

9960

Diagram No. LS-9

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey ... Hydrographic.....
Field No. WH-10-1-81.....
Office No..... H-9960.....

LOCALITY

State Wisconsin-Minnesota.....
General Locality Lake Superior.....
Locality Offshore-Wisconsin Point to.....
..... Duluth Ship Canal.....
..... 1981.....
CHIEF OF PARTY
CDR. F. P. Rossi.....

LIBRARY & ARCHIVES

DATE October 9, 1984.....

9960

HYDROGRAPHIC TITLE SHEET

H-9960

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-10-1-81

State Minnesota Wisconsin - Minnesota

General locality Lake Superior

Locality Duluth Offshore - Wisconsin Point to Duluth Ship Canal

Scale 1:10,000 Date of survey 8 July to 7 October 1981

Instructions dated 12 February 1981 Project No. OPR Z137-WH-81

Vessel WHITING launches 1014 and 1015

Chief of party CDR Frank P. Rossi, Commanding Officer

Surveyed by D. Howard, D. Bland, E. Steigerwald, P. Ruiz, W. Dewhurst

Soundings taken by echo sounder, ~~hand lead, pole~~ Ross Model 5000 - lead-line

Graphic record scaled by WHITING personnel

Graphic record checked by WTD, DKH, DAB, EAS, PJR, RWB

Protracted by N/A Automated plot by Hydroplot

Soundings penciled by N/A

Soundings in ~~various~~ feet at ~~MLW~~ ~~MLLW~~ Low Water Datum (I.G.L.D. 1955:6φφ Feet)

REMARKS: All times are Coordinated Universal Time.

Notes in the Descriptive Report were made in red during verification

STANDARDS CK'D C. LOY

10-15-84

AWOIS and SURF - KWD 4/85

RWW 3/8/99

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A. PROJECT

Hydrographic Survey H-9960 was performed in accordance with Project Instructions for OPR-Z137-WH-81, Lake Superior, dated 12 February 1981, as ammended by Change No. 1 dated 31 March 1981.

B. AREA SURVEYED

The area surveyed was Western Lake Superior outside Duluth Harbor, extending from latitude $46^{\circ}42'08''$ N to $46^{\circ}47'32''$ N, and bounded on the west by the 37 -foot contour, and on the east by longitude $91^{\circ}59'00''$ W. Hydrography on the west side of the sheet was run inshore of the 37 -foot curve in order to maintain good agreement in junctioning with WH-5-1-81, H-9953. The area surveyed was characterized by a gently sloping sand or mud bottom, with the exception of several areas of large boulders. The survey was conducted from 8 July to 7 October 1981, Julian Days 189-280.

C. SOUNDING VESSELS

The sounding vessels used in this survey were WHITING "Jensen" Aluminium Type I survey Launches 1014 and 1015, EDP numbers 2932 and 2931, respectively. Both launches were equipped with standard hydrographic equipment. Numerous problems were encountered with the ARGO electronic positioning equipment. These are discussed in detail in separate reports, dated November 12, 1981, and October 6, 1981, to CAM2.

These problems only affected the efficiency of the survey and in no way affected the quality of the data. No other serious problems were encountered.

D. SOUNDING EQUIPMENT AND CORRECTIONS TO ECHO SOUNDINGS

Launches 1014 and 1015 were equipped with the following Ross Model 5000 fathometers:

<u>Launch</u>	<u>Julian Days</u>	<u>Fathometer s/n</u>
1014	189-204	1049
	206-210	1053
	254-275	1052
1015	216	1049
	222-280	1053

Phase checks were taken regularly and annotated on the fathograms. Due to mechanical problems with fathometer 1053, the phase checks on Julian Days 207, 209, and 210 were off. The phase checks were also off on JD 226 due to operator error. This was taken into account when scanning these days' data. Analog and digital output compared satisfactorily, and no instrument errors were observed.

Bar checks were taken daily, lake conditions permitting. TDC casts were taken with a Martek Model 167 (s/n 127) at the beginning and end of each eleven-day work period whenever possible. All bar checks for an eleven-day period were averaged together, and these average values were plotted on a graph. Any TDC casts taken during the period were also plotted on this graph, and the velocity curve was then drawn from this data. The velocity curves were drawn to fit the bar check values

using the TDC curves as an indication of slope, particularly for depths below that of the bar checks. Velocity correctors were taken from the bar check data.

Settlement and squat trials were run on both launches on 20 May 1981 in Duluth harbor. The graphs and corresponding tables for settlement and squat corrections are included in appendix "D". The settlement and squat correctors and correction to mean lake level will be applied during final processing of the data by OA/CAM3, Processing Division, via the TC/TI tapes.

E. HYDROGRAPHIC SHEETS

The field sheets were prepared on board by WHITING personnel. The survey was divided into east and west sheets, with a skew of 90° and origins as follows:

<u>West</u>	<u>East</u>
46°41'12"N	46°41'12"N
92°01'36"W	91°58'48"W

One sheet for each was plotted with mainscheme lines and crosslines, accompanied by an overlay for each with developments, bottom samples, and detached positions. In addition to the field sheets, two developments were plotted on 8x10 inch sheets at a scale of 1:2,000 and were included in the body of this report (see section P). These developments were the wreck of the THOMAS WILSON on the west sheet and the potable water intake on the east sheet.

F. CONTROL STATIONS

The following stations were used for electronic positioning sites, calibration signals, or fixed calibration points:

<u>Signal #</u>	<u>Name</u>	<u>Year Est.</u>
001	WEBC 1952	1952
004	Duluth General Elevator Flagstaff	1952
005	Duluth Central HS Cupola Spire	1905
010	Duluth Police Radio Station KWA 939 Mast	1952
012	Minnesota Point NB USLS	1870
020	Lester River 1952	1952
021	Anderson RM I	1981
022	MN PT ARGO	1981 - Not used in 1981
023	Wick	1981
100	South Breakwater Outer Light (L. L. #1808)	1980
902	Canal Calibration	1981
903	Canal ARGO	1981

Stations 001, 020, 021, ~~022~~, and 023 were used as electronic control sites, and positions for these stations were obtained from NGS published data.

Stations 004, 005, 010, ~~and~~ ^{011 and 012} were used as calibration signals and positions were obtained from NGS published data. Station 100 was a photogrammetric point (carto code 243) which was also used as a calibration signal.

011	DULUTH PARK POINT SCHOOL STACK	1921
101	DULUTH STEAM CO OP ASSN STACK	1982

Stations 902 and 903 were calibration points located by WHITING personnel during the 1981 field season. Station 902 is not recoverable. All descriptions and computations have been submitted to Operations Division, AMC.

G. HYDROGRAPHIC POSITION CONTROL

Range-range control was used for this survey. Del Norte positioning system was used for 95% of the mainscheme and crosslines. A large null zone near the south end of the sheet made it necessary to complete the hydrography using the ARGO positioning system. ARGO was also used for all developments and bottom samples on this sheet.

Del Norte baseline calibrations were performed every fourteen (14) days, in accordance with section A.5.1.3 of the Hydrographic Manual. The correctors applied to the smooth sheet were those obtained from the baseline calibration data by applying the baseline corrector in increments over the fourteen (14) day period to account for drift over time. Daily calibrations were taken at a fixed calibration point at the beginning and end of each day. These were used as a check for abnormal stepping; none were actually applied to the smooth data.

The following pieces of equipment were used by Launch 1014 (2932):

<u>JD</u>	<u>Master</u>	<u>DMU</u>	<u>Remote 1(left)</u>	<u>Remote 2 (right)</u>
189-196	1066	180	1316	212
202-204	169	189	212	1316
206-210	169	189	212	1322
255	429	246	1322	212

The ARGO equipment was calibrated at the beginning and end of each day using either a fixed point or sextant calibration in accordance with the Hydrographic Manual. The average of the morning and afternoon calibrations was applied as the daily corrector to the smooth field sheet. Phase stabilization equipment was installed on the launches and shore stations on 11 September, Julian Day 254. This entailed installing new RPU's and phase stabilization loops on all antennas. The following equipment was used by Launches 1014 and 1015 during this survey.

