

10024

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. PE-20-1-82
Office No. H-10024

LOCALITY
State Minnesota
General Locality Lake Superior
Locality Duluth to Stony Point

19 82

CHIEF OF PARTY

LIBRARY & ARCHIVES

DATE October 5, 1984

☆U.S. GOV. PRINTING OFFICE: 1980-766-230

10024
10024
10024

10966 } To Sign off
10961 } sec "Record of Application"
10975 }
10500 }

TABLE OF CONTENTS

HYDROGRAPHIC TITLE SHEET

SMOOTH SHEET LAYOUT

A. PROJECT	1
B. AREA SURVEYED	1
C. SOUNDING VESSEL	1
D. SOUNDING EQUIPMENT AND CORRECTIONS TO ECHO SOUNDINGS	2
E. HYDROGRAPHIC SHEETS	5
F. CONTROL STATIONS	5
G. HYDROGRAPHIC POSITION CONTROL	6
H. SHORELINE	11
I. CROSSLINES	11
J. JUNCTIONS	11
K. COMPARISON WITH PRIOR SURVEYS	12
L. COMPARISON WITH THE CHART	15
M. ADEQUACY OF SURVEY	19
N. AIDS TO NAVIGATION	19
O. STATISTICS	20
P. MISCELLANEOUS	20
Q. RECOMMENDATIONS	21
R. AUTOMATED DATA PROCESSING	21
S. REFERENCE TO REPORTS	22
APPENDICES	23
APPROVAL SHEET	34

HYDROGRAPHIC TITLE SHEET

H-10024

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.

PE-20-1-82

State MINNESOTA

General locality LAKE SUPERIOR

Locality DULUTH TO STONY POINT

Scale 1:20,000 Date of survey June 16 - September 30, 1982

Instructions dated March 31, 1982 Project No. OPR-7137-PE-82

Vessel NOAA Ship PEIRCE S328 (VESNO 2830) and Launch (No. 2837)

Chief of party CDR D.E. NORTRUP, CDR W.S. SIMMONS, COMMANDING OFFICERS

Surveyed by A.A. ARMSTRONG, G.E. LEIGH, N.G. MILLET, R. MANDZI, M. MOZGALA, M.P. CONRICOTE,
R.B. HARRIS, S.I. ANDREEVA

Soundings taken by echo sounder, hand lead, pole ROSS 5000 FINELINE

Graphic record scaled by NGM, RM, MM, SIA, IPR, WRM, GS, RW

Graphic record checked by MM, SIA

Protracted by _____ Automated plot by XYNETICS 1201 Plotter
(AMC)

Verification by _____

Soundings in fathoms feet at MLW - MLW Low Water Datum (IGLD 1955: 600.0 FT)

REMARKS: ALL TIMES RECORDED IN THIS SURVEY ARE COORDINATED UNIVERSAL TIME

ALL SOUNDINGS NEED TO BE REDUCED TO THE LOW WATER DATUM OF 600 FEET

FOR LAKE SUPERIOR NOTE: SMOOTH SHEET DEPTHS ARE
APPROPRIATELY REDUCED. DW N/C 24X1

Notes in the Descriptive Report were made in red during office processing of
the survey.

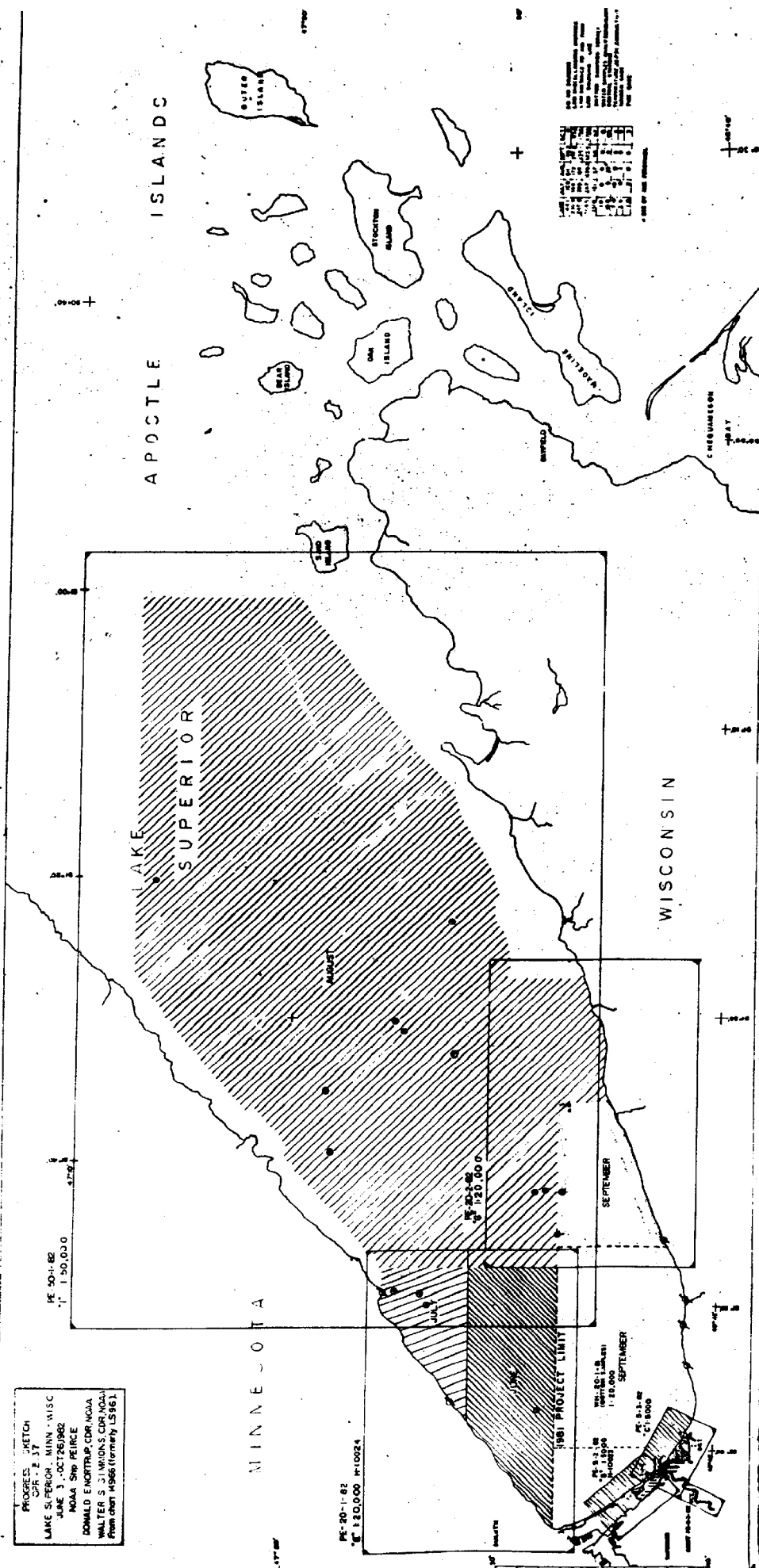
STANDARDS CK'D 10-10-84

C. LOY

ANDIS - 3/7/85 mjt

SURF - 3/7/85 mjt

SMOOTH SHEET LAYOUT



Descriptive Report to Accompany

Hydrographic Survey H-10024

Field No. PE 20-1-82

Walter S. Simmons, Comdg.

