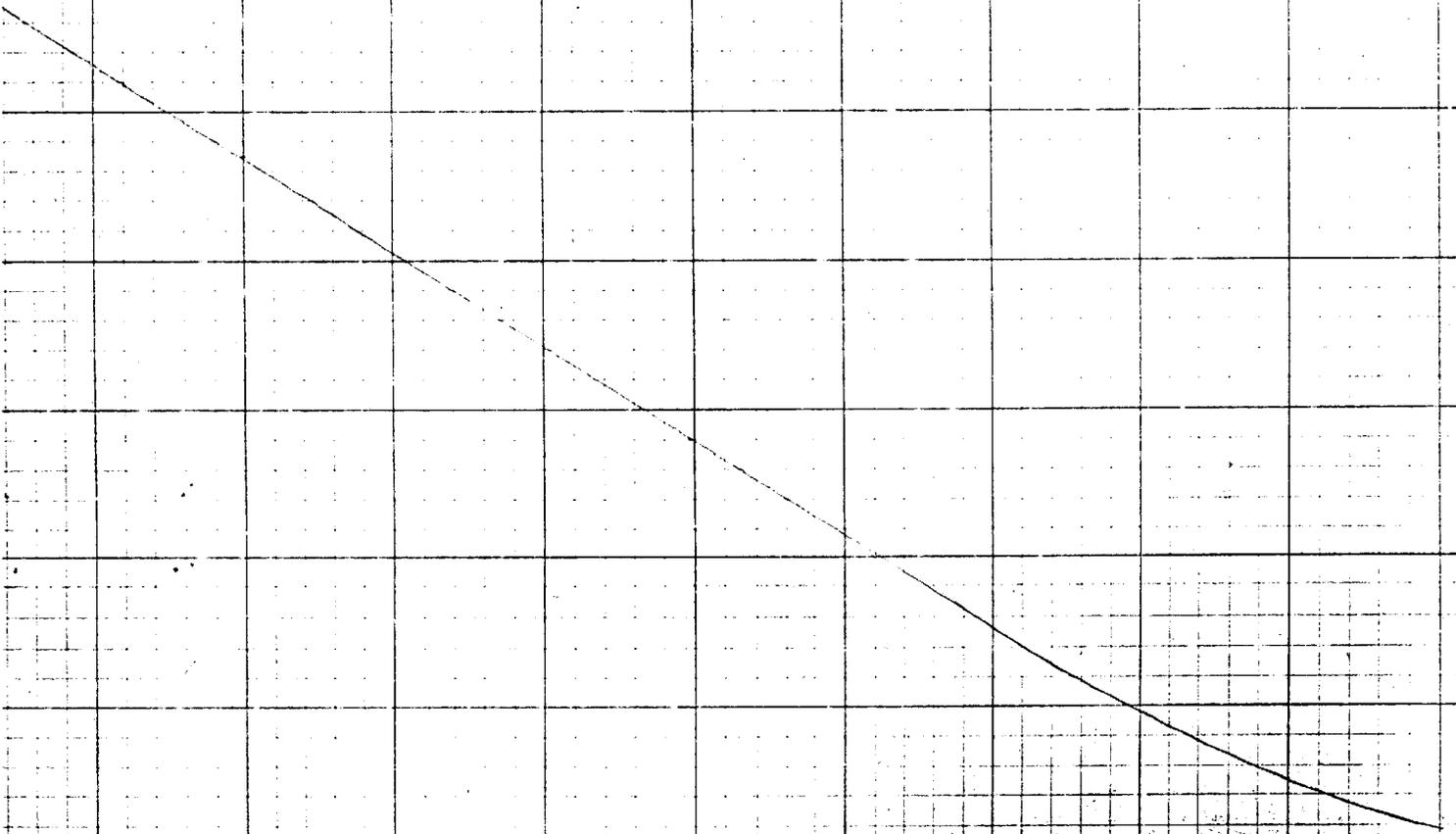
500 fms

600 fms

700 fms

800 fms

900 fms



IN REPLY ADDRESS THE DIRECTOR  
U. S. COAST AND GEODETIC SURVEY  
AND NOT THE SIGNER OF THIS LETTER

AND REFER TO No. 11-DRM

DEPARTMENT OF COMMERCE  
U. S. COAST AND GEODETIC SURVEY

WASHINGTON

August 10, 1928.

SECTION OF FIELD RECORDS

Report on Hydrographic Sheet No. 4768

Kealakekua Bay, Hawaiian Islands

Surveyed in 1928

Instructions dated November 3, 1927

Chief of Party, T. J. Maher.

Surveyed by V. M. Gibbens, H. C. Warwick, E. R. Hand, T. J. M.

Protracted by H. C. W., F. B. Q., V. M. G.

Soundings plotted by H. C. W.

Verified and inked by J. G. Ladd.

1. The records conform to the General Instructions with the exception that more clarifying notes should have appeared in the records, whenever the lines could not be carried closer inshore.
2. The plan and extent of the survey generally satisfy the specific instructions. The spacing of lines between the 10 and 100 fathom curves exceeds the requirements, but owing to the large scale of the chart and the broken bottom between the 10 and 50 fathom curves, this departure seems justifiable. It is assumed that the heavy surf prevented the survey being carried closer to the beach in many places.
3. There are very few cross lines on the sheet, but the lines are spaced close enough to permit a comparison of adjacent lines. Considering the irregularities of the bottom in places the agreement between the adjacent lines is satisfactory.
4. The usual field plotting was completed by the field party and was well executed.
5. The junction with H. 4787 is satisfactory.

The junction with the offshore sheet will be taken up when that sheet is reviewed.

6. No additional work seems necessary as far as the harbor survey is concerned except<sup>n</sup>the 1 5/6 fathom rock to the southwest of Napoopoo in lat. 19° 28' 1000 meters, long. 155° 55' 750 meters. Also the 3 fathom spit making out about 125 meters to the westward of the above sounding should be further examined since it lies in the entrance to Napoopoo Harbor.
7. Attention is called to the fact that outside the 100 fathom curve numerous fathometer soundings were taken which are not shown on this sheet. The reason being that on account of the unusual and irregular slopes existing in this area, the ordinary method of correcting for slope does not give results that agree with the simultaneous vertical casts taken. (See comments by T. J. Maher in Descriptive Report, this sheet.) The information obtained will furnish a basis for a further study in slopes and their effect on fathometer soundings.
8. Reviewed by A. L. Shalowitz, July, 1928.

Approved:

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Chief, Section of Field Records (Charts)

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Chief, Section of Field Work (H. & T.)

Applied to compilation 4140 F.M.A. June 1941

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