<u>Launch</u>	<u>Julian Day</u>	<u>RPU s/n</u>	<u>CDU s/n</u>	<u>ALU s/n</u>
1015	216-226	47851	47821	47858
	255-257	379119	47821	47858
	258-259	47864	37944	47858
	260-280	47864	37940	47858
1014	258-271	47843	47821	980310
	275	47843	37944	980310

All calibration data for this survey was adequate, and no problems were experienced which degraded the position accuracy.

H. SHORELINE - See also section 2. b of the Evaluation Report

No shoreline manuscripts were available for this survey. Shoreline shown in purple on the field sheets was obtained from a 1:10,000 enlargement of chart 14975, 26th ed., and is for orientation purposes only.

I. CROSSLINES

Forty miles of crosslines were run, which is 12% of the mainscheme. Agreement with the mainscheme was very good. Ninety-five percent agreed within one foot of the mainscheme soundings, and 5% agreed within two feet.

J. JUNCTIONS

This survey junctions with H-9953 (WH-5-1-81) to the west, from latitude $46^{\circ}45'15''$ northward, and with H-9979 (WH-20-1-81) to the east. The junction with H-9953 was very good, all depths agreeing within 0-1 ft. Agreement with H-9979 was 1-3 ft. in the area north of latitude $46^{\circ}47'00''$, and 0-2 feet in the area south. H-1423 to the west from Lat. $46^{\circ}42'35''N$ to $46^{\circ}45'45''N$. H-1424 to the north.

K. COMPARISON WITH PRIOR SURVEYS - See also section 6 of the Evaluation Report

The following prior surveys were compared to H-9960:

- L.S. 251 St. Louis River 1861
- L.S. 256 Lake Superior Offshore 1861-1868
- L.S. 257 Lake Superior Offshore 1861
- L.S. 1824 Lake Superior of Duluth 1943
- L.S. 1829 Revisory Survey-Duluth Entrance 1944
- L.S. 1994 Lake Superior Offshore-Duluth to Apostle Is. 1956

Surveys L.S. 256 and 257 could not be compared because they had no latitude and longitude lines. The same was true for L.S. 251, although the position of the 24 and 36 foot contours off Minnesota Point agreed well with this survey.

Agreement with L.S. 1824 was good, with depths 1- to 4-feet shoaler than new survey depths. The only discrepancies were in the area of the 31-foot soundings (PSR item #4). Survey L.S. 1829 covered the area immediately outside the Duluth ship canal. Agreement with H-9960 was very good, all depths being within 0-2 ft. of the present survey. Comparison with L.S. 1994 was difficult because it was done at such a small scale (1:20,000), but agreement was fair, the soundings generally being within 5 ft. of the present survey.

PSR item #4, three 31-foot soundings*, was the only item which fell within the limits of hydrography of this sheet. The area was developed by echo sounder using 45- and 10-meter spacing, and a dive investigation was made. The divers found the area to be a smooth sand bottom, and the least depth obtained by fathometer of the shoal area was 36 feet. It is recommended that these soundings be deleted from the chart. A report³⁴ on the dive investigation follows. Do not concur; see section 6 of the Evaluation Report.

* These were obstructions found on LS-1824(1943)-only two (2) are charted.



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
NOAA Ship WHITING
P.O. Box 40
Duluth, MN 55801

October 2, 1981.

TO: LT Dewhurst
Field Operations Officer

From: Edward J. Tylutki
Divemaster

Diving operations were performed 2 October 1981 (JD 275) on PSR item #4. The launch was driven to the charted location of the 31-foot soundings and anchored. Divers Tylutki and Lowery descended to the anchor and performed a circle search. The bottom in this area was fine sand, and no obstructions were found. Visibility at the bottom was less than one foot.

Divers returned to the surface, and a leadline depth of 37 ft. was obtained at the anchor.* A detached position was taken from the launch; Lat. 46° 43' 24.9" N, Long. 92° 00' 10.7" W.

* A least depth of 34 Feet is on the smooth sheet.



L. COMPARISON WITH THE CHART - See also section 7.2 of the Evaluation Report

Survey H-9960 was compared with NOS chart 14975, 26th ed., April 26, 1980. Charted depths are generally from 0-to 7-feet shoaler than those obtained in this survey with the following exceptions:

<u>Charted Depth</u>	<u>Location</u>	<u>Surveyed Depth</u>	
50'	46°47'08"N	92°03'33"W	74' 72'
55'	46°46'55"N	92°03'25"W	72' 74'
66'	46°46'39"N	92°04'07"W	57' 55'
43'	46°46'07"N	92°04'07"W	53' 54'-52'
54'	46°44'08"N	92°01'36"W	65' 64'
45'	46°43'50"N	92°01'57"W	53' 54'-52'
51' 56	46°43'55"N	91°59'39"W	73' 72'
42' 47	46°43'47"N	91°59'48"W	54' 53'-59'
32'	46°43'19"N	92°00'03"W	48' 44'
44'	46°43'10"N	92°00'49"W	58' 54'

The above soundings should be retained as charted - insufficient hydrography was run to verify or disprove their existence.

The following table lists all charted items which were investigated during this survey, as well as all new items investigated.

Dive investigations in the areas of jagged bottoms showed that these were mainly caused by large boulders in an otherwise smooth sand or mud bottom. Changes in bottom characteristics determined by the divers were noted on the smooth sheets. No new dangers to navigation were found during this survey, and the following changes to the chart are recommended:

^{dangerous submerged} Add a wreck symbol (least depth ^{41.7} 42.5') for the THOMAS WILSON, latitude 46°47'01"N, longitude 92°04'09"W. Change the position of the potable water intake crib and intake pipe from its charted position of 46°44'43"N, 92°01'02"W to 46°44'39"N, 92°01'09"W. Position number ^{41.45} 6426. The wreckage should be shown as delineated ^{12.64} on the smooth sheet.

Delete the 21-foot sounding, 46°42'14"N, 91°59'14"W, and change the depth contours in this area to reflect those obtained in this survey. - ~~Remove and rechart~~; Recommend wire drag/side scan sonar investigation

Developments of the WILSON wreck and potable water intake crib (scale 1:2,000) follow, along with dive reports of the investigations of the "WILSON" wreck and developments K, M, and P.

ITEM	LEAST DEPTH	SOURCE	METHOD OF INVESTIGATION	JULIAN DATE	RECOMMENDATIONS
PSR Item #4 31' soundings	36' (fathos)	Lake Survey #1824 (1943)	10 m spacing and crosslines, E-W splits dive investigation	216, 222 275	Delete from chart (see section K) - Do not cancel
Wreck-"WILSON" Development B	42.5' (Leadline) 41' on S.S.	Coast Pilot, local dive chart	10 m spacing dive investigation	256 255	Add to chart in position determined (pos. #2737). see section D, P. 5
Crib-PWI	56' (fathos)	charted feature	10 m spacing N-S and E-W	280	Chart in new position determined (pos. #6026) along with intake pipe, visible on fathogram. - cancel
Development 1	52' (fathos) 51' on S.S.	shoal on fathogram, JD 192	45 m spacing N-S	210	Apply contours and depths to chart as surveyed. cancel
Development 2	51' (fathos) 49' on S.S.	shoal on fathogram, JD 191	E-W splits and 90 m spacing N-S	210	Apply contours and depths to chart as surveyed. cancel
Development 3	31' (fathos)	21' shoal, charted feature	45 m spacing and NW-SE crosslines	222	Delete from chart, apply depths as surveyed. cancel
Development A	41' (fathos) 40' on S.S.	jagged bottom, pos. #716-717 JD 193	E-W splits and 90 m spacing N-S wreck THOMAS WILSON	257	Apply contours to chart as surveyed. cancel
Development C	50' (fathos) 49' on S.S.	3' spike on fathogram, pos. #209, JD 191	star pattern development same as development #2.	257, 258	Apply depths to chart as surveyed. cancel
Development D	61' (fathos) 60' on S.S.	3' spike on fathogram pos. #782, JD 194	star pattern development	258	No further investigation recommended.
Development E	64' (fathos) 63' on S.S.	jagged bottom, 6' spikes on JD 194	E-W splits and 90 m spacing N-S	258	No further investigation recommended. cancel
Development F	53' (fathos) 52' on S.S.	jagged bottom, 7' spikes on fathogram, pos. # 869, JD 194	E-W splits and 90 m spacing N-S	260	Apply depths to chart as surveyed. cancel
Development G	72' (fathos) 63' on S.S.	reported wreck-"WINNIPEG" local dive chart	star pattern development	258	Wire drag or diver search if more information is available. cancel
Development H	59' (fathos) 58' on S.S.	jagged bottom, fathogram JD 208	E-W splits and 90 m spacing N-S	258, 260	Apply contours to chart as surveyed. cancel

