

9154

Diag. Cht. No. 1219-2.

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

DESCRIPTIVE REPORT
(HYDROGRAPHIC)

Type of Survey ... Hydrographic

Field No. ... WH-10-1-70

Office No. ... H-9154

LOCALITY

State ... Delaware

General Locality ... Delaware Bay

Locality ... Vicinity of Cape Henlopen

19 70

CHIEF OF PARTY

LIBRARY & ARCHIVES

DATE ... 2-22-74

9154

H-9154 ✓

HYDROGRAPHIC TITLE SHEET

INSTRUCTIONS - 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.

WH-10-1-70

State Delaware

General locality Delaware Bay

Locality Vicinity of Cape Henlopen

Scale 1:10,000

Date of survey 12 July 1970-19 November 1970

Instructions dated 28 May 1970

Project No. OPR-492

Vessel USC&GSS Whiting

Chief of party CDR Melvin J. Umbach

* CDR. M.J. Umbach, LCDR. J.W. Carpenter, LT. G.L. Boyack, LTJG L.T. Gillman

Surveyed by LTJG P.L. Campbell, ENS D.W. Nostrant, CST W.A. Hill

Soundings taken by echo sounder, hand load, pole - Echo sounder Raytheon DE-723D Depth Recorder
Ross Digital Depth Recorder

Graphic record scaled by * As above

Graphic record checked by * As above

Protracted by N/A Com plot

Automated plot by AMC Calcomp Plotter #618 (AMC)
Com plot

Soundings penciled by *As above Com plot

Soundings in fathoms feet at MLW MLW Feet, MLW

REMARKS: Ver: H.R. Smith

Ch.
411
1109
1218
1219

Applied to stds 7/25/74
CB

DESCRIPTIVE REPORT
TO ACCOMPANY
HYDROGRAPHIC SURVEY H-9154
FIELD NO. WH 10-1-70

SCALE: 1:10,000

NOAA Ship WHITING
Melvin J. Umbach, CDR, NOAA
Chief of Party

DESCRIPTIVE REPORT
HYDROGRAPHIC SURVEY H-9154

A. PROJECT:

This survey was accomplished in accordance with Project Instructions for OPR-492, Delaware Bay, dated May 28, 1970, as ammended July 15, 1970. ✓

B. AREA SURVEYED:

The area surveyed extends seaward from the shore-line for a distance of approximately four miles and south from the Harbor of Refuge North End Light a distance of approximately six and one-half miles to the city of Rehoboth Beach, Delaware. The survey junctions on the north with ^{H-9153 (1970-71)} ~~prior survey H-7035,~~ ~~which was completed in 1945 at a scale of 1:10,000,~~ and on the east with ^{H-9176 (1970)} ~~a~~ contemporary survey by the High-Speed Launch No. 1257; and on the south with a contemporary survey by the WHITING and her two launches, WH 20-4-70 (H-9136). ✓

The survey was accomplished between 12 July 1970 and 19 November of the same year. The main system of lines was run at 200 m. spacing. All lines inside the 36-foot depth curve were split to 100 m. In addition,

all lines within the charted approachways to the pilotage area were split to 50 meters. The 50-meter splits were run as permission to drag in the area was refused to the RUDE and HECK.

C. SOUNDING VESSEL:

The sounding vessels used in the survey were the Ship WHITING, WHITING Launch No. 1, and WHITING Launch No. 2.

D. SOUNDING INSTRUMENT:

For the major portion of the survey, the sounding instruments used were Raytheon DE-723D Survey Fathometers. The "D" suffix denotes a unit with digitized output. The fathometer used in Launch No. 1 was serial number 37019. The fathometer used in Launch No. 2 was serial number 37018. On the three days that the Ship WHITING worked on the sheet, November 9, 10, and 12, the sounding instrument was the ship's Ross^{Digital} Fathometer, serial number 601.

Bar checks were taken and recorded daily in the deepest water of the survey as often as sea conditions permitted. The depths as measured by bar check and fathometer trace were recorded. When the system would not register a depth to the bar, a vertical cast was taken.

All soundings were plotted ^{on the boat sheet} as corrected for predicted tides. Velocity correctors were not plotted on the boat sheet. These corrections should be applied prior to plotting of the smooth sheet. A table of velocity corrections is appended to this report.

E. SMOOTH SHEET:

The smooth sheet will be plotted on the computer-plotter system at Atlantic Marine Center in Norfolk, Virginia. Position corrections have already been applied.

F. CONTROL:

Two basic methods of control were used during the survey: visual and Raydist_x (Range-Range).

The major portion of the survey was controlled visually. The northeast corner of the sheet was run with Raydist due to poor visibility of objects in this extreme offshore area.

The Hi-Fix arcs were used only as an aid for running a regular line system. (*Not shown on smooth sheet*)

<u>Hi-Fix Sta.</u>	<u>Name</u>	<u>Latitude</u>	<u>Longitude</u>
Master	Navy	38°47'17.199"N	75°05'20.839"W
Slave No. 1	Indian	38°36'18.672"N	75°03'41.663"W
Slave No. 2	Wild	38°59'41.459"N	74°47'44.148"W

Frequency: 1799.6 keKHz

<u>Raydist Sta.</u>	<u>Name</u>	<u>Latitude</u>	<u>Longitude</u>
Slave No. 1	Cotton Patch	38°34'46.641"N	75°03'33.774"W
Slave No. 2	Chap	38°47'29.911"N	75°05'23.944"W
Frequency:	3300.495	KHz	ke

The Raydist method was calibrated five times daily by comparison with a three-point fix. Corrections to the Raydist patterns are listed in an appendix to this report. All stations were located by third-order methods.

G. SHORELINE:

Shoreline was copied from ^{Advanced} Shoreline Manuscripts TP-00062, ~~dated May 1970,~~ and ~~Shoreline Manuscript TP-00063,~~ ^{(1969/70) and} ~~dated May 1970.~~ TP-00121 (1970/70)

H. CROSSLINES:

Crosslines composed 10.5% of the total length of main system of sounding lines. The agreement between crosslines and the main system of lines was good in all areas. See sect. 3-A of the Review

I. JUNCTIONS:

The northern limit of the sheet junctioned ^s with ~~prior survey H-7035 of 1945.~~ ^{H-9153 (1970-71)} The eastern limit of

the sheet junctioned^s with that portion of a con-
temporary survey of WH ~~10-3-70~~^{H-9176 (1970)}, run by the High-
Speed Launch No. 1257. The southern limit of the
sheet junctioned^s with a contemporary survey by the
WHITING and her two launches, WH 20-4-70 (H-9136).

The junction on the north is good in all cases
except those depths in excess of 100 feet. ~~There~~
~~exists a constant shoaling of four to five feet from~~
~~depths reported in the prior survey.~~ The junction
on the east is excellent in all cases. The junction
on the south is good in all cases.

See Review (sect. 6-B)

J. COMPARISON WITH PRIOR SURVEYS:

Comparison was made with the following prior
surveys: H-7035 of 1945 at a scale of 1:10,000;
H-7034 of 1945 at a scale of 1:10,000; and H-4942
of 1929 at a scale of 1:20,000.

In the southern half of the sheet the depths
remain predominantly the same as recorded in the
prior surveys. The northeast corner of the sheet,
near Overfalls Shoals, shows a shoaling of about
four to six feet in most areas. Hen and Chicken
Shoals in the northwest corner of the sheet is
radically changing, with increases in depths of

four to fifteen feet common throughout. The shoreline around Cape Henlopen is growing in a north-northwesterly direction and has advanced approximately one-third mile since the time of the 1945 surveys. See sect 6-D of the Review.