A. PROJECT

This basic hydrographic survey was conducted in accordance with Hydrographic Project Instructions OPR-Z137-PE-82, Lake Superior, dated March 31, 1982.

Two changes to the Project Instructions were made, dated April 21, 1982 and June 16, 1982, respectively. A letter dated June 4, 1982 listed recommended hydrographic survey titles.

B. AREA SURVEYED

The area surveyed is in western Lake Superior, along the north shore, from Duluth to Stony Point. The area is triangular in shape, limited by the shoreline, the meridian at ^{91° 48' 12"}~~92° 05' 24"~~ W and the parallel at 46° 47' 30" N. The inclusive dates of the survey were June 16, 1982 (JD 167) to September 30, 1982 (JD 273).

C. SOUNDING VESSEL

Soundings and most of the bottom samples were obtained by a Jensen Type I aluminum launch, Hull No. 1017, VESNO 2837. The remainder of the bottom samples, POS #2218-2223, were taken by NOAA Ship PEIRCE, VESNO 2830.

D. SOUNDING EQUIPMENT AND CORRECTIONS TO ECHO SOUNDINGS

Two Ross 5000 Fineline ^{echo sounders} ~~fathometers~~ were used by Launch 1017 to obtain sounding data. The first, S/N 1079, was used from JD 167-JD 192 and the second, S/N 1087, from JD 193-JD 273. Soundings were obtained by the ship using another Ross 5000 ^{echo sounder} ~~fathometer~~, S/N 1078 on JD 238. Soundings obtained by the ship were taken when each bottom sample was taken.

Bar checks were taken twice daily, weather conditions permitting. The data was grouped to correspond with the CTD cast grouping, averaged, and graphs were made and compared with graphs plotted from the XBT, CTD and Nansen cast data. All graphs compared favorably and were considered to be interchangeable. The displacement of the bar check curve from the oceanographic curve was small, suggesting negligible residual instrument error. CTD cast data was used to determine velocity correctors for JD 167-206 and XBT data was used on JD 273. The CTD instrument used was a MARTEK Model 167, S/N 177. It was calibrated in February, 1982. The calibration report is included in the supplemental data folder. The following table lists the dates and positions of the stations observed for velocity corrections.

<u>JULIAN DAY</u>	<u>POSITION</u>	<u>TYPE OF CAST</u>
169	46°53'54"N 91°49'18"W	NANSEN #2 * MARTEK #2
169	46°53'06"N 91°48'48"W	XBT #1*
174	46°49'00"N 92°00'54"W	MARTEK #3

176	46°51'12"N 91°55'54"W	MARTEK #4
178	46°48'42"N 91°52'48"W	MARTEKS #5
180	46°51'24"N 91°50'00"W	MARTEK #6
181	46°51'12"N 91°52'06"W	MARTEK #7
182	46°51'36"N 91°49'00"W	MARTEK #8
188	46°51'36"N 91°51'24"W	MARTEK #9
189	46°51'30"N 91°52'30"W	MARTEK #10
192	46°53'12"N 91°48'30"W	MARTEK #11
194	46°53'00"N 91°52'42"W	MARTEK #12
200	46°53'12"N 91°52'30"W	MARTEK #13
202	46°52'54"N 91°51'54"W	MARTEK #14
204	46°54'00"N 91°49'24"W	MARTEK #15
206	46°52'54"N 91°52'48"W	MARTEK #16
273	46°55'00"N 91°49'00"W	XBT #10

* Not used for velocity correction computations.

Velocity tables were derived in the following manner:

Oceanographic cast data was processed through RK 530 generating a table of layer depths and their corresponding velocity correctors. Casts were grouped

and velocity correctors mean in such a way that no one cast's velocity correctors could deviate from the mean by more than the allowable error range of $\pm .25\%$ for each depth (Sec. 4.9.5 of the Hydrographic Manual). Graphs of mean velocity correctors versus corresponding depths were plotted, and the correctors scaled off in the following increments:

<u>Depth (feet)</u>	<u>Scaled (feet)</u>
0-120	0.2
120-660	1.0

The following table shows the grouping of the casts.

<u>Julian Day</u>	<u>CTD Cast #</u>	<u>Covers Dates</u>	<u>Velocity Table #</u>
167-168	#2	June 16-17	#1
172-182	#3-8	June 21 - July 1	#2
187-188	#9	July 6-7	#3
189	#10	July 8	#4
192	#11	July 11	#5
193-204	#12-15	July 12-23	#6
206	#16	July 25	#7
273	XBT Cast #10	Sept 30	#8

Draft and settlement and squat correctors were derived for the launch. The velocity corrector graphs, tape listings and sounding correction abstracts for the above operations are in Appendix D. Substantiating field observations, computations, graphs and reports are included in the supplemental data folder.

E. HYDROGRAPHIC SHEETS

The field sheets for this survey were drawn onboard PEIRCE. They were prepared by the Digital PDP 8/E Computer and Complot System utilizing Program RK201.

The survey area was divided into two plotter sheets at a 1:20,000 scale with a skew of 0, 20, 54 (North and South) containing the mainscheme hydrography, and two overlays (North and South) containing the crosslines, detached positions and bottom samples. In addition to the field sheets, four developments were plotted on large scale sheets. A listing by sheet follows:

<u>SHEET</u>	<u>SCALE</u>	<u>SKEW</u>	<u>ORIGIN</u>
M/S North (N)	1:20,000	0,20,54	46°51'06"N 92°06'12"W
M/S South (S)	1:20,000	0,20,54	46°47'03"N 92°06'12"W
DEV 1 W PWI (S)	1:1,000	90,21,24	46°49'50"N 91°59'56"W
DEV 2 E PWI (S)	1:2,000	90,18,25	46°51'16"N 91°57'10"W
DEV 3 FISHERIES (N)	1:2,000	310,21,34	46°53'52"N 91°54'10"W
DEV 4 SHOAL (S)	1:10,000	0,12,28	46°47'00"N 92°05'00"W

All appropriate data and records have been forwarded to the Atlantic Marine Center for final verification and smooth plot.

F. CONTROL STATIONS

Stations ANDERSON RMI (#113) and MN PT ARGO (#114) were used as electronic control sites. The other stations listed below were used for system calibrations.

The surveying method used to establish stations 4, 6, and 8 was Third Order Intersection performed by USCGS. Stations 44 and 45 were located by Third Order Traverse by PEIRCE personnel and the rest by AMC personnel. All stations are based on the North American Datum (NAD) 1927.