ITEM	LEAST DEPTH	SOURCE	METHOD OF INVESTIGATION	JULIAN DATE	RECOMMENDATIONS
Development I	59' (Fatho)	4'-7' spikes on fathogram (JD 208, 209) in area of reported wreck-"USS ESSEX", local dive chart	star pattern developments	260	Wire drag or diver search if more information is available. <i>cancel</i>
Development J	53' (Fatho)	4' spike on fathogram, pos. #2305, JD 209	star pattern development	260	No further investigation recommended. <i>cancel</i>
Development K	56' (Fatho) 55' on S. S.	jagged bottom on fathogram, JD 209	E-W splits and 90 m spacing N-S dive investigation	260 277	Dive investigation (pos. #5946) showed spikes to be caused by large boulders. Add to bottom features. <i>Spikes not added to S.S. S. S.</i>
Development L	71' (Fatho) 56' on S. S.	jagged bottom, 4' spikes on fathogram, JD 208	E-W splits and 90 m spacing N-S	260	No further investigation recommended. <i>cancel</i>
Development M	70' 69' (Leadline) 68' Fathometer * 70' on S. S.	jagged bottom, 7' spikes on fathogram, pos. #2293, JD 209 and pos. #5016, JD 216	E-W splits and star pattern development dive investigation	261, 271 278	Wire drag or diver search recommended. Rock brought up by diver indicates this may be site of wreck-"MAYFLOWER". <i>cancel</i>
Development N and P	49' (Leadline) 46' on S. S.	jagged bottom, 8'-10' spikes on fathogram, JD 209, 216	E-W splits and 90 m spacing N-S dive investigation	261, 265, 275 278	Dive investigation (pos. #5947) showed spikes to be caused by large boulders. Add to bottom features.
Development O	58' (Fatho)	jagged bottom, 8' spikes on fathogram, JD 209, 216	E-W splits and 90 m spacing N-S	265	Apply contours and depths as surveyed. <i>cancel</i>



U.S. DEPARTMENT OF COMMERCE
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 NATIONAL OCEAN SURVEY

NOAA Ship WHITING
 P.O.Box 40
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September 12, 1981

TO: LT Dewhurst
 Field Operations Officer

FROM: Edward J. Tylutki
 Divemaster

Diving operations resumed on 12 September 1981 (JD 255) in order to determine the exact location and least depth of the wreck of the *THOMAS WILSON. The launch was driven to the marker buoy left at the site of the wreck on Julian Day 254 and anchored. Divers Tylutki and Lowery descended to the wreck and moved the marker buoy to the wreck's bow. They then placed another bouy at the wreck's mid-section and surfaced to change tanks and report their findings.

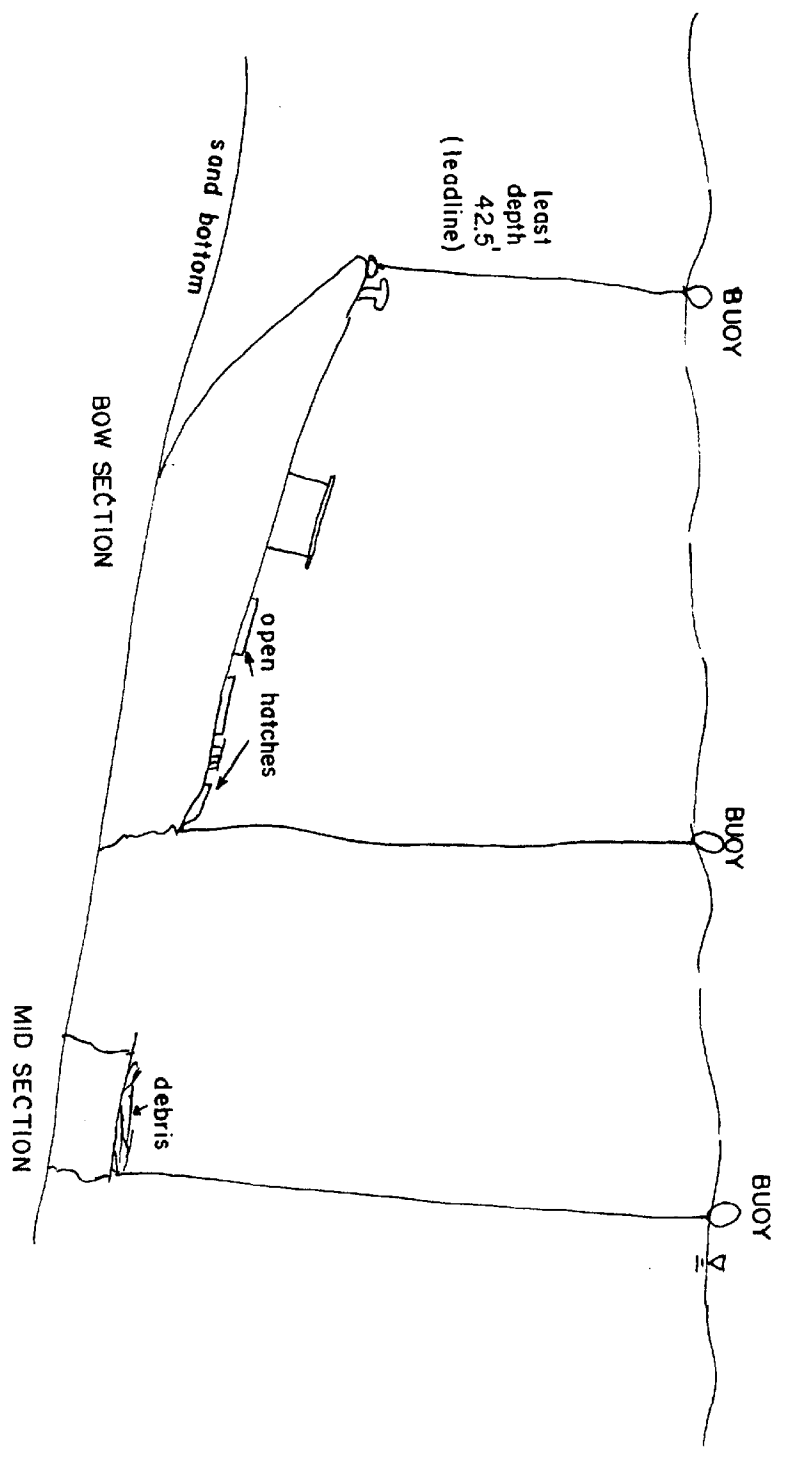
The divers re-entered the water and secured a third bouy to the aft-most point of the bow section. Becoming low on air, they surfaced and changed tanks. They descended a third time in order to try to find the stern section of the wreck. The lack of visibility and deteriorated state of the wreck made this part of the dive hazardous, and forced the divers to stay clear of the wreck. Due to these conditions the divers surfaced without locating the stern section.

A leadline least depth of ^{41.4}~~42.5~~ ft. was obtained at the marker buoy placed at the very bow of the wreck. A detached position was taken at this location, Lat. 46° 47' 00.7" N, Long. 92° 04' 09.4" W.

This was assigned as PSR item # 11 as update of Project Instructions for OPR-2137-81. This was also assigned AWOIS # 42381 on 11 MAY 83 for OPR-2137-PC-83.



