

**F00863**

U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Ocean Service

**DESCRIPTIVE REPORT**

Type of Survey: Navigable Area

Registry Number: F00863

**LOCALITY**

State(s): Michigan

General Locality: Lake Huron

Sub-locality: South of Thunder Bay Island

**2022**

CHIEF OF PARTY  
LTJG Nicholas Azzopardi

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Date:

**HYDROGRAPHIC TITLE SHEET**

**F00863**

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

State(s): **Michigan**

General Locality: **Lake Huron, Michigan**

Sub-Locality: **South of Thunder Bay Island**

Scale: **20000**

Dates of Survey: **07/13/2022 to 07/18/2022**

Instructions Dated: **06/30/2022**

Project Number: **S-X913-NRTNL-22**

Field Unit: **NOAA Navigation Response Team - New London**

Chief of Party: **LTJG Nicholas Azzopardi**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter**

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Low Water Datum IGLD-1985**

**Remarks:**

*Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <https://www.ncei.noaa.gov/>. Products created during office processing were generated in NAD83 UTM 17N, LWD. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.*

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## Descriptive Report to Accompany Survey F00863

Project: S-X913-NRTNL-22

Locality: Lake Huron, Michigan

Sublocality: South of Thunder Bay Island

Scale: 1:20000

July 2022 - July 2022

**NOAA Navigation Response Team - New London**

Chief of Party: LTJG Nicholas Azzopardi

### A. Area Surveyed

The survey is located east of Alpena, Michigan and south of Sugar Island and Thunder Bay Island.

#### A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
45° 1' 19.15" N 83° 13' 31.01" W	44° 59' 3.81" N 83° 10' 24.84" W

*Table 1: Survey Limits*

Survey limits were acquired in accordance with the requirements in the Project Instructions and the HSSD. There are 0 fliers and 15 holidays identified by Pydroexplorer's QC Tools. All but one holiday were located along the edges of the sheet and were found to not be navigationally significant. The one holiday not near the sheet edge was caused by an acoustic shadow and also found to not be navigationally significant.

#### A.2 Survey Purpose

This request is in support of NOAA's Office of Coast Survey, Thunder Bay National Marine Sanctuary and the Great Lakes Environmental Research Lab for a hydrographic survey for the area North of Thunder Bay Island. This area is heavily trafficked by commercial and recreational vessels, so marine commerce is economically vital for the region. The primary purpose of this project is to provide contemporary hydrographic data to update NOAA's nautical charting products. Mapping data from this project will also be used to locate and assess cultural resources (primarily historic shipwrecks). The majority of the prior

data in the project area was partial bottom coverage collected by the U.S. Army Corps of Engineers Lake Survey before 1974. The data from this project will provide modern bathymetry for updating National Ocean Service nautical charting products, improving the safety of maritime traffic and commerce as well as supporting the Lakebed 2030 global mapping initiative. Survey data from this project is intended to supersede all prior survey data in the common area.

### A.3 Survey Quality

The entire survey is adequate to supersede previous data.

The Grid QC tool within QC Tools was used to analyze multibeam echosounder (MBES) data density. The MBES surface meets the HSSD data density requirement.

