H13609

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13609

LOCALITY

State(s):	Ohio
General Locality:	Lake Erie
Sub-locality:	7 NM West of Cleveland

2022

CHIEF OF PARTY
Matthew J. Jaskoski, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13609**

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):	**Ohio**
General Locality:	**Lake Erie**
Sub-Locality:	**7 NM West of Cleveland**
Scale:	**5000**
Dates of Survey:	**05/08/2022 to 06/30/2022**
Instructions Dated:	**04/19/2022**
Project Number:	**OPR-W386-TJ-22**
Field Unit:	**NOAA Ship *Thomas Jefferson***
Chief of Party:	**Matthew J. Jaskoski, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic 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-IGLD 1985. 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 H13609

Project: OPR-W386-TJ-22

Locality: Lake Erie

Sublocality: 7 NM West of Cleveland

Scale: 1:5000

May 2022 - June 2022

NOAA Ship *Thomas Jefferson*

Chief of Party: Matthew J. Jaskoski, CDR/NOAA

A. Area Surveyed

Survey H13609, located in Lake Erie within the sub locality of 7 NM West of Cleveland, was conducted in accordance with coverage requirements set forth in the Project Instructions OPR-W386-TJ-22.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 33' 7.74" N 81° 59' 47.71" W	41° 29' 2.99" N 81° 44' 2.63" W

Table 1: Survey Limits

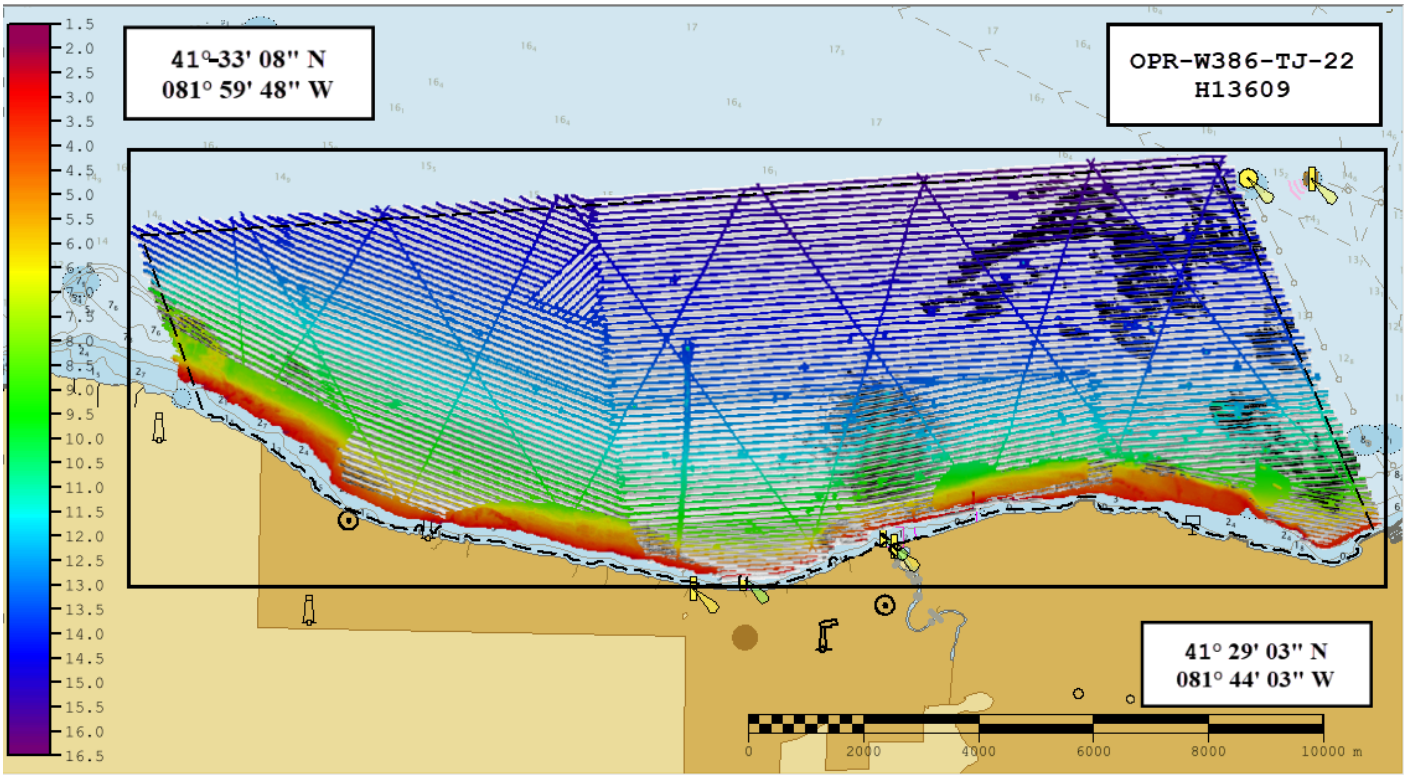


Figure 1: Survey layout for H13609, plotted over ENC US4OH01M. The dashed black outline represents the survey limits set forth by the project instructions. MBES coverage is in color and SSS coverage in greyscale.

Survey data were acquired in accordance with the requirements set forth by the Project Instructions (PI) and the 2022 Hydrographic Surveys Specifications and Deliverables (HSSD).

A.2 Survey Purpose

The Port of Cleveland is one of the largest ports in the Great Lakes and ranks within the top 50 ports in the United States. Roughly 13 million tons of cargo are transported through Cleveland Harbor each year supporting over 20,000 jobs and $3.5 billion in annual economic activity. This project will provide modern bathymetric data for the Cleveland area as well as the vicinity of South Bass Island and Presque Isle. The project area was identified as a statistically significant hot spot within the 2018 hydrographic health model, a risk model that Coast Survey uses for evaluating priorities based upon navigational risks and the necessary quality of data to support modern traffic. Most of this area has not been surveyed since the 1940s, and experiences significant vessel traffic.

A modern bathymetric survey in this area will identify hazards and changes to the seafloor, provide critical data for updating National Ocean Service (NOS) nautical charting products and improve maritime safety. Survey data from this project is intended to supersede all prior survey data in the common area.

https://www.portofcleveland.com/

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Complete coverage requirements were met utilizing a combination of 100% multibeam echo sounder (MBES) coverage and 100% side scan sonar (SSS) with concurrent MBES coverage as specified by the 2022 HSSD. Data acquired in H13609 meet survey quality standards specified in the 2022 HSSD, including crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.2), and density requirements (see Section B.5.2).

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.	Complete Coverage (Refer to HSSD Section 5.2.2.3)
All waters in survey area.	Acquire backscatter data during all multibeam data acquisition (Refer to the HSSD Section 6.2)

Table 2: Survey Coverage

Survey coverage is in accordance with requirements listed in Table 2 and in the 2022 HSSD. Sections of H13609 were surveyed to complete coverage by 100% SSS coverage with concurrent MBES. Other sections, primarily nearshore areas, of H13609 were surveyed to complete coverage by 100% bottom coverage with MBES (Figure 2). Assigned features requiring a disproval radius were addressed with 100% multibeam. Though there are some gaps in the MBES coverage, they are either covered sufficiently by SSS or do not meet specifications to be considered holidays. No holidays exist within the combined coverage achieved on H13609.

Coverage was acquired to the inshore limit of hydrography, the Navigable Area Limit Line (NALL). Areas where survey coverage did not reach the NALL, indicated by the 3.5-meter depth contour, nor the assigned sheet limits, were due to the survey vessel reaching the extent of safe navigation (Figure 3). These areas are characterized as being near shore, subject to dangerous wave action or other hazards.

Following completion of mainscheme acquisition, surveyed soundings were assessed against charted soundings to determine whether bathymetric splits were necessary. Splits were acquired where charted soundings were found to be shallower than neighboring surveyed soundings by more than the maximum allowable TVU at that depth (generally 0.5m or greater).

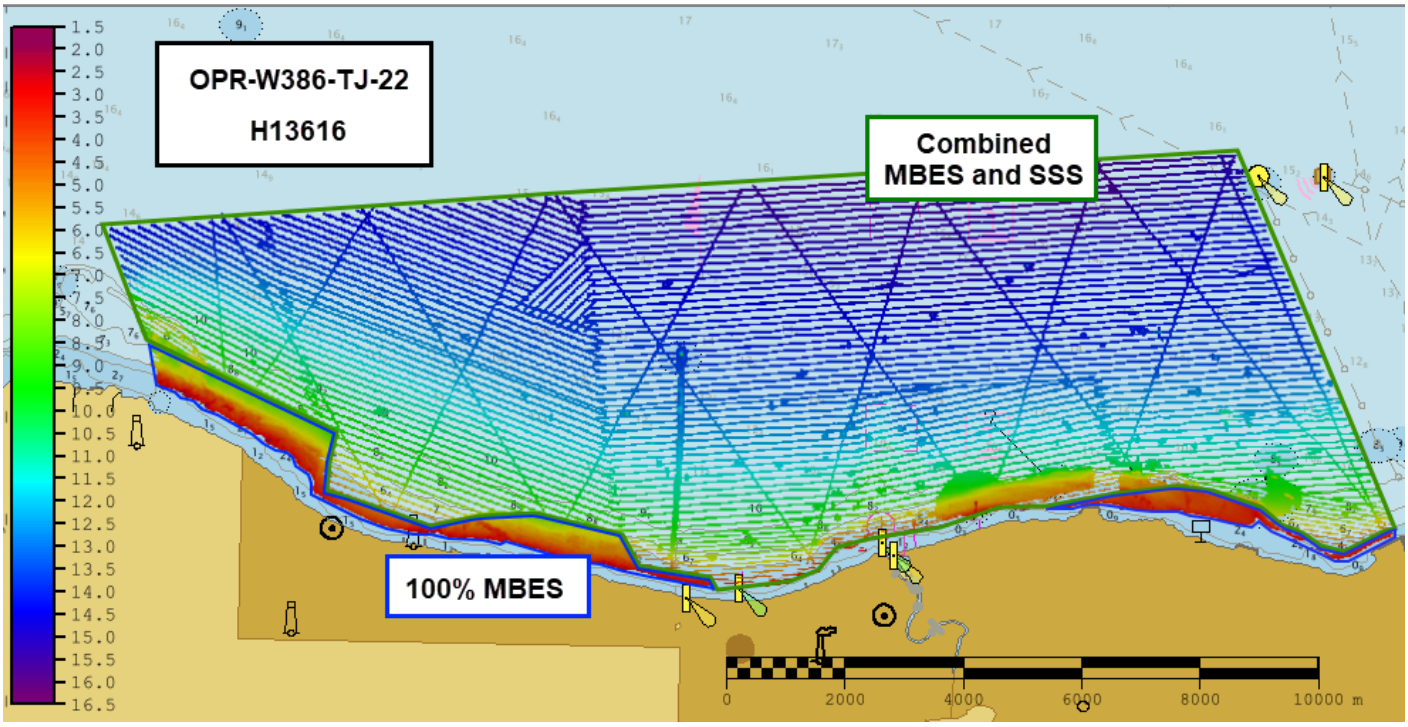


Figure 2: H13609 survey coverage types: 100% multibeam outlined in cobalt and 100% SSS with concurrent multibeam outlined in emerald.