PRE-SURVEY REVIEW ITEMS

Item No. 19

The sunken wreck charted in latitude 38°48'07"N, longitude 75°05'18"W, which is the pilot boat CAPE MAY reported sunk in 84 feet of water, was not found. The fathograms of the sounding lines in the area were examined and no indications of the wreck were found. In accordance with Project Instructions, no specific investigation of this wreck was made. It is recommended the wreck be retained for future charting. *Concur*

Item No. 20

The sunken wreck (6 ft. Rep.) charted in latitude 38°47'56"N, longitude 75°05'11"W, and the sunken wreck (12 ft. Rep.) charted in latitude 38°47'36"N, longitude 75°04'59"W, which were both portions of a barge reported sunk and lying in two sections, were developed by use of sounding lines at a spacing of less than 20 meters. Nothing was located. It is recommended the wrecks ^{and the reported depths} be retained on the chart. *Concur*

Item No. 21

The piling charted in latitude 38°45'22"N, longitude 75°04'09"W was ^{not located.} ~~negatively developed by sounding lines.~~ Development of the area by drag methods was not done. Of the two features alongshore, the piling at latitude 38°46'26"N, longitude 75°04'57"W was found at the charted location. Launch I struck ^{see 5736 describes this as rock} this piling while sounding the shoreline area. A three-point fix and check angle was obtained. The other piling alongshore was not found. Drag methods were not used to develop the area, and sounding line development was not practical in this inshore area. It is recommended that none of the pilings ^{see except as noted in section 7A-5 of the Review,} be deleted from future charts. Concur

K. COMPARISON WITH THE CHART:

The boat sheets were compared with the 22nd Edition of Chart No. 1219, dated August 2, 1969, and the 9th Edition of Chart No. 411, dated May 16, 1970. Agreement between the charts and the boat sheets is very good, with the exception of the scouring of Hen and Chicken Shoals and the growth of Cape Henlopen to the north-northwest.

L. ADEQUACY OF THE SURVEY:

The survey is complete and adequate and should be considered to supersede any prior surveys for charting.

M. AIDS TO NAVIGATION:

The following buoys were located, as detached positions by a three-point fix with check angle taken on each:

<u>Buoy</u>	<u>D.P. Location</u>		<u>Charted Location</u>	
C3	38°44'26"N	75°02'48"W	38°44'27"N	75°02'48"W
Bell 4	38°49'17"N	75°01'35"W	38°49'18"N	75°01'36"W
Gong 5	38°47'12"N	75°03'42"W	38°47'15"N	75°03'45"W
N 6	38°50'2 ³ 1 "N	75°02'0 ⁰ 3 "W	38°50'27"N	75°01'51"W
BELL 7	38°48'0 ⁷ 5 "N	75°05' ¹¹ 09 "W	38°48'06"N	75°05'12"W

The agreement between detached position location and charted location was good in all cases.

N. STATISTICS:

<u>Survey Vessel</u>	<u>Nautical Miles of Sounding Line</u>	<u>Number of Positions</u>
Ship WHITING	72	424
Launch No. 1	599	3992
Launch No. 2	<u>455</u>	<u>2703</u>
Totals	1126	7119

O. MISCELLANEOUS

Duplicate fix numbers exist on positions No.

~~1078, 1161, 1191, 1517, 1525, 2352, 2452, 2523, 2545,~~
~~2720, 2870, 2906, 2910, 3023, 3302, 3367, 3850, 3944,~~
5063, 5731, ⁶to 5737, 5756, 6346, ~~6841, 6860, 8005,~~ and
8640, ^{and} 8166 to 8185. See section 4-C of the Review.

Bottom samples were taken at a spacing of 2-1/2" at the scale of the survey, except in areas closed to bottom work due to hydrophones or unexploded mines.

P. RECOMMENDATIONS:

It is recommended that Hen and Chickens Shoals be labeled "shifting shoals" on the published charts.

Q. REFERENCES TO REPORTS:

Report on OPR-492, Delaware Bay, NOAA Ship WHITING, 1970 Field Season.

Descriptive Report of H-9136, NOAA Ship WHITING, 1970 Field Season.

Corrections to Echo Soundings, NOAA Ship WHITING, 1970 Field Season.

TIDE NOTE

Smooth tides for WH 10-1-70 were obtained from a fixed bubbler tide gage located at Harbor of Refuge Lighthouse in Lewes, Delaware, latitude $38^{\circ}49'57''$ N, longitude $75^{\circ}06'22''$ W.

The gage was installed on June 11, 1970, and maintained by ship's personnel. Mean low water was $3.3^{\frac{2}{3}}$ feet on the tide staff as determined by Tides Division (C3312), Rockville, Maryland.

Hourly heights were scaled by ship's personnel and correctors made by computer, using a parabolic fit program. The time meridian used was 75° W and no time or height corrections were applied. A list of smooth tide correctors is included in this report.