Wreck THOMAS WILSON





U.S. DEPARTMENT OF COMMERCE
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NOAA Ship WHITING
 P.O. Box 40
 Duluth, MN 55801

October 4, 1981

TO: LT Dewhurst
 Field Operations Officer

FROM: Edward J. Tylutki
 Divemaster

Diving operations were performed 4 October 1981 (JD 277) on Development "K", WH-10-1-81. The bottom in this area is very irregular, with 6 foot spikes visible on the fathogram. The launch was driven over the area several times to find the largest spike, and then the anchor was dropped on this. Divers Tylutki and Lowery descended via the anchor line and located the obstruction, which was two large square rocks standing approximately five feet above the bottom. The anchor was dropped almost directly on the rocks, and no further search was made.

A leadline depth of 60.1 ft. was obtained on the top of the rocks, and a detached position was taken in this location; Lat. $46^{\circ} 43' 39.2''$ ^{4.36N}, Long. $92^{\circ} 01' 15.5''$ ^{19.12W}. This was the least depth in this development area. Position 5946





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 NOAA Ship WHITING
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October 5, 1981

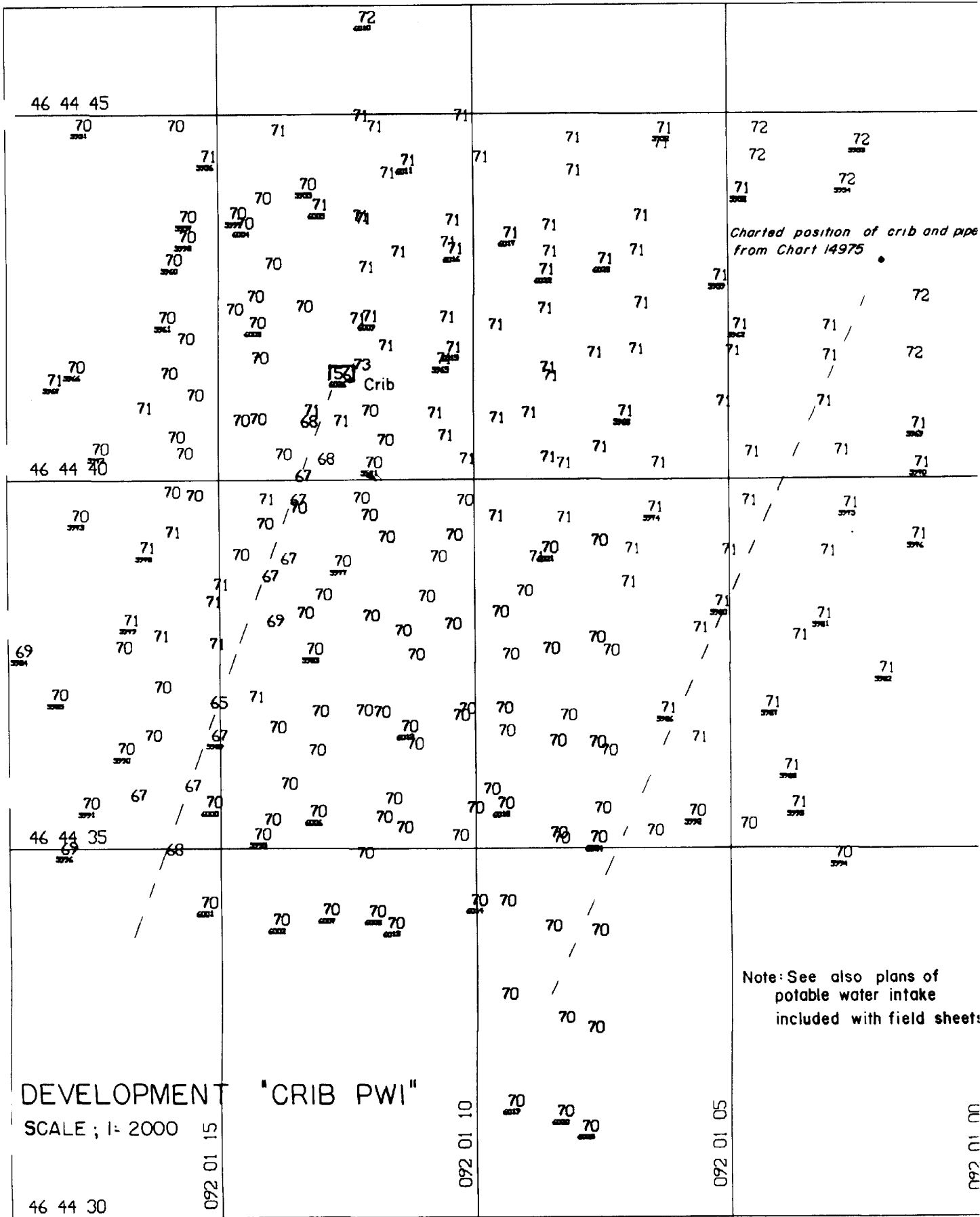
TO: LT Dewhurst
 Field Operations Officer

FROM: Edward J. Tylutki
 Divemaster

Diving operations were performed 5 October 1981 (JD 278) on two areas of jagged profiles visible on the fathogram. (7- to 10- foot spikes). The first area investigated was Development "P" of Wli-10-1-81. The launch was driven over the area to find the largest spikes, at ^{which} ~~which~~ point the anchor was dropped. Divers Tylutki and Lowery descended to the anchor and found the bottom to be covered with large boulders. A circle search was then done to ~~find~~ ^{find} the least depth in ~~the~~ ^{the} immediate area. Leadline depth at this point was 49.1 ft., which was the least depth for this development. A detached position was taken; Lat 46° 42' 57.1" N, Long. 91° 58' 54.6" W. Development P-section L of the Descriptive Report

The launch then moved to Development "M" where the anchor was dropped on what appeared to be a 7-ft. spike on the fathogram. Divers descended the anchor line and found that it had been dropped in an area of clay bottom, with a steep drop-off and with piles of rocks near by. A leadline depth of 70.3 ft. was obtained at ~~the~~ ^{the} top edge of the drop-off which is the least depth for this development. Divers returned to ~~the~~ ^{the} surface and a detached position was taken, Lat. 46° 43' 50.1" N, Long. 91° 59' 14.3" W. Development M-section L of the Descriptive Report.





72

46 44 45

71

71

72

72

Charted position of crib and pipe from Chart 14975

154 Crib

46 44 40

46 44 35

DEVELOPMENT "CRIB PWI"

SCALE ; 1: 2000

46 44 30

092 01 15

092 01 10

092 01 05

092 01 00

Note: See also plans of potable water intake included with field sheets:

M. ADEQUACY OF SURVEY

This survey is sufficiently complete and adequate to supercede prior surveys for charting purposes.

N. AIDS TO NAVIGATION

There were no floating aids to navigation within the limits of this sheet. All fixed aids within the survey limits were verified during field edit and found to adequately serve the purpose for which they were established. All fixed aids were located photogrammetrically in 1980 (TP 01078 and 01086), and no further verification of position was made during this project.

O. STATISTICS

<u>Vesno</u>	<u>No. of Positions</u>	<u>Miles of Sounding Line Run</u>	<u>No. of Bottom Samples</u>
1014	3170	473.2	105
1015	952	93.8	103
Total of Bottom Samples:		208	
Total Miles Run		567.0	
Total Square Miles		18.0	
Total No. of Positions		4122	3875

P. MISCELLANEOUS

None.

Q. RECOMMENDATIONS

See Recommendations in Section K and L (Comparison to Prior Surveys and Chart)

R. AUTOMATED DATA PROCESSING

<u>Program No.</u>	<u>Description</u>	<u>Version Date</u>
RK 111	Range/Range Real Time Hydroplot	05/26/81
RK 112	Range/Range Real Time Hydroplot	05/26/81
RK 201	Grid, Signal and Lattice Plot	04/18/81
RK 211	Range/Range Non-Real Time Plot	02/02/81
RK 300	Utility Computations	10/21/80
RK 330	Reformat and Data Check	05/04/76
AM 530	Layer Correctors for Velocity	05/10/76
RK 561	Range/Range Geodetic Calibration	05/26/81
AM 602	Extended Line Oriented Editor	05/20/75
RK 612	Line Printer Listing	03/22/78

S. REFERRAL TO REPORTS

Field Edit Report OPR-Z137, submitted 23 July 1981.

