

10095

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-20-3-83
Office No. H-10095

LOCALITY

State Wisconsin
General Locality Lake Superior
Locality Bark Point to Iron River

19 83

CHIEF OF PARTY
CDR W.S. Simmons

LIBRARY & ARCHIVES

DATE July 22, 1985

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

10095

Area 7
Chart
14960 }
14966 } TO SIGO DEPT SOI
14961 } "RECORD OF APPLICATION"

HYDROGRAPHIC TITLE SHEET

H-10095

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-20-3-83

State WISCONSIN

General locality LAKE SUPERIOR

Locality BARK POINT TO IRON RIVER

Scale 1:20,000 Date of survey June 7, 1983 - June 21, 1983

Instructions dated May 11, 1983 Project No. OPR-Z137-PE-83

Vessel PEIRCE²⁸³⁰(3280) Launch PE-1²⁸³¹(3281) Launch PE-2²⁸³²(3282) and Monark PE-3²⁸³³(3283)

Chief of party CDR Walter S. Simmons, Commanding Officer

Surveyed by A. Armstrong, G. Leigh, R. Mandzi, M. Conricote, R. Harris, S. Andreeva

Soundings taken by echo sounder, hand lead, pole Ross Model 5000 digital fathometers
Raytheon DE-719B fathometer

Graphic record scaled by A.A., G.L., R.M., M.C., R.H., S.A., B.M., I.P.D., T.O., M.B.

Graphic record checked by G. Leigh, R. Harris, R. Mandzi

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

Verification by D.V. MASON

Soundings in ~~fathoms~~ feet at MKT MKTX LOW WATER DATUM (IGLD 1955: 600 FEET)
IGLD 600.0 FT

REMARKS: (1) All times of records are Coordinated Universal Time.

(2) Water level correctors were applied to data on Port Wing (1:2500)
sheet only. Water level correctors were obtained from unverified water level
data. Soundings on the inset are in feet at LWD of Lake Superior.

FINAL CORRECTIONS APPLIED TO SMOOTH SHEET.

SL 5-2-97 AWOIS and SURF ✓ MUD 5/87

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** A-E AND G, H, FILED WITH ORIGINAL FIELD RECORDS.*

Descriptive Report
 To Accompany
 Hydrographic Survey H-10095
 Field Number PE 20-3-83
 CDR. Walter S. Simmons, Commanding

A. PROJECT

This basic hydrographic survey is part of Project OPR-Z137-PE-83, Lake Superior. It was conducted in accordance with project instructions dated May 11, 1983. The only change to the project instructions that affects this survey is Change No. 1: Supplement to Instructions, dated May 17, 1983.

B. AREA SURVEYED

The survey covered an area along the south shore of western Lake Superior. The area extends westward from Bark Point to approximately 1.2 nautical miles east of the mouth of Iron River. It extends northward three to four nautical miles from the south shore. The survey was conducted from June 7, 1983 to June 21, 1983.

The shoreline from the most western limit of this survey to approximate longitude 91°24.2'W is rocky. The shoreline in the vicinity of Port Wing (longitude 91°24.2'W to longitude 91°22.0'W) is sandy beach. The shoreline eastward from longitude 91°22.0'W to 1 nautical mile west of Bark Point consists of high, eroding bluffs, gradually tapering off to the rocky shoreline at Bark Point.

C. SOUNDING VESSELS

Four sounding vessels were used to conduct this survey. The vessels and their corresponding FDP numbers are as follows: PEIRCE (VesNo ~~3280~~³²⁸⁶), Launch PE-1 (VesNo ~~3284~~³²⁸¹), Launch PE-2 (VesNo ~~3282~~³²⁸³), and the Monark PE-3 (VesNo ~~3283~~³²⁸³). PEIRCE and both survey launches were equipped with the hydroplot system. Data acquisition was obtained manually while using the Monark PE-3. No unusual problems were encountered.

D. SOUNDING EQUIPMENT AND CORRECTION TO ECHO SOUNDINGS

The survey was conducted using the Ross digital ~~Fathometer~~^{ECHOSOUNDER}, Model #5000 and the Raytheon DE-719B. The sounding equipment serial numbers and dates used are listed below:

<u>VesNo</u>	<u>Range of Depth</u>	<u>Fathometer S/N</u>	<u>Julian Date</u>
3280 2830	30-280 ft	Ross (1079) Ross (1078)	172 160
3281 2831	4-280 ft	Ross (1078) Ross (1079)	160-164 158, 159

3282 2832	6-207 ft	Ross (1087)	158-163
3283 2833	1.2-17 ft	Raytheon (5441)	161-162

The sounding pole was used where depths could not be accurately measured with the fathometer. The sounding pole was read and recorded to the nearest 0.2 foot.

There were no major problems with the sounding equipment used during this survey. The echo sounder initial was kept at 0.0 foot. Small deviations of the initial and/or phase checks were accounted for while scanning the graphic records.

Velocity correctors were derived from XBT data. The survey was divided into three time periods to ensure that no sounding would be in error exceeding 0.25% of the depth. Four XBT casts were performed during the survey. The first XBT cast was rejected because it was taken approximately 20 miles north of the working area. The second cast (XBT 002) was applied to hydrographic data from JD 158 through JD 160. The third cast (XBT 004) was applied to hydrographic data from JD 161 through JD 164. The fourth cast (XBT 007) was applied to data on JD 172. The XBT casts were graphed and the velocity table scaled at increments of 0.2 foot for depths 0-150 feet; 0.5 foot for depths of 150-250 feet; 1.0 foot for depths of 250 feet. The XBT (S/N 781209TD; Model MK 2A-1) was tested in November 1981.

<u>TABLE</u>	<u>HYDRO DATES</u>	<u>CAST</u>	<u>JD</u>	<u>LATITUDE/LONGITUDE</u>
36/37	158-161	XBT 002	160	46°50.7'N 91°24.0'W
38	162-164	XBT 004	164	46°55.1'N 91°01.0'W
39	179	SBT 007	172	46°55.9'N 91°12.2'W

Bar checks were compared to the XBT data for corresponding time periods. Correctors from bar checks taken on VesNo ~~3282~~ ²⁸³² agreed within 0.1 foot. Bar check data from ~~3284~~ ²⁸³⁴ revealed an error of +0.4 to +0.6 of a foot. This error was thought to be an instrument error, however, a check on the bar lines on that vessel revealed an error of two feet on one of the lines. Apparently, the 5 feet marking on the line slipped approximately two feet. A bar check was taken after remeasuring the line. Results of that bar check revealed a negligible error, therefore, bar check data for VesNo ~~3284~~ ²⁸³⁴ from 0-10 feet are considered invalid and are not used.

A draft corrector of 10-6 feet for PEIRCE, 1.6 feet for Launches PE-1 and PE-2, and 0.5 of a foot for PE-3 was applied to data via the offline corrector tape. No draft correctors were applied to pole soundings (notated "P" in the sounding volume).

Settlement and Squat corrections for the ship with both launches aboard were determined on June 6, 1983, at the south breakwater pier in Two Harbors, Minnesota. Settlement and Squat for all other vessels used in the survey

was conducted on June 1, 1983 at the Army Corps of Engineers pier in Duluth, Minnesota. Corrector values for speeds used in this survey can be found in the supplemental data files.

All velocity graphs can be found in the supplemental data files of this report. The sounding correction abstracts, listings of the velocity and TC/TI tapes are in Appendix D of this report.

E. HYDROGRAPHIC SHEETS

The final field sheets were constructed and drawn on board PEIRCE. The sheets were prepared by the ship's complot system utilizing program RK 201.

All hydrographic data is presented on three plotter sheets. Two of the sheets are at a scale of 1:20,000 with a skew angle of 015°. One of the 1:20,000 sheets depicts mainscheme and mainscheme split hydrography and the other sheet depicts crosslines, developments, and bottom samples. The third sheet represents the Port Wing harbor survey at a scale of 1:2500 and a skew angle of 0°.

All field records will be forwarded to Atlantic Marine Center for verification and compilation of the final smooth sheet. A listing of the sheets' parameters is in Appendix A.

