H13546

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13546

LOCALITY

State(s):	Maryland
General Locality:	Chesapeake Bay
Sub-locality:	Whitehall Bay

2022

CHIEF OF PARTY
LTJG McMillan

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13546**

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):	**Maryland**
General Locality:	**Chesapeake Bay**
Sub-Locality:	**Whitehall Bay**
Scale:	**5000**
Dates of Survey:	**05/16/2022 to 06/01/2022**
Instructions Dated:	**02/18/2022**
Project Number:	**OPR-E349-NRTST-22**
Field Unit:	**NOAA Navigation Response Team - Stennis**
Chief of Party:	**LTJG McMillan**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

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 18N, MLLW. 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 H13546

Project: OPR-E349-NRTST-22

Locality: Chesapeake Bay

Sublocality: Whitehall Bay

Scale: 1:5000

May 2022 - June 2022

NOAA Navigation Response Team - Stennis

Chief of Party: LTJG McMillan

A. Area Surveyed

The survey area is located in Chesapeake Bay within the sub locality of Whitehall Bay.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
39° 1' 5.51" N 76° 28' 15.24" W	38° 58' 1.93" N 76° 25' 14.14" W

Table 1: Survey Limits

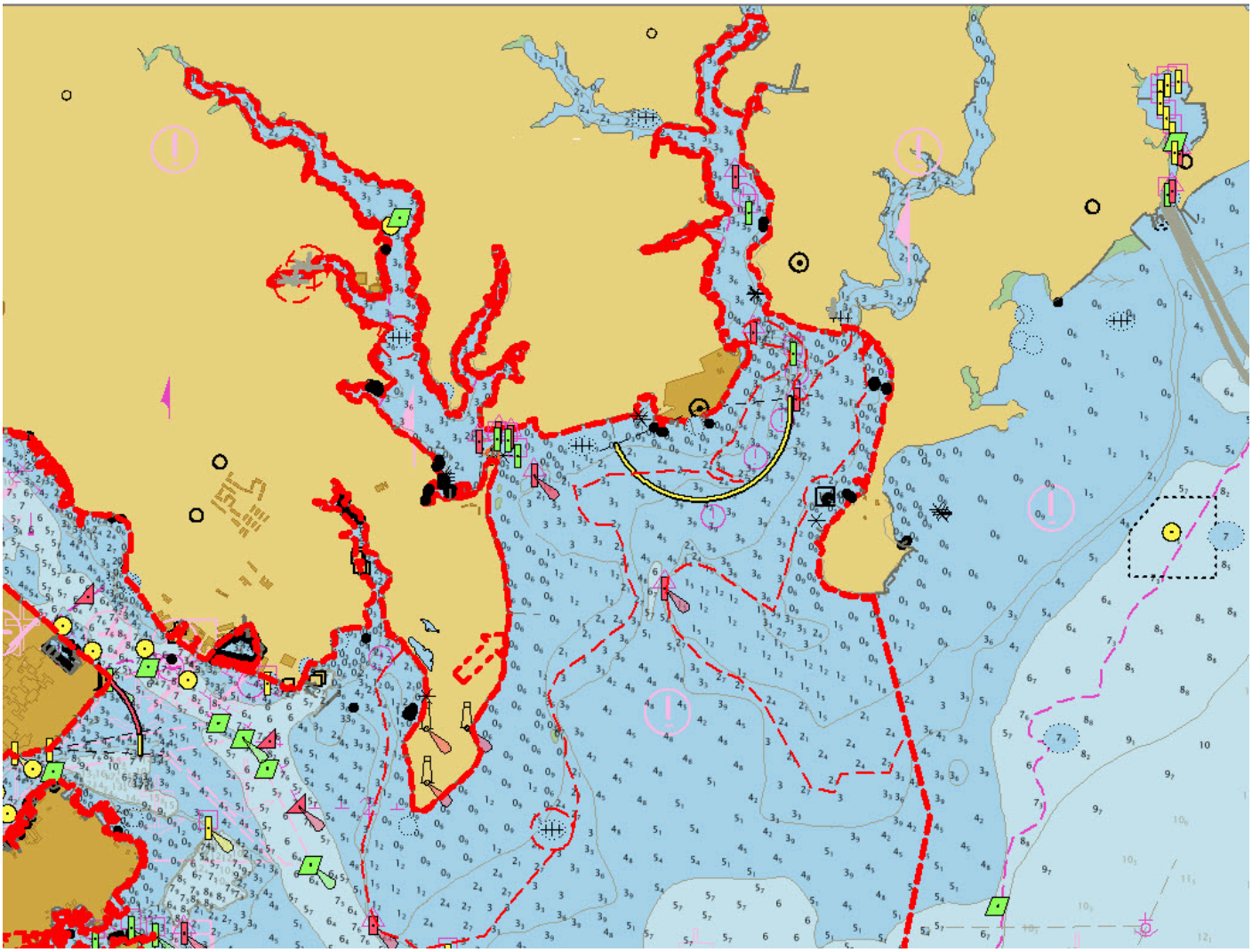


Figure 1: Project Reference File overlaid on ENC US5MD32M & US5MD22M.

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2022 NOS Hydrographic Surveys Specifications and Deliverables (HSSD). In all areas where the 3.5 meter depth contour or the sheet limits were not met, the Navigable Area Limit Line was defined as the inshore limit of bathymetry due to the risks of maneuvering the survey vessel in close proximity to shoreline construction or other danger.

A.2 Survey Purpose

The Chesapeake Bay is the largest estuary in North America and heavily trafficked by commercial and recreational vessels as tourism, fishing, and marine commerce are economically vital for the region. The majority of the prior data in the project area spans from the 1880s to 1940s. The bathymetric data vintage coupled with numerous storms and hurricanes having potentially changed the seabed over the last century

raises a need to survey the area. This 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 Seabed 2030 global mapping initiative.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13546 meets 100% SSS with concurrent MBES.

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 for H13546	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

The entirety of H13546 was acquired in accordance with the 100% SSS with concurrent MBES coverage standard, meeting the requirements listed above and in the HSSD. There are two major holidays present in the assigned area (image 1 and 2) caused by line planning errors. The lines south of Greenbury Point do not extend the the western sheet extents. The spur creek off of Whitehall creek was excluded by accident when a chart feature was mistaken for the sheet boundary during survey planning. Smaller holidays exist (image 3) throughout the survey but are concentrated in the area south of Hackett Point. The majority of these holidays where caused by the presence of crab pots, some are due to the junction off the two vessels not having sufficient overlap, and some are due to data gaps resulting from the autonomous system data collection methods. Due to time constraints these holidays could not be addressed while the field team was in the project area.