LIST OF GEOGRAPHIC NAMES

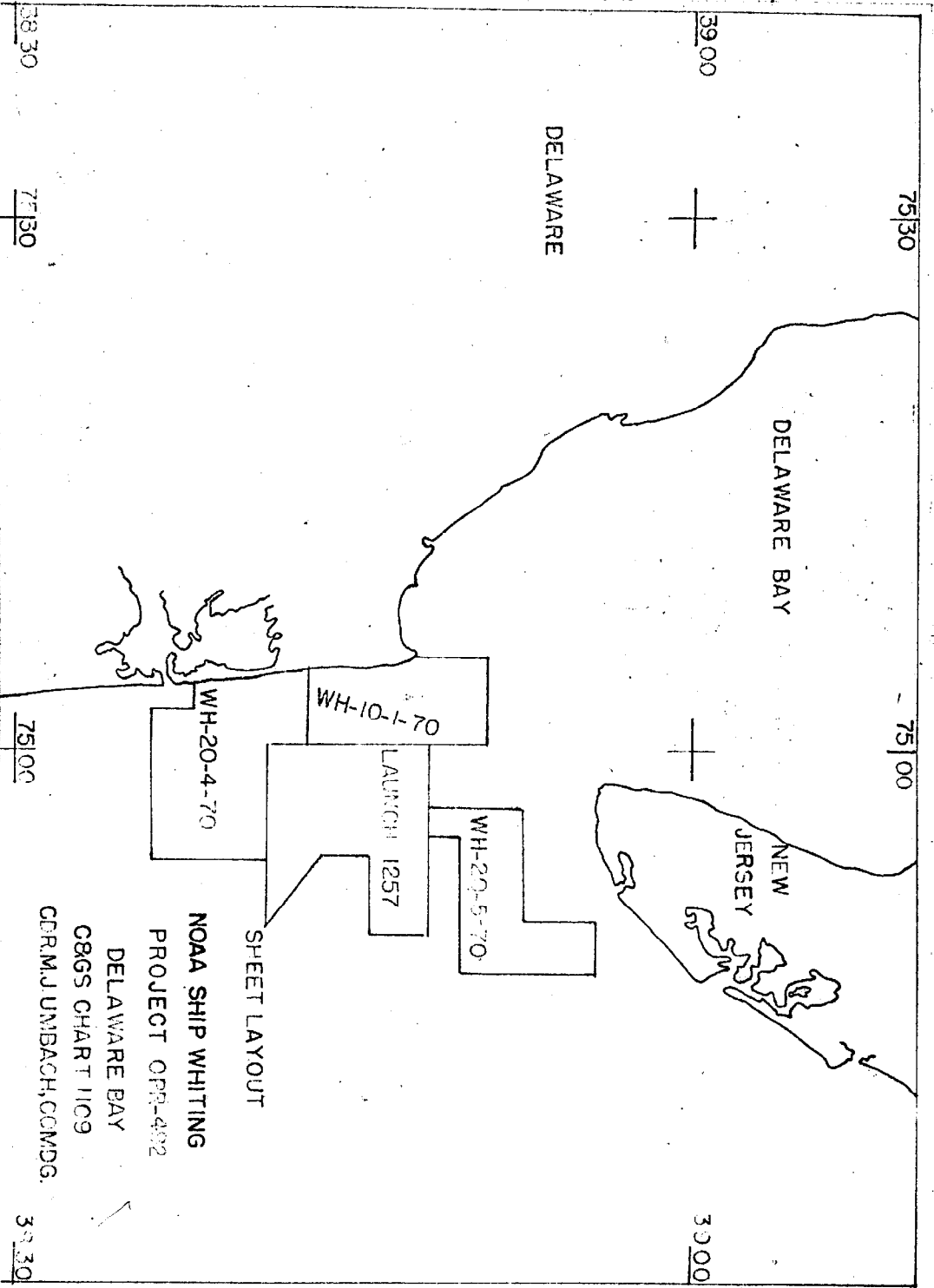
CAPE HENLOPEN

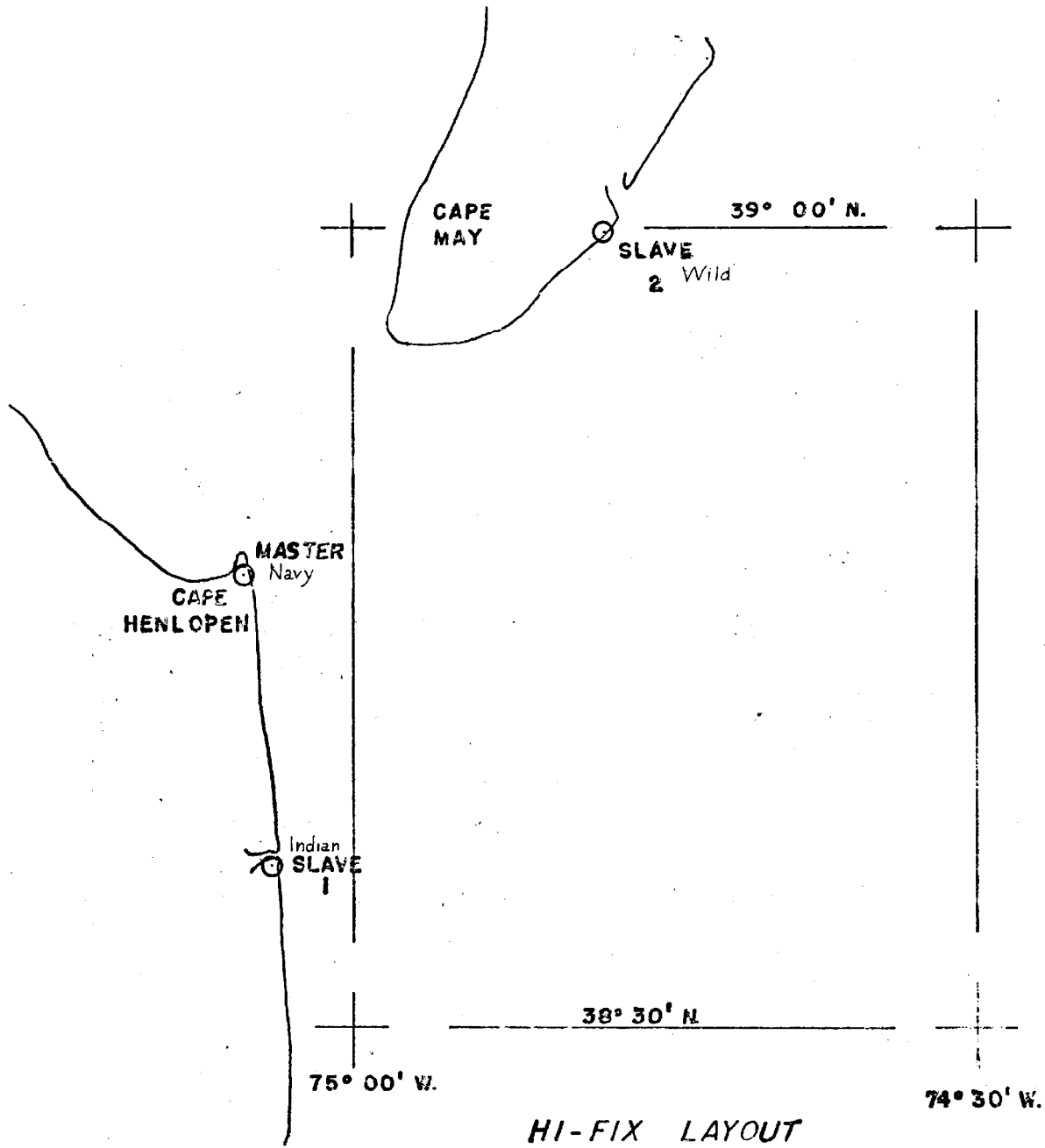
DELAWARE BREAKWATER LIGHTHOUSE

FORT MILES U.S. NAVY WATER TANK

HARBOR OF REFUGE LIGHTHOUSE

HEN AND CHICKENS SHOALS

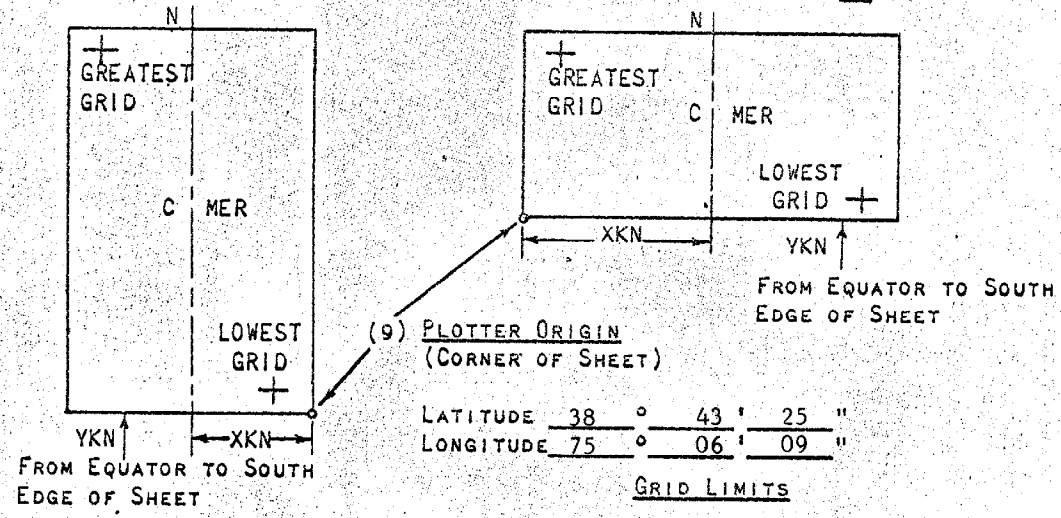




HI-FIX LAYOUT
OVERLAY TO C & GS CHART 1109
NOAA SHIP WHITING
PROJECT OPR-492
DELAWARE BAY
CDR. M.J. UMBACH, COMDG.

PARAMETERS FOR DIGITAL COMPUTING
POLYCONIC PROJECTION

- (1) PROJECT No. 492
- (2) H No. 9154
- (3) FIELD No. WH-10-1-70
- (4) REQUESTED BY _____
- (5) SHIP OR OFFICE Whiting
- (6) DATE REQUIRED _____
- (7) VISUAL
- (8) ELECTRONIC (FILL OUT FORM #3)
- (10) XKN (SP 5) DISTANCE FROM CMER TO EAST EDGE (NYX = 1) OR WEST EDGE (NYX = 0). 8914.7 METERS
- (11) YKN (SP 241) DISTANCE FROM EQUATOR TO SOUTH EDGE OF SHEET. 4,287,305.3 METERS
- (12) CENTRAL MERIDIAN 75° 00' 00"
- (13) SURVEY SCALE 1:10,000
- (14) SIZE OF SHEET (CHECK ONE) 36X54 42X60 OTHER
- (15) NYX, ORIENTATION OF SHEET (CHECK ONE)
NYX = 1 NYX = 0



LIST G.P. OF ALL STATIONS TO BE PLOTTED ON THIS PROJECTION ON THE BACK OF THIS FORM. (DEG., MIN., SEC.)