<u>Signal</u>	<u>Name</u>	<u>Year Established</u>
4	DULUTH CENTRAL HS CUPOLA SPIRE	1905
6	DULUTH PEAVEY ELEVATOR CO STK	1921
8	DULUTH POL RAD STA KWA 939 MST	1952
44	DULUTH HARBOR N PIER LT	1982
45	TALMADGE ROCK (Hydrographic signal, used for calibration, not Third Order, not described)	1982 - located using sextant angles
104	PICNIC AZ MK	1981
105	PICNIC	1981
106	LAKESWOOD	1981
113	ANDERSON RM I	1981
114	MN PT ARGO	1980

A copy of the survey signal list may be found in Appendix F.

G. HYDROGRAPHIC POSITION CONTROL

Range/^{Range}~~range~~ control was used for this survey.

The positional control system used was the DM-54 Automatic Ranging Grid Overlay (ARGO) transmitting on 1646.70kHz. Time slots used were 03/07/00/00 with a smoothing code of 02 and a false frequency of 1647.22 kHz (see Appendix G). Fixed shore station AGC values and antenna range tune values were recorded

frequently while running hydrography and are included in the supplemental data to this report.

The electronic equipment used for this survey is as follows:

<u>VESNO 2837</u>	<u>SERIAL NUMBER</u>	<u>JULIAN DAY</u>
RPU	R 0379117	167
	R 0379115	168-181
	R 047854	182-211
	R 0379107	273
CDU	C 047822	167-168
	C 037944	172-179 AM
	C 047822	179 PM-181
	C 047824	182-273
ALU	A 0379122	167-175
	A 0980310	176-273
Power Supply	V 0478100	167-181
	V 0379124	182-273
Thermal Printer	2126A06969	167-273
Gould Strip Chart Recorder	S 097959	167-168
	S 097944	172-273

Fathometer	1078	167
	1079	168-192
	1087	193-273

<u>VESNO 2830</u>	<u>SERIAL NUMBER</u>	<u>JULIAN DAY</u>
RPU	R 047843	238
CDU	C 047823	238
ALU	A 0379123	238
Power Supply	V 038167	238
Thermal Printer	A 02842	238
Cubic Western Strip Chart Recorder	S 097959160	238
Fathometer	1078	238

<u>SHORE STATIONS</u>	<u>SERIAL NUMBER</u>	<u>JULIAN DAY</u>
-----------------------	----------------------	-------------------

ANDERSON RM I

RPU	R 047851	167-209
	R 0379115	210-251
	R 0379117	252-264
	R 0379119	265-273
ALU	A 0379109	167-273
Power Supply	V 0478106	167-209
	V 0379110	210-224
	V 0478106	225-273

MN PT ARGO

RPU	R 047864	167-273
ALU	A 0379120	167-273
Power Supply	V 0379127	167-272
	H 46339	273

The ARGO equipment was calibrated at the beginning and end of each day using the three point sextant fix with check angle method. On-line partial correctors were based on the opening calibration and entered into the on-line program RK112 via the "NAV-CAL" feature. The average of the opening and closing partial correctors was used as the final corrector value for hydrography completed between the times of each opening and closing calibration.

All calibration data for this survey was adequate, the largest overall spread between partial correctors being 0.22 lanes, and no problems were experienced which might have degraded the expected position accuracy.

No closing calibrations were taken on JD 172 (positions 078-138) and JD 181 (positions 1037-1138) because of breakdowns of the CDU units in the launch. The hydrography run to that point consisted of a shoreline and crossline on JD 172 and M/S lines and Development #2 on JD 181. Careful examination of the strip chart record revealed no indication of loss of lane count on either day. When hydrography resumed on JD 173, the crossline was rerun and the soundings were in excellent agreement, again suggesting no lane count loss.

On JD 181 the clock in the CDU stopped, the result of a bad interrupt card in the unit. Careful examination was made of the data collected up to that point. No positional shifts or depth discontinuities were found and the data was retained.

On days that it rained and/or there were thunder showers the strip chart recorded minor edit marks periodically. Sometimes the digital display unit would flash off and on, also generating edit marks on the strip chart record. However, the calibrations showed no lane losses and the partial correctors compared well with the morning observations.

Early in the season some difficulty was encountered in keeping the launch "on-line" while running hydrography in the westernmost corner of the survey, the limits being $92^{\circ} 04' 24''$ W westward to the sheet limit and $46^{\circ} 47' 30''$ N northward to the shore. The steering needle oscillated off course by as much as 15m. After several unsuccessful attempts at staying "on-line", the effort was discontinued and no data was collected in that area at that time. Two weeks later hydrography was successfully accomplished in that area, and no such problems were encountered. The weather was similar both times, partly sunny and cool with light winds. It is not clear whether the problem was an inexperienced coxswain or unusual electrical or magnetic disturbances affecting the Argo System.

A copy of the Abstract of Corrections to Electronic Position Control and a note on false frequency computation are contained in Appendix G.

H. SHORELINE

The shoreline was obtained from enlargements of U.S. Geological Survey Quadrangle maps photo revised by NOS using 1981 NHAP photographs. A 0.1nm northward shift in the shoreline was noted between the quad maps and the enlargement of NOS Chart 14966, 18th edition, December 22, 1979, the latter shoreline being northward. *TP-41478 (1:50000) used for a small area west of longitude 92°45'W.*

Visual comparisons were made between the shoreline plotted from the quad maps and the actual shoreline. Also, hydrographic data was carefully studied to see how it plotted relative to the shoreline. It was concluded from both types of observations that no discrepancies exist between the actual and plotted shorelines.

I. CROSSLINES

Sixty miles of crosslines were run. This constitutes 12 percent of the sounding line mileage. Crossline soundings and the mainscheme hydrography showed excellent agreement, meeting the criterion for comparison as stated in Sec. 1.1.2 Part B. II.1. of the Hydrographic Manual.

J. JUNCTIONS

This survey junctions with H-9979 (WH-20-1-81), H-9960 (WH-10-1-81) and H-9958 (WH-5-1-81) to the south, and H-10036 (PE-50-1-82) to the east.

Overall the depth agreement at junctions was excellent, meeting the criterion for comparison as stated in Sec. 1.1.2 Part B. 11.1. of the Hydrographic Manual, with a continuity of depth ^{curves} ~~contours~~ being observed in all cases. Slight differences in values may be attributed to different equipment being used, variations in lake level and variation in positional control. Adjustments to soundings and contours are not required.

K. COMPARISON WITH PRIOR SURVEYS

There were no ^{Pre} Prior Survey Review items within the limits of this survey.

Comparisons were made with the following prior surveys:

<u>Registry No.</u>	<u>Scale</u>	<u>Year Surveyed</u>
LS-253	1:16,000	1861
LS-254	1:16,000	1861
LS-256	1:200,000	1861, 1868
LS-257	1:60,000	1861
LS-1824	1:15,000	1943
LS-1994	1:120,000	1956

The accuracy of the comparisons was severely limited by the distortion of the photo-copied prior surveys, the lack of positional grids on some of them, and by the distortion of the magnification process used to match surveys to the same scale. - *concur?*

The first four prior surveys listed above lacked any type of a grid, indicating only the direction of true north. LS-253 and LS-254 were enlarged and LS-257 reduced, to 1:20,000 scale using a Kargal Reflecting Projector, and the shorelines aligned for the best possible fit to facilitate the comparison. With the following exceptions the sounding data from all four surveys agreed with the depth ^{curves} ~~contours~~ of this survey and met the criterion for comparison as stated in section 1.1.2 Part B.II.1 of the Hydrographic Manual.