Figure 2: Greenbury Point holidays

Figure 3: Whitehall Creek holiday

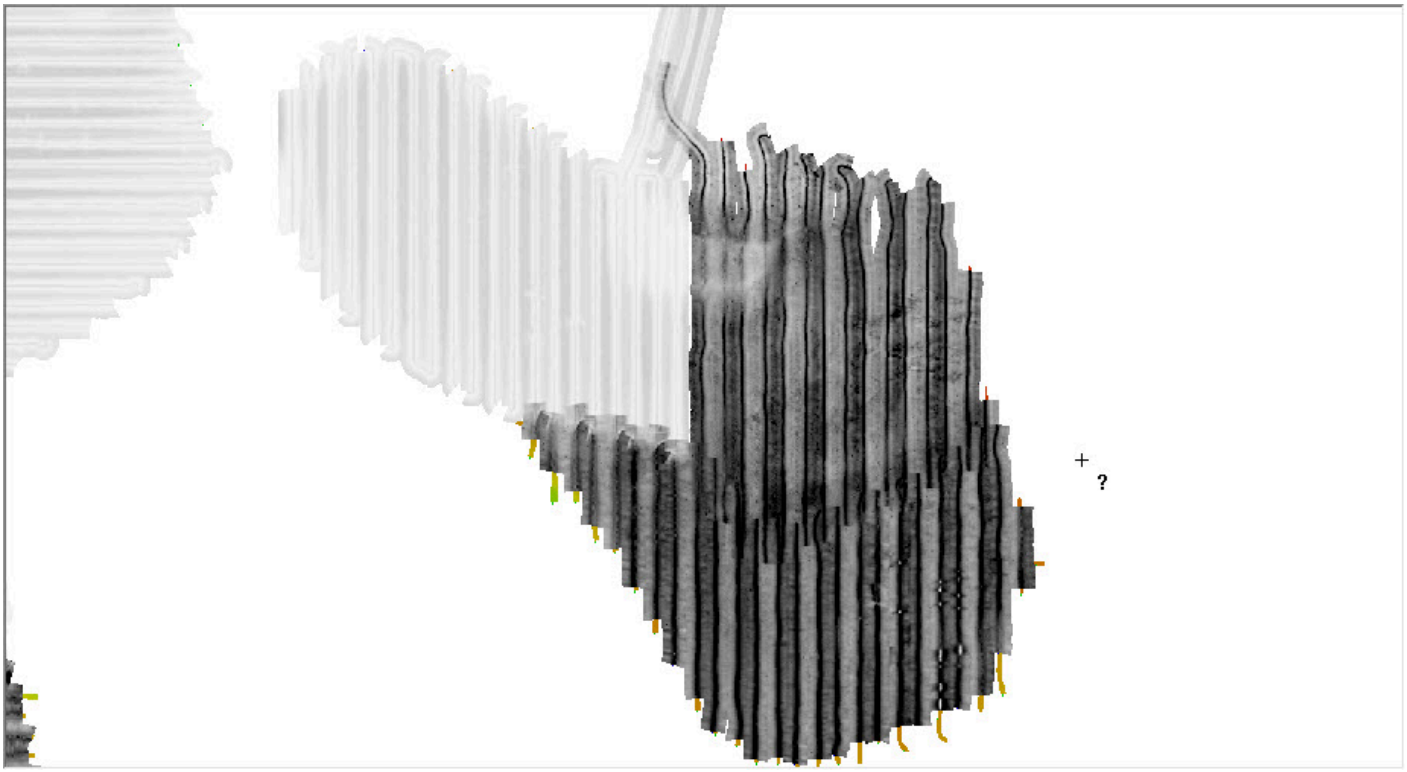


Figure 4: Hackett Point Holidays

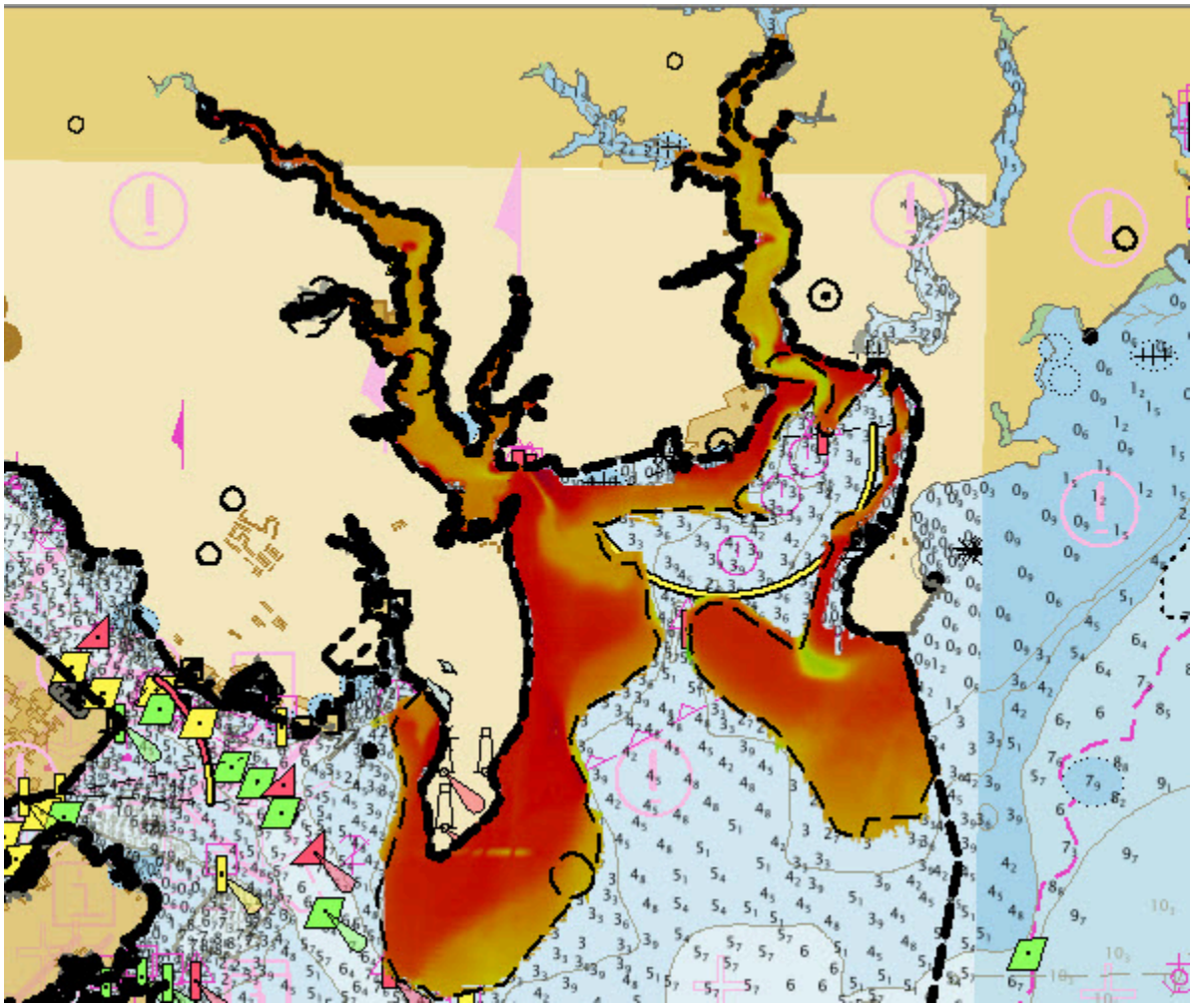


Figure 5: Project Reference File overlaid on 4m TIN model of bathymetry overlaid on ENC US5MD32M & US5MD22M.

A.6 Survey Statistics

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

	HULL ID	*S3005*	*EB240*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0
	MBES Mainscheme	30.817	83.9225	114.7395
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	26.77	73.4367	100.2102
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0
	SBES/MBES Crosslines	2.34	16.69	0.0
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				0
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				0.3522

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
05/26/2023	146
06/01/2022	152

Survey Dates	Day of the Year
05/31/2022	151
05/30/2022	150
05/29/2022	149
05/28/2022	148
05/25/2022	145
05/16/2022	136
05/14/2023	134
05/17/2022	137
05/20/2022	140
05/21/2022	141
05/18/2022	138

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-E349-NRTST-22 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	*S3005*	*EB240*
LOA	31.0 feet	7.9 feet
Draft	1.2 feet	0.21 meters

Table 5: Vessels Used

Table 5 uses a mix of meters and feet for vessels. The draft for Echoboat is 0.7 feet as described in the submitted DAPR.

