F00747

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	F00747

LOCALITY

State(s):	Delaware
General Locality:	Delaware Bay
Sub-locality:	Breakwater Proposed Anchorage and Big Stone Anchorage

2019

CHIEF OF PARTY
LT Patrick Debroisse

LIBRARY & ARCHIVES

Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

F00747

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):	**Delaware**
General Locality:	**Delaware Bay**
Sub-Locality:	**Breakwater Proposed Anchorage and Big Stone Anchorage**
Scale:	**10000**
Dates of Survey:	**06/12/2019 to 08/08/2019**
Instructions Dated:	**01/28/2019**
Project Number:	**S-D901-BH2-19**
Field Unit:	**NOAA R/V *Bay Hydro II***
Chief of Party:	**LT Patrick Debroisse**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via http:// www.ncei.noaa.gov/.

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Descriptive Report to Accompany Survey F00747

Project: S-D901-BH2-19

Locality: Delaware Bay

Sublocality: Breakwater Proposed Anchorage and Big Stone Anchorage

Scale: 1:10000

June 2019 - August 2019

NOAA R/V *Bay Hydro II*

Chief of Party: LT Patrick Debroisse

A. Area Surveyed

The survey area is located in the Delaware Bay within the sub locality of Breakwater proposed anchorage and Big Stone Anchorage.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
39° 0' 50.8" N 75° 14' 53.86" W	38° 50' 52.13" N 75° 5' 31.76" W

Table 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the April 2019 NOS Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figures 1. Along the northeast edge of the surveyed area, where the sheet limits overlap The Lower Middle Shoal, the sheet limits were not met due to shallow depth of the area and the safe maneuverability of the vessel.