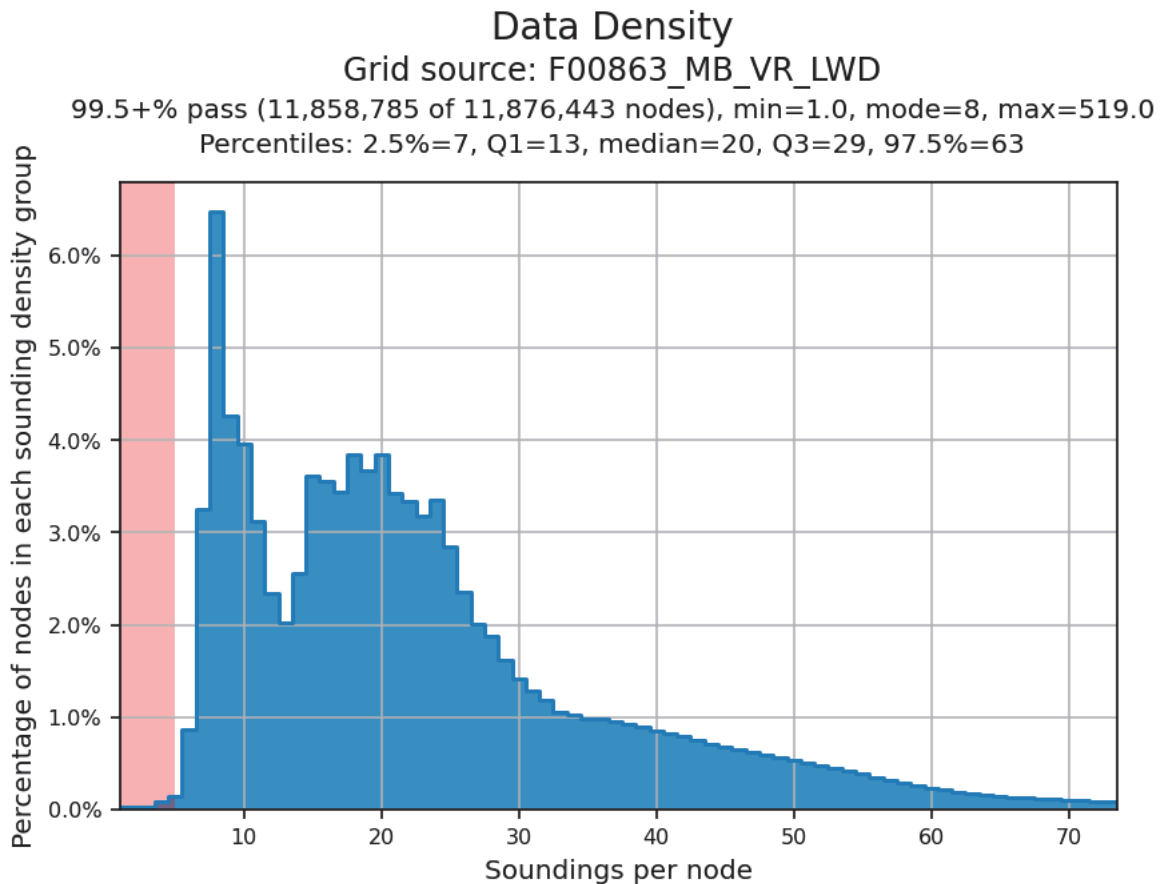


Figure 1: Pydro derived histogram plot showing HSSD object detection compliance of F00863 MBES data within the CUBE VR surface.

### A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Object Detection Coverage (Refer to HSSD Section 5.2.2.2)

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements listed above and in the HSSD.