Prior Survey LS-253

<u>Prior Sounding</u>	<u>Charted Position</u>	<u>Contemporary Sounding</u>	<u>Position No.</u>
90	46° 48' 30"N 92° 02' 48"W	76 77	259 ⁺¹ 46°-48'-33.07"N 92°-02'-44.83"W
95	46° 48' 33"N 92° 02' 30"W	81 80	270 ⁺⁴ 46°-48'-31.92"N 92°-02'-28.35"W
95	46° 48' 36"N 92° 02' 24"W	83 82	279 ⁺¹ 46°-48'-38.04"N 92°-02'-19.52"W
60	46° 48' 54"N 92° 02' 21"W	79 78	279 ⁺⁶ 46°-48'-54.51"N 92°-02'-19.94"W
108	46° 49' 04"N 92° 01' 51"W	87 86	294 ⁺⁵ 46°-49'-02.46"N 92°-01'-54.36"W
42	46° 49' 21"N 92° 01' 39"W	61 60	306 ⁺³ 46°-49'-19.76"N 92°-01'-37.39"W
48	46° 49' 38"N 92° 01' 06"W	63	335 ⁺⁵ 46°-49'-37.76"N 92°-01'-03.96"W
45	46° 49' 41"N 92° 00' 55"W	63 62	343 ⁺⁵ 46°-49'-40.42"N 92°-00'-55.93"W
120	46° 50' 15"N 91° 59' 30"W	109 108	441 ⁺⁵ 46°-50'-13.63"N 91°-59'-30.63"W
24	46° 50' 54"N 91° 58' 48"W	45 44	1061 ⁺¹ 46°-50'-54.00"N 91°-58'-48.19"W

Prior Survey LS-254

<u>Prior Sounding</u>	<u>Position</u>	<u>Contemporary Sounding</u>	<u>Position No.</u>
72	46° 55' 04"N 91° 50' 30"W	65 64	1731 ⁺⁵ 46° 55' - 44.77"N 91° 50' - 29.44"W

Prior Survey LS-257*

<u>Prior Sounding</u>	<u>Position</u>	<u>Contemporary Sounding</u>	<u>Position No.</u>
115	46° 51' 03"N 91° 52' 33"W	207 242	2262 ⁺⁵ 46° 51' - 41.95"N 91° 52' - 44.95"W 39.43
121	46° 52' 03"N 91° 52' 36"W	257 254	2303 ⁺³ 46° 52' - 44.93"N 91° 52' - 37.36"W
121	46° 52' 51"N 91° 52' 36"W	255 248	2289 ⁺⁴ 46° 52' - 52.64"N 91° 52' - 44.91"W

* See Sec. L for the description of the investigation to resolve the discrepancy in these soundings.

LS-256 is a compilation of several surveys, including LS-257, and contains no new information relevant to this survey.

Both LS-1824 and LS-1994 contained grids and were simple to compare. LS-1824 showed 100% agreement in soundings. LS-1994 matched the depth ^{curves} contours well, and only the following few soundings exceeded the criterion for comparison.

PRIOR SURVEY LS-1994

<u>Prior Sounding</u>	<u>Position</u>	<u>Contemporary Sounding</u>	<u>Position No.</u>
272	46° 51' 39"N 91° 50' 48"W	251 254	908 46° 51' - 37.32"N 91° 50' - 44.89"W

55	46° 47' 48"N 92° 04' 18"W	616φ	210+3 46°-47'-47.33"N 92°-04'-17.98"W
123	46° 52' 51"N 91° 54' 09"W	145 144	1594+5 46°-52'-51.62"N 91°-54'-08.47"W
233	46° 52' 36"N 91° 52' 09"W	284 282	2115+1 46°-52'-42.67"N 91°-52'-13.91"W
205	46° 54' 04"N 91° 50' 45"W	281 249	1713+5 46°-54'-44.83"N 91°-50'-37.17"W
202	46° 54' 27"N 91° 50' 03"W	219 217	1744+6 46°-54'-25.23"N 91°-50'-02.93"W
308	46° 54' 45"N 91° 48' 36"W	356 4φ1	2121+6 46°-53'-44.76"N 91°-48'-54.31"W
408	46° 54' 27"N 91° 48' 21"W	427 424	2127 46°-54'-24.61"N 91°-48'-19.06"W

It is recommended that this survey's hydrographic data supersede the data from the above-mentioned prior surveys.

L. COMPARISON WITH THE CHART

A comparison was made with NOS Chart 14966, 18th edition, December 22, 1979, 1:120,000 scale. Seventy-seven percent of the charted soundings (59) met the suggested criterion for comparison as stated in Section 1.1.2 Part B.II.1 of the Hydrographic Manual. The rest of the soundings (18) were shoaler on the chart and randomly distributed throughout the survey area. No dangers to navigation were encountered.

The following table lists the soundings that were radically different and the suggested disposition of same.

<u>Charted Depth</u>	<u>Position</u>	<u>Surveyed Depth/Pos. No.</u>	<u>Developmental Scheme</u>	<u>JD #</u> /POS. No.	<u>Source</u>	<u>Recommendation</u>
✓ 121	46°52'51"N 91°52'36"W	²⁵¹ 255 /2289+4	5E-W lines at 100m spacing	273/2289-2302	LS-257	Delete charted sounding; replace w/surveyed sounding concur
✓ 121	46°52'03"N 91°52'36"W	²⁵³ 257 /2303+3	4E-W lines at 100m spacing	273/2302-2311	²⁵⁷ LS-275	Delete charted sounding; replace w/surveyed sounding concur
✓ 91	46°52'03"N 91°54'36"W	¹⁹⁵ 196 /2283+5	7E-W lines at 100m spacing 2N-S 180m	273/2265-2288 202/2006-2011	Not Found	Delete charted sounding; replace w/surveyed sounding concur
✓ 127	46°51'55"N 91°52'03"N ²⁴⁵ 207 /2262+5	¹⁸⁵ 188 /2275+4	7E-W lines at 100m spacing	273/2265-2288	Not Found	Delete charted sounding; replace w/surveyed sounding concur
✓ 115	46°51'03"N 91°52'33"W	²⁴⁵ 207 /2262+5	4E-W lines at 100m spacing	273/2253-2264	LS-257	Delete charted sounding; replace w/surveyed sounding concur
✓ 31	46°49'21"N 92°01'36"W	⁵⁶ 52 /2235+5	3 lines parallel to shoreline at 90m spacing	273/2233-2252	Not Found	Delete charted sounding; replace w/surveyed sounding concur
✓ 31	46°48'51"N 92°02'36"W	⁵⁶ 52 /2245+4	3 lines parallel to shoreline at 90m spacing	273/2233-2252	Not Found	Delete charted sounding; replace w/surveyed sounding concur