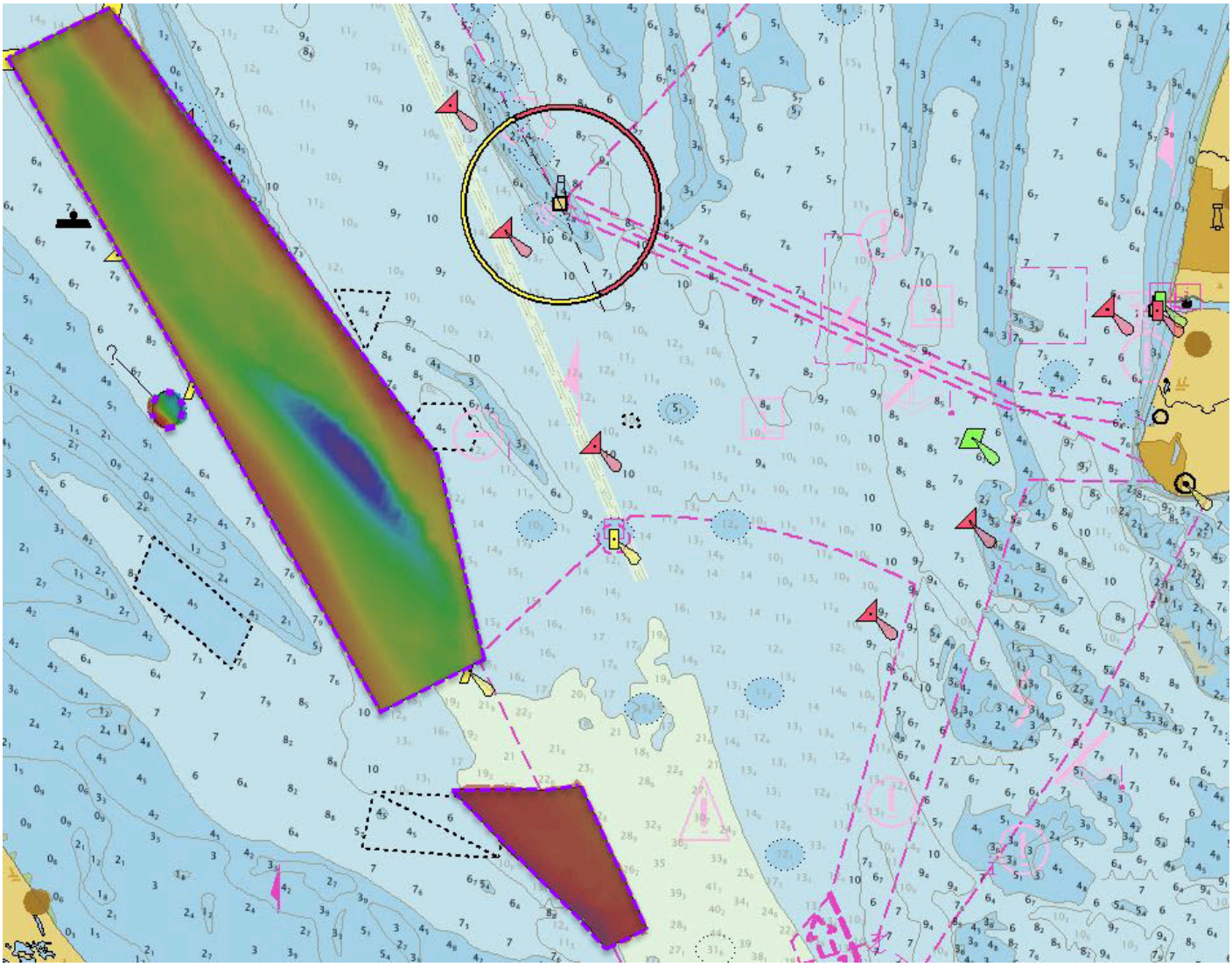


Figure 1: F00747 Survey Area with survey limits outlined in dashed purple line.

A.2 Survey Purpose

The Delaware River Pilots have requested hydrographic surveys in the Delaware River. These requests are for precise water depths for under water keel clearances and locating potential hazards and obstructions in anchorage areas and proposed anchorage areas.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in F00747 meet multibeam echo sounder (MBES) coverage requirements for object detection, as required by the HSSD unless otherwise stated in this report. This includes crosslines (see Section B.2.1),

NOAA allowable uncertainty (see Section B.2.2), and density requirements (see Section B.2.12 Density). Additional compliance statistics can be found in the Digital Data folder located in Appendix II of this report.

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

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements in the Project Instructions and the HSSD with the exception of holidays. In some cases, these holidays resulted from acoustic shadowing within the survey limits provided by HSD, while the rest were caused by an oversight of the hydrographer to identify them during acquisition. After each day of acquisition, the hydrographer processed the day's data using Pydro's Charlene and ran Pydro's QC Tools Holiday Finder to identify holidays while Bay Hydro II was still on the survey grounds. Any holidays found were re-acquired the following survey day to eliminate them. After further investigation into this issue, a cause to this could potentially be due to incorrect settings being using in QC tools, however, the hydrographer is unable to say this with complete certainty. Regardless of the cause, all cases were investigated to ensure there is no threat of an obstruction, and all holidays are identified in an associated F00747_Holidays.hob file in the appendices of this report. The area along the northeastern edge of the survey area where the sheet limits overlap with The Lower Middle Shoal, was deemed too shallow to survey safely with Bay Hydro II (see Figure 2).