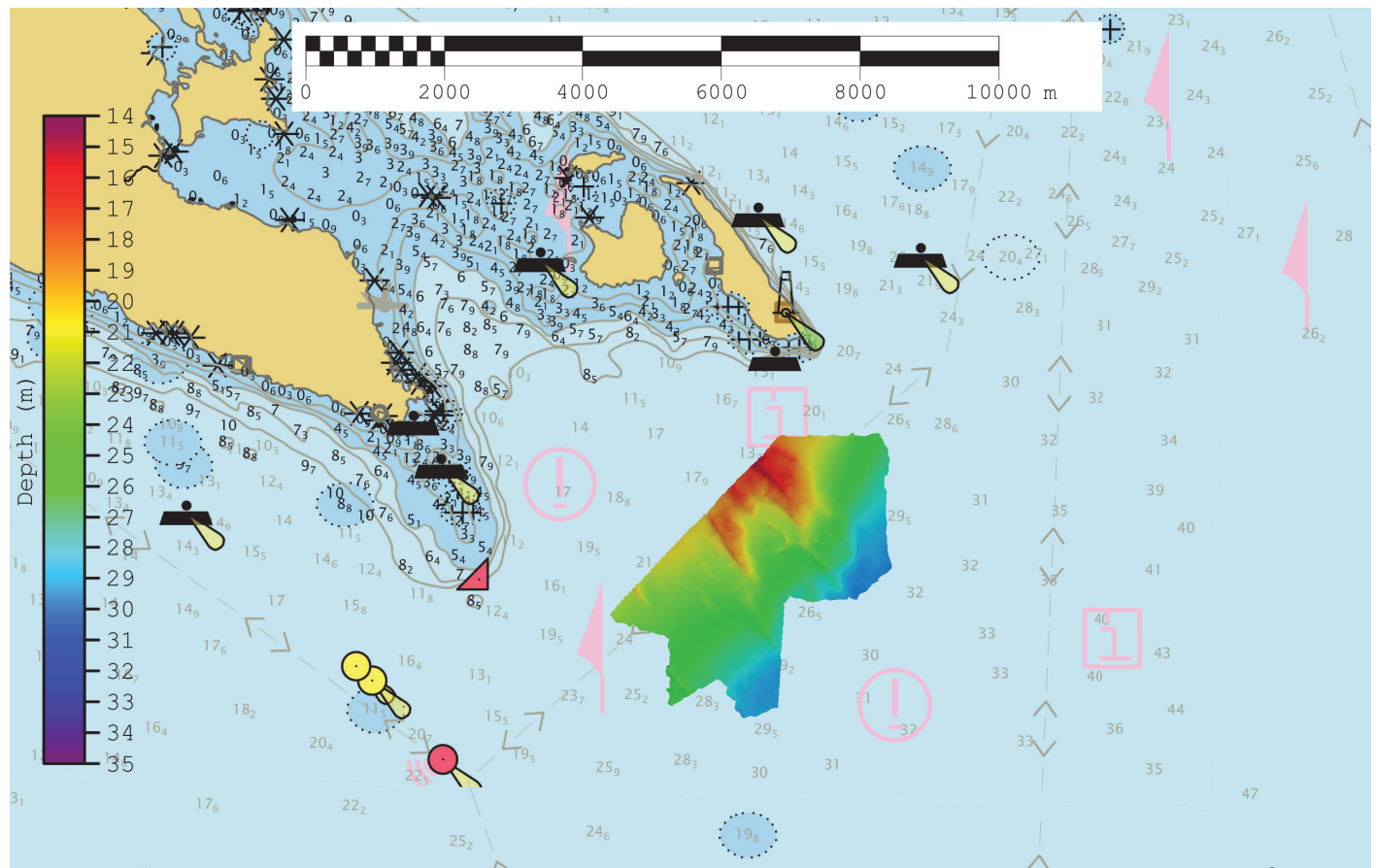


Figure 2: Survey coverage overlaid on ENC US4MI66M.

### A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	<b>HULL ID</b>	<i>S3007</i>	<i>Total</i>
<b>LNM</b>	<b>SBES Mainscheme</b>	0.0	0.0
	<b>MBES Mainscheme</b>	77.29	77.29
	<b>Lidar Mainscheme</b>	0.0	0.0
	<b>SSS Mainscheme</b>	0.0	0.0
	<b>SBES/SSS Mainscheme</b>	0.0	0.0
	<b>MBES/SSS Mainscheme</b>	0.0	0.0
	<b>SBES/MBES Crosslines</b>	4.59	4.59
	<b>Lidar Crosslines</b>	0.0	0.0
<b>Number of Bottom Samples</b>			0
<b>Number Maritime Boundary Points Investigated</b>			0
<b>Number of DPs</b>			0
<b>Number of Items Investigated by Dive Ops</b>			0
<b>Total SNM</b>			2.62

*Table 3: Hydrographic Survey Statistics*

The following table lists the specific dates of data acquisition for this survey:

<b>Survey Dates</b>	<b>Day of the Year</b>
07/13/2022	194
07/14/2022	195

<b>Survey Dates</b>	<b>Day of the Year</b>
07/18/2022	199

*Table 4: Dates of Hydrography*

## **B. Data Acquisition and Processing**

### **B.1 Equipment and Vessels**

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

#### **B.1.1 Vessels**

The following vessels were used for data acquisition during this survey:

<b>Hull ID</b>	<i>S3007</i>
<b>LOA</b>	10.38 meters
<b>Draft</b>	0.6 meters

*Table 5: Vessels Used*



*Figure 3: NRT-NL vessel S3007 with NYC in background.*

## B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

<b>Manufacturer</b>	<b>Model</b>	<b>Type</b>
Kongsberg Maritime	EM 2040C	MBES
YSI	CastAway-CTD	Conductivity, Temperature, and Depth Sensor
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	SV-Xchange	Sound Speed System

*Table 6: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Multibeam crosslines acquired for this survey totaled 5.93% of mainscheme acquisition.

A 4m CUBE surface was created using only mainscheme lines and a second 4m CUBE surface was created using only crosslines. These surfaces were then input into the Pydro Tool "Compare Grids". The comparison passed HSSD specifications.