Respectfully submitted,

Elizabeth A. Steigerwald
Elizabeth Steigerwald, ENS, NOAA

J. APPROVAL SHEET

Supervision of all field and office work on this hydrographic survey was continuous and on a day to day basis to ensure completeness. All work was done in accordance with the Project Instructions and the Hydrographic Manual. This survey is complete and adequate for charting purposes.

Approved/forwarded

Frank P. Rossi

Frank P. Rossi
CDR, NOAA
Commanding Officer, NOAA Ship WHITING

07 Dec 1981

F. LIST OF STATIONS

	STATION NUMBER	OCTANT PLOTTING POS.	LATITUDE	LONGITUDE	CARTO CODE	ANTENNA ELEVATION	FREQUENCY	STATION NAME AND YEAR ESTABLISHED
*	001	0	46/47/24.342	92/06/49.759	250	201	000000	WEDC 1952 ok
*	004	0	46/46/11.550	92/06/38.140	139	000	000000	Duluth General Elevator Flagstaff 1952
*	005	0	46/47/20.600	92/05/59.841	139	000	000000	Duluth Central HS Cupola Spire 1905
*	010	0	46/45/41.758	92/04/46.747	139	000	000000	Duluth Police Radio Station KWA 939 Mast 1952
*	012	0	46/45/27.978	92/04/42.663	139	000	000000	Minnesota Point NB USLS 1870
*	018	0	46/46/51.587	92/05/17.178	250	000	000000	Canal MNHD 1974
+	020	0	46/51/55.621	91/59/16.257	250	168	000000	Lester River 1952
+	021	0	46/46/22.364	91/27/05.678	250	000	164520	Anderson RM 1 1981
+	022	0	46/43/04.575	92/02/05.673	250	000	164520	MN Pt Argo 1981
+	023	0	47/07/31.515	91/28/54.048	250	000	164520	Wick 1981
#	100	0	46/46/48.460	92/05/15.020	243	000	000000	South Breakwater Outer Light, Duluth Ship Canal (L.L. #1808)
+	902	0	46/46/51.812	92/05/17.178	243	000	000000	Canal Calibration 1981
+	903	0	46/46/49.880	92/05/21.802	139	000	000000	Canal Argo 1981
	ϕ_{11}		$46^{\circ} 45' 34.81\phi''$	$92^{\circ} 04' 41.47\phi''$	139			DULUTH PARK POINT SCHOOL STACK 1921
	$1\phi_1$		$46^{\circ} 47' 00.64\phi''$	$92^{\circ} 05' 48.14\phi''$	139			DULUTH STEAM AND CO OP ASSN STACK, 1982

* Obtained from NGS published data.

Photogrammetric position, established 1980.

+ Established by WHITING or AMC personnel, 1981 field season.

G. ABSTRACT OF POSITIONS

LAUNCH 1014 (2932)

OPR Z 137
POSITION DATA SHEET
SHEET WH-10-1-81

REGISTRY # H-9960

VOL	JULIAN DAY	FIRST POS. #	TIME (GMT)	LAST POS. #	TIME (GMT)	DEVELOPMENT POSITIONS	DETACHED POSITIONS	REJECTED POSITIONS	OMITTED POSITIONS
I	189	0001	213200	0022	215233	0001-0022	--	0058-0059	--
I	191	0023	142623	0251	210148	0023-0057 0060-0110 0122-0251	--	0111-0122	--
I	192	0252	150653	0494	211312	0257-0272 0275-0494	--	0252-0256 0273-0274	--
I	193	0498	140502	0728	203644	0498-0515 0524-0528 0528-0567 0578-0648 0661-0670 0674-0687 0690-0705 0709-0728	--	0516-0523 0527 0568-0577 0649-0660 0671-0673 0688-0689 0706-0708	0495-0497
I	194	0738	142426	0983	203856	0738-0841 0843-0888 0892-0917 0921-0925 0930-0970 0977-0983	--	0842 0889-0891 0918-0920 0926-0929 0971-0976	0729-0737
I	195	0984	161214	1012	173530	0984-1000	--	1001-1012	--
I	196	1013	145424	1248	210934	1038-1100 1114-1248	--	1013-1037 1101-1113	--
I	202	1249	192136	1300	211905	1249-1276 1278-1300	--	1277	--
I	203	1301	143501	1403	193851	1301-1320 1331-1351 1354-1394 1397-1403	--	1321-1330 1352-1353 1395-1396	--
I	204	1404	141744	1552	200322	1405-1415 1417-1521 1526-1552	--	1404 1416 1522-1525	--

POSITION DATA SHEET

LAUNCH 1014 (2932)

SHEET WH-10-1-81

REGISTRY # H-9960

VOL.	JUL'N DAY	FIRST POS. #	TIME (GMT)	LAST POS. #	TIME (GMT)	DEVELOPMENT POSITIONS	DETACHED POSITIONS	REJECTED POSITIONS	OMITTED POSITIONS
I	206	1553	144913	1687	221748	1553-1633 1638-1655 1658-1687	--	1634-1637 1656-1657	--
I	207	1688	140822	1967	205735	1688-1899 1901-1967	--	1900	--
I	208	1968	134547	2251	215642	1968-1981 1984-2092 2094-2111 2115-2163 2166-2201 2205-2207 2214-2251	--	1982-1983 2093 2112-2114 2164-2165 2202-2204 2208-2213	--
I	209	2252	134823	2588	211633	2252-2264 2271-2288 2292-2316 2320-2361 2368-2415 2418-2458 2463-2472 2474-2533 2536-2537 2539-2542 2548-2579 2581-2588	--	2265-2270 2289-2291 2317-2319 2362-2367 2416-2417 2459-2462 2473 2534-2535 2538 2543-2547 2580	--
I	210	2589	135523	2732	185607	2589-2732	--	--	--
III	254	2733	181726	2735	194938	--	--	2733-2735	--
III	255	2736	184805	2740	185426	--	2737	2736	--
III	258	2741	181226	2829	221639	2741-2798	--	2799-2829	--
III	259	2830	162122	2838	192223	--	2830-2832 2834-2835 2837-2838	2833 2836	--

POSITION DATA SHEET

LAUNCH 1014 (2932)

SHEET WH-10-1-81

REGISTRY # H-9960

VOL	JUL'N DAY	FIRST POS. #	TIME (GMT)	LAST POS. #	TIME (GMT)	DEVELOPMENT POSITIONS	DETACHED POSITIONS	REJECTED POSITIONS	OMITTED POSITIONS
III	260	2839	150745	2919	215631	2839-2879 2882-2891	2892-2910 2912-2919	2880-2881	--
III	261	2920	144735	2949	200943	--	2920-2940 2942-2948	2941 2949	--
III	264	2950	155851	2967	221705	--	2950-2963 2965-2967	2964	--
III	265	2968	155013	3074	203325	2968-2970 2973-3074	--	2971-2972	--
III	266	3075	193301	3089	204623	--	3075-3089	--	--
III	267	3090	152037	3095	182504	3090-3093	3094, 3095	--	--
III	271	3096	165207	3150	202231	3107-3146 3148-3150	3096-3106	3147	--
III	275	3151	144428	3170	190123	3151-3169	3170	--	--

POSITION DATA SHEET

LAUNCH 1015 (2931)