F. CONTROL STATIONS *SEE ALSO SECTION 2.2 OF THE EVALUATION REPORT.*

The hydrographic survey required the use of twelve horizontal control stations. The following control stations have been monumented and described:

<u>SIGNAL #</u>	<u>STATION NAME</u>	<u>SOURCE</u>	<u>TYPE</u>
113	QUARRY INN, 1981	AMC	Electronic
146	AGATE BAY ARGO, 1983	PE	Electronic
147	SILVER BAY ARGO, 1983	PE	Electronic
151	PORT WING EAST PIER LT, 1982	PE	R/AZ Control
153	QUARRY NAIL, 1983	PE	Electronic
154	QUARRY NO 1, 1982	PE	Electronic
157	PORT WING 3 USE, 1982	PE	Calibration
159	KRAUSS, 1983	PE	Electronic
160	PORT, 1982	PE	Electronic
161	WING, 1982	PE	Electronic

All of the above monumented stations were located by third-order traverse methods with the exception of PORT WING EAST PIER LT, 1982, which was located by third-order intersection methods.

Two unmonumented horizontal control stations were used in this survey. They are CLUMP HUB (162) and LOG HUB (150). These two stations were positioned by third-order traverse methods, in 1982.

All horizontal control stations are based on the North American Datum of 1927. All elevations of horizontal control stations are based on the International Great Lake Datum of 1955, the Low Water Datum of Lake Superior being 600.0 feet. Geodetic abstracts and computations for this work are included in the project's horizontal control reports for 1982 and 1983. A copy of the signal tape is in Appendix F of this report.

G. HYDROGRAPHIC POSITION CONTROL

Hydrographic sounding position control was by range/range using the ARGO and MINI-RANGER systems. Sounding position control for the lake portion of the 1:2500 scale Port Wing Harbor inset survey was by range/azimuth with a second check azimuth. The Wild T-2 theodolites initialed on third-order control stations for azimuths and the MINI-RANGER system was used to obtain ranges. The harbor portion of the survey was positioned by the range/azimuth method using the Hewlett-Packard 3810 Electronic Distance Measuring (EDM) unit.

The MINI-RANGER equipment and serial numbers used in the survey are as follows:

<u>NOAA Ship PEIRCE (3280)</u>	<u>S/N</u>	<u>DATES USED</u>
Console	B0295	160
Receiver Transmitter (RT)	D2123	160
Code 1	C2058	160
Code 2	C2059	160
Code 3	C2075	160
Code 4	C2065	160
 <u>LAUNCH PE-2 (3282)</u>		
Console	824118	158 - 163
RT	C2096	158 - 163
Code 1	C2058	160
Code 2	C2059	158 - 163
Code 3	C2075	158 - 161
Code 4	C2065	160

Baseline calibrations for the MINI-RANGER units with a variable attenuator were conducted according to specifications set forth in the PMC OpORDER,

Appendix M and S: Mini-Ranger III Calibration. Critical systems checks were performed daily by fixed-point calibration along a known range. A minimum of ten discreet readings were observed and recorded.

On June 8, 1983 (JD 159) fixed point calibration at the pier at Port Wing was impossible because of 1-2 foot seas breaking onto the piers. A rough system check was made on the reference station at QUARRY 1, 1982, (Code 3) by maneuvering slowly alongside the pier several times while simultaneously approximating the distance from the pier (PORT WING 3 USE, 1982) to the boat's receiver transmitter (RT). A check was not made on the second reference station at QUARRY INN, 1981, however, a critical system check was performed on the unit (Code 2) the next day. Correctors were within +3 meters of the baseline calibration for that unit.

On June 10, 1983, no closing system check was performed because of seas breaking onto the calibration pier. A baseline check on the reference station (Code 2) the next day revealed a corrector value of 3 meters.

A closing baseline calibration on the MINI-RANGER system had not been conducted prior to the writing of this report. Refer to the Descriptive Report for survey H-10096, PE-20-4-83 for closing baseline calibration information.

The ARGO systems used by PEIRCE and Launch PE-1 were maintained at smoothing codes of 02. Two time slots were incorporated into the ARGO systems to allow for a one second update of rates. Fixed shore stations' AGC values and antenna tune range values were monitored hourly. The ARGO systems operated on a frequency of 1646.7kHz and data were processed using a false frequency of 1647.22kHz to account for wave propagation over Lake Superior as determined in 1982. The ARGO system was used primarily by Launch PE-1 (3281) from June 7 - June 13, 1983 to conduct hydrography. The ARGO system was used by PEIRCE (3280) on June 21 to conduct bottom sampling.

The ARGO equipment and serial numbers used during this survey are listed below:

ARGO EQUIPMENT

NOAA Ship PEIRCE (3280) JD 172	Range Processing Unit	R047859
	Control Display Unit	C047822
	Antenna Loading Unit	A0379109
	Power Supply	V0379124
Launch PE-1 (3281) JD 158 - 164	Range Processing Unit	R047859
	Antenna Loading Unit	A047859
	Control Display Unit	C047821
Station AGATE BAY ARGO, 1983 JD 158 - 172	Range Processing Unit	R047854
	Antenna Loading Unit	A0379116
	Power Supply	V0478108
Station SILVER BAY ARGO, 1983 JD 158 - 164	Range Processing Unit	R0379122
	Antenna Loading Unit	A0379123
	Power Supply	V0379122

The ARGO system was calibrated twice a day by fixed point calibration and/or three point sextant fix with check angle. (Calibration forms can be found in the supplemental data files of this report).

The system went off the air several times as a result of weather (i.e. storms, rain squalls). No data were lost.

On June 8, 1983 (JD 159), Launch PE-1 lost lanes at approximately 1910Z. As a result, no closing calibration was obtained. The data was proven valid by checking crossline and mainscheme agreements, depth curves, and by comparing boat positions with the shore. All the hydrography performed on this date was kept.

On June 9, 1983 (JD 158), Launch PE-1 lost their ARGO rates at 1700Z. Lanes were reset into the ARGO system by determining the ARGO rates at a position approximately 100 meters north of station BARK, 1953. ARGO rates from the position of the boat to the ARGO shore stations at AGATE BAY ARGO, 1983 and SILVER BAY ARGO, 1983 were computed via program RK 300, Function 5 and entered into the ARGO Control Display Unit (CDU). To confirm the validity of this procedure, a fixed point calibration was conducted at the pier in Port Wing and the closing calibration on both shore stations were within - 0.01 lane of the opening calibration of that day.

On June 12, 1983 (JD 163), the ARGO system issued edit marks as a result of a storm in the area. A smoothing code of 03 was used in the system to eliminate fluctuations of several hundredths of a lane in each station. To assure that no lanes were lost, a check of the ARGO system was conducted at a rock exposed three feet above water. (A previous position on the rock was determined from data obtained from JD 159, Position 3033.) Prior to this time, the data were valid. Several minutes later, the system went off the air (Position 3698). Data from positions 3602 - 3691, having a closing lane check at the exposed rock, were kept. All data obtained subsequent to this lane check were lost after the ARGO system went off the air. The daily corrector value for that day was based on the opening calibration only.

The ARGO system on the ship (JD 172) was calibrated by three point sextant fixes with check angle. Occasional checks were made via three MINI-RANGER rates to check on lane loss and to reset lane count after lanes were lost during bad weather. (See Electronic Control Calibration Abstracts in the supplemental files of this report.)

PORT WING HARBOR (1:2500 INSET)

Hydrographic sounding position control for lake portion, the Port Wing survey, conducted on June 10 - 12, 1983, was via range/azimuth with a second check azimuth. All horizontal control stations used in this survey were established using third-order procedures. The sounding vessel (VesNo 3282) was controlled by a range/azimuth station set at QUARRY NAIL, 1983 with a Wild T-2 theodolite initialing on station PORT WING EAST PIER LT, 1982 for azimuths. The range station, also set at QUARRY NAIL, 1983, served a dual

purpose in positioning the boat and acting as a steering range. Line spacing for this survey is 25 meters.

The second azimuth station was at station CLUMP HUB, 198³, an unmonumented third-order control station. A second azimuth was observed for each position simultaneously with the range/azimuth position. Data acquisition was obtained via Program RK 116 (Range-Azimuth Hydroplot program). Only azimuths from station QUARRY NAIL, 1983 were entered in the hydroplot system. The second angles were manually plotted to ascertain that the accuracy of the range/azimuth positions were within the 1.5mm allowable error. The check on the range/azimuth positions with the second azimuth revealed excellent position control. Over 90% of the sounding positions were checked. Over 95% of those checked were within the 1.5mm allowable error. The second azimuths are contained in the supplementary data files.