### Comparison Distribution

Per Grid: MS\_only\_4m-XLs\_4m\_fracAllowErr.csar

99.5+% nodes pass (47683), min=0.0, mode=0.1 mean=0.1 max=3.5

Percentiles: 2.5%=0.0, Q1=0.0, median=0.0, Q3=0.1, 97.5%=0.1

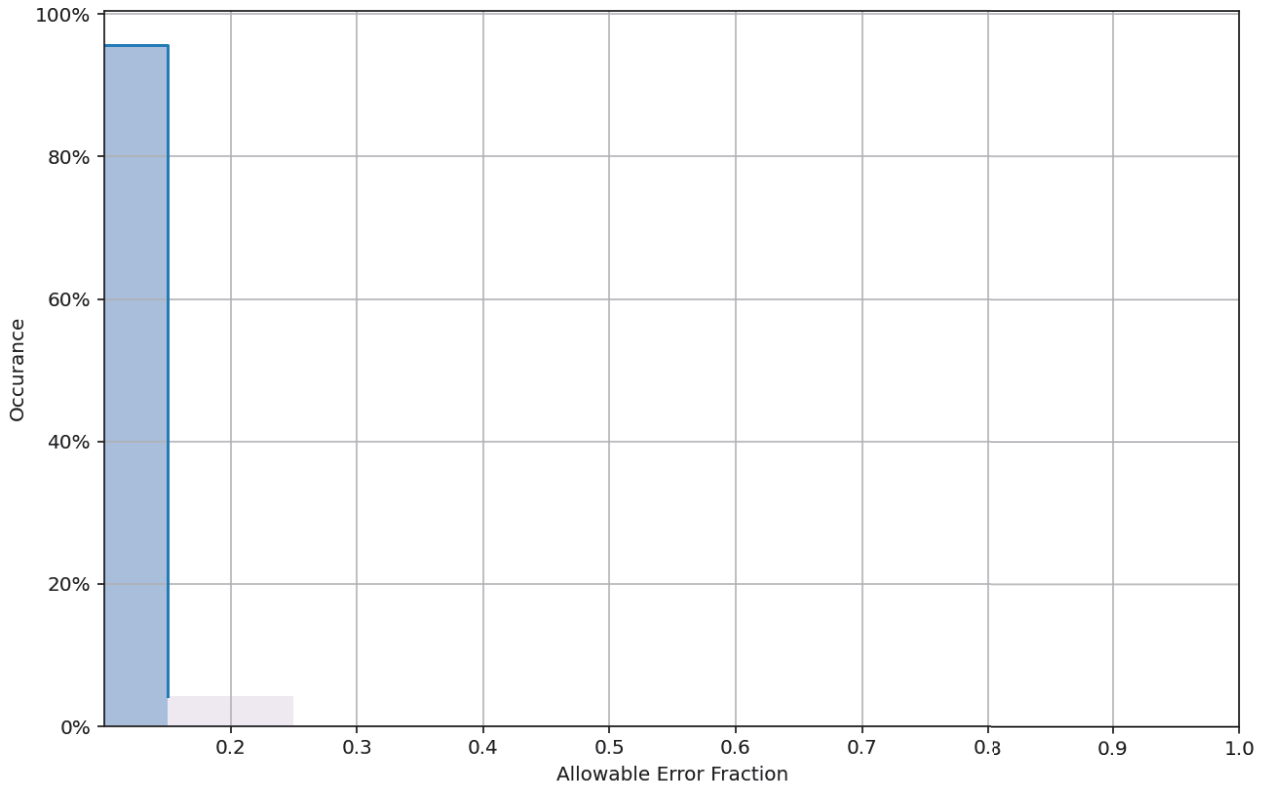


Figure 4: Pydro generated graph showing comparison between mainscheme and crosslines in F00863.