B.1.2 Equipment

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

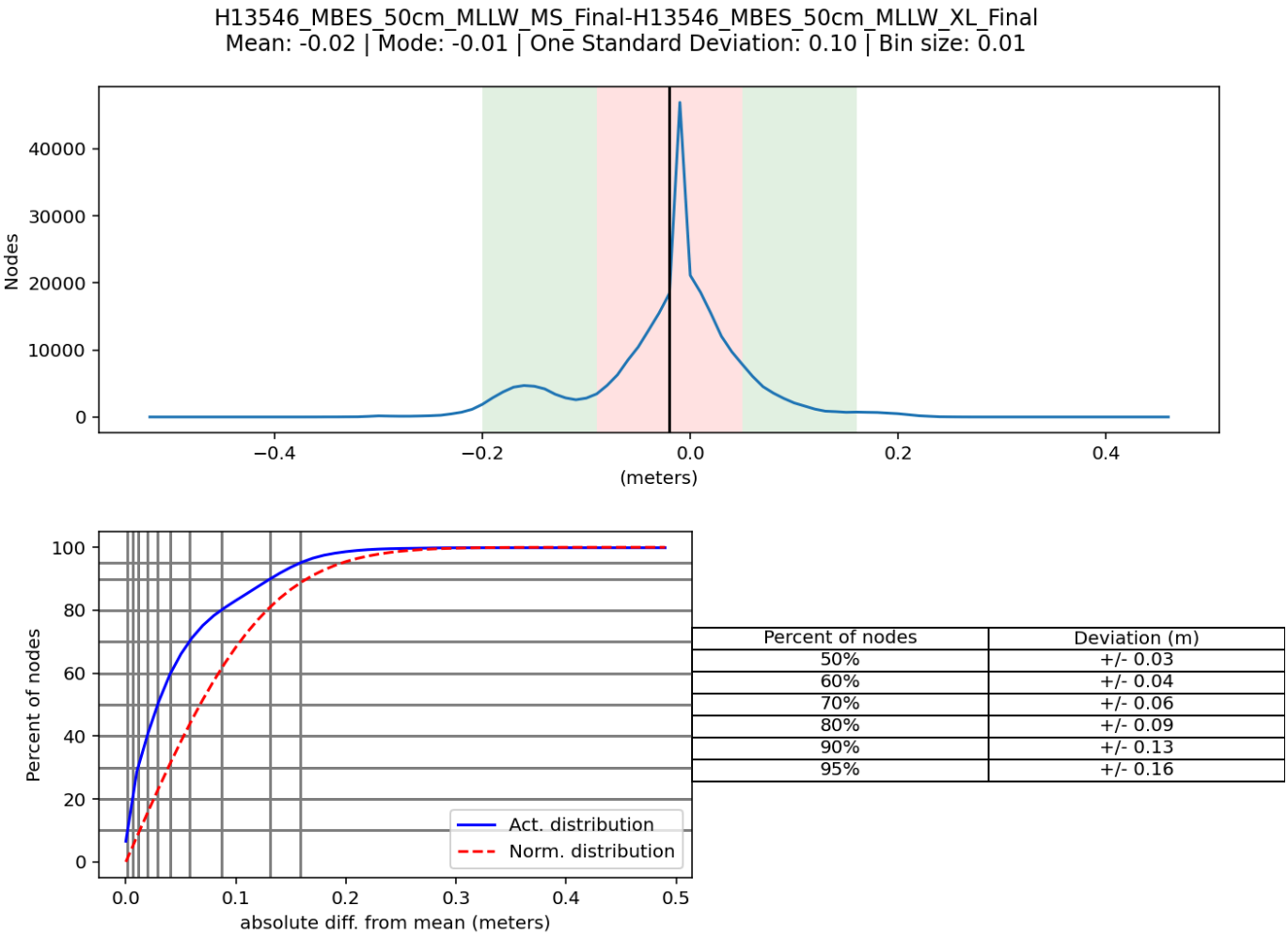
Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
Teledyne RESON	SeaBat T20-P	MBES
EdgeTech	4125	SSS
Tritech	Starfish 453	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
Applanix	POS MV SurfMaster	Positioning and Attitude System
AML Oceanographic	MicroX SV	Sound Speed System
SonTek	CastAway-CTD	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines acquired for this survey totaled 6% of mainscheme acquisition. Mainscheme data were compared with a crossline analysis. Crosslines were collected, processed and compared in accordance with Section 5.2.4.32 of the HSSD. To evaluate crosslines, a surface generated via data strictly from mainscheme lines, and a surface generated via data strictly from crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated, and is submitted in the Separates II Digital Data folder. Using Pydro Compare Grids statistics show the mean difference between the depths derived from mainscheme data and crossline data was -0.02 meters (with mainscheme being deeper) and 95% of nodes falling within +/-0.16 meters. For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.5+% of the depth differences between H13546 mainscheme and crossline data were within allowable NOAA uncertainties.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.06
80%	+/- 0.09
90%	+/- 0.13
95%	+/- 0.16

Figure 6: Pydro Compare Grids Plot mainscheme vs. crosslines.

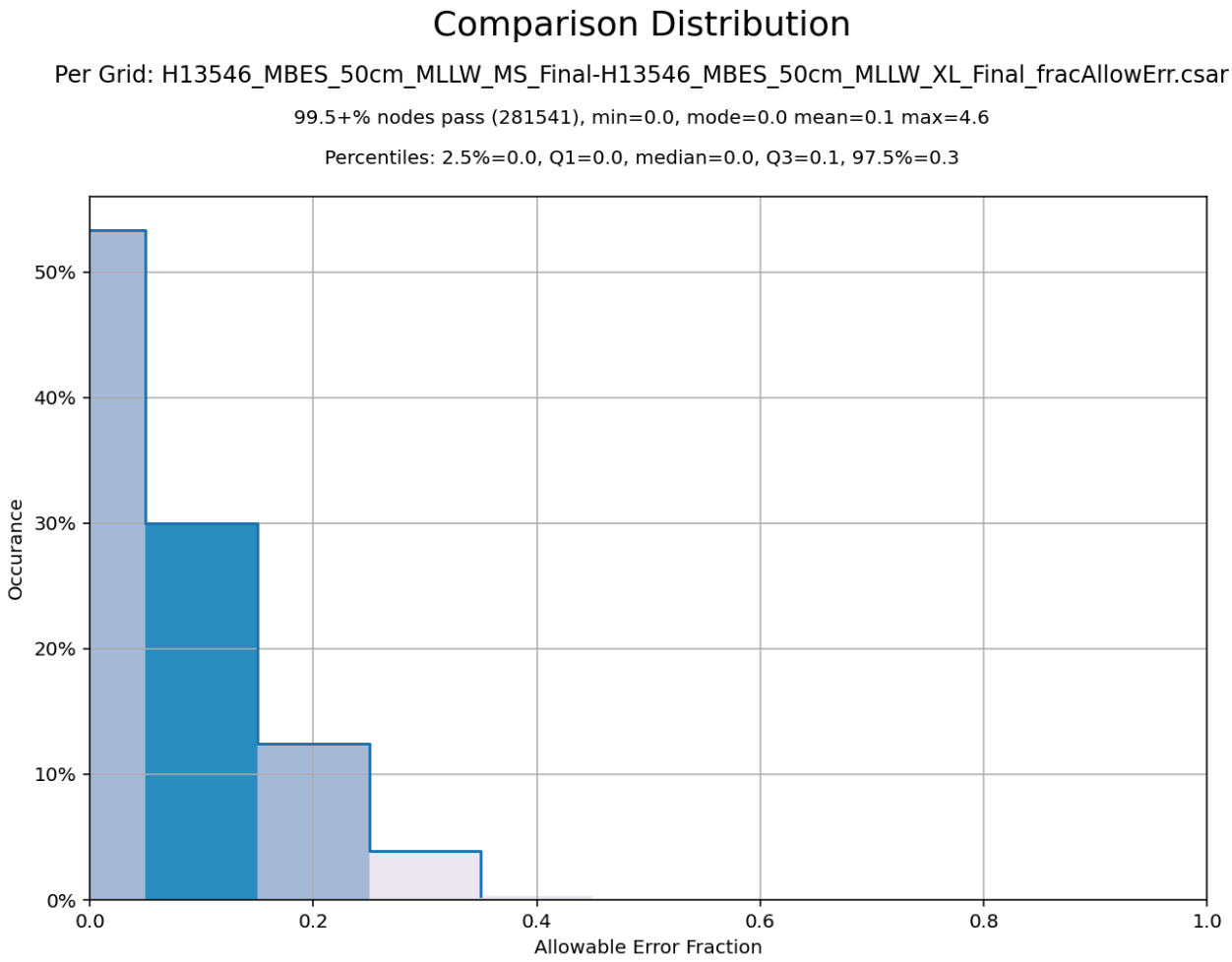


Figure 7: Pydro Compare grids Comparison Distribution plot.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.08 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S3005	2.00 meters/second	0.00 meters/second	0.00 meters/second	0.50 meters/second
EB240	2.00 meters/second	0.00 meters/second	0.00 meters/second	0.50 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty provided via device models for vessel motion, VDatum, Poor Mans VDatum (PMVD), and real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13546. Real-time uncertainties were provided via MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel gps height and navigation were applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac.

B.2.3 Junctions

Junction surveys do exist, but their surfaces are not available yet.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13509	1:5000	2021	TJ	S
H13510	1:5000	2021	TJ	E

Table 9: Junctioning Surveys

H13509

N/A

H13510

N/A

Junction surveys were evaluated during office review. Survey H13509 showed good agreement between the two surveys. Survey H13510 does not junction with survey H13546.

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

Vertical offset due to ERS error.

One line of MBES mainscheme has a vertical offset ranging from approximately 1.1 to 2.7 meters different than that of the compared crosslines in the area. This vertical offset exists for only a portion of the line.