A closing baseline calibration was conducted on the MINI-RANGER reference station (Code 2) used in this survey to ensure the accuracy of the ranges obtained. The baseline calibrations agreed very well with the critical system checks taken each day. The corrector value for this unit was prorated between the opening and closing baseline calibrations and was applied to the data via the off-line corrector tape.

The majority of the soundings obtained in the entrance to the harbor and, all the soundings in the harbor area were by range/azimuth using the Electronic Distance Measuring Unit (EDM), Hewlett-Packard, Model 3810B, A/N 28A0036D. The EDM was set up at stations: PORT, 1982 and WING, 1982. Azimuths were obtained by initialing the EDM's horizontal circle on PORT WING EAST PIER LT, 1982. Ranges from the EDM were made possible by mounting a fourteen prism bank on a pole over the transducer in the sounding vessel (3282). The distances, displayed to the centimeter, were rounded to the nearest meter and the angles were read and recorded to the nearest minute. The Electronic Corrector Abstract is in Appendix E.

H. SHORELINE *SEE ALSO SECTION 2.6. OF THE EVALUATION REPORT.*

Shoreline for this 1:20,000 field sheet was obtained from enlargements of 1:24,000 scale USGS quad maps revised by National Ocean Service from high altitude photographs.

The shoreline is continually shifting southward due to erosion. When comparing the shoreline between Chart 14966, 19th Edition, January 15, 1983 and this survey, shifts of the shoreline ranging from 30 to as much as 120 meters southward were observed. The most noticeable erosion of the shoreline occurred in the area directly west of Port Wing harbor (Latitude 46°47.5'N, Longitude 91°23.5'W) and the area just west of Bark Point (Latitude 46°52.0'N, Longitude 91°23.5'W). The shoreline, as delineated on the final field sheet, was verified by the hydrographer and is adequate for charting.

It is recommended that shoreline from the NOS photo revised USGS quad maps replace the charted shoreline.

There were no control stations seaward of the shoreline.

Port Wing Harbor

The shoreline for this 1:2500 scale survey was taken from a Class III map, TP-01253, Job CM-8310 controlled by PEIRCE 1982 field work. There was no field edit performed on this map prior to conducting the survey. Field edit investigation of the shoreline was performed by the hydrographer June 10 - 12, 1983. The location and delineation of features seaward of the shoreline that may or may not be depicted on this map will be discussed in Section L of this report.

Two new bulkhead shorelines were located during hydrography at the easternmost end of the harbor. The new shorelines were positioned using the Electronic Distance Measuring Unit (EDM), HP 3810B (refer to Section G of this report for position control methods used). Finger piers along the new bulkhead were located by taping their distance from the end of the bulkhead and taping their lengths. The revision of the shoreline is depicted on the Port Wing Harbor field sheet in red.

It is recommended that the charted shoreline be replaced by the shoreline from TP-01253 as modified in red on the final field sheet. *DATA TRANSFERRED TO SMOOTH SHEET.*

There were no control stations seaward of the shoreline.

I. CROSSLINES

A total of 41.7 nautical miles of crosslines were run. This is equal to 12.5% of the total mainscheme hydrography conducted on this survey. One hundred percent (100%) of the crossline and mainscheme agreements were within +2 feet. Depths range from 4 - 290 feet.

J. JUNCTIONS *SEE SECTION 5 OF THE EVALUATION REPORT.*

This survey junctions with contemporary surveys H-10043 (PE-20-2-82) to the west, H-10036 (PE-50-1-82) to the north, H-10096 (PE-20-4-83) to the east, and the Corps of Engineers 1983 survey of Port Wing Harbor.

H-10043 (PE-202-82)

Junctions comparisons with this survey were excellent with 100% of all sounding comparisons within +2 feet. Depth curves are continuous through the junction area.

H-10036 (PE-50-1-82)

Junction comparisons with survey H-10036 were excellent with 100% of all sounding comparisons within +3 feet for depths ranging from 179 to 280 feet. Depth curves are continuous through the junction area.

H-10096 (PE-20-4-83)

This survey junctions with contemporary survey H-10096 to the east. There was no overlap of soundings in this junction area, however, the depth

curves are continuous through the area with depths ranging from 7 - 271 feet. The line spacing at the junction area between the two surveys is 100 meters.

Corps of Engineers 1983, Port Wing Harbor

Junction comparisons with the contemporary Corps of Engineer's survey of the Port Wing Harbor area were excellent with all sounding comparisons within $\pm 0.3 - 0.8$ feet for depths ranging from 1 - 15 feet. (See copy of Corps of Engineers 1983 survey in the supplemental data files of this report, Section K, and Appendix B.)

K. COMPARISON WITH PRIOR SURVEYS *SEE SECTION 6 OF THE EVALUATION REPORT.*

The Lake Superior Presurvey Review was issued March 18, 1981 and is updated through May 11, 1983. There are no presurvey review items within the limits of this survey.

Comparisons were made with the following prior surveys.

<u>PRIOR SURVEY</u>	<u>SCALE</u>	<u>DATE</u>
*LS-443	1:16,000	1869
*LS-444	1:16,000	1869
LS-457	1:120,000	1869
LS-1-1491	1:20,000	1927
LS-1-1492	1:20,000	1927
LS-1-1754	1:10000	1938
LS-1-1765	1:5000	1944
LS-1-1944	1:120,000	1956

DOES NOT APPLY TO THIS SURVEY AREA

* Soundings from these prior surveys are charted on prior surveys LS-1-1491², LS-443, and LS-1491, LS-449). Each survey is discussed separately.

LS-443 / 1492

This prior survey covers the entire area of this survey eastward from Iron River to Longitude 91°19.5'W. It extends north of the shoreline 0.8-1.0 nautical mile. Comparisons between the two surveys were good with 95% of all sounding comparisons within ± 3 feet for depths of 20-60 feet. General differences of as much as 5 feet were observed, however, these discrepancies were observed in areas of fairly steep gradients. Along the shoreline, general agreements were $\pm 2-5$ feet with the majority of this survey sounding deeper than the prior. The cause of these minor discrepancies are probably the result of extreme shoreline and beach erosion and the shifting of the sandbars in the area.

The trend and spacing of depth curves are similar to survey H-10095.

LS-444/449/

This prior survey covers the entire area of this survey eastward from Latitude 91°19.5'W to Bark Point. It extends north from the shoreline 0.8-1.0 nautical mile.

Comparisons with this prior survey reveal very good agreements with 100% of sounding comparisons within +4 feet for depths of 4-6 feet. The minor discrepancies (+2-+4 feet) were observed along the shoreline in areas where erosion is evident. Shifting sandbar may also be the cause of some of the discrepancies. No general pattern is observed in any specific area. All depth curves follow the same basic trend as survey H-10095.

LS-457

Prior survey LS-457 covers the entire area of this survey approximately 1.5nm offshore of the south shore of Lake Superior. The majority of the soundings on Chart No. 14966 originated from this prior survey.

Comparisons with this survey indicate very good agreement with 98% of soundings comparisons within +3 feet for depths of 67-187 feet. The major discrepancies are noted in Section L of this report (Comparison with the Chart).

LS-1492

Comparisons were made with prior survey LS-1492. This survey basically consists of a series of lines running parallel to the depth curves. Comparisons with this prior survey are good with 95% of all sounding comparisons within +4 feet for depths of 30-190 feet. General differences of as much as 5-10 feet were noted in areas of irregular or rocky bottom and along fairly steep gradients. Major discrepancies of significance are listed below:

<u>PRIOR SURVEY</u>	<u>PRESENT SURVEY SOUNDING</u>	<u>LAT/LONG</u>
* 73	99 97	46°49.40'N 91°23.55'W
* 77	104 100	46°49.45'N 91°23.65'W

*The discrepancies are probably the result of inaccurate position control on prior LS-1492. As mentioned previously, the sounding lines on this prior ran parallel to the depth contours; but a particular sounding line charted on the prior survey at Latitude 46°49.5'N, Longitude 91°23.5'W jogged from parallel to perpendicular to contours. All H-10095 records were checked and there was no indication of 10-20 feet shoaling in the area. *CONCVR*

Survey soundings in agreement with the prior survey charted soundings can be found 200m south of those soundings on the prior. It is recommended that H-10095 supersede prior survey LS-1492. *SEE EVALUATION REPORT, SECTION 6*

LS-1491

Comparisons were made with prior survey LS-1491. This survey consists of a series of crosslines running parallel to various depth curves. The prior survey covered the entire area of this survey from Longitude 91°19.5'W eastward to Bark Point.