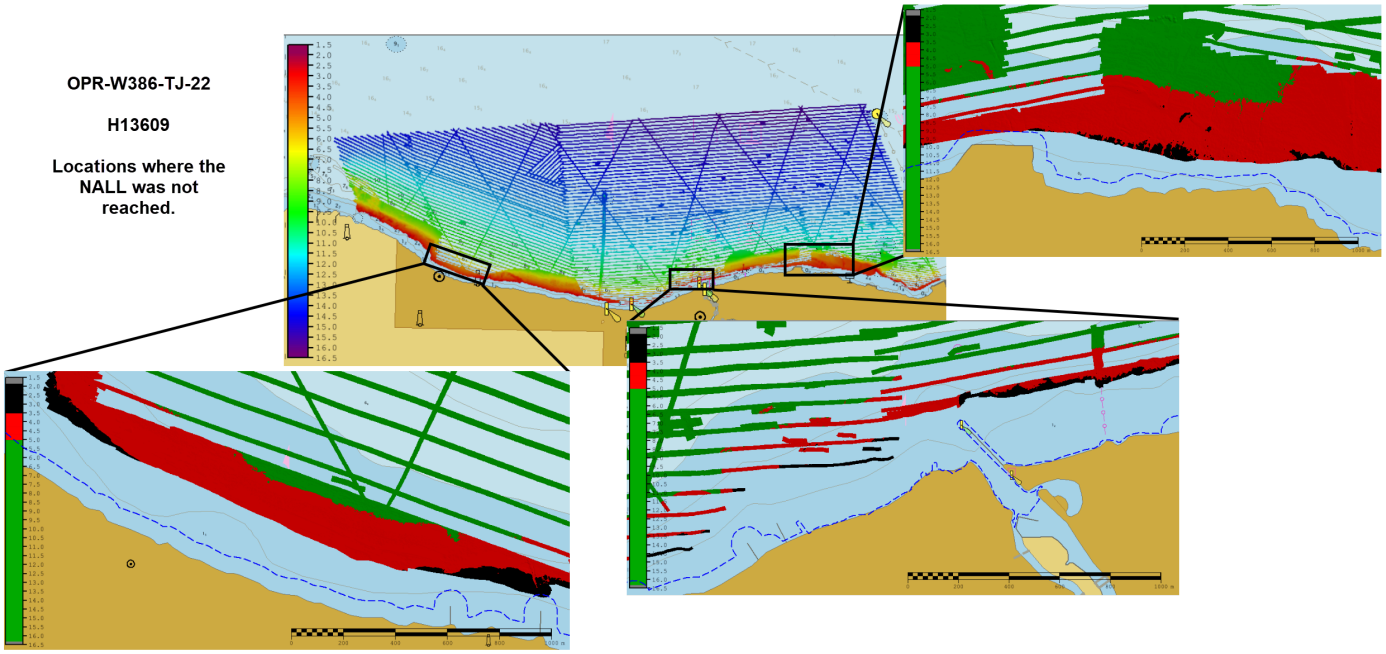


Figure 3: H13609 nearshore areas where the extent of safe navigation was reached before the NALL, shown in black.

A.6 Survey Statistics

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

	HULL ID	*2903*	*2904*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0
	MBES Mainscheme	204.26	146.08	350.34
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	523.35	0.0	523.34
	SBES/MBES Crosslines	47.31	0.0	47.31
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				12
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				32.92

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
05/08/2022	128
05/10/2022	130
05/11/2022	131
05/12/2022	132
05/17/2022	137
05/18/2022	138
05/20/2022	140
05/21/2022	141
05/22/2022	142
05/24/2022	144
05/25/2022	145
05/26/2022	146
06/16/2022	167
06/21/2022	172
06/22/2022	173
06/23/2022	174
06/24/2022	175
06/25/2022	176
06/26/2022	177
06/28/2022	179
06/30/2022	181

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:

Hull ID	*2903*	*2904*
LOA	8.5 meters	8.5 meters
Draft	1.2 meters	1.2 meters

Table 5: Vessels Used

Figure 4: Thomas Jefferson HSL 2903

Figure 5: Thomas Jefferson HSL 2904

B.1.2 Equipment

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

Manufacturer	Model	Type
Applanix	POS MV 320 v5	Positioning and Attitude System
EdgeTech	4200	SSS
Kongsberg Maritime	EM 2040	MBES
Kongsberg Maritime	EM 2040	MBES Backscatter
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System

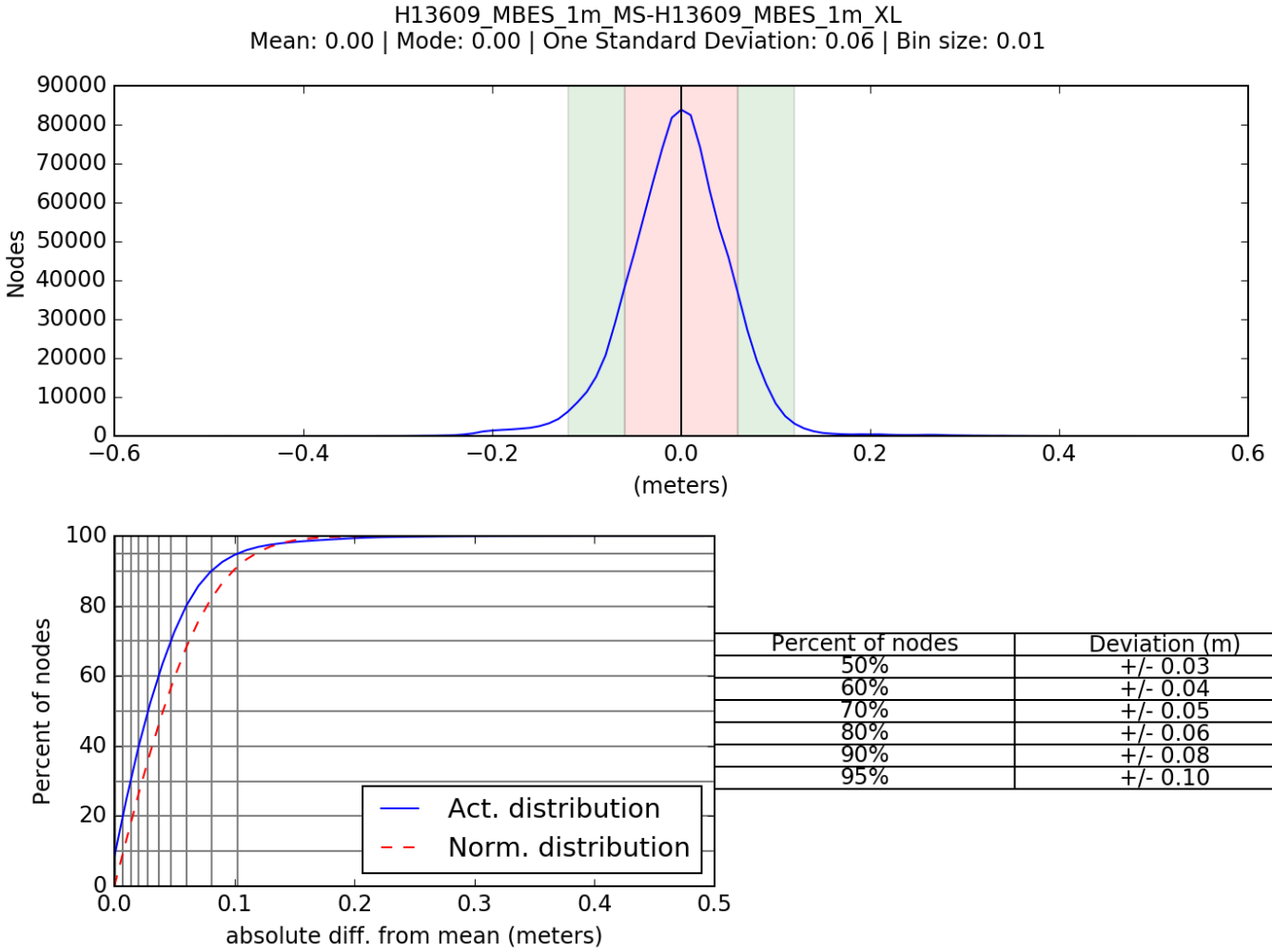
Table 6: Major Systems Used

Vessel configurations, equipment operations, data acquisition, and processing were consistent with specifications described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

HSL 2903 collected 47.31 linear nautical miles of MBES crosslines, or 5.42% of mainscheme MBES data. A single resolution Combined Uncertainty and Bathymetry Estimator (CUBE) surface of mainscheme data at 1m resolution and a single resolution CUBE surface at the 1m resolution of crossline data were differenced - the resulting mean was 0.00 m with a standard deviation of 0.06 m (Figure 6). Though the fractional allowable error has a large range, more than 99.5% of nodes are within the allowable error fraction (Figure 7). Visual inspection of the difference surface indicated no systematic issues (Figure 8).



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.10

Figure 6: H13609 crossline and mainscheme comparison.