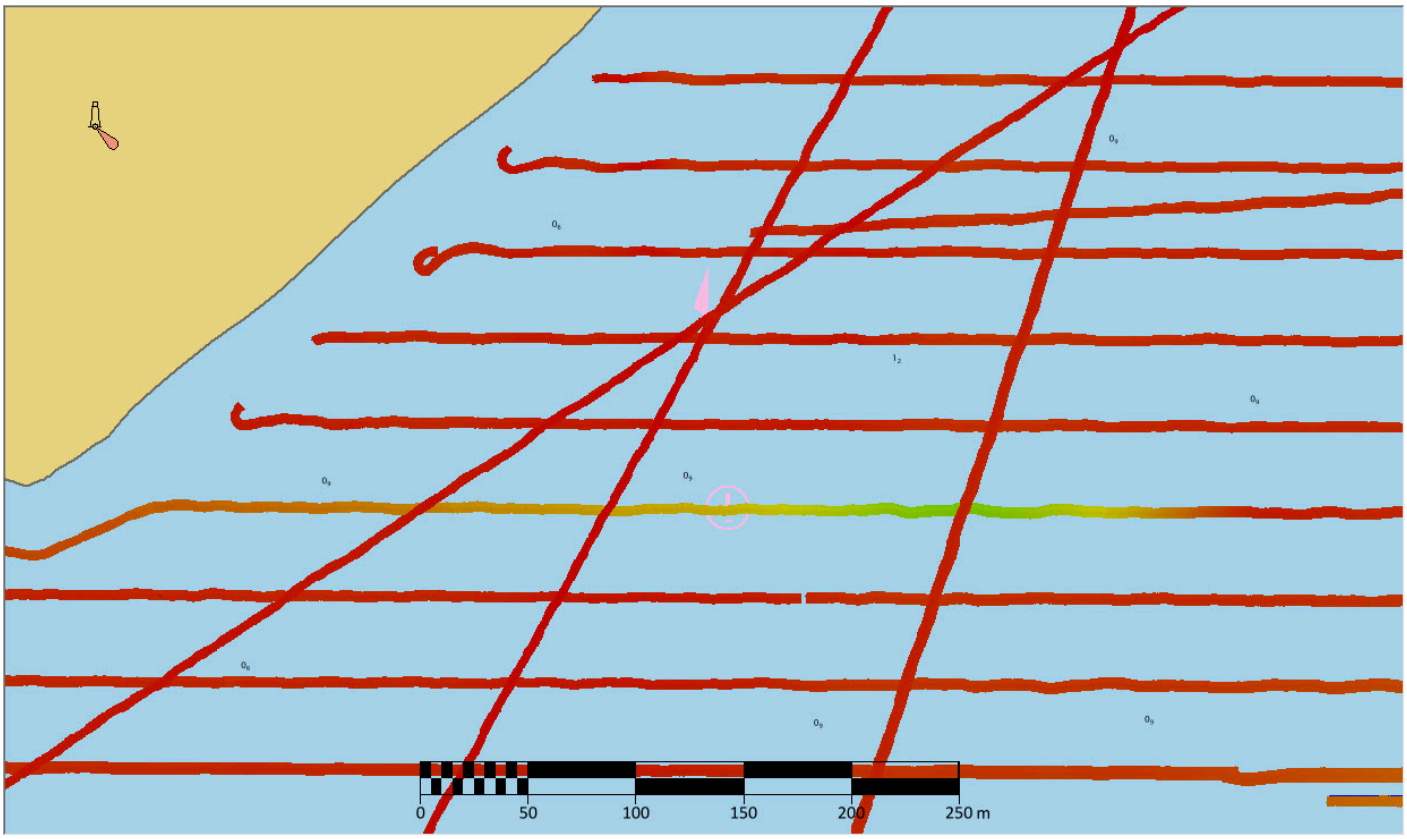


Figure 8: Overview of MBES CSAR surface displaying vertical offset.

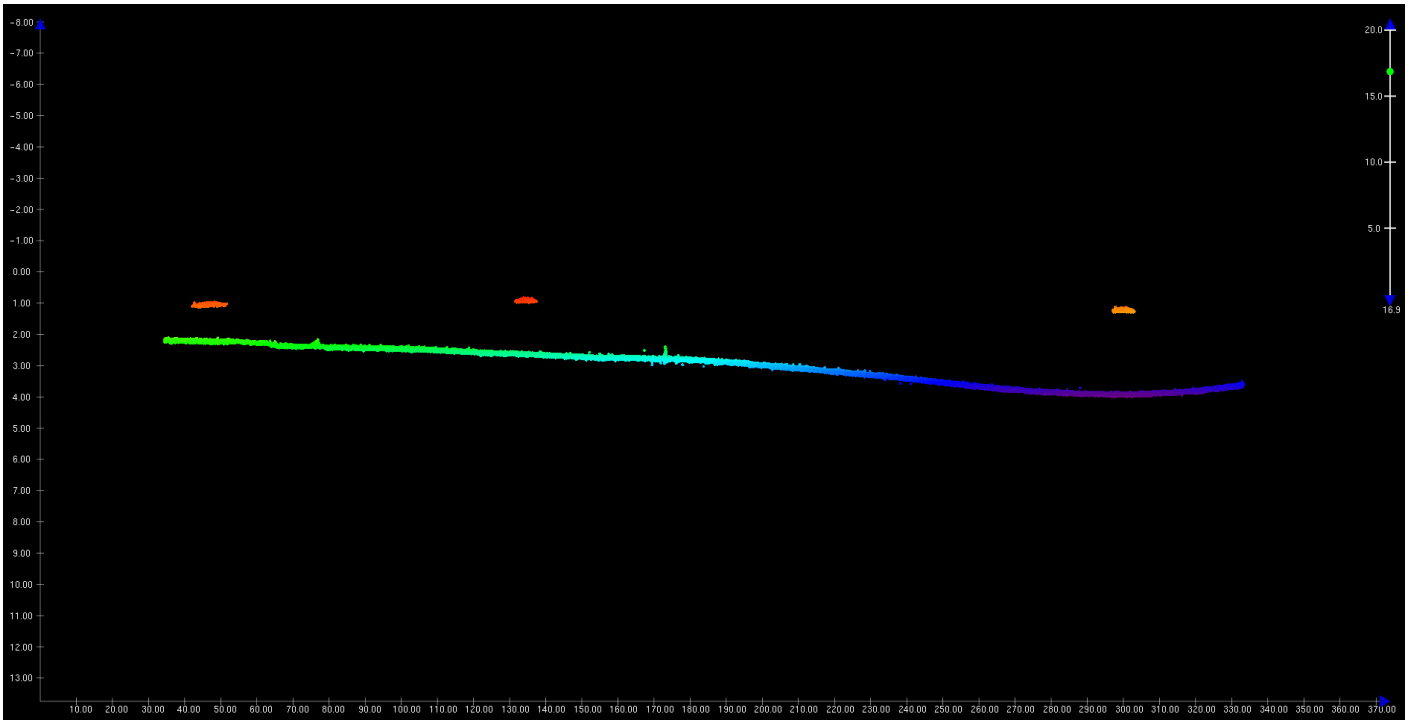


Figure 9: Subset of vertical offset compared with crosslines.