Four developments were conducted during this survey. The descriptions and dispositions of same are as follow:

<u>Development</u>	<u>Lat/Long</u>	<u>JD/Pos. No's</u>	<u>Least Depth/Pos. No.</u>	<u>Remarks</u>
West PWI (1)	46°50'06"N 92°00'02"W	201/1914-1991	⁵¹ 52 feet/1991	Development to confirm position and least depth over crib at the end of the EPA PWI. Recommend remain as charted. concur
East PWI (2)	46°51'33"N 91°57'23"W	181/1083-1138 201/1992-2003 204/2098-2107	⁴⁶ 51 feet/ 1081 ^{±1} 2498 ⁺¹	Development to confirm position and least depth over crib at the end of the City of Duluth PWI. Recommend supersede charted sounding. See also section 7.2 of the Evaluation Report
Fisheries WI (3)	46°53'49"N 91°53'13"W	200/1840-1913 206/2193-2208	⁴⁶ 48 feet/1881 ⁺¹	Development to determine position and least depth over French River Hatchery intake pipe. Recommend include on chart. See also section 7.2 of the Evaluation Report
Shoal (4)	46°47'50"N 92°03'54"W	187/1218-1264 273/2218-2232	⁴⁸ 49/1240 ⁺²	Development to delineate shoal area and determine least depth. Recommend supersede chart. concur

Diver investigations were not done on these developments due to a shortage of divers. A diver investigation was conducted on what appeared to be a wreck configuration on the fathogram. The investigation proved it to be a rock outcrop. A Dive Report containing all pertinent information is included in Appendix J. Pipe layout diagrams for Developments 1 and 3 are included in the supplemental data folder.

M. ADEQUACY OF SURVEY

This survey is considered complete and adequate to supersede all charted information.

N. AIDS TO NAVIGATION

There were no aids to navigation within the limits of this survey. Of the three charted landmarks within the survey limits two were located by 3rd Order Class I Intersection method and are listed on NOAA Form 76-40 in Appendix I.

The location of the third, DULUTH WOODLAND EAST MUN ~~WATER~~ TANK, 1952, was verified by the same method.

Two orange cylindrical buoys with three horizontal white stripes, position numbers 1254 and 2217 were encountered. They are located at $46^{\circ} 48' 04''$ N, $92^{\circ} 03' 52''$ W and $46^{\circ} 48' 45''$ N, $92^{\circ} 02' 50''$ W, respectively. These are racing buoys seasonally set in May and removed in November by the Keel Club of Duluth, Minnesota.

This information was obtained from the LAKEHEAD BOAT BASIN MARINA, Duluth, Minnesota.

O. STATISTICS

<u>Category</u>	<u>VESNO</u>		<u>Total</u>
	<u>2837</u>	<u>2830</u>	
Total # of Positions	2311	6	2317
Nautical Miles of Sounding Lines	539.4	0	539.4
Square Miles of Hydrography	49.6	0	49.6
	<u>VESNO</u>		<u>Total</u>
	<u>2837</u>	<u>2830</u>	
<u>Velocity Casts</u>			
Nansen Casts	0	2	
CTD Casts	15	1	
XBT Casts	1	0	
Water Level Stations	---	---	5
Bottom Samples	65	6	
Current Stations	0	0	
Magnetic Stations	---	---	2

P. MISCELLANEOUS

Seventy-one bottom samples were taken during this survey. A copy of the Oceanographic Log Sheet "M" is contained in Appendix H of this report. The bottom samples were submitted to Professor Thomas Johnson, Department of Geology, University of Minnesota, Duluth.

Q. RECOMMENDATIONS

This survey is considered adequate for charting purposes. No further field work is considered necessary.

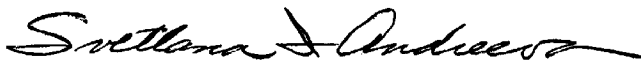
R. AUTOMATED DATA PROCESSING

<u>Program No.</u>	<u>Description</u>	<u>Version Date</u>
RK 112	Hyperbolic, R/R Hydroplot	8-4-81
RK 201	Grid, Signal, and Lattice Plot	4-18-75
RK 211	Range-Range Non-Real Time Plot	2-2-81
RK 300	Utility Computations	10-21-80
RK 330	Reformat and Data Check	5-4-76
PM 360	Electronic Corrector Abstract	2-2-76
RK 530	Layer Corrections for Velocity	5-10-76
RK 561	H/R Geodetic Calibration	2-19-75
AM 602	Elinore--Line Oriented Editor	5-20-75
RK 612	Line Printer List	3-22-78

S. REFERENCE TO REPORTS

LORAN C Comparison, Horizontal Control, Magnetism and Coast Pilot reports were transmitted to the Atlantic Marine Center at the end of the 1982 field season.

Respectfully submitted,



SVETLANA I. ANDREEVA

ENS, NOAA

APPENDICES

- * A. ELECTRONIC CONTROL PARAMETERS
- * B. FIELD WATER LEVEL NOTE
- * C. GEOGRAPHIC NAMES LIST (FIELD)
- * D. ABSTRACT OF CORRECTIONS TO ECHO SOUNDINGS
- * E. ABSTRACT OF CORRECTIONS TO ELECTRONIC POSITION CONTROL
- F. LIST OF STATIONS
- * G. ABSTRACT OF POSITIONS
- * H. BOTTOM SAMPLES
- I. LANDMARKS FOR CHARTS
- J. DIVE REPORT
- K. APPROVAL SHEET

* Removed from the Descriptive Report and filed with the original survey records.

APPROVAL SHEET

H-10024

Field work on this survey was conducted under my supervision with frequent personal examination of the field sheet and records. This report and the final field sheet have been reviewed and found to represent a complete and adequate survey.

No additional field work is required. This survey should supersede all prior surveys and charted information in the common areas.

Until such time as a new chart is constructed, the geographic position of any information from this survey must be converted to chart datum before application. Horizontal datum for this survey is NAD 1927.

A handwritten signature in dark ink, appearing to read 'W. S. Simmons', with a long horizontal flourish extending to the right.