Sounding agreements were excellent with 100% of all soundings with +3 feet. Survey H-10095 revealed the deeper sounding in most cases. The most noticeable differences were observed along the shoreline in depths of 18-20 feet which probably results from the shifting of sand bars in the areas and the erosion of the shoreline.

It is recommended that H-10095 supersede all of the prior surveys for charting purposes. *SEE EVALUATION REPORT, SECTION 6*

Port Wing Harbor *SEE EVALUATION REPORT, SECTIONS 6 & 7.2.5) AND 6)*

LS-1-1754

Comparisons were made with prior survey LS-1-1754, scale 1:10,000, surveyed on July 7-8, 1938. General agreements are within 2 feet with the majority at the prior survey soundings deeper than this survey. Prior survey LS-1-1754 covers the entire area of the Port Wing Harbor.

Water level correctors were applied to this 1:2500 scale survey of Port Wing harbor to reduce soundings to the chart datum which is 600.0 feet for Lake Superior. According to notes on prior survey LS-1-1754 (1938), soundings were referenced to the LWD which for Lake Superior was 601.6 feet above the Mean Tide at New York. The plane of reference for this survey is the mean water level at Father's Point, Quebec, IGLD of 1955. The difference in the two datums may or may not account for the shoaler soundings obtained during this survey.

Depths found in the harbor on survey LS-1-1754 range from 2-4 feet. This area has since been dredged to accommodate a small boat facility. The controlling depth of the dredged area is charted at 6 feet (see Chart 14966, PORT WING INSET).

Pilings located at the mouth of the harbor of Flag River are evident in the prior survey. All depth curves in the lake portion of Port Wing appear similar in shape. Generally, agreements of sounding comparisons in the lake end of the survey ± 1 feet. It is recommended that H-10095 and the June 1983 Corps OF ENGINEERS Survey supersede prior survey LS-1-1754 for charting purposes.

LS-1-1765

Comparisons were made with prior survey LS-1-1765, scale 1:5000, surveyed in 1944. General agreements of all sounding comparisons are within 2 feet--soundings from this survey being shoaler than the prior survey soundings. The difference in the vertical datums may account for the relatively shoaler soundings obtained from this survey.

The area in the harbor east of the breakwater piers was not dredged at the time of the 1944 survey. Sounding from survey LS-1-1765 ranged from 1-5 feet in the harbor.

Pilings located at the mouth of the Flag River are evident in the prior survey. The general trend curves are similar. It is recommended that prior LS-1-1765 be superseded by survey H-10095 and the June 1983 Corps of Engineers survey.

L. COMPARISON WITH THE CHART *SEE ALSO SECTION 7 OF THE EVALUATION REPORT.*

Comparisons were made with Chart 14966, 19th Edition, January 15, 1983. Sounding agreement were good with 90% of soundings within +4 feet for depths of 30-289 feet.

The majority of soundings that are charted appears to have originated from three 1869 surveys (LS-~~443~~, ~~444~~, 457). Discrepancies of more than 5 feet are noted below. *1491 1492*

<u>CHARTED DEPTH</u>	<u>SURVEY DEPTHS</u>	<u>POSITIONS</u>	<u>CHARTED LAT/LONG</u>	<u>REMARKS</u>
151 ft	169-173	77+1	46°49.65'N 91°26.2'W	No evidence of a 20' shoal in the area, 200 meter line spacing. Least depth found: 169 ft. Recommend supersede the chart. <i>CONCUR</i>
67 ft	66	171-192	46°48.7'N 91°25.1'W	Development of 67' charted shoal. 100 meter line spacing, crosslines. Least depth found: 66 ft. Recommend supersede the chart. Depth of 66' approx. 500m SW of charted 67 feet. <i>CONCUR</i>
108 ft	131-137	528-541	46°49.8'N 91°27.4'W <i>3</i>	Development of 108' charted sounding. 100 meter spacing. Least depth found: 131 ft. <i>127 ft.</i> Recommend supersede the chart.
115 ft	129-135	506-527	46°49.8'N 91°22.4'W	Development of 115' charted sounding. 100 meter spacing. Least depth found: 129 ⁵ ft. Recommend supersede the chart. <i>CONCUR</i>
109	119-123	3504-3508	46°50.1'N 91°18.3'W <i>20</i>	Development of 100 ¹⁰⁹ ' charted sounding. 100 meter spacing. Least depth found: 119 ft. Recommend supersede the chart. <i>CONCUR</i>

100 ft	109-119	3511-3524	46°51.0'N 91° 18 ¹⁶ .3'W	Development of 100' charted sounding. 100 meter spacing. Least depth found: 109 ft. Recommend supersede the chart. <i>Concur</i>
49 ft	61-69	3511-3524	46°50.45'N 91°18.15'W	Development of 49' charted sounding. 100 meter spacing. Least depth found: 61 ft. Recommend supersede the chart. <i>Concur</i>
49 ft	59-68	3699-3705	46°53.4'N 91°12.0'W	Sounding of 49' observed in area of steep gradient. 100 meter spacing. Least depth obtained: 59 ft. Recommend supersede the chart. <i>Concur</i>

Discrepancies between the survey and chart may have been the result of position control and sounding methods used in the 1869 surveys. Generally, survey depths (H-10095) agreeing with the above anomalous soundings were observed within 200-500 meters of the charted soundings in a southerly direction. The trend and spacing of depth curves are similar to that of the chart.

It is recommended that survey H-10095 supersede the chart for charting purposes. Recommendations and references to the shoreline can be found in Section H of this report, *AND SECTION 7.2. OF THE EVALUATION REPORT.*

Port Wing Harbor

Comparisons were made with Chart 14966, 19th Edition, January 15, 1983, Port Wing Harbor Inset.

Sounding comparisons with the chart were excellent, with 98% of the soundings in the open lake portion of the survey within ± 2 feet. Agreement of soundings in the harbor were generally ± 1 foot. In most cases, this survey revealed the shoaler depth. Discrepancies of significance outside the harbor are listed below.

<u>CHART</u>	<u>SURVEY</u>	<u>POSITION</u>
17'	23 24'	λ 46°47.65'N ϕ 91°22.94'W
13'	20 21'	λ 46°47.63'N ϕ 91°22.95'W
8'	13 5'	λ 46°47.6 'N ϕ 91°22.95'W
19'	25 24'	λ 46°47.65'N ϕ 91°23.15'W

To disprove the discrepancies, additional mainscheme lines were run in the area. The discrepancy between the chart and survey H-10095 could be the result of shifting sand bars in the area.

~~It is recommended that survey H-10095 supersede Chart 14966, Port Wing Harbor, for charting. It is recommended that shoreline compiled for this survey (TP-01253) and revised by the hydrographer be used for charting purposes. CONCUR~~

Comparison of Non-Sounding Features SEE SECTION 7.2. OF THE EVALUATION REPORT.