SHEET WH-10-1-81

REGISTRY # H-9960

VOL	JUL'N DAY	FIRST POS. #	TIME (GMT)	LAST POS. #	TIME (GMT)	DEVELOPMENT POSITIONS	DETACHED POSITIONS	REJECTED POSITIONS	OMITTED POSITIONS
II	216	5000	152057	5142	201512	5000-5142	--	--	--
II	217	5143	181455	5153	184448	--	--	5143-5153	--
II	222	5143	143055	5276	191946	5143-5186 5188-5210 5213-5238 5241-5276	--	5187 5211-5212 5239-5240	--
II	226	5277	185653	5310	204840	5277-5310	--	--	--
II	255	5311	145810	5373	224423	--	5311-5313 5315-5353 5355-5371 5373	5314 5354 5372	--
II	256	5374	151006	5510	223711	5374-5486	5487-5510	--	--
II	257	5511	164326	5568	193425	5511-5568	--	--	--
II	258	5569	183848	5670	000514	5569-5670	--	--	--
II	259	5671	145758	5689	192708	--	5671-5689	--	4
II	260	5690	143152	5850	222453	5690-5850	--	--	--
II	261	5851	142607	5937	202637	5851-5937	--	--	--
II	275	5938	205403	5939	205949	--	--	5938-5939	--
II	276	5940	183104	5943	191113	--	--	5940-5943	--
II	277	5944		5946	180613	--	5946	--	5944-5945
II	278	5947	184622	5948	185732	--	5947, 5948	--	--
II	280	5951	142201	6026	155732	5951-6025	6026	--	--

I. LANDMARKS FOR CHARTS

*Note: All Form 76-40's are copies
of those submitted with the
Field Edit Report for OPR Z137.

NONSTANDARD LANDMARKS FOR CHARTS

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

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRP.
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

Replaces C&GS Form 567.

TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT (If field Party, Ship or Office)
NOAA Ship WHITTING

STATE
Minnesota

LOCALITY
Duluth Harbor

DATE
7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO. 2137-WH-81

JOB NUMBER

SURVEY NUMBER TP-01078

DATUM
North American 1927

METHOD AND DATE OF LOCATION
(See instructions on reverse side)

FIELD

CHARTS AFFECTED

CHARTING NAME	DESCRIPTION <i>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)</i>	LATITUDE		LONGITUDE		OFFICE	FIELD	CHARTS AFFECTED
		° /	' //	° /	' //			
RTR	(Duluth TV Station WIBC, Mast, 1952)	46	25.78	92	50.09	Triangulation	F-3-7-V 7/12/81	14975 14966
SPIRE	(Duluth Cath. or Me. Church, Spire, 1905)	46	15.92	92	18.96	Triangulation	V-Vis 6/81	14975
TOWER	(Duluth Central High School, Cupola Spire, 1905)	46	20.60	92	59.84	Triangulation	F-3-7-V 7/12/81	14975
STACK		46	08.64	92	48.14	80 EC 5735 8/31/80	F-3-7-V 7/12/81	14975
TANK		46	58.78	92	45.46	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
TANK		46	58.95	92	44.96	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
FLAGPOLE		46	48.84	92	32.39	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
FLAGPOLE	(Duluth General Elevator Flagstaff, 1952)	46	11.55	92	38.14	Triangulation	F-3-7-V 7/12/81	14975
TV MAST, TALLER OF TWO		46	21.35	92	50.72	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975 14966
RTR	delete- gone <i>NC L-635(82)</i>	46	18.53	92	26.19	80 EC 5737 8/31/80	V-Vis	14975

NONEXHAUSTIVE INDEX OF LANDMARKS FOR CHARTS

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

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
- GEODETIC PARTY
- PHOTO FIELD PARTY
- COMPILATION ACTIVITY
- FINAL REVIEWER
- QUALITY CONTROL & REVIEW CRT
- COAST PILOT BRANCH

(See reverse for responsible personnel!)

Replaces C&GS Form 567.

TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT (If field party, ship or office)
 NOAA Ship WHITTING

STATE
 Minnesota

LOCALITY
 Duluth Harbor

DATE
 7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

CHARTING NAME	DESCRIPTION <small>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)</small>	LATITUDE		LONGITUDE		METHOD AND DATE OF LOCATION <small>(See instructions on reverse side)</small>	FIELD	CHARTS AFFECTED
		° / ' "	D.M. Meters	° / ' "	D.P. Meters			
OPR PROJECT NO. 2137-WH-81	JOB NUMBER TP-01078	North American 1927		DATE				
TOWER	(Duluth U.S.C.G. Lookout Tower, 1952)	46 46	20.89	92 05	22.84	Triangulation	V-Vis 7/81	14975
TV MAST	delete - not of landmark value	46 46.3		92 06.8			V-Vis 7/81	14975
NEON SIGN, LETTERS "NC"	delete - gone	46 47.0		92 06.1			V-Vis 7/81	14975
NEON SIGN FIGURE "T"	delete - gone	46 47.1		92 06.0			V-Vis 7/81	14975
W S SIG STA	delete - gone	46 46.4		92 05.4			V-Vis 7/81	14975 14966
CHY	delete - not of landmark value	46 46.4		92 05.4			V-Vis 7/81	14975

NC 1-635(84)

~~NONRECOGNIZED~~ LANDMARKS FOR CHARTS

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

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRP
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

Replaces CGGS Form 567.
 TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT
NOAA Ship WHITTING

STATE
Minnesota

LOCALITY
Duluth Superior Harbor

DATE
7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO.
2137-MH-81

JOB NUMBER
TP-01082

DATUM
North American 1927

METHOD AND DATE OF LOCATION
(See instructions on reverse side)

CHARTS AFFECTED

CHARTING NAME	DESCRIPTION <small>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)</small>	LATITUDE		LONGITUDE		OFFICE	FIELD	CHARTS AFFECTED
		° / ' "	D.M. Meters	° / ' "	D.P. Meters			
R MAST	(Duluth Pol. Rad. Sta, KWA 939, Mast, 1952)	46 45	41.758	92 04	46.747	Triangulation	F-3-7-V 7/13/81	14975
CHIMNEY	(Duluth Park Point School Stack, 1921)	46 45	30.81	92 04	41.47	Triangulation	F-3-7-V 7/13/81	14975
AERO		46 43	38.21	92 02	46.16	80 EC 5759 8/31/80	F-3-7-V 7/13/81	14966
TANK		46 44	09.04	92 04	41.81	80 EC 5758 8/31/80	F-3-7-V 7/13/81	14975
ELEVATOR		46 44	17.07	92 04	53.11	80 EC 5758 8/31/80	F-3-7-V 7/13/81	14975

NC-1.635(82)

NONFLOATING AIDS ~~GENERAL MARKERS FOR ROCKERS~~

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

ORIGINATING ACTIVITY

Replaces C&GS Form 567.

REPORTING UNIT
(If field party, ship or office)
NOAA Ship WHITTING

STATE
Wisconsin
Minnesota

LOCALITY
Superior Harbor

DATE
7/81

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILED ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW
 - COAST PILOT BRANCH
- (See reverse for responsible persons)

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

CHARTING NAME	DESCRIPTION (Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)	JOB NUMBER	SURVEY NUMBER	LATITUDE		LONGITUDE		METHOD AND DATE OF LOCATION (See instructions on reverse side)	FIELD	CHARTS AFFECTED
				° / ' "	D.M. Meters	° / ' "	D.P. Meters			
OPR PROJECT NO. 2137-WH-81			TP-01086	DATUM North American 1927						
South Breakwater Light	L.L. #1789			46 42	36.74	92 00	22.22	80 EC 5762 8/31/80	V-VIS 7/81	14975 14966
North Breakwater Light	L.L. #1790			46 42	42.15	92 00	27.60	80 EC 5762 8/31/80	V-VIS 7/81	14975 14966
Inner North Pierhead Light	L.L. #1791			46 42	30.90	92 00	49.26	80 EC 5762 8/31/80	V-VIS 7/81	14975
Inner South Pierhead Light	L.L. #1792			46 42	26.75	92 00	45.05	80 EC 5762 8/31/80	V-VIS 7/81	14975
Superior Harbor Basin Light 1	L.L. #1793			46 42	16.44	92 01	00.53	80 EC 5762 8/31/80	F-3-7-V 7/13/81	14975
Allouez Ore Dock#3 West Light	L.L. #1794			46 42.2		92 01.8			P-5-V 5/21/81 80 EC 5762	14975
Allouez Ore Dock #3 East Light	L.L. #1795			46 42.2		92 01.8			P-5-V 5/21/81 80 EC 5762	14975
Burlington Northern East Dock Light	L.L. #1796.10			46 42.3		92 01.7			V-VIS 7/81	14975
Burlington Northern West Dock Light	L.L. #1797			46 42.3		92 01.7			V-VIS 7/81	14975
Superior Range Rear Light	Front Channel L.L. #1801			46 42	16.45	92 01	53.45	80 EC 5762 8/31/80	F-3-7-V 7/13/81	14975

NC 2.635(8)

B. FIELD WATER LEVEL NOTE

FIELD WATER LEVEL NOTE

Field water level reductions were not performed on hydrographic survey H-9960. A primary water level gage located at Lat. $46^{\circ}46'34''$ N and Long. $92^{\circ}05'32''$ W in Duluth, MN was monitored daily and found to be in proper working order. This gage was monitored throughout the survey by a paid observer.