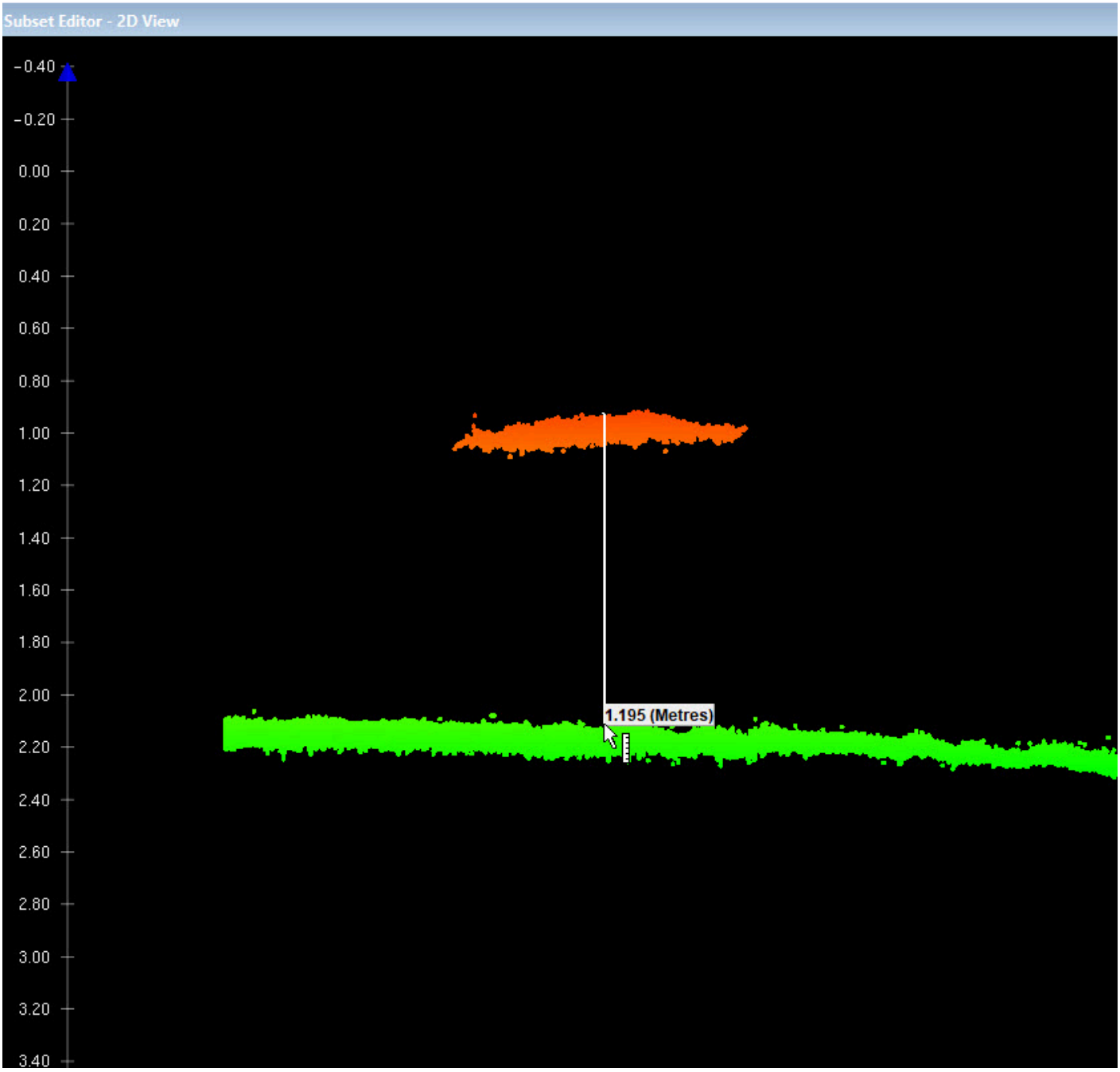


Figure 10: Measurement of offset at ~1.1 meters.

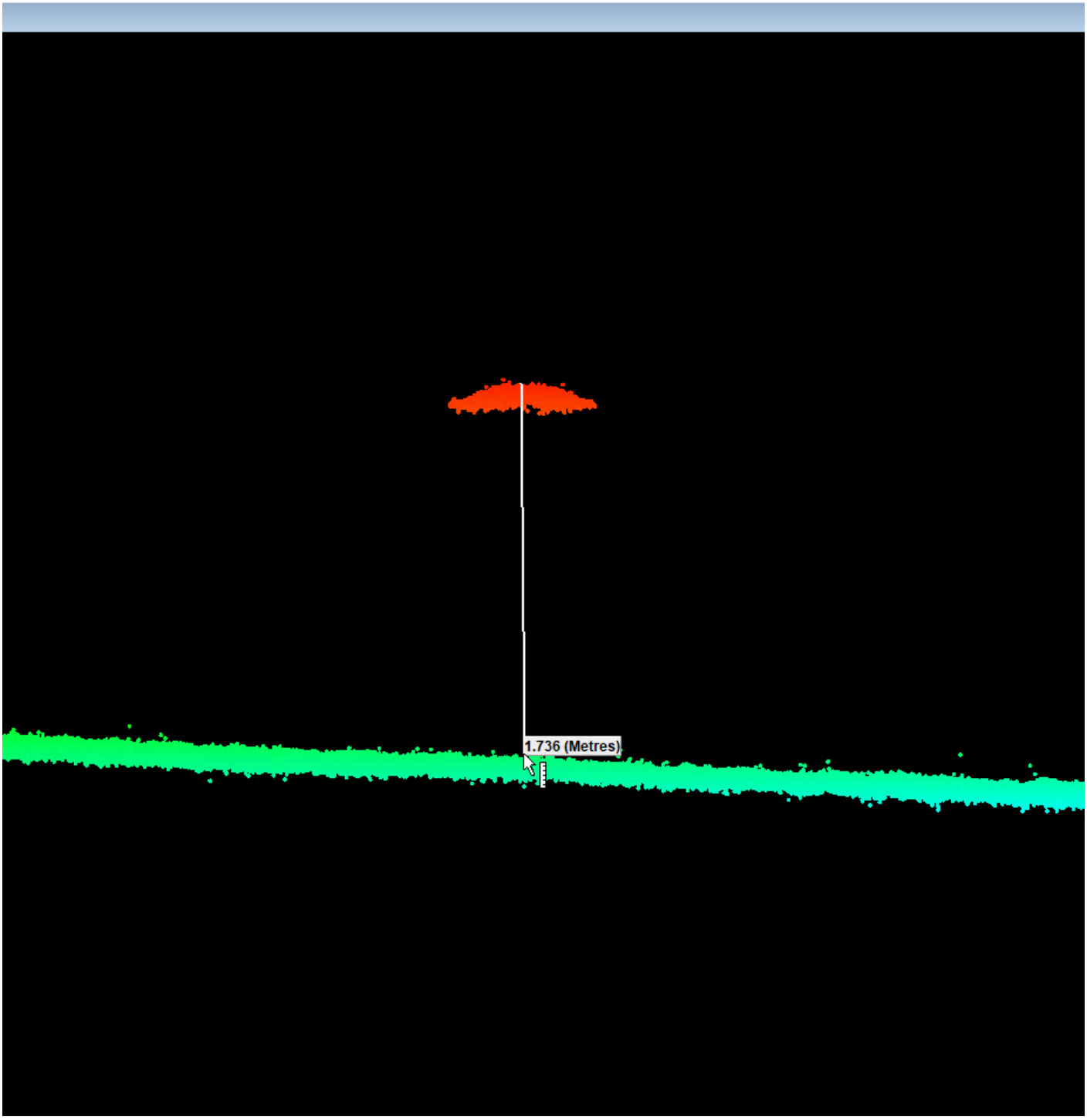


Figure 11: Measurement of offset at ~1.7 meters.