Walter S. Simmons
Commander, NOAA
Commanding Officer
NOAA Ship PEIRCE

SIGNAL LIST

OPR Z137-PE-82

H-10024 PE-20-1-82

LAKE SUPERIOR

004 0	46 47	20600	092 05	59841	139 0000	000000	DULUTH ^{CENTRAL AS CUPOLA, 1905} ENGINE MEMORIAL (NGS) TOWER, 1952
006 0	46 45	38602	092 05	55842	139 0000	000000	DULUTH PEAVEY ELEVATOR (NGS) CO STK, 1921
008 0	46 45	41758	092 04	46747	139 0000	000000	DULUTH POL RAD STA KWA (NGS) 939 MST, 1952
044 5	46 46	51551	092 05	17035	139 0000	000000	DULUTH HARBOR N PIER LT (PE) 1982 field position
045 0	46 52	54873	091 55	04999	²⁴³ 139 0015	000000	TALMADGE ROCK (PE)
104 0	46 52	11356	091 56	44877	139 0000	000000	PICNIC AZ MK, 1981 (AMC) field position
105 0	46 51	50022	091 57	24212	139 0000	000000	PICNIC, 1981 (AMC) field position
106 0	46 52	25746	091 56	09102	139 0000	000000	LAKEWOOD, 1981 (AMC) field position
113 6	46 46	22364	091 27	05678	¹⁶⁴⁷²² 164494	250 0000	ANDERSON RM1, 1981 (AMC) field position
114 0	46 43	04575	092 02	05673	¹⁶⁴⁷²² 164494	250 0000	MN PT ARGO, 1980 (AMC) field position

All of the above are basic control stations.

Stations 004, 006, and 008 are located in the NGS Data Base Printout for Western Lake Superior.

Stations 044 and 045 are in the PEIRCE 1982 Horizontal Control Report.

Stations 104, 105, 106, 113, and 114 are in the AMC 1980 Horizontal Control Report.

Replaces C&GS Form 567.

NONFLOATING AIDS OR 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)

<input type="checkbox"/> TO BE CHARTED <input checked="" type="checkbox"/> TO BE REVISED <input type="checkbox"/> TO BE DELETED	REPORTING UNIT (Field Party, Ship or Office) NOAA Ship PEIRCE S328	STATE Minnesota	LOCALITY Duluth to Stony Point	DATE 11-19-82
---	--	--------------------	-----------------------------------	------------------

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

OPR PROJECT NO. Z137

JOB NUMBER

SURVEY NUMBER

DATUM

N.A. 1927

METHOD AND DATE OF LOCATION
(See instructions on reverse side)CHARTS
AFFECTEDDESCRIPTION
(Record reason for deletion of landmark or aid to navigation.
Show triangulation station names, where applicable, in parentheses.)

LATITUDE

° / ' "

D.M. Meters

POSITION

° / ' "

D.P. Meters

LONGITUDE

° / ' "

D.M. Meters

OFFICE

FIELD

14966

Tank

(ERL WHITE TANK, 1982)

46 50

21.14

92 00

09.63

Tank

(BOWARC CHECKERED TANK, 1982)

46 55

48.27

91 53

01.10

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

14966

DIVE REPORT: OPR-Z137-PE-82

DIVE DATE: September 2, 1982

I. AREA OF INVESTIGATION

A. LOCATION

North shore of Lake Superior, approximately 1.6 nm NE of Duluth Harbor Entrance, 0.2 nm offshore.

B. POSITION

Latitude: 46°48'03"N Longitude: 92°03'45"W
Obtained using ARGO positioning system.

C. SURVEY SHEET

Registry No. H-10024

Field No. PE-20-1-82

II. PURPOSE

Investigation was to identify and ascertain the least depth on what appeared to be a wreck configuration on the fathogram. The area investigated is covered by the following position numbers: JD 187/1255-1256, JD 203/2044-2097, JD 206/2209-2211. A least depth of 53 feet was found at pos. no. 2090¹.

III. SURVEY PROCEDURE

The dive site was determined from the basic hydrographic development of the area in question. Visual references, electronic positioning rates and the fathogram trace were used to locate the apparent shoalest spot and a marker buoy deployed.

Divers visually circled the area, the maximum depth of the water being 65 feet.

IV. DIVE DATA

DIVERS: SS Theodore R. Owens, OS Elizabeth Kintzing
TIME: 1044-1102 Local (Bottom Time: 18 min.)
DEPTH: 65 feet maximum
CURRENT: None
VISIBILITY: 8-10 feet
WATER TEMPERATURE: 48°F

V. RESULTS

A large rock outcropping was found. Because of its size, no dimensions were taken. A least depth of 53 feet was determined by use of an under-water depth gage.

VI. RECOMMENDATIONS

Recommend include least depth on chart.

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

WATER LEVEL NOTE FOR HYDROGRAPHIC SHEET

Processing Division: Atlantic Marine Center: MOA231

Hourly heights are approved for

Water Level Station Used: Duluth, Minnesota (909-9068)

Period: June 16, 1982 - September 30, 1982

HYDROGRAPHIC SHEET: H-10024

OPR- Z137-PE-82

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955: 600.00 Feet)

Remarks:

Zoning not required. Data from other gages on Lake Huron indicates no unusual water level movement during the survey period.

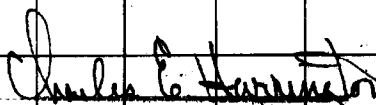
Philip C. Marub
Chief, Water Levels Section

GEOGRAPHIC NAMES

H-10024

Name on Survey	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 ATLAS	G GRAND McNALLY ATLAS	H U.S. LIGHT LIST	K
CHESTER CREEK									1
DULUTH									2
FRENCH RIVER									3
FRENCH RIVER (locality)									4
LAKE SUPERIOR									5
LESTER PARK (locality)									6
LESTER RIVER									7
MINNESOTA (title)									8
PALMERS									9
STONY POINT									10
SUCKER CREEK									11
TALMADGE RIVER									12
									13
									14
									15
									16
									17
									18
									19
									20
									21
									22
									23
									24
									25

Approved:


Chief Geographer - N/C&S

8 JUNE 1984

NOAA FORM 77-27				U.S. DEPARTMENT OF COMMERCE		REGISTRY NUMBER		
HYDROGRAPHIC SURVEY STATISTICS						H-10024		
RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.								
RECORD DESCRIPTION			AMOUNT		RECORD DESCRIPTION			AMOUNT
SMOOTH SHEET			1		SMOOTH OVERLAYS: POS., ARC, EXCESS			4
DESCRIPTIVE REPORT			1		FIELD SHEETS AND OTHER OVERLAYS			13
DESCRIP- TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR- GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS			
ACCORDIAN FILES	1							
ENVELOPES					2			
VOLUMES	2				4			
CAHIERS	2							
BOXES								
SHORELINE DATA								
SHORELINE MAPS(List):								
PHOTOBATHYMETRIC MAPS(List):								
NOTES TO THE HYDROGRAPHER(List):								
SPECIAL REPORTS(List):								
NAUTICAL CHARTS(List):								
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						2317		
POSITIONS REVISED				480				
SOUNDINGS REVISED				249	2			
CONTROL STATIONS REVISED								
				TIME - HOURS				
				VERIFICATION	EVALUATION	TOTALS		
PRE-PROCESSING EXAMINATION				21		21		
VERIFICATION OF CONTROL				4		4		
VERIFICATION OF POSITIONS				25		25		
VERIFICATION OF SOUNDINGS				175		175		
VERIFICATION OF JUNCTIONS				87	2	9		
APPLICATION OF PHOTOBATHYMETRY								
SHORELINE APPLICATION/VERIFICATION				8	2	10		
COMPILATION OF SMOOTH SHEET				94		94		
COMPARISON WITH PRIOR SURVEYS AND CHARTS					12	12		
EVALUATION OF SIDESCAN SONAR RECORDS								
EVALUATION OF WIRE DRAGS AND SWEEPS								
EVALUATION REPORT					54	54		
OTHER					9	9		
DIGITIZING				3		3		
TOTALS				337	79	416		
Pre-processing Examination by D.V. Mason, R.R. Hill, Jr., R.G. Roberson				Beginning Date 12 DEC 1982		Ending Date 15 JAN 1983		
Verification of Field Data by D.V. Mason, M. W. Holloway, F. L. Saunders				Time(Hours) 337		Ending Date 15 JUNE 1984		
Verification Check by G. F. Trefethen				Time(Hours) 61		Ending Date 12 APRIL 1984		
Evaluation and Analysis by R. H. Whitfield				Time(Hours) 79		Ending Date 13 JULY 1984		
Inspection by C. D. Meador				Time(Hours) 14		Ending Date 12 JULY 1984		