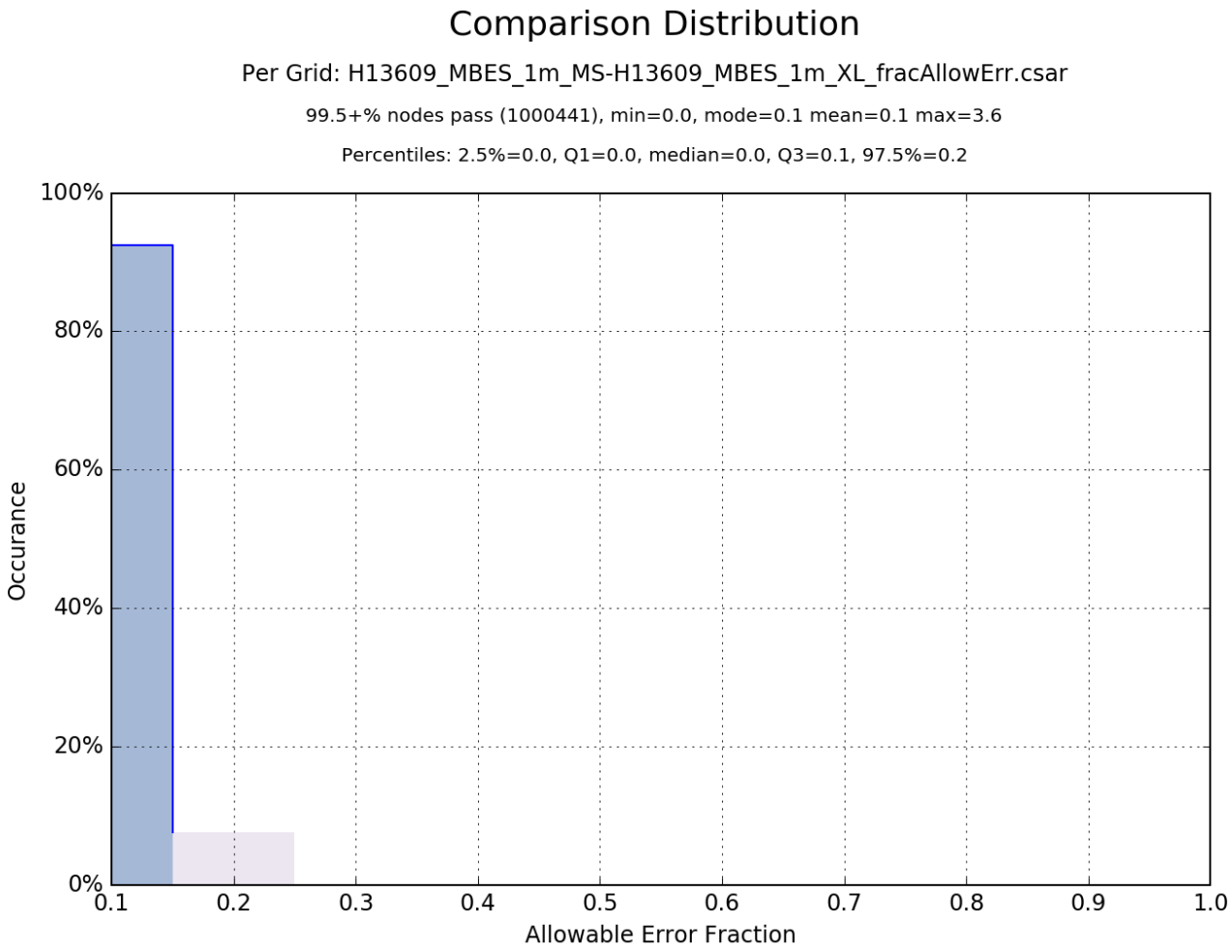


Figure 7: H13609 fractional allowable error node distribution.

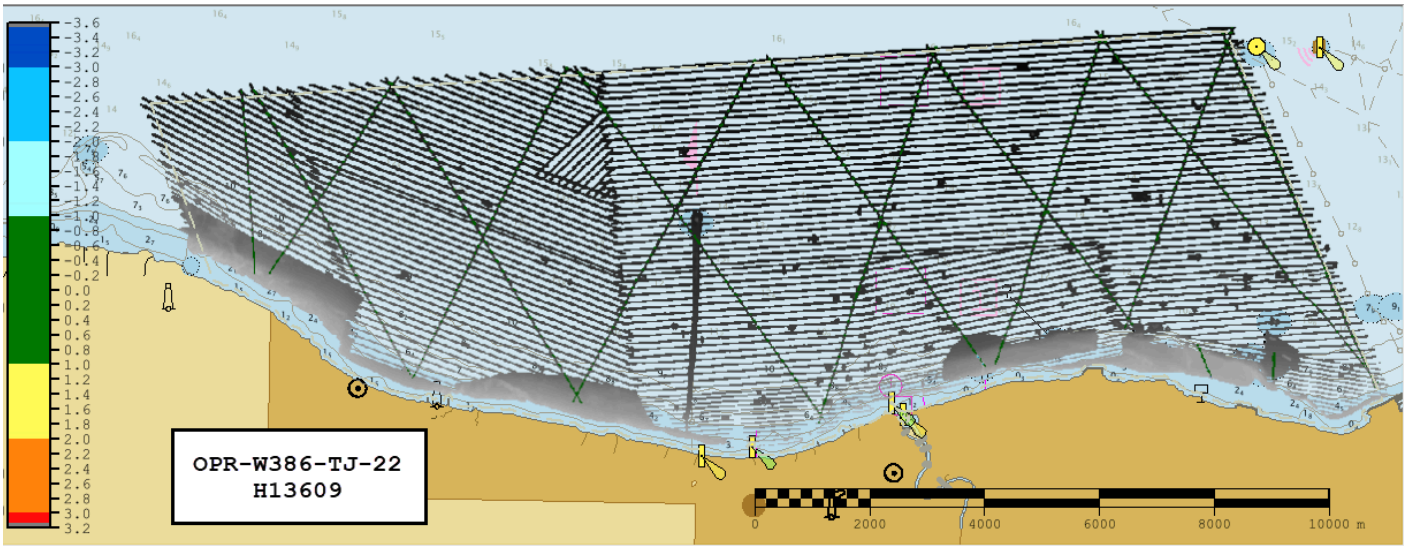


Figure 8: H13609 crossline fractional allowable error shown in color, overlaid onto survey data shown in greyscale.

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.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
2903	4.0 meters/second	N/A meters/second	N/A meters/second	0.2 meters/second
2904	4.0 meters/second	N/A meters/second	N/A meters/second	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The bathymetric surface's uncertainty layer is compliant with 2022 HSSD uncertainty standards. Over 99.5% of all nodes pass uncertainty standards (Figure 9).

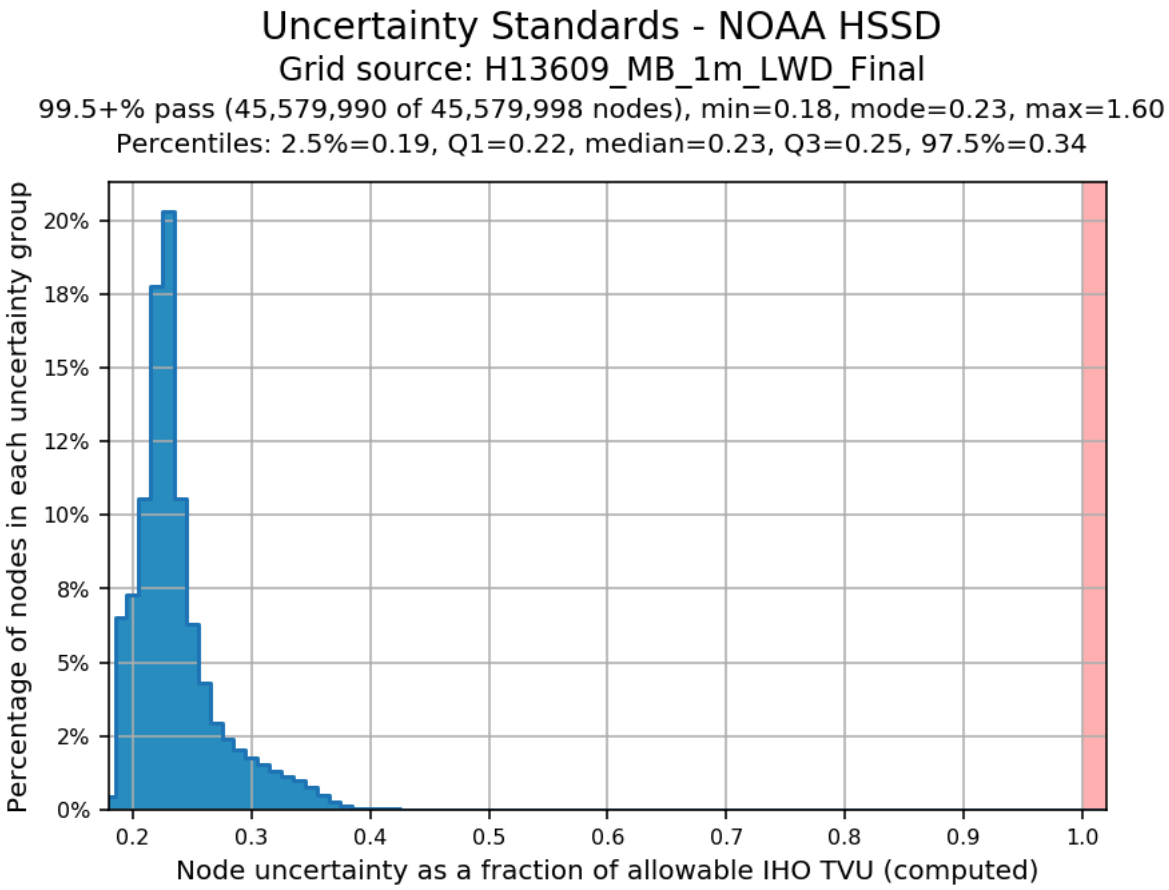


Figure 9: H13609 uncertainty standards

B.2.3 Junctions

Survey H13609 junctions with H13607 and H13616 within the OPR-W386-TJ-22 project (Figure 10).