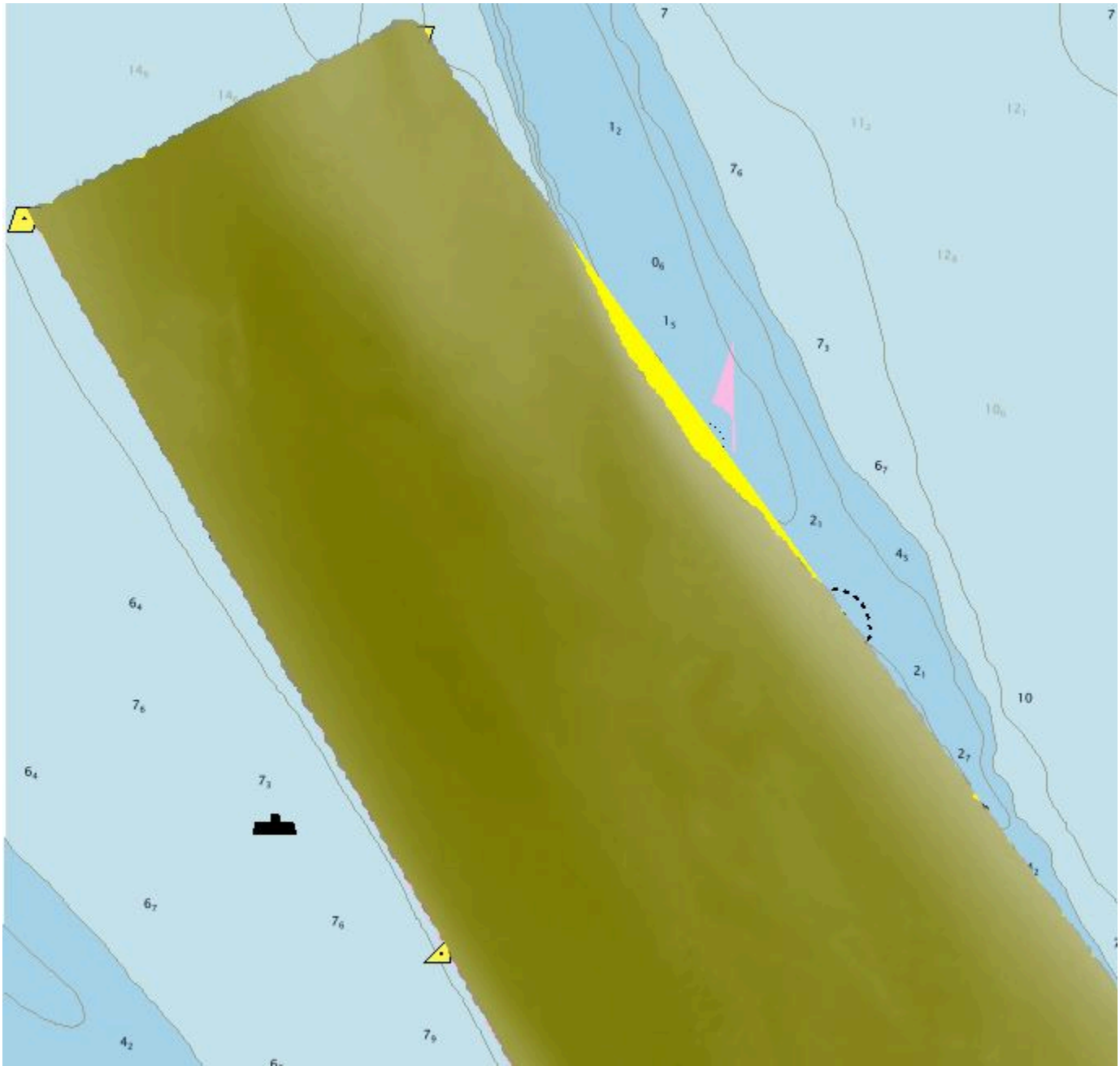


Figure 2: F00747 Survey coverage (in olive) overlaid onto the sheet limits indicating the area Bay Hydro II deemed too unsafe to meet survey limits (in yellow).