- (16) GREATEST LATITUDE 38° 51' 00" (PROJECTION LINE)
- (17) LOWEST LATITUDE 38° 44' 00" INTERVAL, PAGE 4
- (18) DIFFERENCE 07' 00" HYDRO MANUAL)
- (19) 00' 00"
- (20) 14 YSN
- (21) GREATEST LONGITUDE 75° 06' 00"
- (22) LOWEST LONGITUDE 75° 01' 00"
- (23) DIFFERENCE 05' 00"
- (24) 00' 30"
- (25) 10 XSN

VERIFICATION LIST OF CONTROL

H-9154 (WH-10-1-70)

Triangulation

number	^m name
317 *	ROUND ,1962
332 *	REHOBOTH BEACH MUNICIPAL WATER TANK, 1962
332	GORDON, 1962
350	FORT MILES U S NAVY WATER TANK, 1962
356 *	LEWES WEST OIL FACTORY ^R CHIMNEY, 1962
357	FORT MILES OBSERVATION TOWER NO 8, 1962
358	DELAWARE BREAKWATER LIGHTHOUSE, 1927 - 62
360*	DELAWARE BREAKWATER WEST END LIGHT, 1933 - 62
362	HARBOR OF REFUGE LIGHTHOUSE (NEW) , 1927 - 62
500*	HARBOR OF REFUGE NORTH END LIGHT, 1970

Traverse

- 334 *
- 336
- 338
- 340
- 344
- 346
- 348
- 352
- 354
- Photo
- 359

* These stations fall outside the limits of this survey.

57 OFFSHORE FEATURES

It was necessary to locate the angle points of the two offshore breakwaters and eleven ice breakers by ground survey methods. The positions were computed by A.M.C. and by the SHIP WHITING, and are enclosed with the field edit data.

58 LANDMARKS AND AIDS

Form 567 is submitted for all nautical landmarks and fixed aids to navigation.

Harbor of Refuge North End Light was razed in August 1970 and a new light erected about 25 feet to the south-southeast. A new third-order position was determined. *(No. 364 on Hydro. sheet)*

The radar towers in the southeast portion of the map were razed during the 1970 Summer season. *(No. 500 on Hydro. sheet)*

59 GENERAL STATEMENT

All field edit notes have been made in violet ink both on the field edit sheet and ratio photographs.

The Commanding Officer of the SHIP WHITING has been kept informed of all field edit operations. He has selected the Nautical Landmarks and has been furnished copies of all pertinent data.

15 October 1970
Submitted by:

Robert S. Tibbetts
Robert S. Tibbetts
Surveying Technician

New Position

Lat. 38° 49' 56.87"
Long. 75° 06' 22.02"

This is in adequate agreement with position in signal list

APPROVAL SHEET

Submitted by:

Donald W. Nostrant

Donald W. Nostrant
ENSIGN, NOAA

Approved/Forward

Melvin J. Umbach

Melvin J. Umbach
CDR, NOAA
Commanding Officer, NOAA Ship WHITING



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852

Date: February 10, 1971
Reply to
Attn of: C331W-39-MCFOB
Subject: Tidal Data, Delaware Bay

To: Chief, Processing Division, CFN3
Atlantic Marine Center

In accordance with memorandum dated January 21, 1971, from Commanding Officer, Ship WHITING, mean low water on the Harbor of Refuge 1970 tide staff is 3.2 feet.

For sheet WH¹⁸~~20~~-1-70 (9154) no tide correction is required.

For sheet WH20-5-70 (9153) use correction of -0 15 minutes in time and zero height correction.

Enclosed are hourly heights submitted by the WHITING.

L. C. Wharton
L. C. Wharton
Tides & Currents Branch
Oceanography Division
National Ocean Survey

Enclosures

July 2, 1973

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

TIDE NOTE FOR HYDROGRAPHIC SHEET ✓

Processing Division: Atlantic Marine Center

Hourly heights are approved for

Tide Station Used (NOAA form 77-12): Harbor of Refuge Lighthouse

Period: July 12-Nov. 19, 1970

HYDROGRAPHIC SHEET: H-9176, H-9154

OPR: 492

Locality: Delaware Bay, Delaware

Plane of reference (mean lower low water): 3.2 ft.

Height of Mean High Water above Plane of Reference is 4.0 ft.

Remarks:

*Applied directly
no zoning, as per instructions from Hubbard, Tides
Division 7/16/73. WFT*

Robert A. Cummings

Chief, Tides Branch

5-14-17
C 142

WILSON'S TRAV. POSITIONS
OF HOUND SPAS,
ABSTRACT OF TRAVERSE POSITIONS

AND REFERENCE MEASUREMENTS TO

MEAN HIGH WATER LINE

JOB-PH6905

INDIAN RIVER INLET TO CAPE MEXLOPEN

DELAWARE

STATION	FOOT	FOOT	DISTANCE TO HIGH WATER LINE
HAPPY	600575.08	221 102.66	
304 ✓	599 937.09	254 305.02	390 FEET
306 ✓	599 940.92	236 421.57	234
308 ✓	599 823.81	238 948.13	323
10 ✓	599 506.29	241 451.79	386
312	599 278.27	244 077.61	397 ON
314	598 953.11	246 655.66	355 5' OUTSIDE
ROUND RE: 316	598 123.56	247 174.11	
318	598 716.16	249 118.08	257 5' INSHORE
320	598 539.92	250736 .50	114 5' INSHORE
322	598 162.79	252 730.5338	87 5' INSHORE
324	597 724.48	255 094.66	142 20' INSHORE
326	597 362.17	257 872.56	218 40' INSHORE
328	597 129.19	260 429.11	187 30' INSHORE
330	597 025.60	261 836.33	106 60' INSHORE
334	596 755.66	263 560.55	122 10' INSHORE
336	596 246.36	266 420.91	237 - 20' INSHORE
338	596 062.52	268 663.86	106 - 20' INSHORE
340	595 825.18	271 157.41	154 - 25' INSHORE
GORDON RE: 1	595 430.69	272 963.77	
14	595 437.36	275 080.50	244 - 10' INSHORE
346 20 h.	595 256.12	277 348.15	192 - 10' INSHORE
348 30 h.	595 272.26	278 894.06	180 - 30' INSHORE
352	594 504.21	282 839.95	154
354	593 885.15	285 799.56	223
RADIO, 1932	592 734.73	287 954.37	

HYDROGRAPHIC SIGNALS

OPR 492 1970

DELAWARE BAY

300 38 36 2380 075 03 5304
 301 38 36 3267 075 03 4674
 302 38 37 5525 075 03 5806
 303 38 38 0114 075 04 0246
 304 38 38 3433 075 04 0042
 305 38 38 5527 075 04 0019
 308 38 39 2023 075 04 0165
 310 38 39 4499 075 04 0478
 312 38 40 1095 075 04 0828
 313 38 40 2153 075 04 0991
 314 38 40 3645 075 04 1220
 317 38 40 4094 075 04 1740
 318 38 41 0080 075 04 1513
 319 38 41 1680 075 04 1728
 322 38 41 3652 075 04 2194
 324 38 41 5991 075 04 2736
 326 38 42 2738 075 04 3180
 328 38 42 5266 075 04 3461
 330 38 43 0657 075 04 3586
 332 38 43 0067 075 04 5767
 334 38 43 2363 075 04 3918
 336 38 43 5192 075 04 4547
 8 38 44 1410 075 04 4769
 340 38 44 3875 075 04 5057