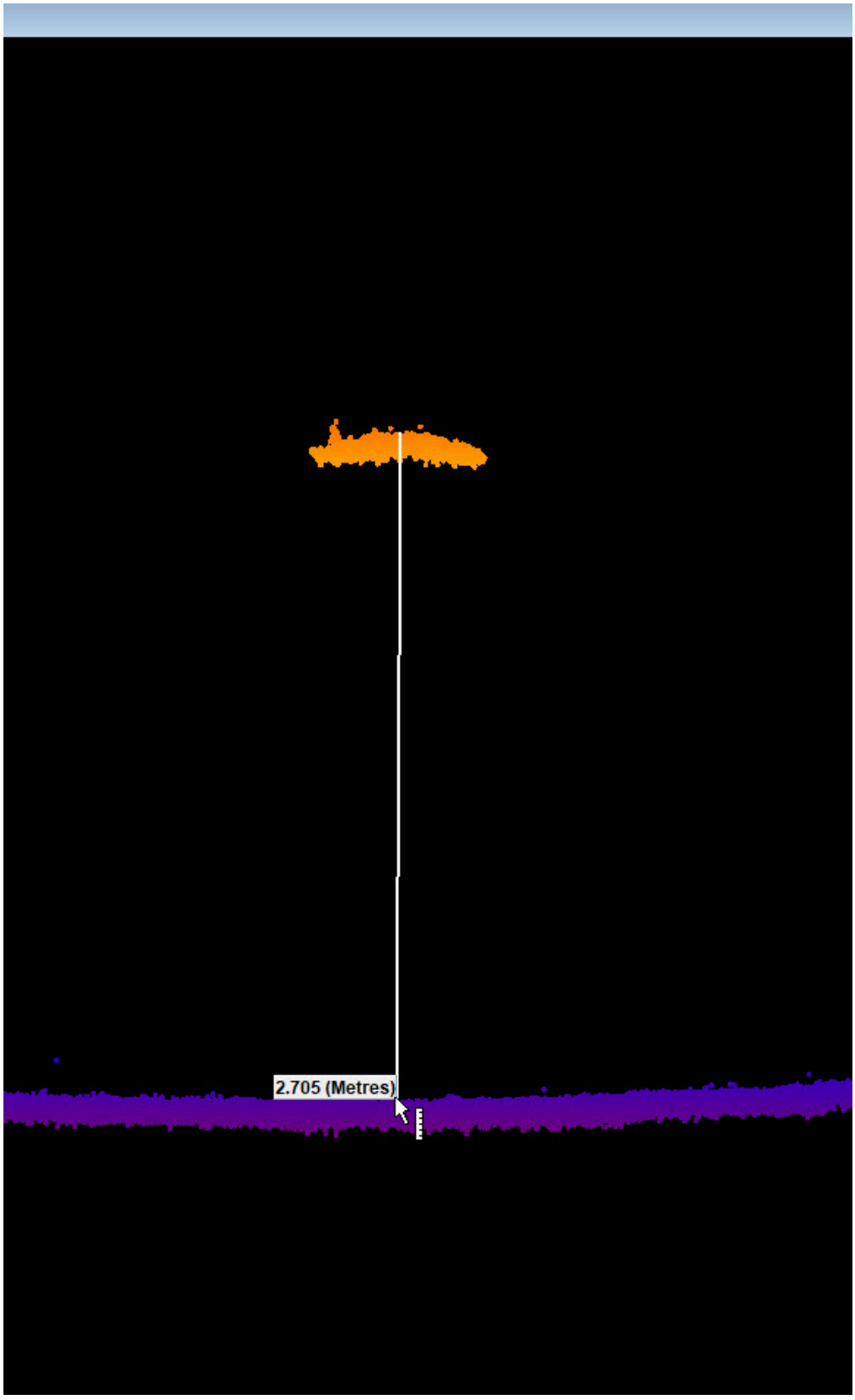


Figure 12: Measurement of offset at ~2.7 meters.

Concur with clarification that the portion of MBES line affected by the vertical offset issue was removed from the grid during branch processing.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: At least every 4 hours.

Casts were conducted at a minimum of one every four hours during launch acquisition. Casts were conducted more frequently in areas where the influx of freshwater had an effect on the speed of sound in the water column and when there was a change in surface sound speed greater than two meters per second. All sound speed methods were used as detailed in the DAPR.

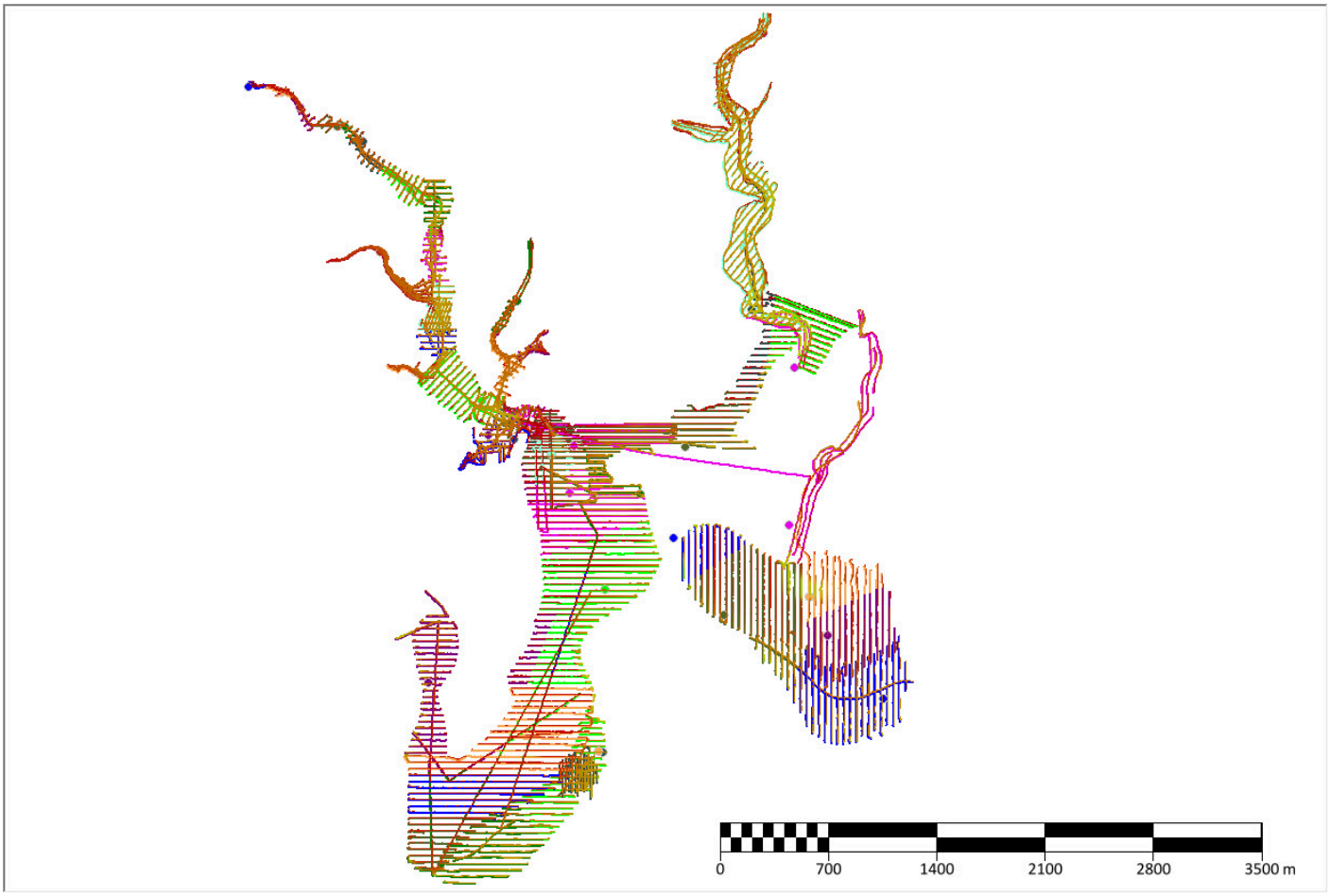


Figure 13: Overview of MBES track lines symbolized by SV cast distribution.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature and the results are shown below. Density requirements for H13546 were achieved with at least 99% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3. The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep slopes and rocky areas where acoustic shadowing occurred, and at the edges of the survey limits. For the individual graph of density requirements.