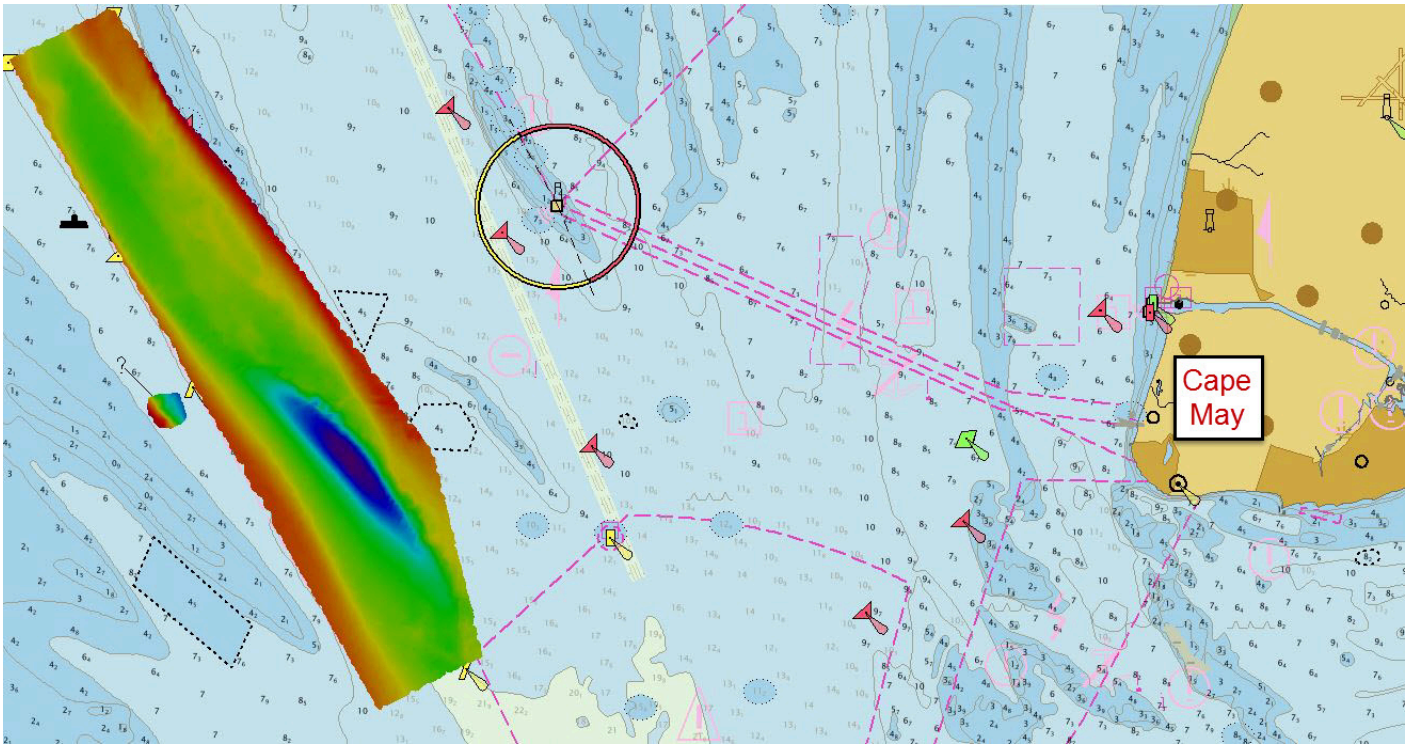


Figure 3: F007147 Big Stone Anchorage and Wreck PA survey coverage overlaid onto ENC US4DE11M.