HAPPY, 1962

INDIAN RIVER COAST GUARD TOWER, 1962

INDIAN RIVER COAST GUARD CUPOLA, 1909, 1962

ROUND , 1962

REHOBOTH BEACH MUN. WATER TANK, 1962

342	38 44 5743	075 04 5384	GORDON, 1962
344	38 45 1754	075 04 5528	
346	38 45 3996	075 04 5747	
348	38 45 5525	075 04 5719	
350	38 46 0794	075 05 1224	FORT MILES U S NAVY WATER TANK, 1962
352	38 46 3427	075 05 0570	
354	38 47 0355	075 05 1439	
355	38 46 4529	075 07 1280	FORT MILES OBSERVATION TOWER NO 13, 1962
356	38 46 5355	075 07 0011	LEWES WEST OIL FACTORY CHIMNEY, 1962
357	38 47 1731	075 05 4284	FORT MILES OBSERVATION TOWER NO 8, 1962
358	38 47 4922	075 06 0124	DELAWARE BREAKWATER LIGHTHOUSE, 1927-62
359	38 47 3872	075 05 3047	<i>Step</i> Photo Station (See Signal Printout in H-9136 (1970) Descriptive Report)
360	38 48 0138	075 07 0127	DELAWARE BREAKWATER WEST END LIGHT, 1933-62
362	38 48 5183	075 05 3398	HARBOR OF REFUGE LIGHTHOUSE (NEW), 1927
364*	38 49 5707	075 06 2219	HARBOR OF REFUGE NORTH END LIGHT, 1933, 1962
365	38 49 5688	075 06 2200	<i>Step</i> HARBOR OF REFUGE NORTH END LIGHT, 1933, 1970
750	38 56 1356	074 54 5599	CAPE MAY MUN. WATER TANK, 1936, 1962
751	38 56 4053	074 54 2234	CAPE MAY C G TEL REPEATER TOWER, 1962
753	38 56 4691	074 53 3541	CAPE MAY C G STATION WEST TANK, 1969
754	38 56 4908	074 53 1119	CAPE MAY C G TANK, 1952, 1962
755	38 56 5807	074 52 0247	CAPE MAY US C G ELECTRONICS MAST 1, 1962
756	38 55 5838	074 57 3876	CAPE MAY LIGHTHOUSE, 1859-1932

* LIGHT MOVED BY U.S.C.G. ON 1 AUG 1970.

Signal 364 was moved and renumbered 500. The new position should be digitized from the smooth sheet of H-9203. Position adequate, (1971)

Position of Signal 359 (above) is in error. The correct position should be as shown below:

359 38 47 38,91 075 05 3040 From TP 00063 (1969-70) (Advanced Manuscript)

This position used to revise only a few fixes. Position above used for most fixes.

OPR 492

Delaware Bay

WH-10-1-70

Launch 2

See Review section 4-7

<u>Day</u>	<u>Time</u>	<u>Pattern 1</u>	<u>Pattern 2</u>
245	1350	+0.02	+0.26
	1700	-0.41	-0.21
246	0920	+0.09	+0.28
	1110	+0.06	-0.02
	1230	-0.06	+0.10
	1400	+0.08	+0.03
	1430	0.32	0.24
	1500	0.14	0.40
250	0900	+0.03	+0.14
	0905	+0.22	+0.22
	1000	-0.13	+0.58
	1200	+0.09	+0.79
	1205	-0.31	+0.12
	1445	+0.16	+0.44
251	0810	+0.01	+0.21
	0815	+0.24	-0.05
	0950	-0.06	+0.22
	0955	+0.11	-0.28
	1150	+0.32	+0.42
	1400	+0.35	+0.35
252	0950	-0.10	-0.29
253	0900	-0.18	+0.40
254	1310	-0.16	+0.12
	1745	+0.11	+0.12
255	1015	+0.50	+0.10
	1030	-0.08	-0.13
	1045	+0.02	-0.02
	1121	-0.08	+0.22
	1125	-0.28	+0.18
	1130	+0.40	+0.29
256	0810	+0.32	-0.16
	1330	-0.07	+0.12
	1340	+0.08	+0.14
	1620	-0.10	+0.24
257	0757	-0.17	+0.31
	0758	-0.12	+0.34
	1200	+0.20	+0.25
	1203	-0.13	+0.18
	1310	-0.16	+0.22
	1645	+0.21	+0.26
	1648	+0.16	+0.14
1700	+0.02	+0.10	

Abstract of Raydist Correctors

OPR-492

Delaware Bay

WH-10-1-70 ✓

Launch 2

<u>Day</u>	<u>Time</u>	<u>Pattern 1</u>	<u>Pattern 2</u>
258	0815	-.42	-.09
	1500	-.09	+.17
259	0816	-.26	+.00
	1450	-.14	+.05
	1743	-.33	+.02

Ship WHITING 1970

OR 492 Delaware Bay

VELOCITY USE TABLE

<u>TABLE NUMBER</u>	<u>INSTRUMENT</u>	<u>DAYS (JULIAN)</u>
1	DE723	170-175
2	ROSS	170-175
3	DE723	176-187
4	ROSS	176-187
5	DE723	188-245
6	ROSS	188-245
7	DE723	246-269
8	ROSS	246-269
9	DE723	270-290
10	ROSS	270-290
11	DE723	291-323
12	ROSS	291-323

The DE723 data was used for the launches, including the High speed Launch. The ROSS data was used for the Ship WHITING.

Project OPR-492
Delaware Bay
CDR. Melvin J. Umbach, Cmdg.
NOAA Ship Whiting

WH-20-5-70 (H-9153)

Ship Days 196, 197, 223, 224, 225,
Launch 1 222, 258, 259

WH-20-4-70 (H-9136)

Ship Days 170, 171, 173, 174, 181, 182, 189, 190, 191, 192
Launch 1 171, 172, 173, 174, 182, 188, 189, 210, 252
Launch 2 171, 172, 174, 182, 208, 210, 217

WH-10-1-70 (H-9154)

Ship Days 313, 314, 316
Launch 1 193, 194, 195, 203, 204, 217, 219, 220, 221, 230, 231, 234, 236, 237, 238, 239,
240, 241, 244, 245, 246, 248, 250, 251, 278, 279, 280, 281, 282, 285, 286, 287,
288, 292, 293, 296, 307, 310, 311, 315, 318, 321, 322, 323,
Launch 2 195, 203, 204, 217, 219, 220, 221, 230, 231, 236, 237, 241, 242, 243, 244, 246,
248, 250, 251, 253, 254, 255, 256, 257, 258, 259, 274, 275, 278, 279, 280, 281,
283, 285, 288, 292, 293, 297, 298, 310, 311, 321, 322

DELAWARE HAY OPM 492
VELOCITY CORRECTORS

000073 0 0000 0001 000 000000 0000000
140 0 0002
000200 0 0004
000272 0 0006
000360 0 0008
000511 0 0010
000726 0 0012
000984 0 0014
001260 0 0016
001505 0 0018
199999 0 0000
000041 0 0000 0002 000 000000 0000000
000110 0 0002
000176 0 0004
000248 0 0006
000470 0 0008
001270 0 0010
000950 0 0012
199999 0 0000
000060 0 0000 0003 000 000000 0000000
000090 0 0002
000220 0 0004
000305 0 0006
000335 0 0008
000470 0 0010
000550 0 0012
000630 0 0014
000710 0 0016
000790 0 0018
000875 0 0020
000960 0 0022
001040 0 0024
001120 0 0026
000905 0 0028
00127750 0030
001370 0 0032
001450 0 0034
199999 0 0000
000040 0 0000 0004 000 000000 0000000
000120 0 0002
000200 0 0004
000284 0 0006
000370 0 0008
000463 0 0010
000570 0 0012
000680 0 0014
000800 0 0016
000920 0 0018
001045 0 0020
001170 0 0022
001290 0 0024
001410 0 0026
199999 0 0000
000061 0 0000 0005 000 000000 0000000
000170 0 0002