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.045 meters

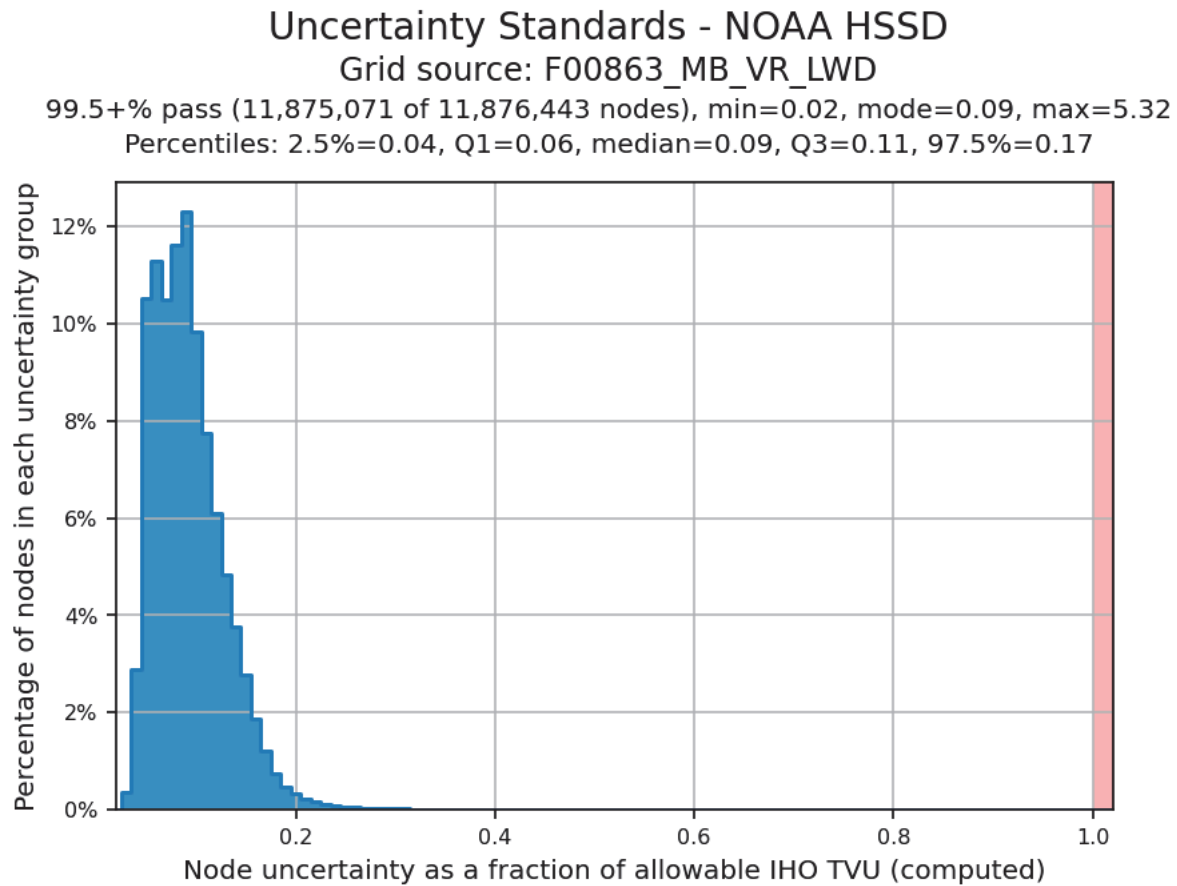
Table 7: Survey Specific Tide TPU Values.

<b>Hull ID</b>	<b>Measured - CTD</b>	<b>Measured - MVP</b>	<b>Measured - XBT</b>	<b>Surface</b>
S3007	2 meters/second	0 meters/second	0 meters/second	0.5 meters/second

*Table 8: Survey Specific Sound Speed TPU Values.*

Total Propagated Uncertainty (TPU) values for F00863 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. The uncertainty for the VDatum model was provided to the field units in the Project Instructions. A visual inspection of the Uncertainty layer revealed the areas of higher uncertainty occur in the outer beams, and a visual inspection of the Density layer revealed the areas of lowest density are in the deepest areas of the survey and directly at nadir.

In addition to the usual a priori estimates of uncertainty, some real time and post processed uncertainty sources were also incorporated into the depth estimates of the survey. Real-time uncertainties from the Kongsberg MBES sonars were incorporated and applied during post processing. Uncertainties associated with vessel roll, pitch, gyro, navigation, and heave were applied during post-processing. All of the aforementioned uncertainties were applied in CARIS. As stated, F00863 is an ellipsoidally referenced survey (ERS) and the tidal component was accomplished with a separation model.



*Figure 5: Pydro derived histogram plot showing HSSD Uncertainty Standards compliance of F00863 MBES data within the CUBE VR surface.*

### B.2.3 Junctions

F00863 does not have any surveys to junction with.