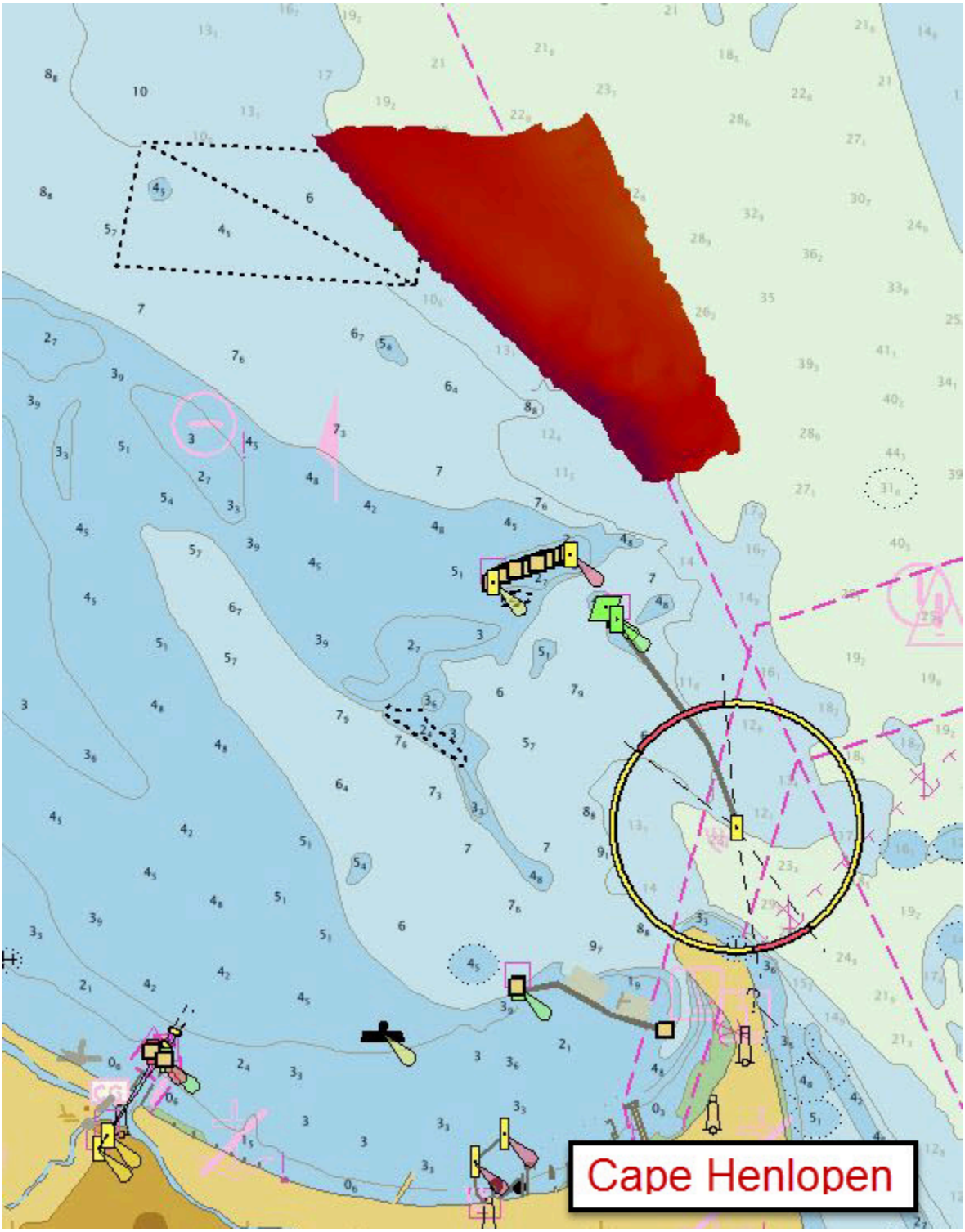


Figure 4: F00747 Proposed Breakwater Anchorage overlaid onto ENC US4DE11M.

A.6 Survey Statistics

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

	HULL ID	*S5401*	*Total*
LNM	**SBES Mainscheme**	0	0
	MBES Mainscheme	816.28	816.28
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	61.82	61.82
	Lidar Crosslines	0	0
Number of Bottom Samples			4
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			14

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/12/2019	163
06/13/2019	164
06/14/2019	165
06/15/2019	166
06/16/2019	167
06/17/2019	168
06/18/2019	169
06/19/2019	170
07/21/2019	202
07/22/2019	203
07/24/2019	205
07/25/2019	206
07/26/2019	207
07/27/2019	208
07/28/2019	209
07/29/2019	210
07/30/2019	211
07/31/2019	212
08/01/2019	213
08/02/2019	214
08/05/2019	217
08/06/2019	218
08/08/2019	220

Table 4: Dates of Hydrography

No multibeam data was acquired between 20 June and 20 July 2019 due to previously scheduled obligations, and weather prevented data acquisition on 23 July, 03 August, 04 August, and 07 August 2019.

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	***S5401***
LOA	17.3 meters
Draft	1.8 meters

Table 5: Vessels Used

Figure 5: R/V Bay Hydro II S5401

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040	MBES
Applanix	POS MV 320 v5	Positioning and Attitude System
Valeport	MiniSVS	Sound Speed System
SonTek	CastAway-CTD	Sound Speed System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 7.57% of mainscheme acquisition.

Crosslines were collected, processed, and compared in accordance with Section 5.2.4.2 of the HSSD. To evaluate crosslines, a Variable Resolution (VR) CUBE surface using strictly mainscheme lines, and a Variable Resolution (VR) CUBE surface using strictly crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated at a Variable Resolution (VR)resolution (Figures 6 - 8), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from mainscheme and crosslines was 0.01 meters with mainscheme being deeper and 95% of nodes falling within 0.19 meters (Figure 9). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards using Pydro's Compare Surfaces tool. In total, 99.5% of the depth differences between F00747 mainscheme and crossline data were within allowable NOAA uncertainties (Figure 10).