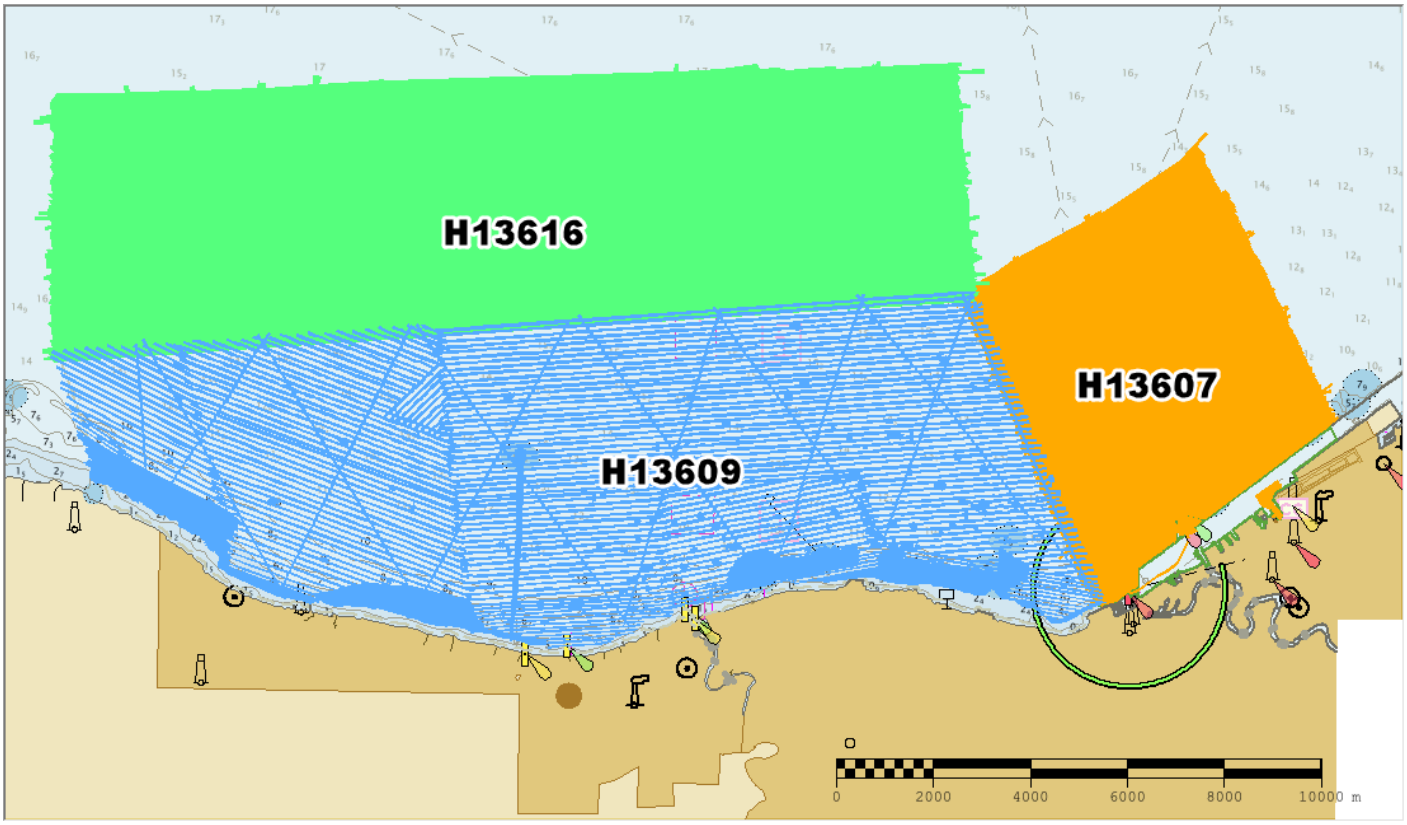


Figure 10: H13609, in baby blue, along with junctioning sheet H13607, in goldenrod, and H13616, in mint.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13607	1:5000	2022	NOAA Ship Thomas Jefferson	E
H13616	1:5000	2022	NOAA Ship Thomas Jefferson	N

Table 9: Junctioning Surveys

H13607

Refer to survey H13607 Descriptive Report for junction analysis.

H13616

The northern edge of H13609 junctions with sheet H13616. A 1m SR CUBE surface of H13609 data and a 1m SR CUBE surface of H13616 data were differenced (Figure 11). The mean difference between

bathymetric surface nodes was 0.10 m with a standard deviation of 0.05 m (Figure 12). Statistics and visual inspection indicate that surveys H13609 and H13616 are in general agreement.

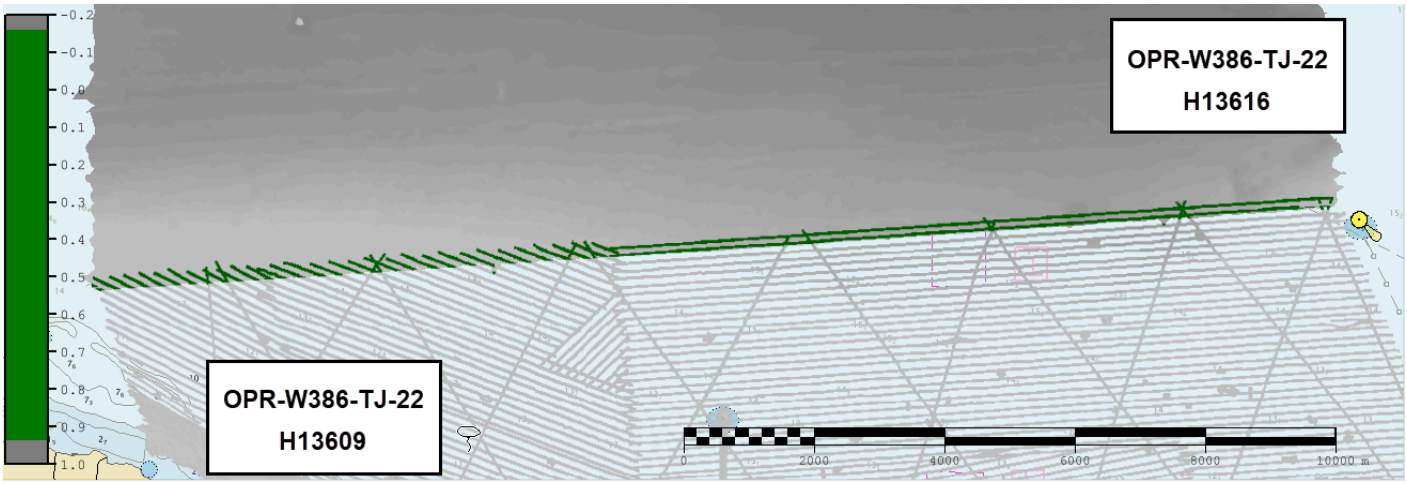
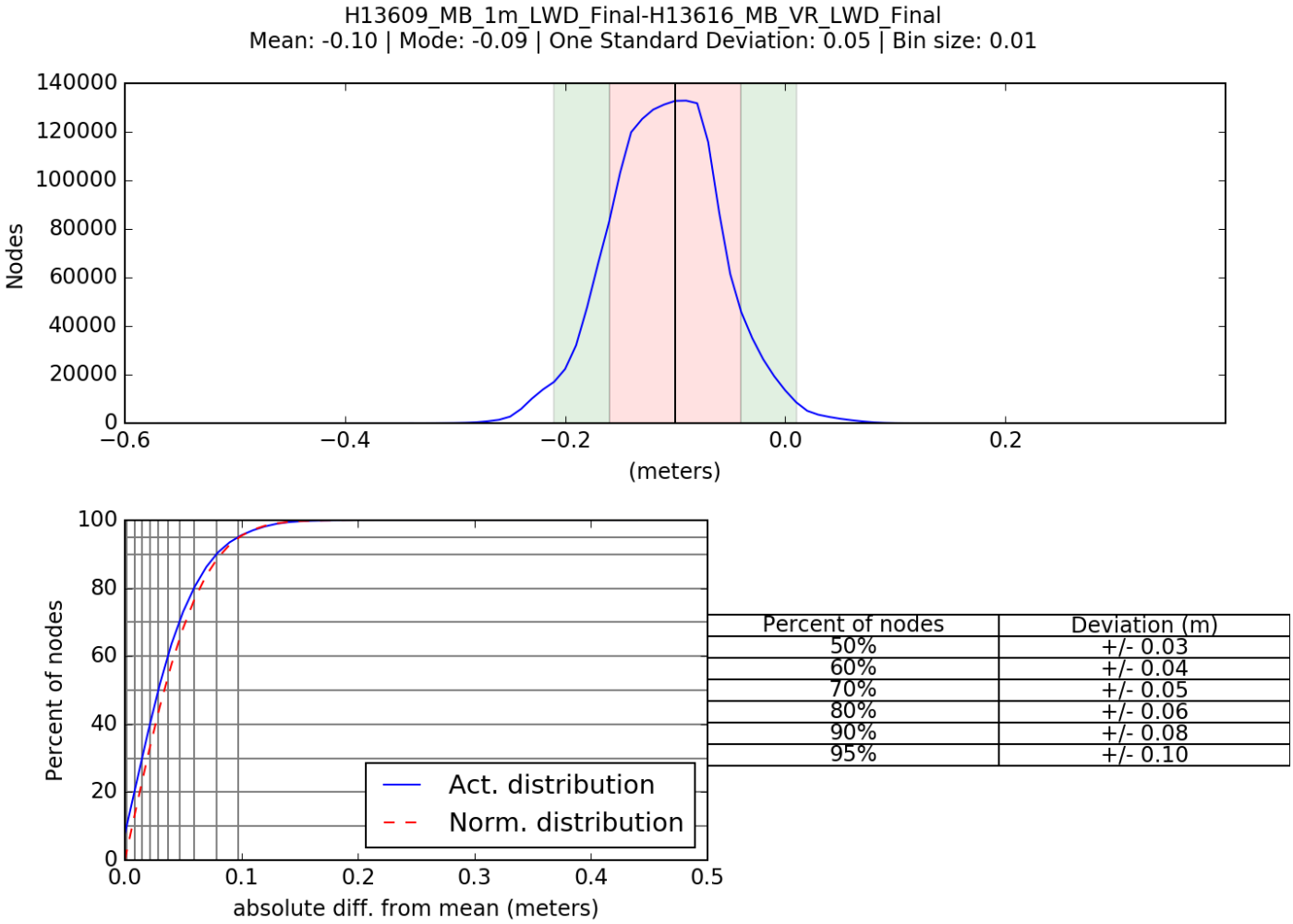


Figure 11: Fraction of allowable error surface difference comparison in color between H13609 and H13616.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.10

Figure 12: H13609 and H13616 surface difference comparison statistics.

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

Refraction in SSS data

H13609 is located in an area that exhibits intense thermal stratification. This layering greatly affects sound speed (Figure 13) and results in refraction that can be observed in the SSS imagery (Figure 14). The side scan towfish are hull-mounted on the launches and cannot be lowered below the thermocline. Varying degrees of refraction were observed in SSS data collected by HSL 2903, however the hydrographer determined that all data are of acceptable quality to be able to discern contacts on the lake bed.