The following non-sounding features were investigated during this survey and recommendations for charting are listed below:

<u>ITEM</u>	<u>LAT/LONG</u>	<u>REMARKS</u>
Rock (3033)	46°52' ^{40"} 68"N 91°11' ^{43"} 77"W	Visible above sounding datum located 20 meters from shore. Recommend chart item. SEE SMOOTH SHEET FOR DELINEATION.
Pier Ruin (3053)	46°47' ^{50"} 11"N 91°15' ^{43"} 83"W	Extends 15 feet from shore. Recommend do not chart. DO NOT CONCUR. PLOT AS SHOWN ON SMOOTH SHEET.
Pile (8013)	vic { 46°47' ^{16"} 26"N 91°23' ^{11"} 18"W	Northernmost pile of a group of piling. Recommend chart as depicted on manuscript (TP-01253). CONCUR CHART AS SHOWN ON SMOOTH SHEET.
Pile (8015)	46°47' ^{16"} 28"N 91°23' ^{11"} 19"W	Salient Pile. Visible above sounding datum. Chart as visible pile. CONCUR. CHART AS SHOWN ON SMOOTH SHEET.
Piles (8020)	vic { 46°47' ^{29"} 37"N 91°23' ^{10"} 13"W	Pile bares ^{2.0} 0.5 ft. Visible above sounding datum. Chart as visible pile. DO NOT CONCUR. CHART AS SHOWN ON SMOOTH SHEET. AREA DELINEATED BY LIMIT LINE. AWASH
Subm Pile (8021)	46°47' ^{24"} 37"N 91°23' ^{11"} 13"W	Pile subm 1.5 feet. Chart as submerged pile. DO NOT CONCUR. CHART AS SHOWN ON SMOOTH SHEET. AREA DELINEATED BY LIMIT LINES.
Subm Pile (8022)	46°47' ^{24"} 37"N 91°23' ^{10"} 11"W	Corner pile of group piling submerged 1.5 ft. Chart piling as depicted on manuscript (TP-01253). AWASH-CHART AS SHOWN ON SMOOTH SHEET. AREA IS DELINEATED BY LIMIT LINES.
Overhead Cable	46°47.45'N 91°22.85'W	Overhead cable east of bridge. No hazard to navigation and of no landmark value. Do not chart.
Bridge (Road Crossing)	46°47.45'N 91°22.88'W	Bridge Clearance 1 foot , 3 FEET AT LWD. CONCUR
Shoal (8049, 8050) Port Wing Harbor		Chart as depicted in red on field sheet. Water less than 0.5 feet. Visible as land at LWD. CHART AS SHOWN ON SMOOTH SHEET.
Subm Rock (8051)	46°47' ^{28"} 46"N 91°23' ^{13"} 25"W	Submerged ² 3.0 ft. Chart as submerged rock. CONCUR 2RK
Subm Rock (8052)	46°47' ^{28"} 47"N 91°23' ^{13"} 22"W	Rock submerged ² 3.2 ft. Not visible above sounding datum. Chart as submerged rock. CONCUR 2RK

Subm Rock (8053)	46°47' ^{28"} 47 " N 91°23' ^{13"} 22 " W	Rock submerged ² 3.7 ft. Chart as submerged rock. <i>CONCUR 2 RK</i>
Rock (8054)	46°47' ^{28"} 45 " N 91°23' ^{13"} 24 " W	Rock bares ³ 1.5 ft. Rock visible above sounding datum. Chart rock. <i>CONCUR, RETAIN AS CHARTED.</i>
Sandbar (8057,8058) Port Wing Harbor	<i>REVISED TO APPROX HWL</i>	Chart as depicted in red on ^{<i>SMOOTH SHEET</i>} field sheet . <i>CONCUR</i>
*Piles (2 piles)	46°47' ^{27.8"} 48 " N 91°23' ^{01.7"} 18 " W	Disproven. Delete from chart (See comments below). <i>CONCUR</i>
*Piles (2 piles)	46°47' ^{27.5"} 46 " N 91°22' ^{57"} 95 " W	Disproven. Delete from chart. (See comments below.) <i>CONCUR</i>

* A small boat chain drag (VesNo 3283) was conducted in the harbor of Port Wing to locate two sets of two charted piles.

The area of the northern set of ^{two} piles charted at Latitude 46°47'^{27.5"}~~46~~" N, Longitude 91°23'^{01.7"}~~17~~" W was swept several times with no snags.

The southern set of ^{two} piles charted at ^{LATITUDE 46°47' 27.5" N,} Longitude 91°22'^{57"}~~95~~" W were snagged. In an attempt to free the chain, the two piles were pulled from the bottom. The piles were loaded into the survey boat and were removed from the harbor.

Both sets of piles have been disproven and should be removed from the chart.

There are no dangers to navigation within the limits of the survey.

M. ADEQUACY OF SURVEY

Survey H-10095 is considered complete and adequate to supersede all prior surveys for charting purposes with the exception of the contemporary survey conducted in the Port Wing harbor in early June 1983 by the U.S. Army Corps of Engineers. These two surveys should replace all charted soundings in the common area. *SEE ALSO SECTION 6 OF THE EVALUATION REPORT.*

A copy of the Corps' survey at a scale of 1:1200 is submitted with this report.

N. AIDS TO NAVIGATION

The only aid to navigation located within the survey limits is Port Wing East Pier Light which marks the entrance to Port Wing Harbor, Wisconsin. The aid is maintained all year and adequately serves the purpose for which it was established. This light is characterized as follows: Fl 4 sec 30 FT 6 ST M. This fixed aid is maintained by the U.S. Coast Guard. It was established in 1913-1950 (Light List, Vol. IV, 1983).

A revised geographic position for PORT WING EAST PIER LT was computed by PEIRCE personnel in 1982. A comparison of this geographic position with the position listed in the latest edition of the Light List and Chart No. 14966, 19th Edition, January 15, 1983 is listed below:

<u>SURVEY POSITION</u>	<u>LIGHT LIST</u>	<u>CHART 14966</u>
46°47' ^{35.13"} 34.73" N	46°47'36" N	46°47'35" N
91°23'10.07" W	91°23'12" W	91°23'10" W

The revised position for this light is included on Form 76-40 (Nonfloating Aids or Landmarks for Chart). The original of this form has been submitted to N/MOAI for forwarding to N/CG243.

There is one small bridge (road crossing over creek) located within the survey limits. It is located at the eastern end of the Port Wing Harbor (Latitude 46°47'27"N, Longitude 91°22'50"W). Clearance under the bridge was measured at less than one foot (see sounding Volume I, PE 20-3-83, pg. 9). *3 Ft AT LWD WITH SMOOTH LAKE WATER LEVELS APPLIED.*

An overhead cable is located approximately 10 meters east of the bridge. Vertical clearance under this cable was estimated at 40 feet. *41 Ft, WITH SMOOTH LAKE WATER LEVELS APPLIED*

Vertical clearances under these two items should be based on the Low Water Datum of Lake Superior which is 600 feet on the International Great Lake Datum of 1955. The state of the lake level at the time of this observation (JD 162, 1430 UTC, June 11, 1983) was approximately 1.2 feet above the Low Water Datum of Lake Superior. This information was based on unverified water level records from Port Wing (909-9058) water level station. *SEE SMOOTH SHEET FOR VERIFIED CORRECTION TO OBSERVATIONS.*

There are no pipelines, submarine cables or ferry lines within the limits of this survey.

0. STATISTICS

<u>Category</u>	2830 <u>3280</u>	2831 <u>3281</u>	2832 <u>3282</u>	2833 <u>3283</u>	<u>Total</u>
Nautical Miles of Sounding	2.7	206.0	166.2	0.8	375.7
Total Number of Positions	54	698	844	62	1658
XBT Casts	1	2	-	-	3
Bottom Samples	43	0	12	10	65
Water Level Stations	-	-	-	-	3
Settlement and Squat	1	1	1	1	4

Note: Total number of positions does not include rejected and omitted positions.

P. MISCELLANEOUS

A total of sixty-five (65) bottom samples were taken on this survey. Twenty-two of the bottom samples were taken in the Port Wing harbor area (1:2500 survey). The bottom samples were not retained.

Loran-C comparisons were observed in conjunction with bottom samples taken on June 21, 1981 (JD 172) by PEIRCE (VesNo 3280) by interfacing the 6000 Loran-C receiver with the HYDROPLOT system and by invoking the HYDROPLOT program RK 112's Loran-C option. Loran-C rates that were monitored are 8970-X and 8970-Y.

This information will be transmitted to Hydrographic Surveys Branch, Atlantic Marine Center (N/MOA23) via the survey's raw data master tape. *DATA WILL BE TRANSMITTED IN ACCORDANCE WITH APPLICABLE CURRENT HYDROGRAPHIC SURVEY GUIDELINES.*

Q. RECOMMENDATION

It is recommended that data compiled for this survey supersede all existing charts and information. It is also recommended that information pertaining *LOWE DR* to controlling depths for the harbor of Port Wing be obtained from U.S. Army Corps of Engineers recent survey of the harbor. The project area charted south of Latitude 46°47.4' in Port Wing Harbor is no longer a Corps project (Re: Al Klein, U.S. Army Corps of Engineers, June 27, 1983.) It is therefore recommended that this project be deleted from the chart.