The percentage of crosslines to mainscheme was less than required by the HSSD due to time constraints.

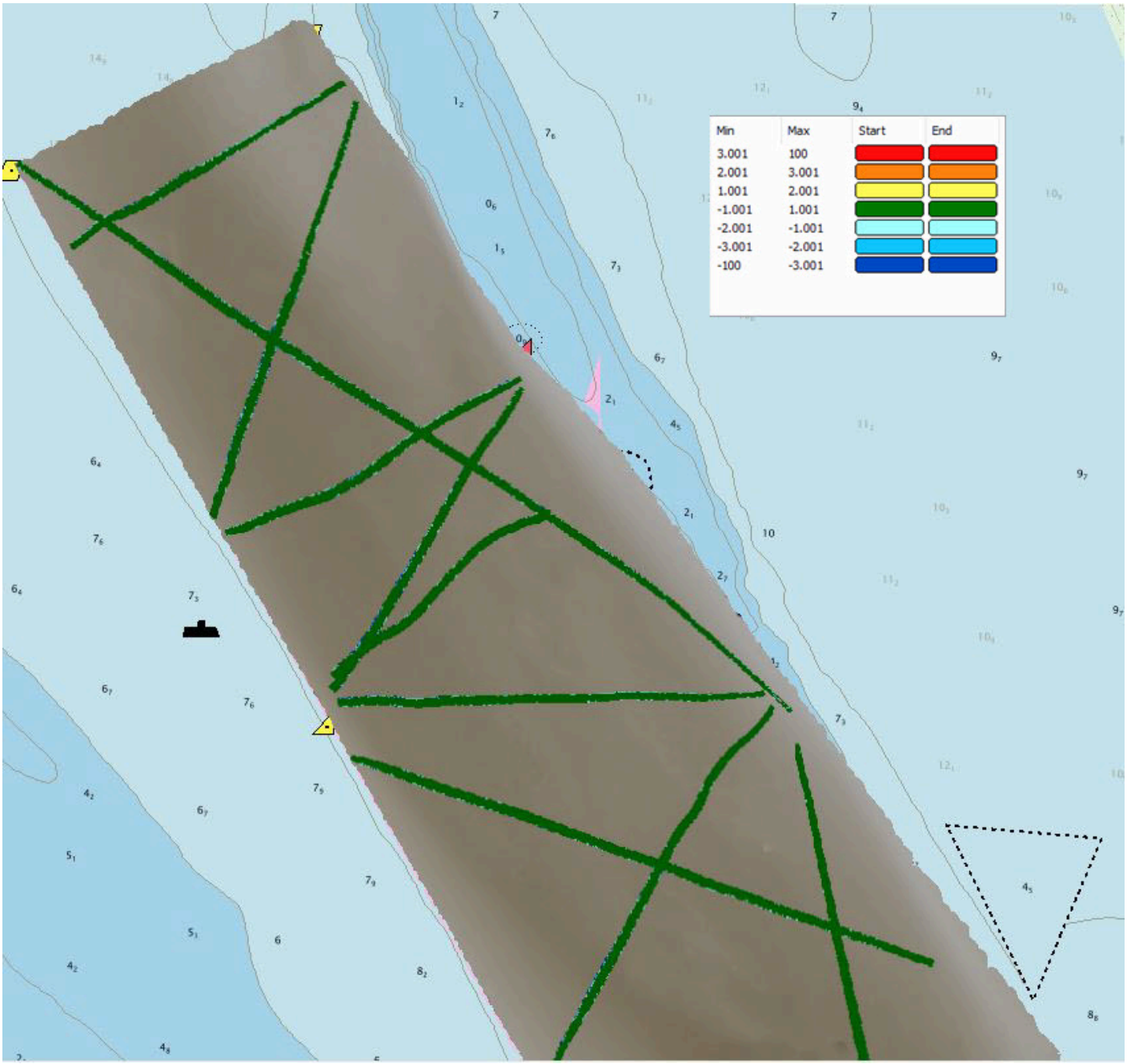


Figure 6: Depth differences between F00747 mainscheme (colored in gray) and F00747 crossline data in the northwestern part of the Big Stone Anchorage.