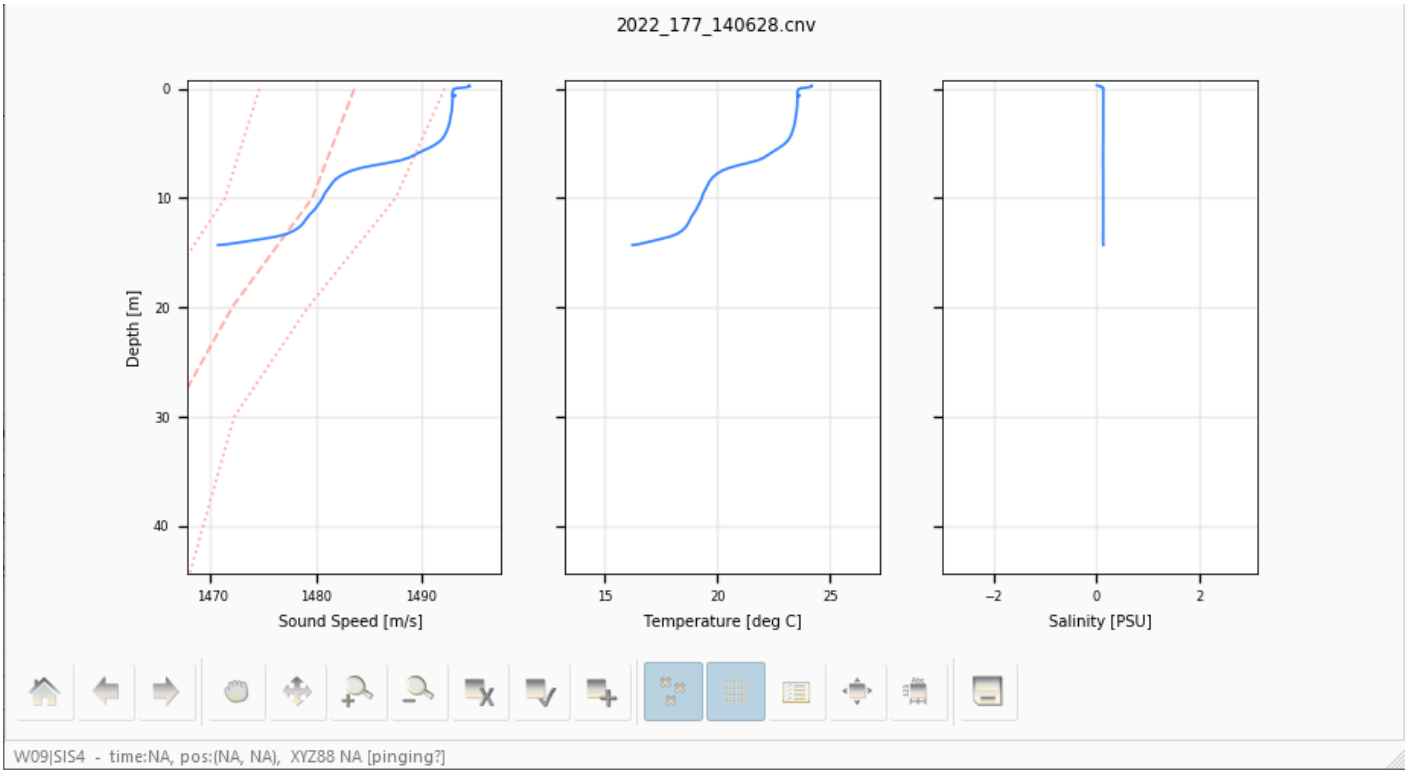


Figure 13: Example of conductivity, temperature, and sound speed profiles collected on H13609 showing the effect of temperature on sound speed.

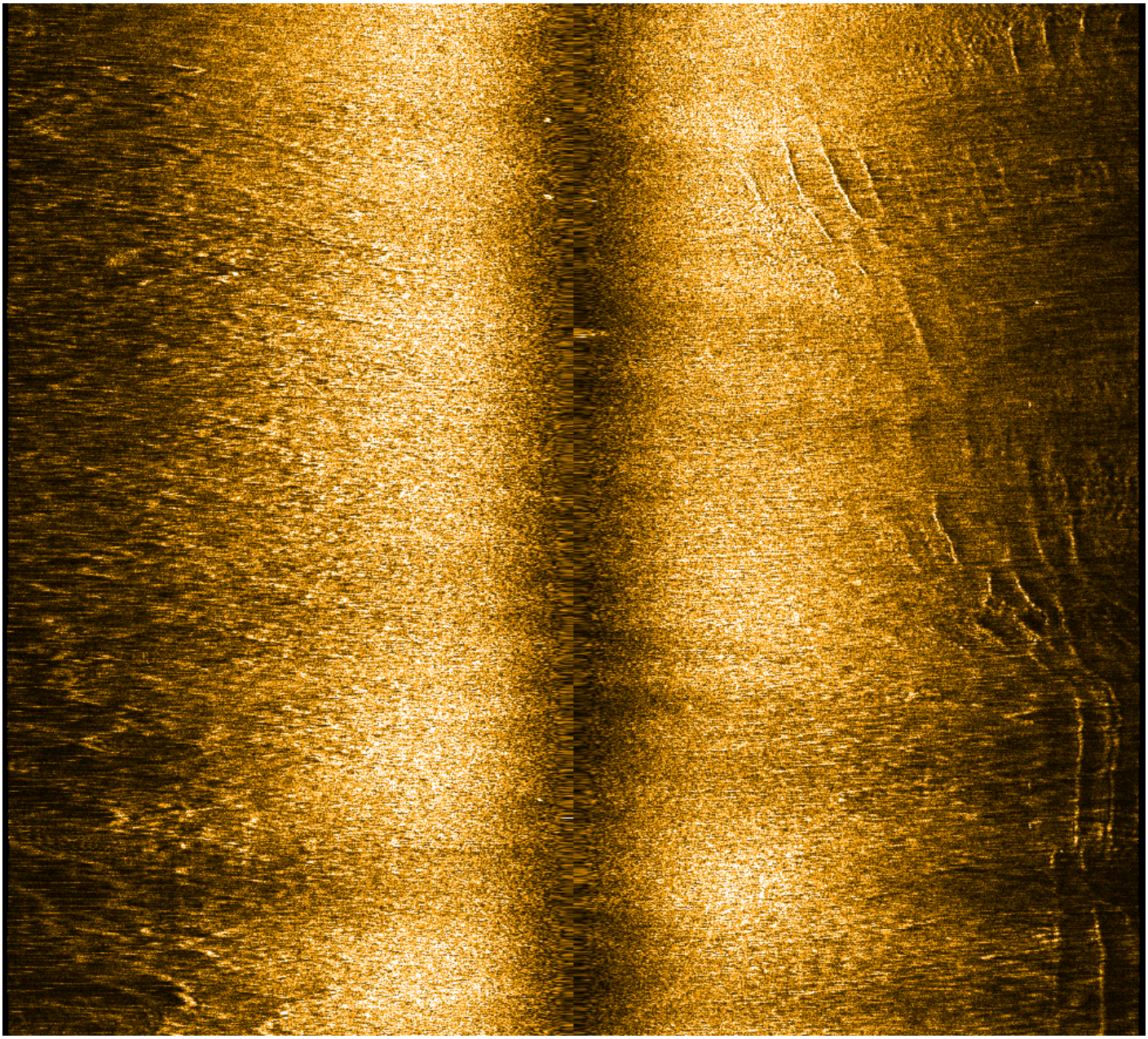


Figure 14: An example of refraction that was observed in SSS imagery collected on H13609.

Unknown environmental issue in nearshore areas

The nearshore area of H13609 is made up of what appear to be rocky ledges. In the area of these rocky ledges, the Kongsberg 2040 sonars on HSLs 2903 and 2904 had trouble bottom tracking throughout the swath which created soundings below the CUBE surface in a "V" shape (Figure 15). This issue occurred only in the rocky ledge area of the sheet and with both sonars suggesting an environmental issue rather than one with the equipment. The erroneous data were rejected from the CUBE surface and the field unit

attempted to reacquire over the area using adjusted settings in the Kongsberg MBES system. However, the problem persisted and no further re-acquisition efforts were made.

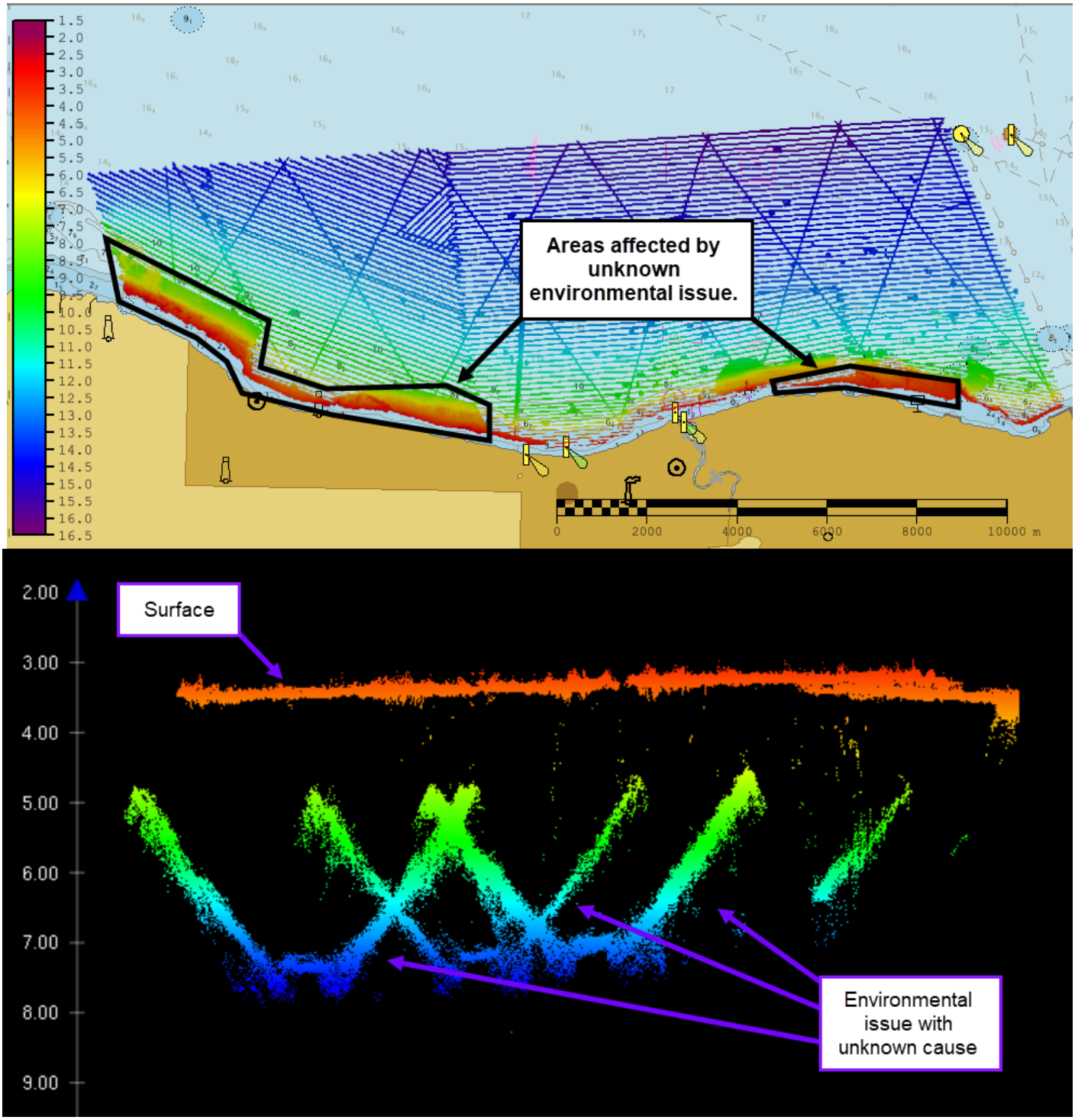


Figure 15: Areas in H13609 with an the displayed "V" shape soundings

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at the start of each acquisition day and within four hours of each previous cast per the 2022 HSSD specifications. Casts were conducted more frequently in areas with a strong thermocline that was associated with changes in the sound speed in the water of up to 20 meters per second.