ATLANTIC MARINE CENTER
EVALUATION REPORT

SURVEY NO.: H-10024

FIELD NO.: PE-20-1-82

Minnesota, Lake Superior, Duluth to Stony Point

SURVEYED: 16 June through 30 September 1982

SCALE: 1:20,000

PROJECT NO.: OPR-Z137-PE-82

SOUNDINGS: Ross Digital Echo
Sounder

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

Chief of Party.....D. E. Nortrup
.....W. S. Simmons

Surveyed by.....A. A. Armstrong
.....G. E. Leigh
.....N. G. Millett
.....R. M. Mandzi
.....M. Mozgala
.....M. P. Conricote
.....R. B. Harris
.....S. I. Andreeva

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

1. INTRODUCTION

a. Four developments were conducted during this survey. The majority of the data collected did not add to the existing information portrayed on the smooth sheet. Only pertinent data was retained and plotted on the smooth sheet.

b. No unusual problems were encountered during verification.

c. Notes in the Descriptive Report were made in red during office processing.

2. CONTROL AND SHORELINE

a. The control is adequately discussed in sections F and G of the Descriptive Report.

b. West of Longitude 92°05'00"W, the shoreline originates with 1:5,000 scale Shoreline Manuscript TP-01078 of 1980-82. East of Longitude 92°05'00"W, shoreline was added in brown from 1:20,000 scale enlargements of 1:24,000 scale U.S. Geological Survey Quadrangles photo revised with 1981 NHAP photographs and is for orientation purposes only.

3. HYDROGRAPHY

a. Soundings at crossings agree within the criteria stated in sections 4.6.1 and 6.3.4.3 of the Hydrographic Manual and section 6.6 of the Project Instructions.

b. Except for the 6-foot curve, which could not be completely developed in the alongshore areas, the standard depth curves could be drawn in their entirety. The charted twenty-four (24) foot supplemental depth curve and brown curves were added to better show the bottom topography.

c. Development of the bottom configuration and determination of least depths is considered adequate with the following exceptions:

1) The development of a shoal feature in Latitude 46°47'54"N, Longitude 92°04'00"W should have been more extensive to the north. Additional lines of hydrography in this area would have confirmed or disproved the northward continuation of the shoal feature and its connection to the sixty (60) foot depth curve running parallel to the shoreline.

2) Lines of hydrography run normal to the depth curves should have been extended closer to the shore in order to provide a better delineation of the depth curves along the shore. The existing parallel lines of hydrography along the shore do not always provide sufficient data for the accurate drawing of the depth curves.

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. The survey was not submitted to AMC in the prescribed time interval of six (6) weeks after termination of field operations found in section 6.13 of the Project Instructions. The survey was received five and one-half (5½) weeks late.

b. The hydrographer failed to locate the shore ends of the pipelines leading to shore from Potable Water Intake (PWI) developments at the following locations: West PWI in approximate Latitude 46°50'06"N, Longitude 92°00'06"W, East PWI in approximate Latitude 46°51'30"N, Longitude 91°57'18"W, and Fisheries WI in approximate Latitude 46°53'42"N, Longitude 91°53'12"W. During verification, the echogram traces of these pipelines were used to determine the direction they ran toward shore.

c. The control station Duluth Central HS Cupola Spire, 1905 was called Duluth Enger Memorial Tower, 1952 on the field's signal list.

d. One crossline (positions 1819 to 1834) on year day 194 was found to be in error because the electronic correctors had been incorrectly

applied by the field. This was corrected during office processing of the survey.

e. The Descriptive Report states that three landmarks were located. Only two are shown on the NOAA Form 76-40, Landmarks for Charts, that was submitted with the survey. The third landmark is mentioned on page 19 of the Descriptive Report.

f. A comparison of echo sounder depths with leadline vertical casts for determination of instrument error was not done as required by section 4.9.5.1.2 of the Hydrographic Manual.

g. Scanning of the echograms in the shoal water was poor.

h. No TC/TI tape was submitted for VESNO 2830, NOAA Ship PEIRCE. This was corrected during office processing of the survey.

i. Master and Corrector tape numbers did not match for nineteen (19) days of hydrography. This was corrected during office processing of the survey.

j. Velocity table number 6 was not tabulated deep enough to cover the range of survey depths. The tabulation was amended during office processing and the appropriate correctors were applied to the survey data.

k. The data tapes were submitted with the wrong frequency for the electronic positioning system. This was corrected during office processing of the survey.

l. No bottom samples were taken on the shoals in the vicinity of Latitude 46°47'30"N, Longitude 92°04'00"W, as required by section 8.1 of the Project Instructions and section 4.5.9.2 of the Hydrographic Manual.

m. In order to reduce the bulk of the Descriptive Report, sections A-S should be single spaced rather than double spaced.

5. JUNCTIONS

H-9953 (1981) to the south
H-9960 (1981) to the south
H-9979 (1981) to the south
H-10036 (1982) to the east

Excellent junctions were effected between the present survey and the surveys listed above.

6. COMPARISON WITH PRIOR SURVEYS

LS-253 (1861) 1:16,000
LS-254 (1861) 1:16,000
LS-256 (1861-1868) 1:200,000
LS-257 (1861) 1:60,000
LS-1824 (1943) 1:15,000
LS-1994 (1956) 1:120,000

These surveys taken together cover the present survey area in its entirety. Since prior surveys LS-253 (1861), LS-254 (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) covers only a small portion of the southern edge of the present survey. The depths in this area compare favorably to present survey depths with differences of plus or minus (+/-) two (2) feet.

LS-1994 (1956) shows a general trend of being one (1) to two (2) feet shoaler than the present survey.

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

7. COMPARISON WITH CHART 14966 (18th Edition, Dec 22/79)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources. Specific soundings tabulated and discussed on page 16 of the Descriptive Report have charting recommendations on that page and require no additional comments.

The East PWI charted in approximate Latitude 46°51'30"N, Longitude 91°57'18"W with a charted Depth over crib 62-ft was developed by the hydrographer. An echo sounder depth of forty-six (46) feet was found in Latitude 46°51'31.41"N, Longitude 91°57'19.74"W with surrounding depths of sixty (60) to sixty-five (65) feet. It is recommended that the crib remain as charted with a revised noted Depth over crib 46-ft unless subsequent information indicates otherwise.