000285 0 0004
000403 0 0006
000534 0 0008
000661 0 0010
000790 0 0012
000917 0 0014
001040 0 0016
001170 0 0018
001293 0 0020
001421 0 0022
199999 0 0000
000039 0 0000 0006 000 000000 000000
000149 0 0002
000261 0 0004
000380 0 0006
000497 0 0008
000610 0 0010
000728 0 0012
000842 0 0014
000960 0 0016
001078 0 0018
001192 0 0020
001310 0 0022
001424 0 0024
199999 0 0000
000060 0 0000 0007 000 000000 000000
000124 0 0002
000190 0 0004
000253 0 0006
000315 0 0008
000380 0 0010
000440 0 0012
000505 0 0014
000570 0 0016
000630 0 0018
00070 0 0020
000765 0 0022
000833 0 0024
000900 0 0026
000970 0 0028

001190 0 0032
001192 0 0034
001270 0 0036
001340 0 0038
001420 0 0040
100199 0 0000
000070 0 0000 0009 000 000000 000000
000132 0 0002
000200 0 0004
000261 0 0006
000329 0 0008
000390 0 0010
000457 0 0012
000520 0 0014
000586 0 0016
000650 0 0018
000715 0 0020
000780 0 0022
000846 0 0024
000916 0 0026
000972 0 0028
001040 0 0030
001100 0 0032
001168 0 0034
001230 0 0036
001293 0 0038

001360 0 0040
001420 0 0042
199999 0 0000
000073 0 0000 0011 000 000000 000000
000210 0 0002
000340 0 0004
000470 0 0006
000605 0 0008
000740 0 0010
000870 0 0012
001002 0 0014
001140 0 0016
001270 0 0018
001402 0 0020
199999 0 0000
000110 0 0000 0012 000 000000 000000
000240 0 0002
000373 0 0004
000510 0 0006
000645 0 0008
000780 0 0010
000920 0 0012
001050 0 0014
001190 0 0016
001320 0 0018
001460 0 0020
199999 0 0000

ATLANTIC MARINE CENTER
APPROVAL SHEET
FOR
AUTOMATED SURVEY H-9154

- A. All revisions and additions made on the smooth sheet during verification have been entered in the magnetic tape records for this survey. A new final position printout has/~~XXXXXXXX~~ been made. A new final sounding printout has/~~XXXXXXXX~~ been made.

Date: February 19, 1974

Signed:

William L. Johns
William L. Johns

Title: Chief, Verification Branch

- B. The verified smooth sheet has been inspected, is complete, and meets the requirements of the Hydrographic and AMC Manuals. Exceptions are listed in the verifier's report.

Date: February 19, 1974

Signed:

C. Dale North, Jr.
C. Dale North, Jr. LCDR NOAA
Chief, Processing Division

See the Review (section no. 4)

GEOGRAPHIC NAMES

H-9154 ✓

Name on Survey	Source of Name											
	A	B	C	D	E	F	G	H	K			
	<small> A ON CHART NO. B ON PREVIOUS SURVEY NO. C ON U.S. QUADRANGLE MAPS D FROM LOCAL INFORMATION E ON LOCAL MAPS F P.O. GUIDE OR MAP G RANDOMLY H U.S. LIGHT LIST K </small>											
ATLANTIC OCEAN												1
CAPE HENLOPEN												2
HARBOR OF REFUGE												3
HEN AND CHICKENS SHOAL												4
REHOBOTH BEACH												5
OVERFALLS SHOAL												6
												7
												8
												9
												10
												11
												12
												13
												14
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												21
												22
												23
												24
												25

Approved by:
 Chas. E. Hamilton
 Staff Geographer
 3 Oct. 1974

ATLANTIC MARINE CENTER
VERIFICATION OF SMOOTH TIDES

SURVEY H-9154 (WH10-1-70) ✓

PLANE OF REFERENCE MLW OR ~~MHW~~
TIME MERIDIAN 75 W
HEIGHT DATUM ON STAFFS 1. 3.2 2. _____ 3. _____

TIDE STATIONS	POSITION	TYPE GAGE	TIME CORR.		HEIGHT CORR. *	
			H.W.	L.W.	H.W.	L.W.
1. Harbor of Refuge Lt. Ho. Del.	038 48'52" 75 05'34" 5		--	--	--	--
2.	∅ Y					
3.	∅ Y					

HOURLY HRIGHTS FROM ROCKVILLE OFFICE
 FROM FIELD MARIGRAMS

VERIFIED BY: Rockville office

TIDE ZONING NOT APPLICABLE
 BY COMPUTER
 FROM TWO OR MORE GAGES

LIMITS AND DESCRIPTION OF ZONING METHODS

TIDE CORRECTIONS COMPILED BY COMPUTER
 MANUALLY

VERIFIED BY: BTD
VERIFIED BY: _____

HEIGHT OF MHW ABOVE PLANE OF REFERENCE 4.0

TIDE CORRECTIONS VERIFIED ON SOUNDING PRINTOUT BY: BTD

DATE OF VERIFICATION 8/24/73

*OR RATIO

W. J. Jones
EXAMINED & APPROVED

Reg. No. H-9154

The Computer and Excess Sounding Cards for this survey have not been corrected to reflect the changes made to the Computer Card and Excess Card Printouts at this time of the review.

When the cards have been updated to reflect the final results of the survey, the following shall be completed:

CARDS CORRECTED

DATE _____ TIME REQ'D _____ INITIALS _____

REMARKS:

1. The position of station #359 was in error on the verified smooth sheet. During review the position was revised to agree with TP-00063. During update the soundings with coordinates crossed out in the smooth plot printouts should be digitized and the new position of 359 listed in descriptive report should be entered into data bank.

H-9154 (1970)

Items for Future Presurvey Review

This is an area of constantly shifting sand bottom and changeable shoreline. During future work in the area the items discussed in section 9 should be investigated.

<u>Position</u>	<u>Index</u>	<u>Bottom Change</u>	<u>Use</u>	<u>Resurvey</u>
<u>Lat.</u>	<u>Long.</u>	<u>Index</u>	<u>Index</u>	<u>Cycle</u>
384	0751	4	9	10 Years
385	0751	5	9	10 Years

OFFICE OF MARINE SURVEYS AND MAPS
MARINE CHART DIVISION
HYDROGRAPHIC SURVEY REVIEW

REGISTRY NO. H-9154

FIELD NO. WH-10-1-70

Delaware, Delaware Bay, Vicinity of Cape Henlopen

SURVEYED: July 12 through November 19, 1970

PROJECT NO.: OPR-492

SCALE: 1:10,000

SOUNDINGS: Raytheon DE-723D Depth
Recorder, Ross Digital
Depth Recorder

CONTROL: Raydist (Range-
Range) and Sextant
Fixes on Shore
Signals

Chief of Party M. J. Umbach
Surveyed by M. J. Umbach
..... J. W. Carpenter
..... G. L. Boyack
..... L. T. Gillman
..... P. L. Campbell
..... D. W. Nostrant
..... W. A. Hill
Automated Plot by Cal-Comp #618 Plotter (AMC)
Verified and Inked by H. R. Smith
Reviewed by K. W. Wellman
Date: 1-3-75
Inspected by D. J. Romesburg

1. Description of the Area

This survey covers a rectangular area along the Atlantic coast of Delaware north from Rehoboth Beach to lat. 38°50'30", in the entrance to Delaware Bay and eastward to long. 75°00'30".

The irregular bottom in the survey area is generally characterized by shifting sand ridges and shoals rising 5 to 35 ft. above surrounding depths. The most prominent features in the survey area are Hen and Chickens Shoal, with least depths of 5 ft., generally paralleling the shoreline southward from Cape Henlopen and, in the northeast corner of the survey area, Overfalls Shoal with least depths of 15 ft. Maximum depths of 144 ft. are found in the northwest portion of the survey area.