HSLs 2903 and 2904 conducted casts using a Sea-Bird Scientific SBE 19plus V2 CTD. A total of 86 sound speed profiles were collected in and around the survey limits of H13609 and display good spatial diversity (Figure 16). Twelve of these casts were located outside of the sheet limits and display profiles representative of the area. All casts were concatenated into a master file and applied to MBES data using the "Nearest distance within time" (4 hours) profile selection method.

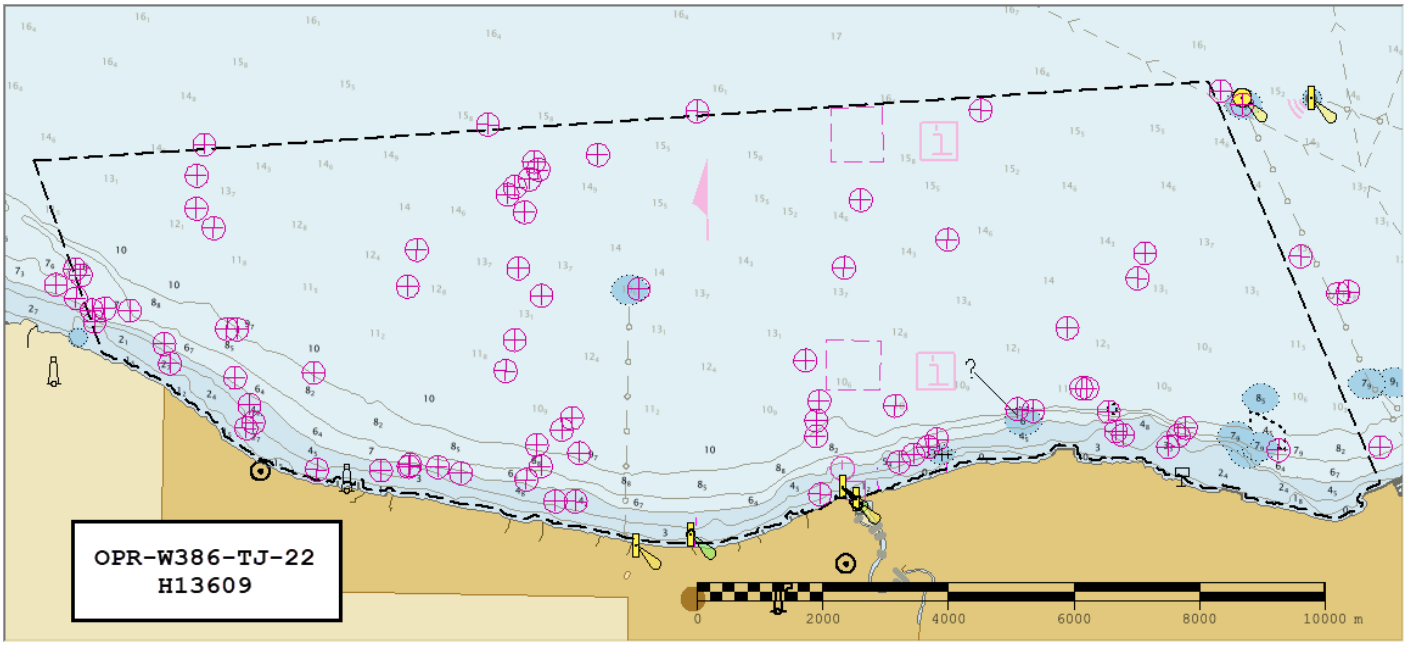


Figure 16: Overview of H13609 CTD locations, plotted in plum.

B.2.8 Coverage Equipment and Methods

Complete coverage requirements were met by 100% SSS coverage with concurrent MBES and 100% complete coverage MBES as specified under section 5.2.2.2 of the 2022 HSSD. Launch 2903 was outfitted with a Kongsberg EM2040 MBES system, an Edgetech 4200 SSS system, and was primarily used to acquire 100% SSS coverage with concurrent MBES, 100% MBES coverage, developments, and crosslines to address assigned features. Launch 2904 was outfitted with a Kongsberg EM2040 MBES system and was primarily used to acquire 100% complete coverage MBES, developments, bathymetric splits, and holidays.

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. Raw MBES backscatter was flagged as part of the .all file from the Kongsberg EM2040 systems. Backscatter was processed in QPS Fledermaus GeoCoder Toolbox (FMGT) software, and the exported geotiffs are included in the final processed data submission package (Figures 17, 18. & 19).

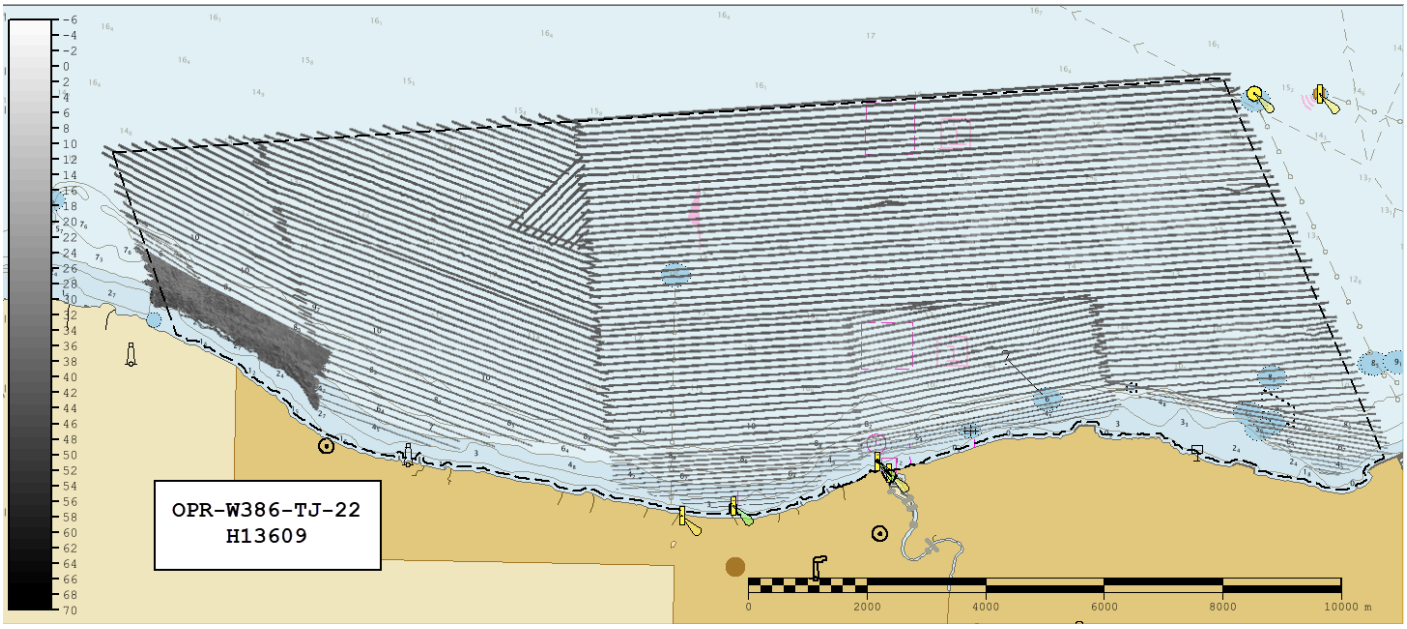


Figure 17: 300kHz backscatter mosaic from data acquired by 2903.

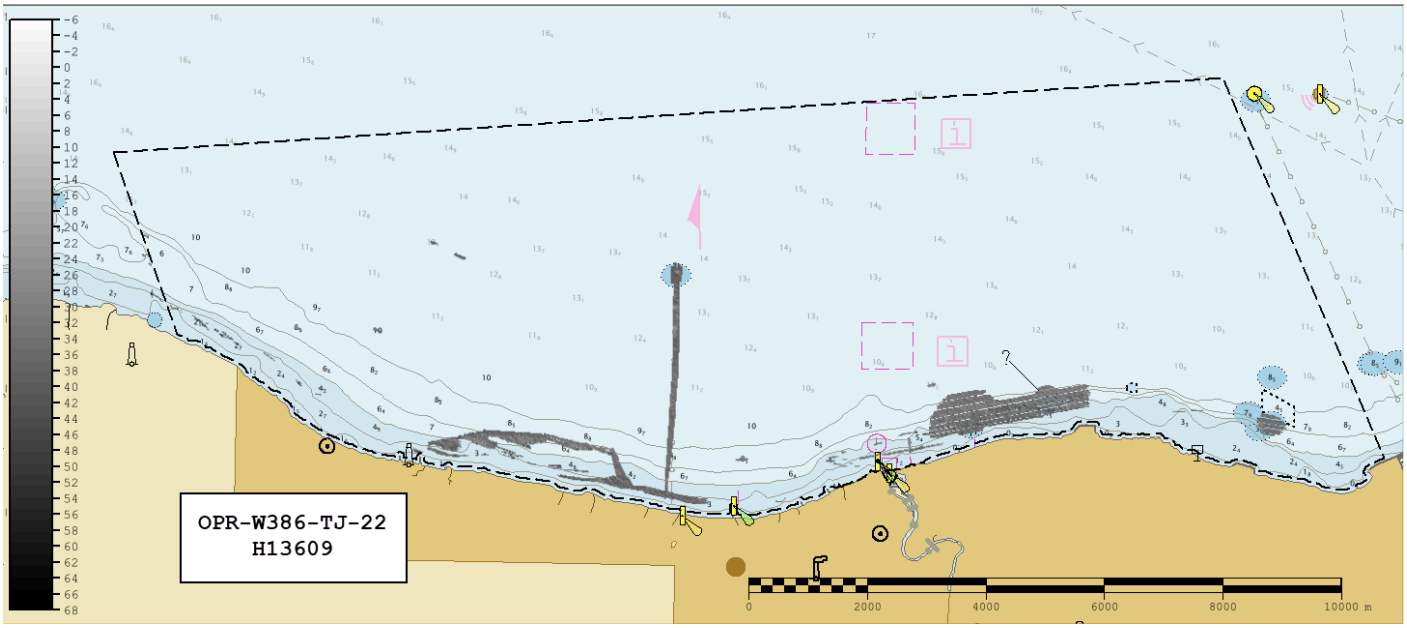


Figure 18: 400kHz backscatter mosaic from data acquired by 2903.