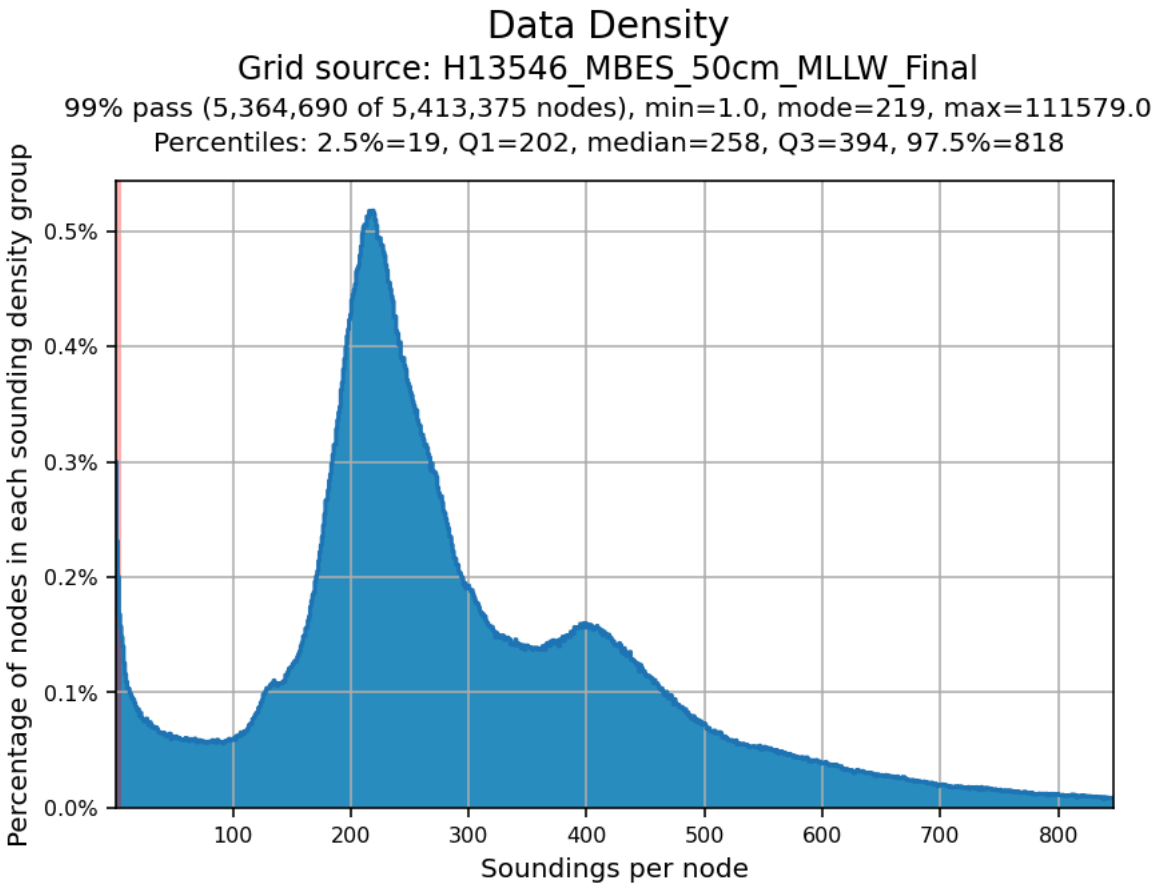


Figure 14: H13546 Data Density plot results from Pydro QC Tools.

B.2.10 Total Vertical Uncertainty

The surface was analyzed using the HydroOffice QC Tools Grid QA feature and the results are shown below. Total Vertical Uncertainty is determined by a ratio of uncertainty to allowable error per NOAA and IHO specification: TVU\, QC = Uncertainty / \sqrt{A^2 + (B * Depth)^2}. Where A = 0.5, B = 0.013 for Order 1 (depths less than 100 m), and A = 1.0, B = 0.023 for Order 2 (depths greater than 100 m). TVU requirements for survey H13546 were achieved with 99% of nodes passing.

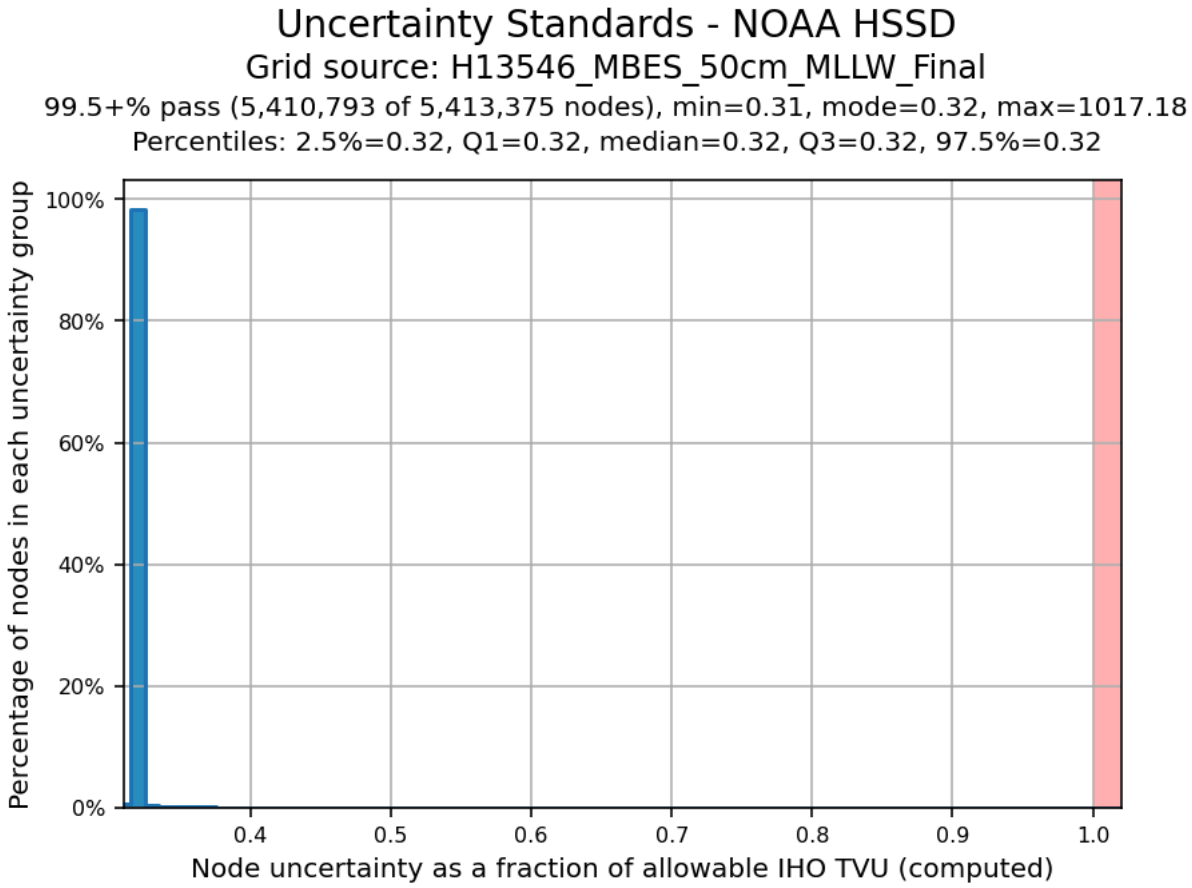


Figure 15: H13546 plot of Uncertainty Standards.

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

Raw Backscatter data was stored in the .all file for S3005, a Kongsberg system. The backscatter data was processed to GSF files and a floating point mosaic was created using Fledermaus FMGT. Backscatter was not processed for EB240 because the vessel was not set up to collect backscatter data. This has been remedied and future projects utilizing this system will have backscatter data.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.4.6
CARIS	BASE Editor	5.5

Table 10: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.4.6

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Pool 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
H13546_MBES_50cm_MLLW_Final	CARIS Raster Surface (CUBE)	0.5 meters	-0.276 meters - 13.002 meters	NOAA_0.5m	Concurrent MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13546_SSSAB_1m_450kHz_1of2	SSS Mosaic	1 meters	-	N/A	100% SSS
H13546_SSSAB_1m_450kHz_2of2	SSS Mosaic	1 meters	-	N/A	200% SSS
H13546_MBES_50cm_MLLW	CARIS Raster Surface (CUBE)	0.5 meters	-	NOAA_0.5m	Concurrent MBES
H13546_MBAB_2m_S3005_300kHz_1of1	MB Backscatter Mosaic	2 meters	-	N/A	MBES Trackline

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13546. The surfaces have been reviewed where noisy data, or "fliers", are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed. Flier Finder, part of the QC Tools package within HydrOffice, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run iteratively until all remaining flagged fliers were deemed to be valid aspects of the steep slopes and dynamic nature of the seafloor.

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 Mean Lower Low Water.

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-E349-TJ-21_CMMB_alt_NAD83-MLLW_xGeoid20B

Table 13: 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 18.

The following PPK methods were used for horizontal control:

- Smart Base
- RTX

Vessel kinematic data were post-processed using Applanix POSPac processing software and RTX positioning methods described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error Root Mean Square (RMS) data were applied to all MBES data in HIPS and SIPS.

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

No significant differences found in chart comparisons except for channel noted in image 3 below.