Bottom composition is primarily sand with varying amounts of mud, clay, shells and pebbles.

2. Control and Shoreline

The origin of control is given in Section F of the Descriptive Report.

The shoreline originates with advanced photogrammetric surveys TP-00062 and TP-00063 of 1969/70 and TP-00121 of 1970.

3. Hydrography

A. Depths at crossings are, in general, in good agreement. Minor differences of one to three ft. are attributed to sea conditions and irregularities on the bottom.

B. The usual depth curves are adequately delineated except for the zero curve which falls near the surf zone. Several brown curves have been added to emphasize isolated shoaler depths. Supplemental depth curves of 36 and 78 feet have been added to better delineate the large sand ridges that exist in the northeast section of the survey.

C. The development of the bottom configuration and the investigation of least depths are considered adequate. The area abounds in sand ridges, which would have been impracticable to delineate completely. However, the development in general has provided representative depths on these features adequate to characterize the dangers in this area.

The close spacing of lines over much of the area was necessary because the possibility of unexploded mines on the bottom precluded wire-drag investigation of the area.

D. Inasmuch as most of the sand ridges trend in a northeast-southwest direction, a pattern of sounding lines running northwest-southeast would have been more effective in developing the bottom particularly on the east portion of the survey.

4. Condition of Survey

The sounding records, automated plotting and the Descriptive Report are adequate and conform to the requirements of the Hydrographic Manual supplemented by the Instruction Manual-Automated Hydrographic Surveys with the following exceptions:

- A. The verifier did not include the Descriptive Report Data Record as required by section 12-1 of the automated surveys manual.
 - B. The verifier hand plotted some selected excessed soundings without altering the printout as required by section 12-10-C of the automated surveys manual. In addition, some soundings excessed on the smaller scale junctional sheet H-9153 (1970) were hand plotted on the present survey.
 - C. Duplicated position numbers were not indicated on the smooth plot printout as required by section 12-12b paragraph 5 of the automated surveys manual. Duplicated positions should be identified by alphabetical letters with a single position number which maintains the chronological consecutive order (see section 4-6 also).
 - D. The position of station no. 359 was in error on the verified smooth sheet. It was revised during review and the plotting of those critical soundings which were affected by this change in position were revised accordingly.
-

E. Topographic manuscripts, utilized during verification, were not listed as required in item no. 4 Part II of the Verifiers Report.

F. Form no. 3 (Computer Parameters for Electronically Controlled Surveys) is not included in the Descriptive Report.

G. The Raydist correctors utilized in the final position printout do not agree with those listed in the abstract of Raydist Correctors in the Descriptive Report. Inasmuch as the correctors used appear to be from calibrations and are found in some of the raw data printouts they were accepted in preference to those listed in the abstract.

H. Because of digital recording of soundings in areas of chop, depths may be in error by 1 foot. There were several soundings misread by 10 feet.

I. No adjustments in the TRA correctors were made for initial variance on Launch No. 2 data. A check of Launch No. 2 fathograms revealed initial discrepancies of + 1 ft. to -0.4 ft. on certain days.

J. Least depth determination was by fathometer only. No attempt was made to verify least depths with leadline, drift soundings, or divers.

K. Position numbers in the printouts for each vessel were not in numerical order and in excessively small blocks adverse to ease of manual reference. Requirements of section 4-5 of the automated surveys manual should be followed together with sequence of position numbers in chronological order for each vessel.

L. The transfer of soundings and curves in several junctional areas was inaccurately done during verification and necessitated excessive revision during review.

5. Junctions

Adequate junctions were effected with H-9202 (1971), H-9203 (1971) and H-9204 (1971) on the west and H-9153 (1970-71) on the north and northeast.

The junctions with H-9176 (1970) on the southeast and H-9136 (1970) on the south were discussed in the respective reviews of those surveys.

6. Comparison with Prior Surveys

A. H-101 (1844) 1:400,000	H-1633 (1884) 1:40,000
H-117 (1841) 1:40,000	H-3076 (1910) 1:20,000
H-118 (1842-43) 1:20,000	H-3314 (1911) 1:200,000
H-148 (1841-43) 1:80,000	H-3526 (1913) 1:10,000
H-149 (1844) 1:20,000	H-3731 (1914) 1:20,000
H-151 (1844) 1:40,000	H-4164 (1920) 1:40,000
H-670 (1859) 1:400,000	H-4799 (1927) 1:20,000
H-1558 (1882-83) 1:300,000	H-4816 (1928) 1:20,000
H-1566 (1883) 1:20,000	H-4942 (1929) 1:20,000

These prior surveys afford the earliest coverage of the survey area. Reviewed surveys H-7034 (1945) and H-7035 (1945) discussed below supersedes in part most of these prior surveys. The small portions of the prior surveys which are not covered by the 1945 surveys and fall within the area of the present survey are either sparsely developed, plotted at a small scale, or fall within constantly changing areas so that a comparison would serve no useful purpose.

The present survey is adequate to supersede these prior surveys within the common area.

B. H-7034 (1945) 1:10,000
H-7035 (1945) 1:10,000
<u>F.E. No. 12 (1951) 1:10,000</u>

These prior surveys cover most of the area of the present survey. A comparison between the present and prior surveys reveals a variable pattern of depth differences with present

depths generally 1 to 4 ft. deeper than prior depths over most of the area. Localized depth variations of 5 to 25 ft. are noted in the vicinities of Overfalls Shoal and Hen and Chickens Shoal. Sand ridges in the Overfalls Shoal area have shifted considerably and many have been removed by scouring of the bottom.

The general axis of Hen and Chickens Shoal, between latitudes $38^{\circ}45.40'$ and $38^{\circ}46.75'$, has migrated approximately 100 to 200 meters seaward since 1945. During this same time period, Cape Henlopen has accreted approximately 550 meters to the northwest filling in prior depths of 40 to 50 feet. These depth and shoreline changes are attributed to natural causes.

A rock awash, several bottom characteristics and soundings have been carried forward from H-7035 (1945) to supplement the present survey. In addition, groups of piling have been carried forward as submerged piling on the present survey. With these additions the more completely developed present survey is adequate to supersede the prior surveys in the common area.

C. F.E. No. 9 W.D. (1950) 1:40,000

This wire-drag survey covers portions of the northwest corner of the present survey area. Conflicts of 5 to 7 ft. between present depths and effective drag depths on this wire-drag survey were found. These discrepancies are attributed to shifting sediments in the area, making the conflicting effective depths presently invalid. Two hang depths, 39 ft. at lat. $38^{\circ}48.23'$, long. $75^{\circ}04.11'$, charted as cleared by 37 ft. and 49 ft. at lat. $38^{\circ}50.34'$, long. $75^{\circ}05.40'$ charted as cleared by 50 ft. were carried forward to the present survey. A wreck with a recorded depth of 42 ft. was found on the present survey in lat. $38^{\circ}48.28'$, long. $75^{\circ}04.07'$ approximately 120 meters north-east of the prior 39 ft. hang depth. The wreck on the present survey is supported by an uncharted hang on F.E. No. 9 at the same position and is considered to be part of the same wreck revealed to the southwestward by the prior wire-drag survey.

D. H-9172 W.D. (1968-70) 1:20,000 (unverified)

This is an unverified wire-drag survey. Comparison with the present survey will be made at the time of its review.

7. Comparison with Chart 12216 (formerly C&GS 411) 14th Ed., October 12, 1974A. Hydrography

The charted hydrography originates with the previously discussed prior surveys which require no further consideration supplemented by the partial application of the boat sheets of the present survey, surveys by the Corps of Engineers and U.S. Navy, Notices to Mariners and Chart Letters.