There are no contemporary surveys that junction with this survey.

### B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

### **B.2.5 Equipment Effectiveness**

There were no conditions or deficiencies that affected equipment operational effectiveness.

### **B.2.6 Factors Affecting Soundings**

There were no other factors that affected corrections to soundings.

### **B.2.7 Sound Speed Methods**

Sound Speed Cast Frequency: At least once every 4 hours.

SVP casts were taken at least once every four hours in the deepest water nearest to the survey area being worked on. The SVP casts were applied to the MBES lines in CARIS using the "nearest in distance within time of 4 hours" method.

### **B.2.8 Coverage Equipment and Methods**

All equipment and survey methods were used as detailed in the DAPR.

## **B.3 Echo Sounding Corrections**

### **B.3.1 Corrections to Echo Soundings**

All data reduction procedures conform to those detailed in the DAPR.

### **B.3.2 Calibrations**

All sounding systems were calibrated as detailed in the DAPR.

## B.4 Backscatter

All equipment and survey methods were used as detailed in the DAPR.

## B.5 Data Processing

### B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

### B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
F00863_MB_VR_LWD.csar	CARIS VR Surface (CUBE)	Variable Resolution	14.409 meters - 30.016 meters	NOAA_VR	Object Detection
F00863_MB_VR_LWD_Final.csar	CARIS VR Surface (CUBE)	Variable Resolution	14.409 meters - 30.156 meters	NOAA_VR	Object Detection

*Table 9: Submitted Surfaces*

## C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

## C.1 Vertical Control

The vertical datum for this project is Low Water Datum IGLD-1985.

### ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	S-X913-NRTNL-22_VDatum_100m_NAD83-LWD_IGLD85_geoid12b.csar

Table 10: ERS method and SEP file

## C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 17.

The following PPK methods were used for horizontal control:

- Smart Base

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
DRUMMOND ISLAND	MIDI
INDIAN RIVER	MIND
TAWAS CITY	MITW
ALPENA	NOR3
GODERICH	GOD2
MIAL ALPENA	MIAL

Table 11: CORS Base Stations

### WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition.

## D. Results and Recommendations

### D.1 Chart Comparison

#### D.1.1 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4MI66M	1:60000	11	03/31/2022	03/31/2022

*Table 12: Largest Scale ENC's*

#### D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

#### D.1.3 Charted Features

No charted features exist for this survey.