Specific recommendations concerning charted features and other items were made in Section K and L of this report.

R. AUTOMATED DATA PROCESSING

The following programs were used in acquiring and processing data for this survey.

<u>PROGRAM</u>	<u>PROGRAM NAME</u>	<u>VERSIONS</u>
RK 112	Hyberbolic, R/R Hydroplot	5/11/83
RK 116	Range-Azimuth Hydroplot	5/15/83
RK 201	Grid, Signal, Lattice Plot	4/18/75
RK 211	Range-Range Non-Real Time Plot	2/02/81
RK 212	Visual Station Table Load	4/01/79
RK 216	Range-Azimuth Non-Real Time Plot	2/09/81
RK 300	Utility Computations	10/21/80
RK 330	Reformat and Data Check	5/04/76
RK 360	Electronic Correctors Abstract	2/02/76
RK 530	Layer Corrections for Velocity	5/10/76

RK 561	H/R Geodetic Calibration	12/01/82
AM 602	Elinore--Extended Line Oriented Editor	12/08/82
AM 612	Line Printer List	3/22/78

S. REFERENCE TO REPORTS

The ship's personnel installed three water level stations during this survey. Two of the three temporary stations were required for this survey. A water level report has been submitted to Water Levels Section, Rockville, Maryland (see Water Levels Report in Appendix B). All leveling records and monthly water level data will be submitted to that office.

The following is a list of reports that will be submitted to the following offices subsequent to the end of the 1983 field season in Lake Superior.

<u>REPORTS</u>	<u>SUBMITTED TO</u>	<u>DATE</u>
Coast Pilot Report	Coast Pilot Section Rockville, Maryland	October 1983
Loran-C Comparisons	Operations Branch AMC	July 1983
Horizontal Control Report	Operations Branch AMC	October 1983

All supplemental and related data will be forwarded with this report.

Respectfully submitted;


 Roslyn B. Harris, ENS, NOAA

APPENDIX J

APPROVAL SHEET

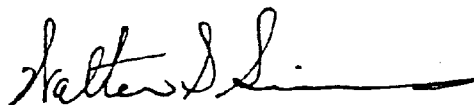
APPROVAL SHEET

H-10095

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. *See sections 6 and 7. a. of the Evaluation Report.*

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.



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

APPENDIX F

LIST OF STATIONS

SIGNAL TAP

PE-20-3-83

H-10095

113	5	46	46	23191	091	27	09880	250	0007	000000	QUARRY INN, 1981
146	0	47	00	48487	091	39	47683	250	0000	164722	AGATE BAY ARGO, 1983
147	0	47	17	08757	091	15	08616	250	0000	164722	SILVER BAY ARGO, 1983
150	7	46	47	31386	091	22	40073	250	0003	000000	LOG HUB, 1982
151	7	46	47	34729	091	23	10067	139	0000	000000	PORT WING EAST PIER LT, 198 ²
153	5	46	47	36709	091	24	08267	250	0002	000000	QUARRY NAIL, 1983
154	7	46	47	41493	091	24	27404	250	0003	000000	QUARRY NO 1, 198 ²
157	5	46	47	34936	091	23	10166	139	0001	000000	PORT WING 3 USE, 1982
159	7	46	47	51482	091	21	40662	139	0002	000000	KRAUSS, 1983
160	7	46	47	26718	091	23	12543	250	0001	000000	PORT, 1982
161	7	46	47	22116	091	23	10720	250	0001	000000	WING, 1983
162	7	46	47	30835	091	23	09411	254	0002	000000	CLUMP HUB, 198 ³

Replaces CGS Form 567.

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

NONFLOATING AIDS OR LANDMARKS FOR CHARTS

REPORTING UNIT
(If field party, ship or office)

STATE

LOCALITY

DATE

ORIGINATING ACTIVITY

NOAA Ship PEIRCE

Wisconsin

Lake Superior

6/4/83

- TO BE CHARTED
- TO BE REVISED
- TO BE DELETED

NOAA Ship PEIRCE

Wisconsin

Lake Superior

6/4/83

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

HAVE HAVE NOT

been inspected from seaward to determine their value as landmarks.

DATUM

NAD 1927

(See instructions on reverse side)

JOB NUMBER

H-10095

POSITION

OFFICE

FIELD

CHARTING NAME

FI 4sec

30 ft

6 St M

CHARTS AFFECTED

DESCRIPTION

(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)

(Port Wing East Pier Lt, 1982)

46 47

34.73 091 23 10.07

LATITUDE

LONGITUDE

D.M. Meters

D.P. Meters

14960
14966
14961

CHARTING NAME

FL 4sec

30 ft

6 St M

CHARTS AFFECTED

DESCRIPTION

(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)

(Port Wing East Pier Lt, 1982)

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6 St M

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34.73 091 23 10.07

LATITUDE

LONGITUDE

D.M. Meters

D.P. Meters

14960
14966
14961

CHARTING NAME

FL 4sec

30 ft

6 St M

CHARTS AFFECTED

DESCRIPTION

(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)

(Port Wing East Pier Lt, 1982)

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34.73 091 23 10.07

LATITUDE

LONGITUDE

D.M. Meters

D.P. Meters

14960
14966
14961

CHARTING NAME

FL 4sec

30 ft

6 St M

CHARTS AFFECTED

DESCRIPTION

(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)

(Port Wing East Pier Lt, 1982)

46 47

34.73 091 23 10.07

LATITUDE

LONGITUDE

D.M. Meters

D.P. Meters

14960
14966
14961

CHARTING NAME

FL 4sec

30 ft

6 St M

CHARTS AFFECTED

NC - Ref L-664 (83)



UNITED STATES DEPARTMENT OF COMMERCE
National Ocean and Atmospheric Administration
~~NATIONAL OCEAN SERVICE~~
Rockville, Md. 20852
NATIONAL OCEAN SERVICE
CHARTING AND GEODETIC SERVICES N/CG142:LDH

July 18, 1983

TO: Cdr. Paul M. Duernberger
Chief, Operations Branch
ATTN: N/MO11
Atlantic Marine Center
National Ocean Service, NOAA
439 W. York Street
Norfolk, Virginia 23510

FROM: N/CG142 - Larry D. Hothem *L.D. Hothem*

SUBJECT: Doppler Point Position Results for Lake Superior Doppler Project

Attached are the following information and data for the point position results of the Doppler observations performed by AMC in the Lake Superior region during September 1982:

1. Geodetic Summaries for all Doppler stations of the Lake Superior project and Apostle Island project (performed in 1978).
2. Tables of datum shift computations used to transform the Doppler stations to the NAD 1927 datum.

It is apparent from Table 3 there is considerable inconsistencies in the horizontal control between station FINLAND (50281) located on the west side of the lake and project area, and station MCM91 (50299) located on the eastern part of the project area. The differences between the NAD 1927 and transformed Doppler are relative to the two stations DRONTO (50302) and BLACK (50303) located in the central region of the project area. Because of the large spread in latitude of 4 meters and in longitude of 5.4 meters between the 4 stations, the Doppler coordinates were transformed using the datum shift appropriate for each region.



The transformed stations and corresponding datum shift used were:

<u>Datum Shift Computed From</u>	<u>Stations Transformed</u>
50281	50283, 50284, 50285, 50286, 50287
Mean 50302 and 50303	50288, 50289, 50300, 50301, 50290, 50291, 50292
50299	50293, 50294, 50295, 50296, 50297, 50298, 50304, 50305, 50306

The estimated uncertainties for the horizontal coordinates are given for each station in the geodetic summaries.

We are now in the final stages of testing the most updated version of the Doppler short arc program GEODOPV. We expect to begin within a couple of weeks the reduction of the Lake Superior data. The relative position results will be analyzed by comparison with the point position data. It is expected there will be some improvement in the internal consistency of the Doppler derived raw coordinates. However, the improvements will only be in the precision of the unadjusted coordinates since the distortions in the NAD 1927 network will affect the accuracy of the final transformed Doppler coordinates. After the NAD 83 readjustment is completed, the differences between the Doppler derived control and NAD 83 should be under a few decimeters.

Should you have any questions or if you would like additional information, please contact Ms. Madeline White, Lt. David Minkel, or myself. Our telephone number is (FTS) 443-8580.