This water level station was not plotted on the Field Sheet. The location was revised using information provided by Water Levels Section at the Atlantic Marine Center, N/MOA 212. This ~~data~~ information was provided by Mr. Jim Dixon.



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
NOAA Ship WHITING
439 W. YORK ST.
NORFOLK, VA 23510

OCTOBER 23, 1981

TO : Chief, Tides and Water Levels Branch (OA/C23)

FROM : *Frank P. Rossi*
Commander Frank P. Rossi, NOAA
Commanding Officer, NOAA Ship WHITING

SUBJECT: Smooth Water Level Data for Survey H-9960

Please forward smooth water level data for the western coast of Lake Superior, Duluth, MN, to Chief, Processing Division (CAM3), Atlantic Marine Center, Norfolk, VA. Hydrography was run from Lat. 46°41'12"N to Lat. 46°47'30"N and Long. 91°58'48"W to Long. 92°05'36"W. Smooth data is needed for Julian Days 189 through 280, 1981.



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

WATER LEVEL NOTE FOR HYDROGRAPHIC SHEET

Processing Division: Atlantic Marine Center: CAM3

Hourly heights are approved for

Water Level Station Used: Duluth, Minnesota (909-9064)

Period: July 8, 1981 - October 7, 1981

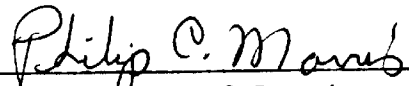
HYDROGRAPHIC SHEET: H-9960

OPR- Z137-WH-81

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955 : 600.0 Feet)

Remarks: Zoning not required. Data from other gages on Lake Superior indicated no unusual water level movement during the survey period.



Chief, Water Level Branch

GEOGRAPHIC NAMES

H-9960

Name on Survey	<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">A ON CHART NO.</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">B ON PREVIOUS SURVEY NO.</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">C ON U.S. QUADRANGLE MAPS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">D FROM LOCAL INFORMATION</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">E ON LOCAL MAPS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">F P.O. GUIDE OR MAP</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">G RAND MCNALLY ATLAS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">H U.S. LIGHT LIST</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">K</div> </div>											
	DULUTH	X										
DULUTH SHIP CANAL	X											2
LAKE SUPERIOR	X											3
MINNESOTA (title)	X											4
MINNESOTA POINT	X											5
SUPERIOR	X											6
SUPERIOR ENTRY	X											7
WISCONSIN (title)	X											8
WISCONSIN POINT	X											9
												10
												11
												12
												13
												14
												15
												16
												17
									Approved:			18
												19
									<i>Charles E. Harrington</i>			20
									Chief Geographer - N/C62x5			21
									6 APRIL 1984			22
												23
												24
												25

HYDROGRAPHIC SURVEY STATISTICS

H-9960

RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT
SMOOTH SHEET		1	SMOOTH OVERLAYS: POS., ARC, EXCESS		3
DESCRIPTIVE REPORT		1	FIELD SHEETS AND OTHER OVERLAYS		4
DESCRIP- TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR- GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS
ACCORDIAN FILES	3				
ENVELOPES					1
VOLUMES					3
CAHIERS				2	4
BOXES					

SHORELINE DATA

SHORELINE MAPS(List):

PHOTOBATHYMETRIC MAPS(List):

NOTES TO THE HYDROGRAPHER(List):

SPECIAL REPORTS(List):

NAUTICAL CHARTS(List): 14975

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS		
	VERIFICATION	EVALUATION	TOTALS
POSITIONS ON SHEET			3875
POSITIONS REVISED	243		
SOUNDINGS REVISED	64		
CONTROL STATIONS REVISED	2		
	TIME - HOURS		
	VERIFICATION	EVALUATION	TOTALS
PRE-PROCESSING EXAMINATION	23		23
VERIFICATION OF CONTROL	16		16
VERIFICATION OF POSITIONS	59		59
VERIFICATION OF SOUNDINGS	210	18	228
VERIFICATION OF JUNCTIONS		39	39
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION/VERIFICATION	10		10
COMPILATION OF SMOOTH SHEET	588		588
COMPARISON WITH PRIOR SURVEYS AND CHARTS		9	9
EVALUATION OF SIDESCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT		33	33
OTHER			
DIGITIZING	8		8
TOTALS	914	99	1013
Pre-processing Examination by R.L. Keene, H.R. Smith, F.L. Saunders	Beginning Date 28 DEC 81	Ending Date 4 JAN 82	
Verification of Field Data by J.B. Wilson, R.L. Keene, H.R. Smith, R.G. Roberson	Time(Hours) 914	Ending Date 24 MAY 84	
Verification Check by H.R. Smith, L.G. Cram, R.R. Hill, Jr., R.G. Roberson	Time(Hours) 116	Ending Date 19 MA 84	
Evaluation and Analysis by R.G. Roberson	Time(Hours) 99	Ending Date 25 MAY 84	
Inspection by	Time(Hours)	Ending Date	

ATLANTIC MARINE CENTER
EVALUATION REPORT

REGISTRY NO.: H-9960

FIELD NO.: WH-10-1-81

Wisconsin--Minnesota, Lake Superior, Offshore--Wisconsin Point to Duluth Ship Canal

SURVEYED: 8 July through 7 October 1981

SCALE: 1:10,000

PROJECT NO.: OPR-Z137-WH-81

SOUNDINGS: Ross Digital
Echo Sounder,
Leadline

CONTROL: Cubic Western DM-54
ARGO (Range/Range),
Del Norte (Range/Range)

Chief of Party.....F. P. Rossi

Surveyed by.....D. K. Howard
.....D. A. Bland
.....E. A. Steigerwald
.....P. J. Ruiz
.....W. T. Dewhurst

Automated Plot by.....Xynetics 1201 Plotter (AMC)

1. INTRODUCTION

- a. No unusual problems were encountered during verification of the survey.
- b. Notes in the Descriptive Report were made in red during verification.

2. CONTROL AND SHORELINE

a. Control is adequately discussed in sections F and G of the Descriptive Report and is supplemented by a control report "Duluth Harbor-Minnesota-Wisconsin, WHITING, 1980."

b. Shoreline on this survey originates with 1:5,000 scale final reviewed, Class I, Photogrammetric Manuscripts TP-01078, TP-01082, and TP-01086 of 1980-82.

3. HYDROGRAPHY

a. Soundings at crossings agree within the limits stated in sections 4.6.1 and 6.3.4.3 of the Hydrographic Manual.

b. The standard depth curves could be adequately delineated. The six (6), twelve (12), and eighteen (18) foot curves were not completely defined on this

survey; however, these curves were completely defined on the inshore junctional surveys. Brown and dashed curves were added to better show the bottom topography.

c. Development of the bottom configuration and determination of least depths is considered adequate except as noted in section 7.a. of this Evaluation Report.