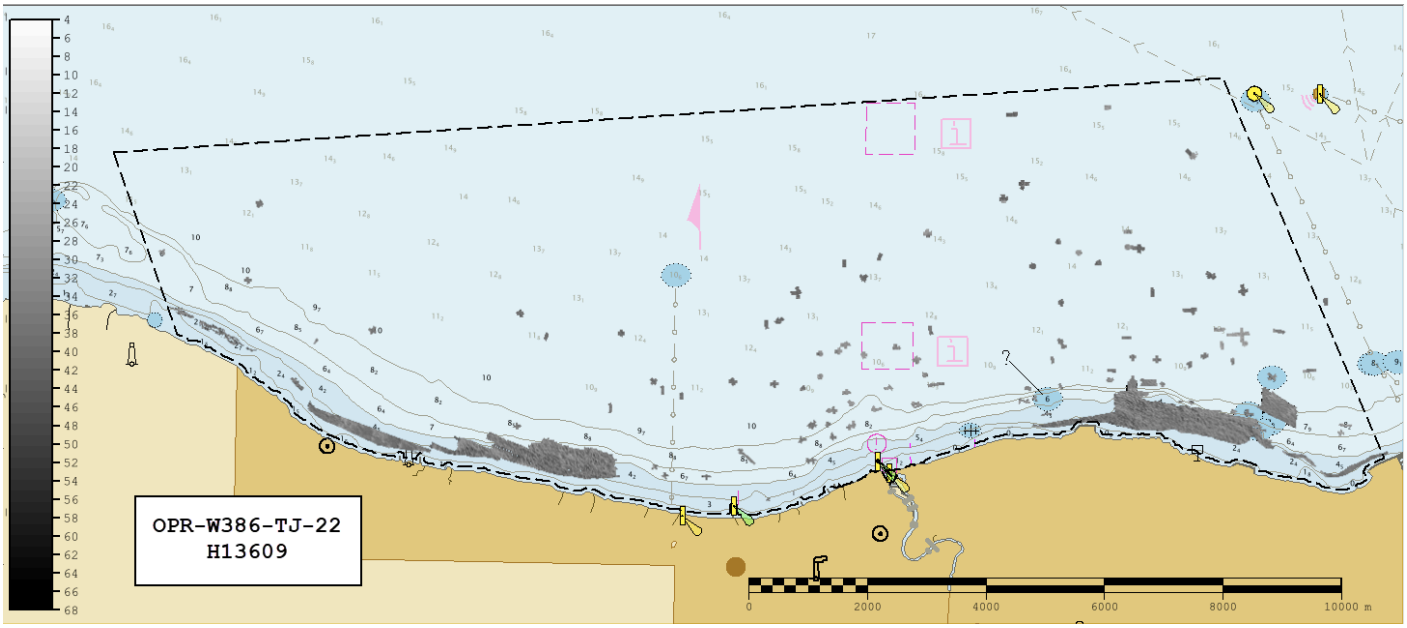


Figure 19: 300kHz backscatter mosaic from data acquired by 2904.

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
H13609_MB_1m_LWD	CARIS Raster Surface (CUBE)	1 meters	1.8 meters - 16.4 meters	NOAA_1m	Complete MBES
H13609_MB_1m_LWD_Final	CARIS Raster Surface (CUBE)	1 meters	1.8 meters - 16.4 meters	NOAA_1m	Complete MBES
H13609_SSSAB_600kHz_1of1	SSS Mosaic	1 meters	-	N/A	100% SSS
H13609_MBAB_2m_300kHz_1of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13609_MBAB_2m_400kHz_2of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13609_MBAB_2m_300kHz_3of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES

Table 10: Submitted Surfaces

Complete coverage requirements were met by 100% SSS coverage with concurrent MBES and 100% complete coverage MBES as specified under section 5.2.2.2 of the 2022 HSSD. All bathymetric grids for H13609 meet density requirements per the HSSD 2022 (Figure 19). The combined MBES and SSS coverage for this survey resulted in zero holidays.

After multiple rounds of surface cleaning, a total of 79 fliers remain as detected by NOAA's QC Tool Flier Finder available in the Pydro XL-19 suite. The hydrographer reviewed the flagged grid nodes, considers them to be to be accurate representations of the lake bed, and has retained them in the final delivered surface.

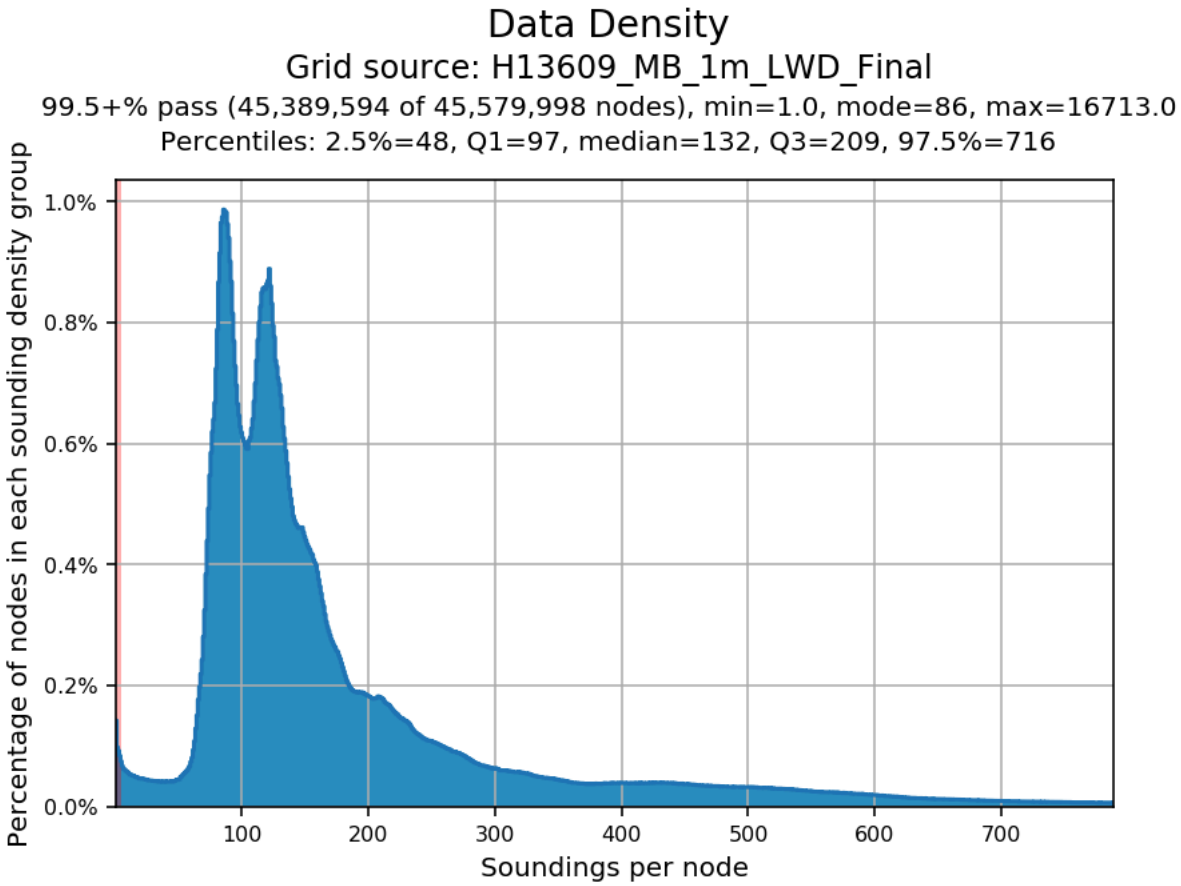


Figure 20: H13609 data density standards.

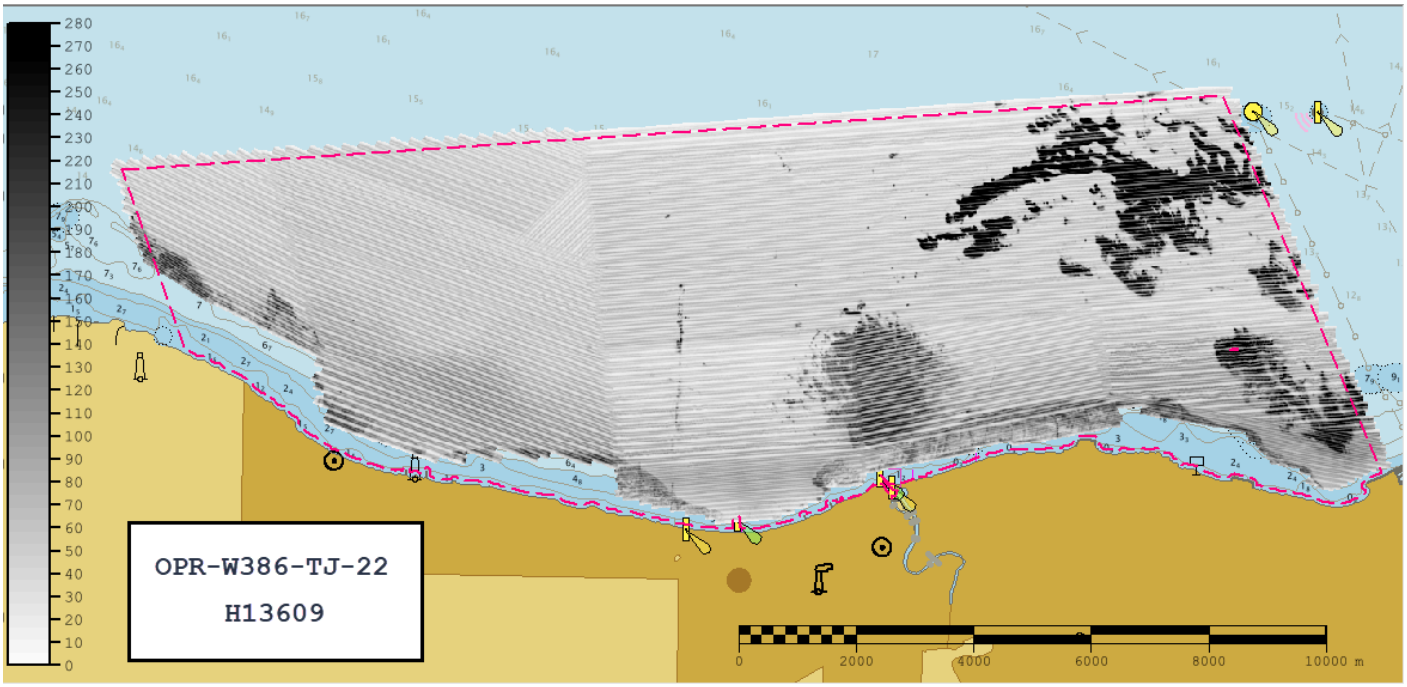


Figure 21: H13609 SSS mosaic with a 1m resolution. Gaps in coverage were addressed with complete MBES coverage.