Attachments

cc:

Mr. Gary Fredericks, AMC

The local network which the ^{is based upon} Argo positioning data (stations Agate Bay Argo, 1983 and Silver Bay AR40, 1983) were located from Doppler stations) relative to the local net in the vicinity of the Apostle Islands, are probable accurate to ± 2 meters. This is insignificant regarding the Argo positioned hydrographic data in the survey area. Further inquiring if desired may be had by contacting Mr. Larry D. Hothorn, NGS Suckville Md. or Mr. Gary Fredericks, AMC.

R.W. Sawicki

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: Port Wing, Wisconsin (909-9058)

Period: June 7 - 21, 1983

HYDROGRAPHIC SHEET: H-10095

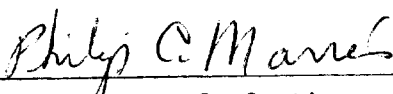
OPR- Z137-PE-83

Locality: Lake Superior

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

Remarks:

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



Chief, Water Levels Section

LETTER TRANSMITTING DATA

140A23-78-85

RHW

DATA AS LISTED BELOW WERE FORWARDED TO YOU BY (Check):

- ORDINARY MAIL
- AIR MAIL
- REGISTERED MAIL
- EXPRESS
- GBL (Give number) _____

TO:

CHIEF, DATA CONTROL SECTION
 HYDROGRAPHIC SURVEYS BRANCH, N/CG243
 NATIONAL OCEAN SERVICE, NOAA
 ROCKVILLE, MD 20852

DATE FORWARDED

JULY 8, 1985

NUMBER OF PACKAGES

1 TUBE 1 BOX

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

H-10095, OPR-E137

WISCONSIN, LAKE SUPERIOR, BARK POINT TO IRON RIVER

Pkg #1: 1 TUBE CONTAINING:

- 11 - MYLAR SMOOTH SHEET FOR H-10095
- 11 - MYLAR SMOOTH POSITION OVERLAY
- 12 - MYLAR SMOOTH EXCESS OVERLAYS
- 11 - ORIGINAL DESCRIPTIVE REPORT
- 12 - FINAL FIELD SHEETS
- 11 - FINAL FIELD SHEET OVERLAY
- 17 - PRELIMINARY FIELD SHEETS

Pkg #2: 1 BOX CONTAINING:

- 1 - ACCORDIAN FILE CONTAINING ECHOGRAMS AND FIELD DATA PRINTOUTS FOR:
 VESNO 2830: JD 160 (BOTTOM SAMPLES) AND 172.
 VESNO 2831: JD 158, 159, 160, 161, 162, 163 AND 164.
 VESNO 2832: JD 158, 159, 160, 161, (R/R MINI-RANGER) 161 (R/AZ, MR) AND 162.
 VESNO 2833: JD 161 AND 162.

FROM: (Signature)

R.H. Whitfield

RICHARD H. WHITFIELD

RECEIVED THE ABOVE
(Name, Division, Date)

Dwayne S. Clark
 July 22, 1985
 NICG243

Return receipted copy to:

ATLANTIC MARINE CENTER
 HYDROGRAPHIC SURVEYS BRANCH, N/140A23
 NOAA, NATIONAL OCEAN SERVICE
 439 W. YORK STREET
 NORFOLK, VA 23510

MOA23-78-85

RNW

LETTER TRANSMITTING DATA

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PAGE 2 OF 2

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TO:

CHIEF DATA CONTROL SECTION
HYDROGRAPHIC SURVEYS BRANCH, N/CG243
NATIONAL OCEAN SERVICE, NOAA
ROCKVILLE, MD 20852

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

Pkg #2 CONTINUED:

- ✓ 1 - ENVELOPE WITH SUPPLEMENTAL DATA FROM PRINTOUTS.
- ✓ 1 - FOLDER WITH SHIP'S SUPPLEMENTAL DATA.
- ✓ 2 - SOUNDING VOLUMES.
- ✓ 1 - BUNDLE OF SAWTOOTH POSITION CHARTS.
- ✓ 1 - FOLDER POSITION CALIBRATION RECORDS
- ✓ 1 - FOLDER ^{TRA} ~~VELOCITY~~ CORRECTION RECORDS
- ✓ 1 - RANGE/AZIMUTH LOG
- ✓ 2 - FAIL LOGS
- ✓ 1 - CAHIER WITH FINAL POSITION PRINTOUT AND FINAL CONTROL PRINTOUT.
- ✓ 1 - CAHIER WITH FINAL SOUNDING PRINTOUT AND L-FILE.

FROM: (Signature)

R. H. Whitefield
RONARD H. WHITEFIELD

RECEIVED THE ABOVE
(Name, Division, Date)

Dwayne S. Clark
July 22, 1985
NICG243

Return receipted copy to:

ATLANTIC MARINE CENTER
HYDROGRAPHIC SURVEYS BRANCH, N/MOA23
NOAA, NATIONAL OCEAN SERVICE
439 W. YORK STREET
NORFOLK, VA 23510

HYDROGRAPHIC SURVEY STATISTICS
REGISTRY NO.: H-10095

Number of positions	<u>1633</u>
Number of soundings	<u>9155</u>
Number of control stations	<u>12</u>

	<u>TIME-HOURS</u>	<u>DATE COMPLETED</u>
Preprocessing Examination	<u>8</u>	<u>9/07/83</u>
Verification of Field Data	<u>298</u>	<u>2/14/85</u>
Quality Control Checks	<u>62</u>	
Evaluation and Analysis	<u>55</u>	<u>5/15/85</u>
Final Inspection	<u>16</u>	<u>5/30/85</u>
TOTAL TIME	<u>493</u>	
Marine Center Approval		<u>5/31/85</u>

Transmittal letter of survey and survey records will be included in the Descriptive Report to identify the records accompanying the survey.

ATLANTIC MARINE CENTER
EVALUATION REPORT

SURVEY NO.: H-10095

FIELD NO.: PE-20-3-83

Wisconsin, Lake Superior, Bark Point to Iron River

SURVEYED: 7 June through 21 June 1983

SCALE: 1:20,000

PROJECT NO.: OPR-Z137-PE-83

SOUNDINGS: Ross Digital Echosounder
Raytheon DE-719B
Fathometer and Pole
Sounding

CONTROL: ARGO DM 54
(Range/Range),
Mini-Ranger Falcon 484
(Range/Range),
Mini-Ranger Falcon 484
and Wild T-2
Theodolite (Range/
Azimuth), and HP3810B
EDM (Range/Azimuth).

Chief of Party.....W. S. Simmons

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

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

1. INTRODUCTION

- a. No unusual problems were encountered during verification.
- b. Notes in the Descriptive Report were made during office processing.

2. CONTROL AND SHORELINE

a. The control is adequately discussed in sections F, G, and S of the Descriptive Report. See also letter dated July 18, 1983, Subject: Doppler Point Position Results for Lake Superior Doppler Project, appended to the Descriptive Report.

b. Shoreline was added in brown from 1:20,000 scale enlargements of 1:24,000 scale U.S. Geological Surveys Quadrangles photo revised with 1981 NHAP photographs and is for orientation purposes only. Shoreline for the Port Wing area originates with a 1:5,000 scale final reviewed Photogrammetric Manuscript TP-01253 of 1983 which was enlarged and applied to the smooth sheet and supplemental data shown in red determined by the hydrographer.

A discrepancy exists with the shoreline from the 1:20,000 scale enlargement of the U.S. Geological Quadrangle in the vicinity of Port Wing, Latitude 46°47'33"N, Longitude 91°23'10"W. The east jetty at the entrance to the harbor is too far to the east (approximately 1 mm at the scale of the smooth sheet). It appears that the jetty was drawn in error along a grid line, Longitude 91°23'10"W. This grid line is shown in Inset No. 1 on the smooth sheet which is correct.

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 because of the proximity of the shoreline, the standard depth curves and the charted 24-foot supplemental depth curve were drawn in their entirety. Dashed and brown curves were added to better show bottom topography.

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

1) Numerous submerged rocks were located by the hydrographer. The depths on these rocks are Echosounder depths and may not be the least depth.