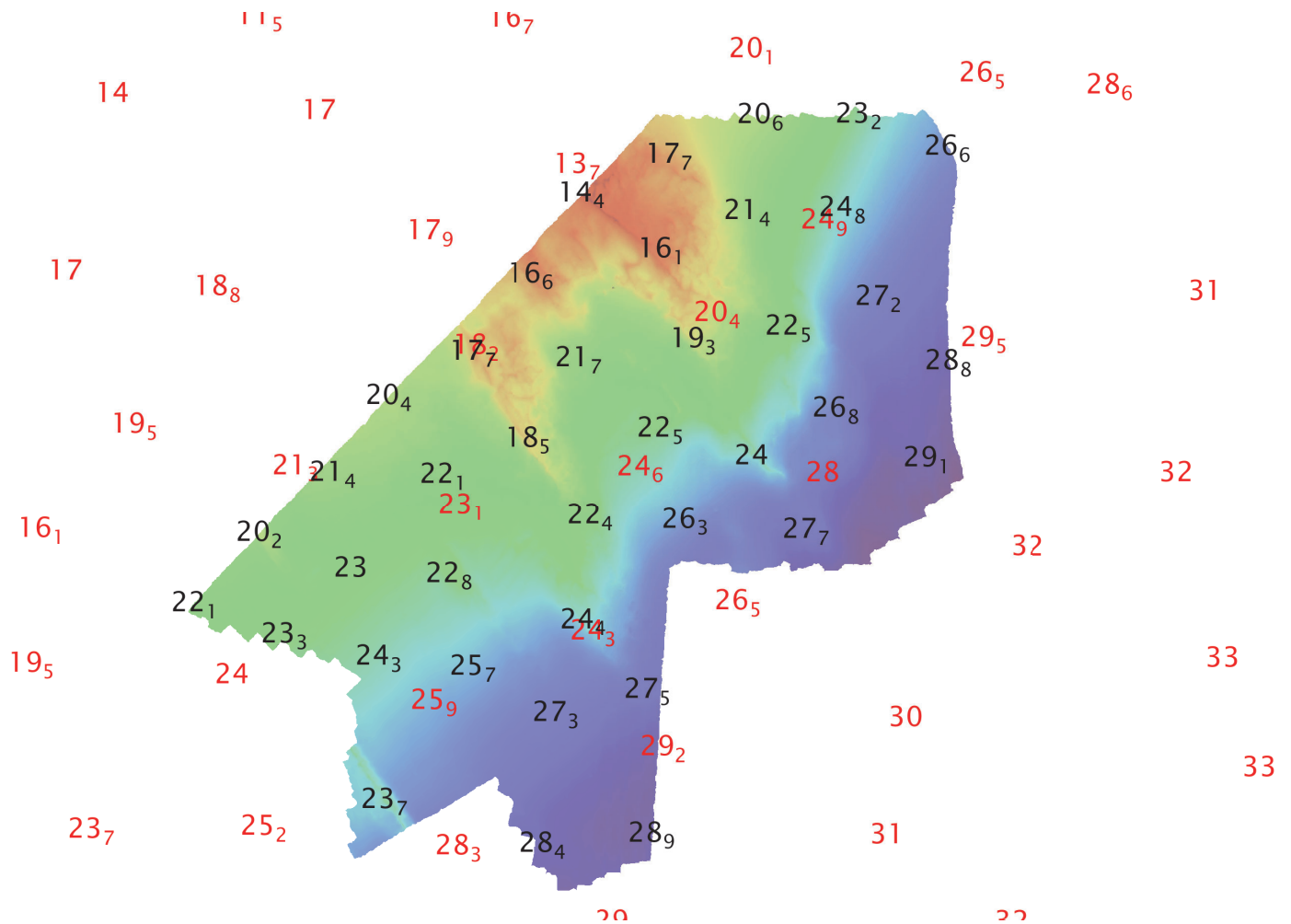


Figure 6: Charted soundings (red) and F00863 soundings (black) are similar.

**D.1.4 Uncharted Features**

No uncharted features exist for this survey.

**D.1.5 Channels**

No channels exist within the survey limits.

**D.2 Additional Results**

**D.2.1 Aids to Navigation**

No Aids to navigation (ATONs) exist for this survey.

**D.2.2 Maritime Boundary Points**

No Maritime Boundary Points were assigned for this survey.

**D.2.3 Bottom Samples**

No bottom samples were required for this survey.

**D.2.4 Overhead Features**

No overhead features exist for this survey.

**D.2.5 Submarine Features**

No submarine features exist for this survey.

**D.2.6 Platforms**

No platforms exist for this survey.

**D.2.7 Ferry Routes and Terminals**

No ferry routes or terminals exist for this survey.

**D.2.8 Abnormal Seafloor or Environmental Conditions**

No abnormal seafloor or environmental conditions exist for this survey.

**D.2.9 Construction and Dredging**

No present or planned construction or dredging exist within the survey limits.

**D.2.10 New Survey Recommendations**

No new surveys or further investigations are recommended for this area.

### **D.2.11 ENC Scale Recommendations**

No new ENC scales are recommended for this area.

## E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
LTJG Nicholas Azzopardi	Chief of Party	10/25/2022	AZZOPARDI.NIC HOLAS.JAMES.1 539165093 Digitally signed by AZZOPARDI.NICHOLAS.JA MES.1539165093 Date: 2022.11.03 10:46:04 -04'00'
PST Michael Bloom	Sheet Manager	10/25/2022	BLOOM.MICHAEL L.GRAHAM.1029 463049 Digitally signed by BLOOM.MICHAEL.GRAHAM. 1029463049 Date: 2022.10.25 16:23:02 -04'00'