4. CONDITION OF SURVEY

The smooth sheet and accompanying overlays, hydrographic records and reports are adequate and conform to the requirements of the Hydrographic Manual with the following exceptions:

- a. NOAA Forms 76-40 were not properly completed. A separate form should be filled out for objects to be revised, charted, or deleted. The last landmark found on page 64 of the Descriptive Report is to be deleted. The top of the page is marked to be charted. Page 68 of the Descriptive Report is also completed in a similar manner.
 - b. The dive report for Presurvey Review Item #4 failed to note the extent of the area covered by the circular search. The Presurvey Review required a minimum 200 meter radius area be searched. Considering the information provided in the dive report of visibility of one (1) foot on the bottom, it is seriously doubted that the 200 meter requirement could have been accomplished with any degree of confidence. A bottom chain drag or small boat wire drag would have been a more appropriate search technique for this area. (See section 7.a.1 of this report.)
 - c. The spacing between soundings exceeded the maximum distance of six (6) millimeters found in section 1.4.6 of the Hydrographic Manual for a majority of the survey. The requirement was only slightly exceeded, less than one (1) millimeter, and does not seriously degrade the accuracy of the survey.
 - d. The survey data was not submitted within six (6) weeks after completion of the survey as required by section 6.13 of the Project Instructions. The survey arrived at the Marine Center three (3) weeks late.
 - e. Velocity tables submitted by the field unit did not cover the entire range of depth data acquired. Velocity tables submitted were extended by personnel of the Verification Section. Velocity tables submitted never exceeded sixty-five (65) feet; tables were extended to depths of 115 feet.
 - f. Section 6.7.2 of the Project Instructions states that the hydrographer take velocity measurements, "as frequently as once a week or even more frequently." This minimal requirement was not met. The hydrographer took only one (1) velocity measurement per trip.
 - g. Section 6.10.2 of the Project Instructions states "Any discrepancies... must be resolved or explained in the Descriptive Report..." The tabulation of soundings found on page 5 of the Descriptive Report does not
-

resolve or explain the disparity between charted and survey depths, nor does it make charting recommendations. The tabulation found on pages 5A and 5B does address additional items and does provide suggested disposition of these items.

- h. A copy of the local dive chart mentioned as a source of information on pages 5A and 5B of the Descriptive Report should have been included with the survey data.

5. JUNCTIONS

H-9953 (1981) to the northwest
H-9979 (1981) to the east
H-10023 (1982) to the west
H-10024 (1981) to the north
H-10028 (1982) to the southwest

Adequate junctions were effected with H-9953 (1981), H-9979 (1981), H-10023 (1982), and H-10024 (1982). The junction between H-10028 (1982) and the present survey will be discussed in the Evaluation Report for H-10028 (1982).

6. COMPARISON WITH PRIOR SURVEYS

LS-251 (1861) 1:16,000
LS-256 (1861-68) 1:200,000
LS-257 (1861) 1:60,000
LS-1824 (1943) 1:15,000
LS-1829 (1944) 1:15,000
LS-1994 (1956) 1:120,000

The above prior surveys cover the present survey area in its entirety.

Since prior surveys LS-251 (1861), LS-256 (1861-68), and LS-257 (1861) have no grid, a meaningful comparison could not be made with the present survey. These prior surveys serve only as historical documents of the area.

LS-1824 (1943) agrees well with the present survey. The present survey is generally four (4) feet shoaler to three (3) feet deeper than the prior survey. One (1) sounding and three (3) obstructions were brought forward to the present survey smooth sheet.

LS-1829 (1944) is a composite of five (5) large scale insets of various areas in Lakes Superior and Huron. The Duluth, Minnesota inset covers only the area surrounding the Duluth Ship Canal. The present survey ranges from excellent agreement to one (1) to three (3) feet shoaler than the prior survey.

LS-1994 (1956) is in good agreement with the present survey. Present survey depths are two (2) to three (3) feet deeper than prior survey depths.

Except as noted above, the present survey is adequate to supersede the prior surveys in the common area.

7. COMPARISON WITH CHART 14975 (26th Edition, April 26, 1980)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources and is generally one (1) to fifteen (15) feet shoaler than the present survey. Attention is directed to the following:

1) Presurvey Review Item #4, three (3) thirty-one (31) foot soundings, only two (2) of which are charted, in the vicinity of Latitude $46^{\circ}23'24''N$, Longitude $92^{\circ}00'08''W$, originate with survey LS-1824 (1943). The hydrographer's echo sounder search and dive investigation were not extensive enough to locate the least depths on this shoal. The two (2) thirty-one (31) foot depths should remain as charted and the notation "Obstr" placed beside each one (1). (See section 4.b of this report.)

2) A 42-ft sounding charted from LS-1824 (1943) in Latitude $46^{\circ}43'48''N$, Longitude $91^{\circ}59'48''W$, is nine (9) to eleven (11) feet shoaler than the surrounding hydrography. The area investigated was not extensive enough to adequately cover the sounding in question. The hydrographer had reduced line spacing in the area but failed to extend the sounding lines far enough to the east to provide complete coverage of the charted 42-ft sounding. This sounding should be retained as charted.

3) Three (3) soundings 47-ft, 47-ft, and 49-ft, charted in a line from Latitude $46^{\circ}47'03''N$, Longitude $92^{\circ}03'45''W$, to Latitude $46^{\circ}47'23''N$, Longitude $92^{\circ}03'20''W$, originate with a not readily ascertainable source. The present survey found a shoal which may represent a terminal moraine, with least depths of fifty-one (51) feet in this area. The hydrographer's development of this area was not extensive enough to locate the least depth on this shoal and these soundings should remain as charted.

4) The 21-ft sounding charted in Latitude $46^{\circ}42'15''N$, Longitude $91^{\circ}59'15''W$, originates with a not readily ascertainable source. The hydrographer's fifty (50) meter line spacing found a thirty-one (31) foot least depth in Latitude $46^{\circ}42'13.05''N$, Longitude $91^{\circ}59'23.00''W$. The present survey shows no indication of an extensive shoal in the area. The source of this 21-ft sounding should be researched, and the final charting disposition is deferred to the chart compiler. *Expunge the charted 21' sdg, 10 meter development of this area on #1002 (1982) disapproved the 21' charted sdg, 795*

Additional charting recommendations are found in section L of the Descriptive Report.

The present survey is adequate to supersede the charted hydrography except as noted above.

b. Aids to Navigation

There are sixteen (16) fixed aids to navigation on the survey smooth sheet. These aids appear adequate to serve their intended purpose.

8. COMPLIANCE WITH PROJECT INSTRUCTIONS

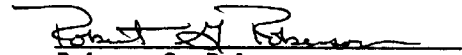
This survey adequately complies with the Project Instructions except as noted in section 4 of this report.

9. ADDITIONAL FIELD WORK

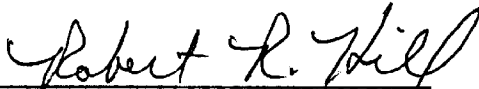
This is an adequate basic survey; additional field work, wire drag/side scan sonar, should be considered after a thorough examination is made of the "dive chart" mentioned in the Descriptive Report and of the specific recommendations made in the Descriptive Report.



Harry R. Smith
Senior Cartographic Technician
Verification of Field Data



Robert G. Roberson
Senior Cartographer
Evaluation and Analysis



Robert R. Hill, Jr.
Senior Cartographic Technician
Verification Check

INSPECTION REPORT
H-9960

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the magnetic tape record for this survey. Final control, position, and sounding printouts of the survey have been made. The survey complies with National Ocean Service requirements except as noted in the Evaluation Report. The survey records comply with NOS requirements except where noted in the Evaluation Report.

Inspected

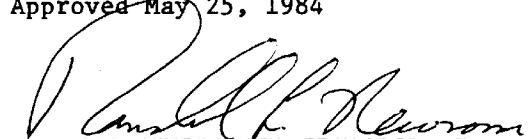


Charles D. Meador
Chief, Evaluation and Analysis Group



David B. MacFarland, Jr., LCDR, NOAA
Chief, Hydrographic Surveys Branch

Approved May 25, 1984



Wesley V. Hull, RADM, NOAA *FCH*
Director, Atlantic Marine Center