Attention is directed to the following:

1. The wire-drag cleared depths listed below should be retained on the chart:

<u>Cleared depth</u>	<u>Lat.</u>	<u>Long.</u>	<u>Source</u>
50 ft. Obst.	38°50.34'	75°05.4'	F.E. No. 9 W.D. (1950)
59 ft.	38°50.00'	75°04.8'	H-9172 W.D. (1968-70)
39 ft. Wk.	38°48.75'	75°04.38'	F.E. No. 9 W.D. (1950)
37 ft. Wk.	38°48.21'	75°04.11'	F.E. No. 9 W.D. (1950)

2. The piling (Pre-Survey Review Item 19) charted in lat. 38°45.36', long. 75°04.15' were not verified or disproved by the present survey. These piling should be revised to submerged piling as other groups of piles, included as part of this PSR item, were either verified or found to be submerged.

3. The submerged piles charted at lat. 38°45.75', long. 75°04.85' originated with preliminary information, on the present survey. These piles were located on the present survey and are not submerged. The chart should be revised to indicate piling at this location.

4. The following dangerous wrecks charted on Hen and Chickens Shoal are not disproved by the present survey and should be retained on the chart.

<u>Item</u>	<u>Lat.</u>	<u>Long.</u>	<u>Source</u>
Wk	38°48'07"	75°05'18"	NM 40 (1962)
Wk (6 ft. rep.)	38°47'56"	75°05'11"	NM 33 (1968)
Wk (12 ft. rep)	38°47'36"	75°04'59"	NM 33 (1968)
			NM 40 (1968)

Except as noted above, the present survey is adequate to supersede the charted hydrography within the common area.

B. Aids to Navigation

The aids to navigation on the present survey are in substantial agreement with their charted positions and adequately mark the intended features.

8. Compliance with Instructions


Line spacing of 100 meters was not followed in a 750 meter wide area extending northwesterly from lat. 38°44.2', long. 75°01.45' to lat. 38°47.25', long. 75°04.00'. Except for this, the survey adequately complies with the project instructions.

9. Additional Field Work

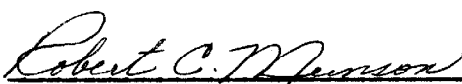
This is a good basic survey and no additional hydrography is recommended. At an opportune time, wire-drag investigations of the following items should be accomplished:

<u>Item</u>	<u>Lat.</u>	<u>Long.</u>	<u>Pos. No.</u>
A. 54 ft. sounding	38°47.23'	75°03.51'	5230
B. 56 ft. sounding Wk	38°48.76'	75°04.43'	8184
C. 42 ft. sounding Wk	38°48.28'	75°04.07'	7325
D. Submerged Piling	38°45.38'	75°04.16'	
E. Submerged Piling	38°45.33'	75°04.76'	
F. 11 ft. sounding	38°47.55'	75°05.10'	

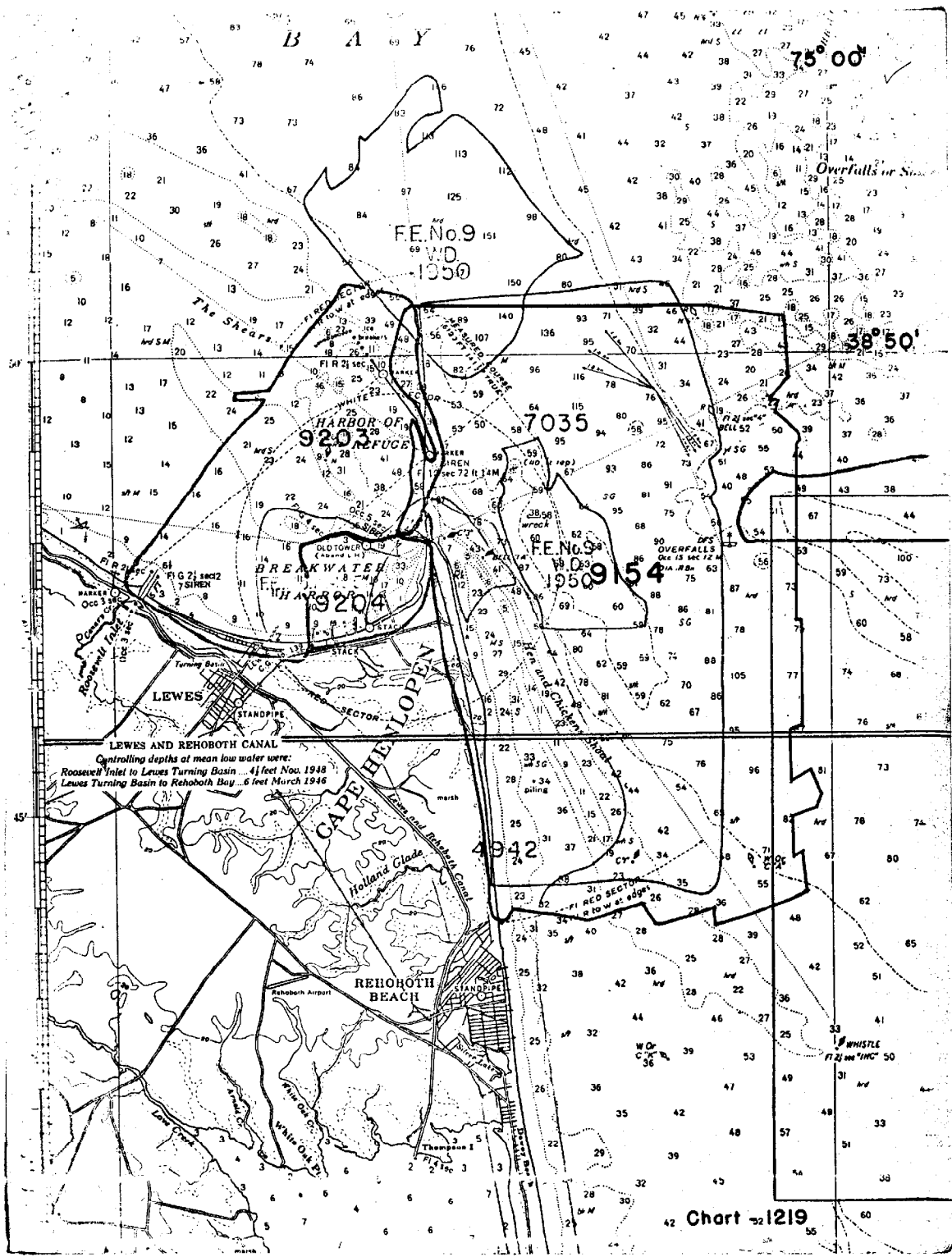
Inspected and Approved:



Chief
Marine Chart Division



Associate Director
Office of Marine Surveys and Maps



RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-9154

INSTRUCTIONS

- A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.
- 1. Letter all information.
- 2. In "Remarks" column cross out words that do not apply.
- 3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
411	8/7/74	D. Harpine	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>A CRITICAL CORRECTIONS</u>
1218	9/16/74	J. Chabon	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>App'd thru chrt. 411 aug #22 and this chart for critical corr. only.</u>
1219	1-6-75	D. Harpine	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>Exam FOR Critical Corr changed 2 Pks to Subm</u>
1109	1-7-75	D. Harpine	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>Exam FOR Critical Corr</u>
411	1-17-75	W. Chandler	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>Exam FOR Critical Corr Changed 1 pile to Subm Changed 5 fth curve Before</u>
411	1/28/76	Richard L. Hogan	Full Part Before After Verification Review Inspection Signed Via Drawing No.
1219	4/29/76	Richard L. Hogan R.L.H.	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>THRU CHART 411</u>
1218	5/3/76	Richard L. Hogan R.L.H.	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>THRU CHART 411</u>
1109	1/3/77	Richard L. Hogan	Full Part Before After Verification Review Inspection Signed Via Drawing No. <u>THRU CHART 1219</u>
			Full Part Before After Verification Review Inspection Signed Via Drawing No.