The water intake pipe for the French River Hatchery was developed, and an echo sounder depth of forty-six (46) feet was found in Latitude 46°53'49.21"N, Longitude 91°53'13.52"W. It is recommended that the intake pipe be charted with a Depth over pipe 46 ft at the above location unless the construction permit can be found and a better description ascertained by the chart compiler. *Do not concur. See Examination Report.*

The present survey is adequate to supersede the charted hydrography within the common area.

b. Aids to Navigation

There are no fixed or floating aids to navigation in the survey area.

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; no additional field work is recommended.



Franklin L. Saunders
Cartographic Technician
Verification of Field Data



For Richard H. Whitfield
Cartographic Technician
Evaluation and Analysis



Guy F. Trefethen
Senior Cartographic Technician
Verification Check

Inspection Report
H-10024

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

Charles D. Meador
Chief, Evaluation and Analysis
Group
Hydrographic Surveys Branch

David B. MacFarland, Jr.

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

Approved July 13, 1984

Wesley V. Hull

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



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF CHARTING AND GEODETIC SERVICES
ROCKVILLE, MARYLAND 20852

N/CG242:LQ

July 11, 1985

TO: N/CG24 - Roy K. Matsushige

FROM: N/CG242 - *George K. Myers, Jr.*
George K. Myers, Jr.

SUBJECT: Examination of Hydrographic Survey H-10024 (1982), Minnesota, Lake Superior, Duluth to Stony Point

Chief of Party	D. E. Nortrup
.....	W. S. Simmons
Field Unit	NOAA Ship PEIRCE
Processed by	Atlantic Marine Center
Examined by	L. Quinlan

An examination of hydrographic survey H-10024 (1982) was accomplished to monitor the survey for adequacy with respect to data acquisition, conformance with applicable project instructions, delineation of the bottom, determination of least depths, navigational hazards, junctions, sounding line crossings, smooth plotting, shoreline transfer, digital data standards, decisions made and actions taken by the evaluator, and the cartographic presentation of data.

The origin of the shoreline is U.S. Geological Survey quadrangle maps revised by 1981 National Ocean Service (NOS) National High Altitude Program photographs. These maps were unavailable during examination.

Cartographic deficiencies and constructive comments are noted on a $\frac{1}{2}$ -scale copy of the survey smooth sheet which will be forwarded to the marine center. Digital data and/or programming deficiencies are identified on the full-scale plot made from the magnetic tape transmitted by the marine center. This plot will also be forwarded to the marine center.

In general, the survey was found to conform to NOS standards and requirements except as stated in the Evaluation Report and as follows:

1. Four rocks that uncover at Low Water Datum were observed during the survey. These were rejected during processing and are not on the smooth sheet. The reason given for rejecting the rocks was "... because the distance from the rocks to the launch was not noted on any data." The hydrographer was running a line of soundings near the beach and recorded distances from the



shore to the rocks; i.e., "D.P. Large rock abeam 10 yds off beach." It is therefore felt that the plotting of these rocks could have been accomplished.

Positions of the rocks were plotted by the examiner from the information given in the survey records and positions scaled as follows:

<u>FEATURE</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
*	46°52'87.12"	91°55'45.58"
*	46°52'43.33"	91°55'29.32"
*(1)	46°53'07.02"	91°54'38.35"
*	45°55'26.41"	91°50'32.32"

These rocks are not shown on the smooth sheet due to examination restrictions, so charting action is deferred to the chart compiler.

2. A 52-foot sounding Rk is plotted in error at latitude 46°48'03"N, longitude 92°03'48"W. A 62-foot sounding falls at this position. An excessed 52-foot sounding at latitude 46°48'03"N, longitude 92°03'45"W, approximately 70 meters due east, is actually the highest point of a rock outcrop as shown on the echogram trace. The 52 Rk should be charted at the latter position.

3. The label, Obstr, should not be affixed to the offshore end of the French River Hatchery Intake Pipe at latitude 46°53'48"N, longitude 91°53'11"W. There is no evidence in the survey records that reveals the existence of a feature except the submerged pipe at this location. The pipe is adequately depicted on the smooth sheet.

4. On Day 168, positions 051-077, the hydrographer was running near the shoreline. Notations on the echogram indicate that the following uncharted items exist alongshore. However, no detached position or other information were furnished by the field. Final disposition of these items is deferred to the chart compiler.

<u>Latitude (N)</u>	<u>Longitude (W)</u>	<u>Description from Echogram</u>
46°48'00.91"	92°04'17.43"	Jog around rock outcropping
46°48'00.70"	92°04'15.22"	Jog around rock outcropping
46°48'41.73"	92°03'14.00"	Marine railway (PVT)
46°48'50.40"	92°02'59.55"	Jog around cement dock
*46°49'10.98"	92°02'18.07"	Jog around boulder
46°51'22.66"	91°58'09.78"	Jog around outcropping
46°51'23.25"	91°58'07.03"	Jog around outcropping

*U.S. Geological Survey Quad (Duluth, Minnesota) shows an islet at this position.

5. There is no evidence on the echogram that a reduced 83-foot unsupported sounding plotted at latitude 46°48'00"N, longitude 92°00'20"W exists. An 88.8-foot digital depth in the raw data listing reduces to an 88-foot corrected depth. This sounding is supported by crossline soundings and is considered correct.

6. Excess Sounding Overlay No. 1 of 2 includes three separate areas of congested soundings. These soundings overlap to the extent that numbers are obliterated, while Excess Sounding Overlay No. 2 of 2 shows only a few soundings in these areas. A selection of soundings to be excessed at various levels should be made so that sounding numbers can be clearly read.

7. The depth of 46 feet over the pipeline (intake pipe) at latitude $46^{\circ}53'49''\text{N}$, longitude $91^{\circ}53'13''\text{W}$ as recommended for charting by the evaluator is considered unnecessary and confusing. This feature is covered by many depths as depicted on the smooth sheet, including 33- and 54-foot soundings, inshore and offshore respectively, of the 46-foot depth. It is recommended that this submerged feature be charted as a submarine pipeline.

8. Nine symbols with labels, Obstr (Cartographic Code 272), in the vicinities of latitude $46^{\circ}50.15'\text{N}$, longitude $92^{\circ}00.05'\text{W}$; latitude $46^{\circ}51.60'\text{N}$, longitude $91^{\circ}57.35'\text{W}$; and latitude $46^{\circ}53.85'\text{N}$, longitude $91^{\circ}53.35'\text{W}$ were erroneously entered into the digital file to identify the submerged pipelines shown on the smooth sheet. Submerged pipeline data (dashed line, Cartographic Code 803) should have been entered into the file. Also, a bottom characteristic, med br S, at latitude $46^{\circ}48.38'\text{N}$, longitude $92^{\circ}03.40'\text{W}$ was omitted.