C. Vertical and Horizontal Control

No Horizontal and Vertical Control Report (HVCR) is required for this survey.

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	OPR-W386-TJ-22_NAD83_2011_VDatum_LWD_IGLD85

Table 11: ERS method and SEP file

All soundings submitted for H13609 are reduced to the International Great Lakes Low Water Datum using VDatum techniques as outlined in the DAPR.

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:

- RTX

Trimble-RTX service was used with an Applanix POS MVv5 GNSS_INS system to obtain highly accurate ellipsoidally referenced position data to meet ERS specifications for H13609 MBES data from vessels HSL 2903 and 2904.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition on vessels HSL 2903 and 2904.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US4OH01M	1:80000	16	04/27/2018	05/15/2020
US5OH1AM	1:10000	2	11/28/2017	03/07/2018

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

A total of nineteen features were assigned for investigation. Seven features were not addressed due to being inshore of the NALL. Twelve charted features were investigated: no features were deemed appropriate for updating, six features were deemed appropriate for deletion, and six features were deemed appropriate to be retained as charted. One wreck was designated as an Unverified Charted Feature (UCF) with a 200m search radius. It could not be fully disproved due to reaching the limit of safe navigation and has been marked for retention. Reference the Final Feature File for further information.

D.1.4 Uncharted Features

Nineteen uncharted features were identified and investigated. None were considered to be dangerous to navigation and no DTON reports were submitted. Reference the Final Feature File for further information.

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines 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

Twelve bottom samples were acquired for survey H13609. However the hydrographer chose to collect samples in alternate locations guided by differences observed in the the SSS acoustic backscatter imagery. One sample was opportunistically collected from the anchor of NOAA ship Thomas Jefferson and is in a similar location to a bottom sample later collected. All bottom samples were entered in the H13609 Final Feature File. See Figure 21 for a graphical overview of sample locations.

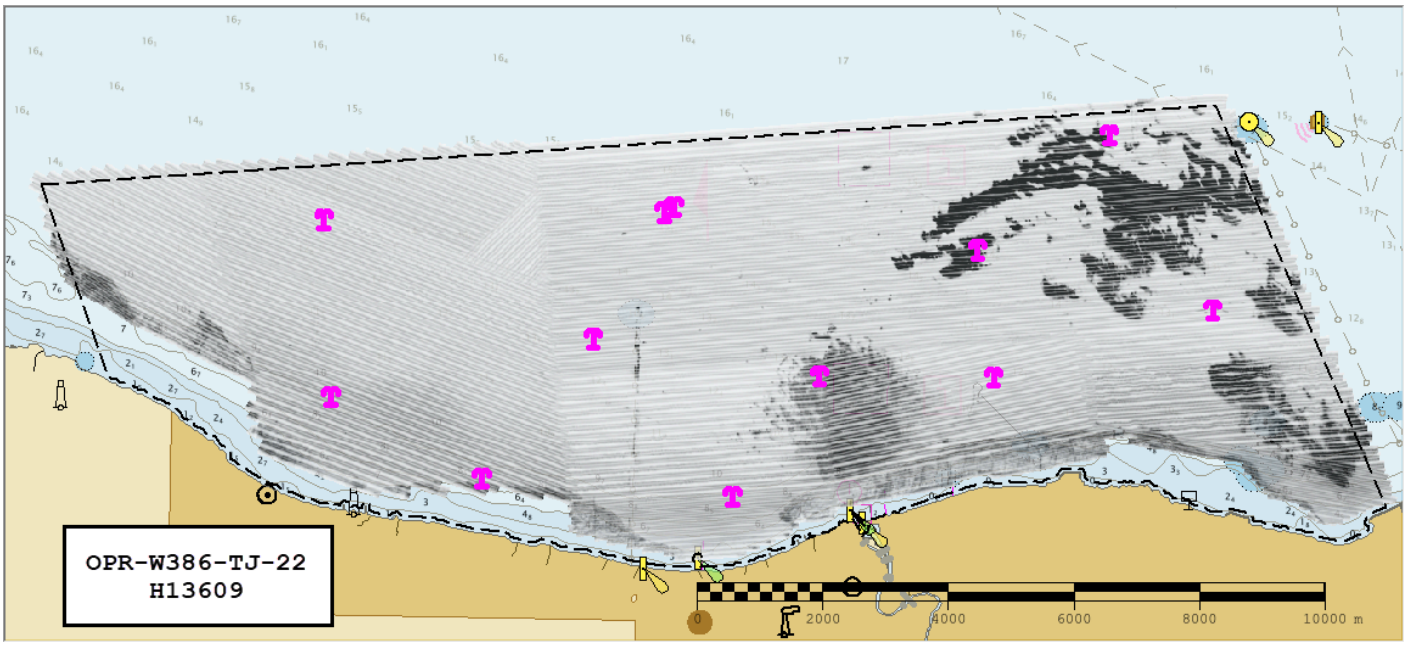


Figure 22: H13609 bottom sample locations in magenta plotted over the 1m resolution side scan sonar mosaic.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Four submarine pipelines were assigned for investigation within H13609. Only one, the western-most pipeline, was observed in MBES and SSS data near its charted location. The western central pipeline was not seen in MBES or SSS imagery. The eastern central pipeline was found to be unburied and was reported following guidance in the 2022 HSSD. The eastern-most pipeline was not addressed due to being inshore of the NALL, but there is evidence of this pipe approximately 100 m to the northwest and was reported following guidance in the 2022 HSSD. Reference H13609_Discrepancies.000 in the S-57 folder of the submission drive for more information as well as the DR Appendices for a record of communications.

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

Large piles of sediment were found in two areas on the eastern side of the sheet ranging from 0.75km-2.5km offshore (Figure 22). These sediment mounds seem to be anthropogenic in origin and possibly the leftovers of dredging.

Other abnormal seafloor or environmental conditions were observed in this survey. Refer to Section B.2.6 Factors Affecting Soundings for more information.

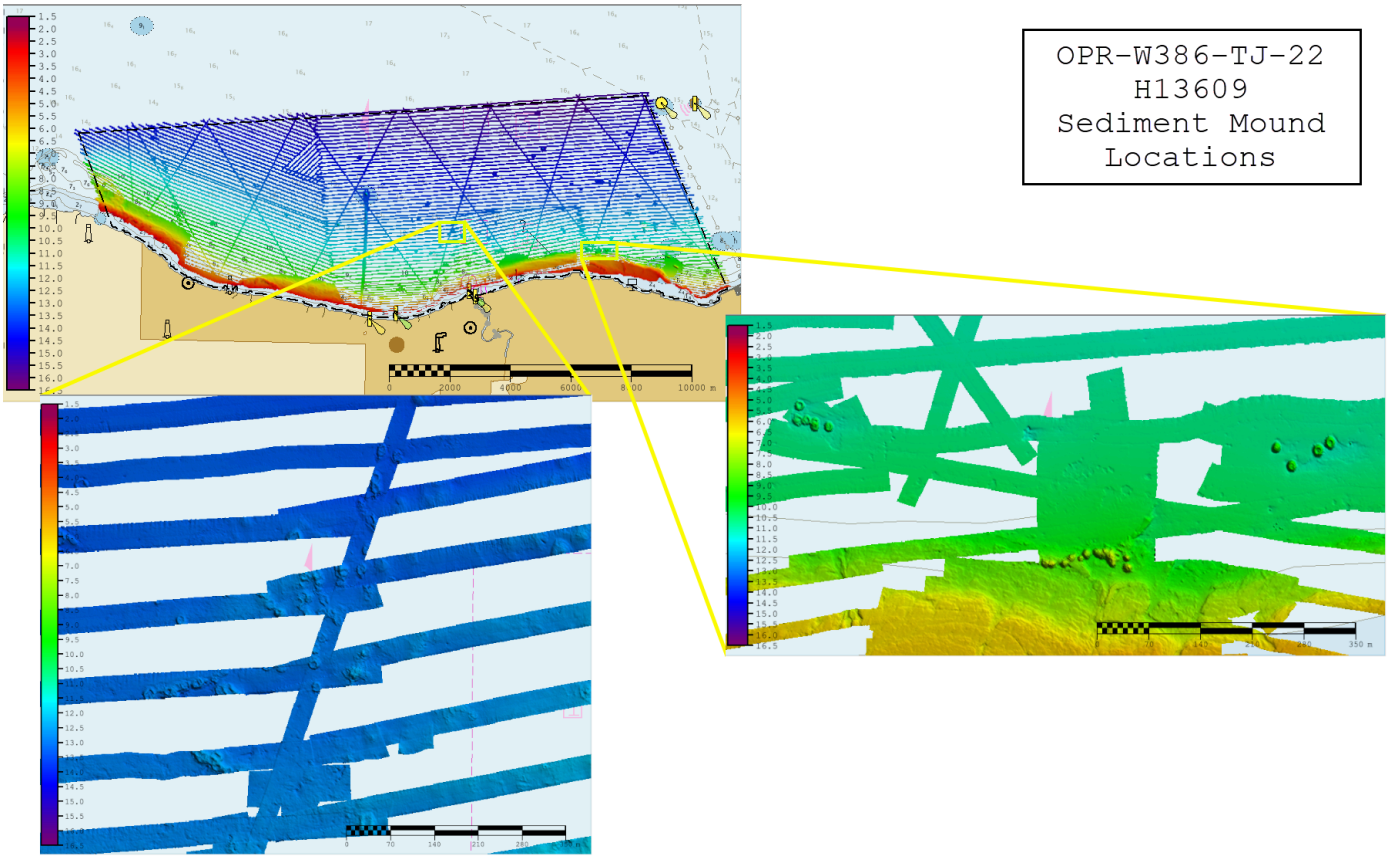


Figure 23: Locations of sediment mounds found in H13609 outlined in canary.

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
Matthew J. Jaskoski, CDR/NOAA	Chief of Party	09/24/2022	JASKOSKI.MATTHEW.JACOB.1275636262 2022.09.26 15:36:19 -04'00'
Michelle M. Levano, LT/NOAA	Field Operations Officer	09/24/2022	Digitally signed by LEVANO.MICHELLE.MARIE.1516645888 Date: 2022.09.24 15:21:00 -04'00'
Erin K. Cziraki	Chief Survey Technician	09/24/2022	CZIRAKI.ERIN.KAYE.1550015338 Digitally signed by CZIRAKI.ERIN.KAYE.1550015338 Date: 2022.09.24 06:07:05 -04'00'
Sarah G. Thompson	Sheet Manager	09/24/2022	THOMPSON.SARAH.GRACE.1083063544 Digitally signed by THOMPSON.SARAH.GRACE.1083063544 Date: 2022.09.24 02:23:05 -04'00'

F. Table of Acronyms

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

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

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