## F. Table of Acronyms

<b>Acronym</b>	<b>Definition</b>
<b>AHB</b>	Atlantic Hydrographic Branch
<b>AST</b>	Assistant Survey Technician
<b>ATON</b>	Aid to Navigation
<b>AWOIS</b>	Automated Wreck and Obstruction Information System
<b>BAG</b>	Bathymetric Attributed Grid
<b>BASE</b>	Bathymetry Associated with Statistical Error
<b>CO</b>	Commanding Officer
<b>CO-OPS</b>	Center for Operational Products and Services
<b>CORS</b>	Continuously Operating Reference Station
<b>CTD</b>	Conductivity Temperature Depth
<b>CEF</b>	Chart Evaluation File
<b>CSF</b>	Composite Source File
<b>CST</b>	Chief Survey Technician
<b>CUBE</b>	Combined Uncertainty and Bathymetry Estimator
<b>DAPR</b>	Data Acquisition and Processing Report
<b>DGPS</b>	Differential Global Positioning System
<b>DP</b>	Detached Position
<b>DR</b>	Descriptive Report
<b>DTON</b>	Danger to Navigation
<b>ENC</b>	Electronic Navigational Chart
<b>ERS</b>	Ellipsoidal Referenced Survey
<b>ERTDM</b>	Ellipsoidally Referenced Tidal Datum Model
<b>ERZT</b>	Ellipsoidally Referenced Zoned Tides
<b>FFF</b>	Final Feature File
<b>FOO</b>	Field Operations Officer
<b>FPM</b>	Field Procedures Manual
<b>GAMS</b>	GPS Azimuth Measurement Subsystem
<b>GC</b>	Geographic Cell
<b>GPS</b>	Global Positioning System
<b>HIPS</b>	Hydrographic Information Processing System
<b>HSD</b>	Hydrographic Surveys Division

<b>Acronym</b>	<b>Definition</b>
<b>HSSD</b>	Hydrographic Survey Specifications and Deliverables
<b>HSTB</b>	Hydrographic Systems Technology Branch
<b>HSX</b>	Hypack Hysweep File Format
<b>HTD</b>	Hydrographic Surveys Technical Directive
<b>HVCR</b>	Horizontal and Vertical Control Report
<b>HVF</b>	HIPS Vessel File
<b>IHO</b>	International Hydrographic Organization
<b>IMU</b>	Inertial Motion Unit
<b>ITRF</b>	International Terrestrial Reference Frame
<b>LNM</b>	Linear Nautical Miles
<b>MBAB</b>	Multibeam Echosounder Acoustic Backscatter
<b>MCD</b>	Marine Chart Division
<b>MHW</b>	Mean High Water
<b>MLLW</b>	Mean Lower Low Water
<b>NAD 83</b>	North American Datum of 1983
<b>NALL</b>	Navigable Area Limit Line
<b>NTM</b>	Notice to Mariners
<b>NMEA</b>	National Marine Electronics Association
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NOS</b>	National Ocean Service
<b>NRT</b>	Navigation Response Team
<b>NSD</b>	Navigation Services Division
<b>OCS</b>	Office of Coast Survey
<b>OMAO</b>	Office of Marine and Aviation Operations (NOAA)
<b>OPS</b>	Operations Branch
<b>MBES</b>	Multibeam Echosounder
<b>NWLON</b>	National Water Level Observation Network
<b>PDBS</b>	Phase Differencing Bathymetric Sonar
<b>PHB</b>	Pacific Hydrographic Branch
<b>POS/MV</b>	Position and Orientation System for Marine Vessels
<b>PPK</b>	Post Processed Kinematic
<b>PPP</b>	Precise Point Positioning
<b>PPS</b>	Pulse per second

<b>Acronym</b>	<b>Definition</b>
<b>PRF</b>	Project Reference File
<b>PS</b>	Physical Scientist
<b>RNC</b>	Raster Navigational Chart
<b>RTK</b>	Real Time Kinematic
<b>RTX</b>	Real Time Extended
<b>SBES</b>	Singlebeam Echosounder
<b>SBET</b>	Smooth Best Estimate and Trajectory
<b>SNM</b>	Square Nautical Miles
<b>SSS</b>	Side Scan Sonar
<b>SSSAB</b>	Side Scan Sonar Acoustic Backscatter
<b>ST</b>	Survey Technician
<b>SVP</b>	Sound Velocity Profiler
<b>TCARI</b>	Tidal Constituent And Residual Interpolation
<b>TPU</b>	Total Propagated Uncertainty
<b>USACE</b>	United States Army Corps of Engineers
<b>USCG</b>	United States Coast Guard
<b>UTM</b>	Universal Transverse Mercator
<b>XO</b>	Executive Officer
<b>ZDF</b>	Zone Definition File