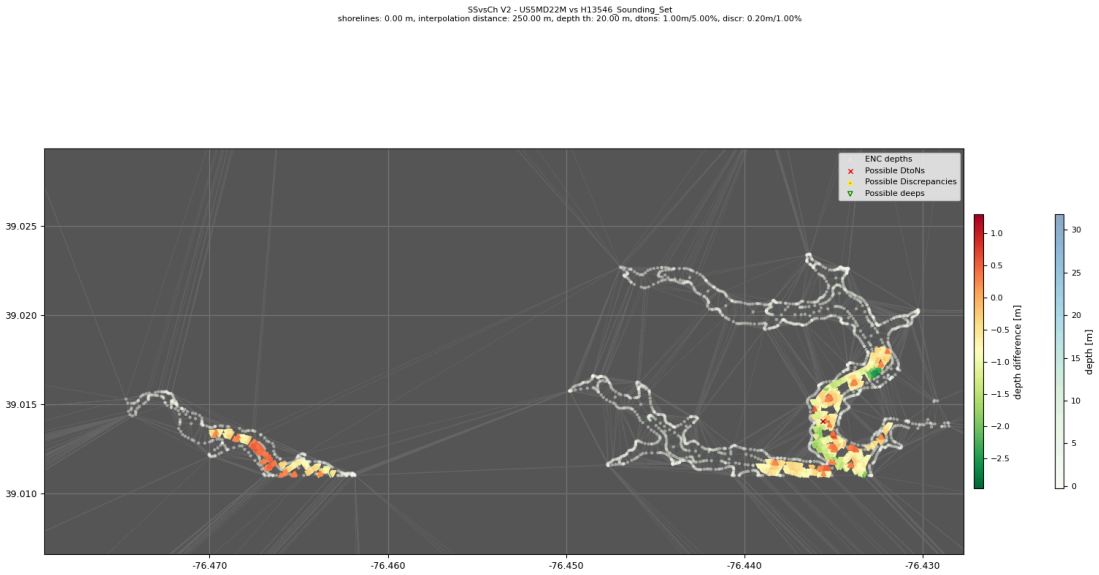


Figure 16: Northern section of H13546 chart comparison

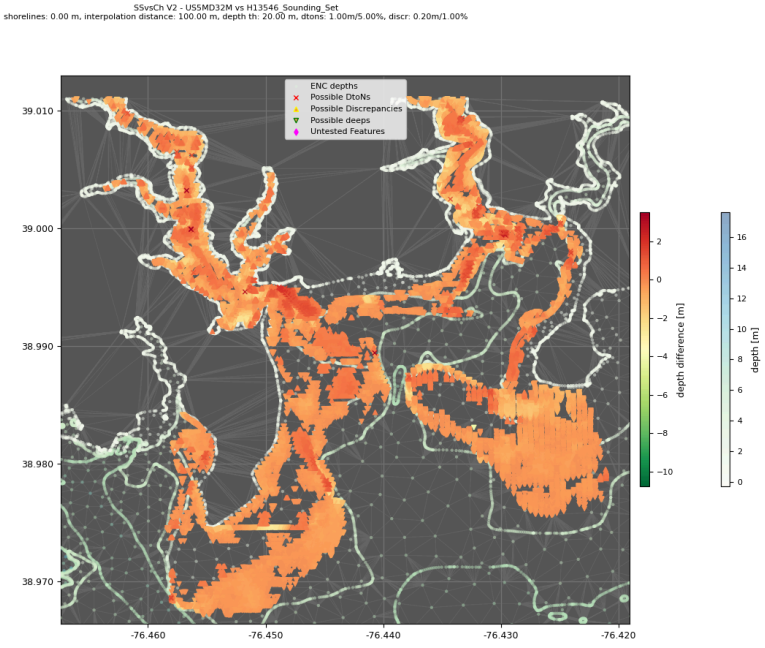


Figure 17: Southern section of H13546 chart comparison

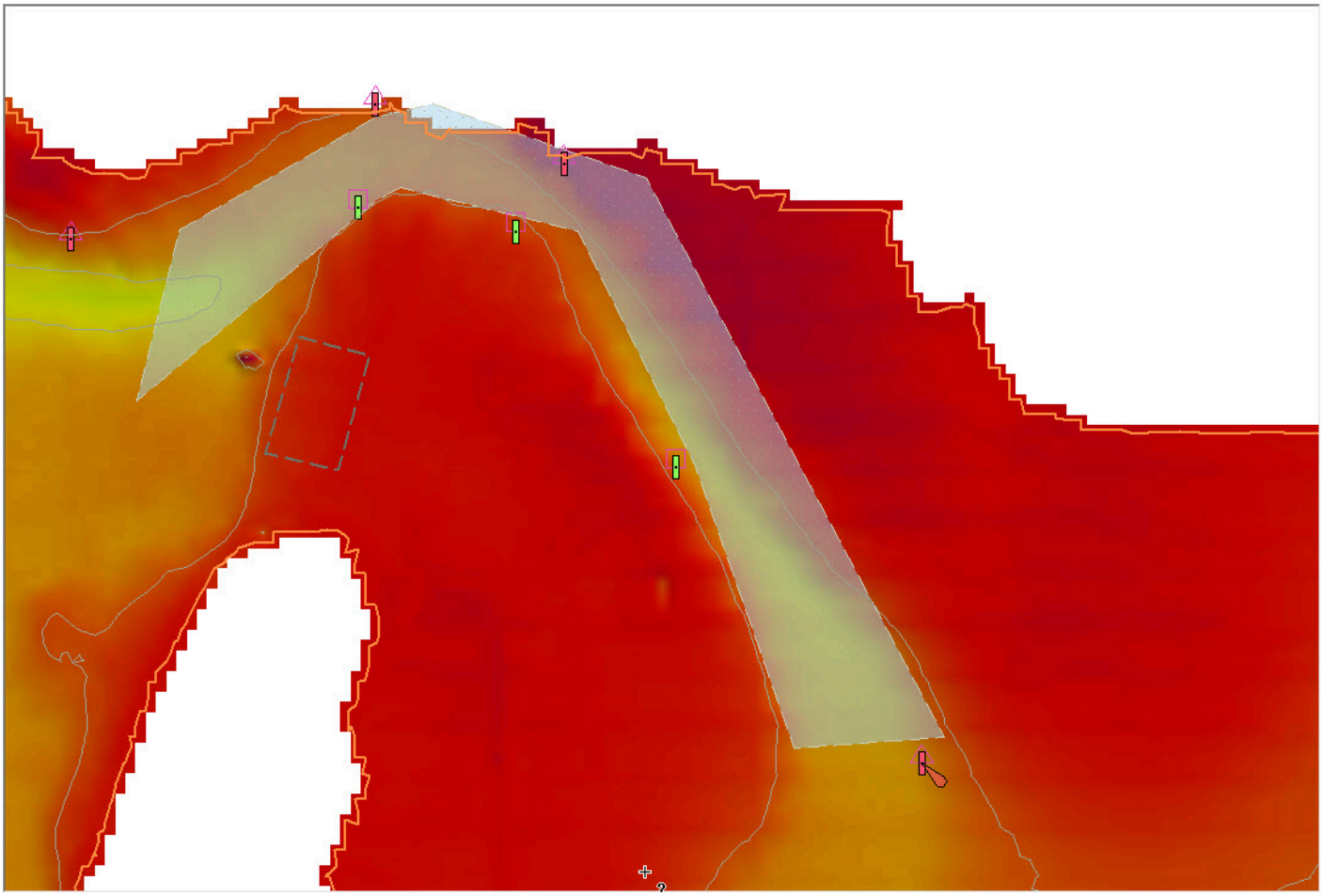


Figure 18: Physical channel deviates from ENC charted position

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
US5MD22M	1:25000	15	01/07/2022	02/09/2022
US5MD32M	1:10000	20	10/20/2021	02/09/2022

Table 14: Largest Scale ENCs

There are a new set of ENCs that covers survey H13546: ENC US5MD1MC, edition 1 ENC US5MD1MD, edition 1 ENC US5MD1NC, edition 1 and ENC US5MD1ND, edition 1. These ENCs were evaluated during office review to ensure there were no dangers to navigation present.

D.1.2 Shoal and Hazardous Features

Refer to the H13546 Final Feature File.

D.1.3 Charted Features

Refer to the H13546 Final Feature File.

D.1.4 Uncharted Features

Survey H13546 has 3 new features that are addressed in the H13546 Final Feature File. Of these features, there are 3 new Obstructions, 0 new Seabed Areas, 0 new Underwater Rocks of which 0 are submitted as DTONs.

D.1.5 Channels

There is a discrepancy between the ENC charted contours and the surveyed contours of the channel at Greenbury Point. See H13546_FFF for details.

D.2 Additional Results

D.2.1 Aids to Navigation

Refer to H13546 Final Feature File.

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
PST Joshua Bergeron	Sheet Manager	05/01/2023	BERGERON.JOSHUA.STEPHAN.1239796180 Digitally signed by BERGERON.JOSHUA.STEPHAN.1239796180 Date: 2023.05.05 13:26:33 -05'00'
LTJG Collin McMillan	Chief of Party	05/01/2023	MCMILLAN.COLLIN.OWEN.1544969958 Digitally signed by MCMILLAN.COLLIN.OWEN.1544969958 Date: 2023.05.05 13:29:17 -05'00'

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