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 Calibration Report was well done.

b. Overall development of the survey was well done.

c. In development of shoal areas, least depths noted on the field sheet overlays should be brought through to the final field sheet.

d. The hydrographer's comparison with prior surveys, section K. of the Descriptive Report, is very confusing. The hydrographer discusses two (2) prior surveys, LS-443 (1869) and LS-444 (1869), which do not appear to apply to the present survey as having soundings transferred to prior surveys LS-1491 (1927) and LS-1492 (1927) that do apply to the present survey.

e. The hydrographer failed to make a comparison with prior survey LS-1994 (1956).

f. The wrong EDP numbers for the ship and launch identification were used throughout the survey. This was revised during survey processing at AMC.

g. The original approval sheet was not submitted with the original Descriptive Report.

h. The hydrographer failed to discuss in the Description Report two (2) charted items and one (1) uncharted item that were confirmed and located.

5. JUNCTIONS

H-10036 (1982) to the north

H-10043 (1982) to the west

H-10096 (1983) to the east

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

6. COMPARISON WITH PRIOR SURVEYS

LS-457 (1869) 1:120,000

LS-1491 (1927) 1:20,000

LS-1492 (1927) 1:20,000

LS-1754 (1938) 1:10,000

LS-1765 (1944) 1:5,000

LS-1994 (1956) 1:120,000

LS-457 is a small scale survey which covers the west half of the present survey. The data on this survey is sparse with the soundings ranging from five (5) to twenty (20) feet shoaler than the present survey.

LS-1491 covers the east half of the present survey with soundings generally agreeing within plus or minus (+/-) three (3) feet for depths of 60 to 250 feet. Depths for the inshore areas range from plus or minus (+/-) four (4) feet. Differences from four (4) feet shoaler to fifteen (15) feet deeper were found on the present survey. In the vicinity of Latitude 46°49'48"N, Longitude 91°18'50"W, a few soundings are five (5) to nine (9) feet shoaler than the present survey. Present survey depths indicate that because of bottom change due to natural processes, shoaler depths have shifted to the south as the bottom is sandy in this area. The mouth of the Cranberry River has shifted from the west to the east. There is a general deepening trend shown by the present survey alongshore extending to depths of about sixty (60) feet. Two shoal prior survey depths not considered disproved have been brought forward to supplement the present survey. There were no conflicts between the present survey depths and the swept depths shown on this prior survey.

LS-1492 covers the west half of the present survey with soundings being generally shoaler by two (2) to six (6) feet than the present survey; however, there is a general deepening trend shown by the present survey alongshore extending to depths of about sixty (60) feet. These differences can probably be attributed to the difference in the lake water level datum and erosion of the sandy bottom. The shoreline west of Port Wing to Quarry

Point has receded up to 180 meters resulting in depth of three (3) to ten (10) feet deeper on the present survey. The shoreline east of Port Wing has receded twenty (20) to sixty (60) meters. Large discrepancies of soundings in section K, page 10 of the Descriptive Report are adequate and need no further discussion in this Evaluation Report. Two shoal prior survey depths not considered disproved have been brought forward to supplement the present survey. There were no conflicts between the present survey depths and the swept depths shown on this prior survey.

The comparison of prior surveys LS-1754 and LS-1765 in section K. of the Descriptive Report is adequate and needs no further discussion in this Evaluation Report.

LS-1994 is a small scale survey that covers a small portion of the western part of the present survey. The few soundings that fall within the survey limits compare well with the present survey.

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

7. COMPARISON WITH CHART 14966 (19th Ed., Jan. 15/83)

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys which need no further consideration and miscellaneous sources. Specific soundings tabulated and discussed in section L, pages 12 and 13, of the Descriptive Report have charting recommendations on these pages and require no additional comments.

In addition to the recommendations in section L of the hydrographer's report, the following should be noted:

- 1) A charted jetty in ruins, in Latitude $46^{\circ}50'06.6''N$, Longitude $91^{\circ}15'49.7''W$, was located by the hydrographer. It is recommended that the jetty in ruins be charted as delineated on the smooth sheet.
- 2) The hydrographer located a pile awash, in Latitude $46^{\circ}47'24.8''N$, Longitude $91^{\circ}23'11.8''W$, that is the corner pile of a row of charted piles. It is recommended that the piles be charted as shown on the smooth sheet.
- 3) The following uncharted items were located by the hydrographer; a rock, in Latitude $46^{\circ}47'28.0''N$, Longitude $91^{\circ}23'13.8''W$, submerged two (2) feet, a rock, in Latitude $46^{\circ}47'28.4''N$, Longitude $91^{\circ}23'13.5''W$, submerged two (2) feet, and a rock, in Latitude $46^{\circ}47'28.2''N$, Longitude $91^{\circ}23'13.6''W$, submerged two (2) feet. These items are in the same area as two (2) charted submerged rocks, depths unknown. Revise the charted rocks as shown on the smooth sheet.
- 4) The hydrographer located a group of rocks submerged four (4) feet, in Latitude $46^{\circ}47'31''N$, Longitude $91^{\circ}23'13''W$. It is recommended that the rocks be charted at the location shown on the smooth sheet with a depth over rocks of four (4) feet.

5) The four visible piles, charted in the vicinity of Latitude 46°47'25.5"N, Longitude 92°23'11"W in Port Wing were not considered verified or disproved. It is recommended that they be retained and revised to submerged piles.

6) Hydrography inside Port Wing is only of reconnaissance value. The U. S. Army Corps of Engineers survey should be used to chart the area with the present survey supplementing the C of E survey data, except as noted above.

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

b. Aids to Navigation


There is one fixed aid to navigation on the survey smooth sheet. This aid appears adequate to serve its intended purpose.

8. COMPLIANCE WITH INSTRUCTIONS

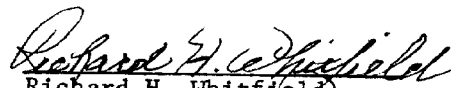
This survey adequately complies with the Project Instructions except as noted elsewhere in this report.

9. ADDITIONAL FIELD WORK


This is an good basic survey; no additional field work is recommended.



Douglas V. Mason
Cartographic Technician
Verification of Field Data



Richard H. Whitfield
Cartographic Technician
Evaluation and Analysis

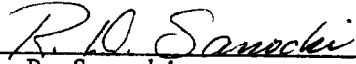


Leroy G. Cram
Supervisory Cartographic Technician
Verification Check

Inspection Report
H-10095


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



R. D. Sanocki
Chief, Hydrographic Surveys
Processing Section
Hydrographic Surveys Branch

Approved May 31, 1985



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



UNITED STATES - GREAT LAKES
LAKE SUPERIOR
HYDROGRAPHIC SURVEY
SCALE 1:50,000

REPRODUCTION OF PART OF MAP 11071, ADRIAN LAKE, IN LAKES SUPERIOR

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HYDROGRAPHIC SURVEYS	
DATE	HYDROGRAPHER
1890	W. S. Williams
1900	W. S. Williams
1902	W. S. Williams
1904	W. S. Williams
1906	W. S. Williams
1908	W. S. Williams
1910	W. S. Williams
1912	W. S. Williams
1914	W. S. Williams
1916	W. S. Williams
1918	W. S. Williams
1920	W. S. Williams
1922	W. S. Williams
1924	W. S. Williams
1926	W. S. Williams
1928	W. S. Williams
1930	W. S. Williams
1932	W. S. Williams
1934	W. S. Williams
1936	W. S. Williams
1938	W. S. Williams
1940	W. S. Williams
1942	W. S. Williams
1944	W. S. Williams
1946	W. S. Williams
1948	W. S. Williams
1950	W. S. Williams
1952	W. S. Williams
1954	W. S. Williams
1956	W. S. Williams
1958	W. S. Williams
1960	W. S. Williams
1962	W. S. Williams
1964	W. S. Williams
1966	W. S. Williams
1968	W. S. Williams
1970	W. S. Williams
1972	W. S. Williams
1974	W. S. Williams
1976	W. S. Williams
1978	W. S. Williams
1980	W. S. Williams
1982	W. S. Williams
1984	W. S. Williams
1986	W. S. Williams
1988	W. S. Williams
1990	W. S. Williams
1992	W. S. Williams
1994	W. S. Williams
1996	W. S. Williams
1998	W. S. Williams
2000	W. S. Williams

Diagram LS-9