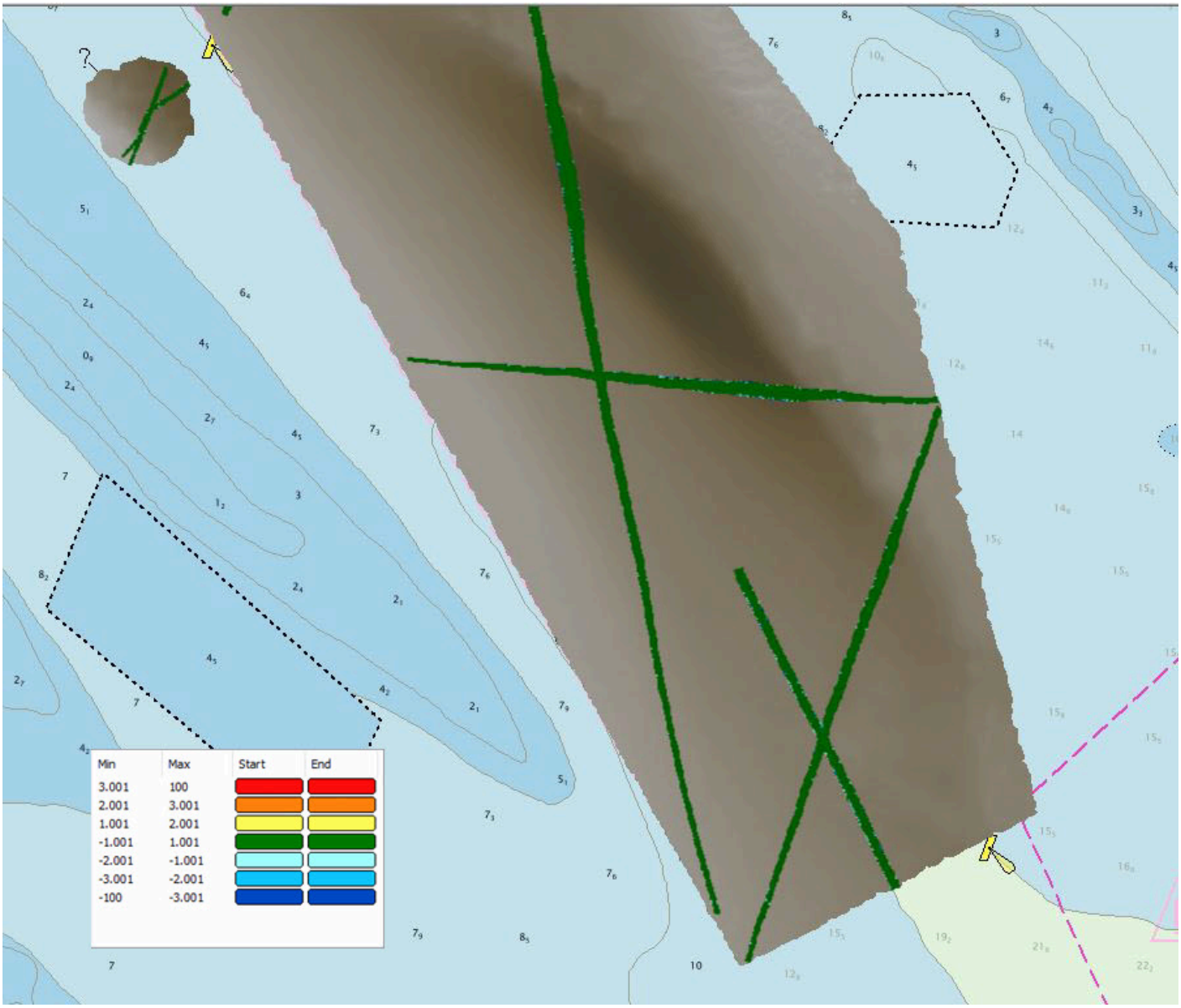


Figure 7: Depth differences between F00747 mainscheme (colored in gray) and F00747 crossline data in the southeast part of the Big Stone Anchorage and the assigned Wreck PA.

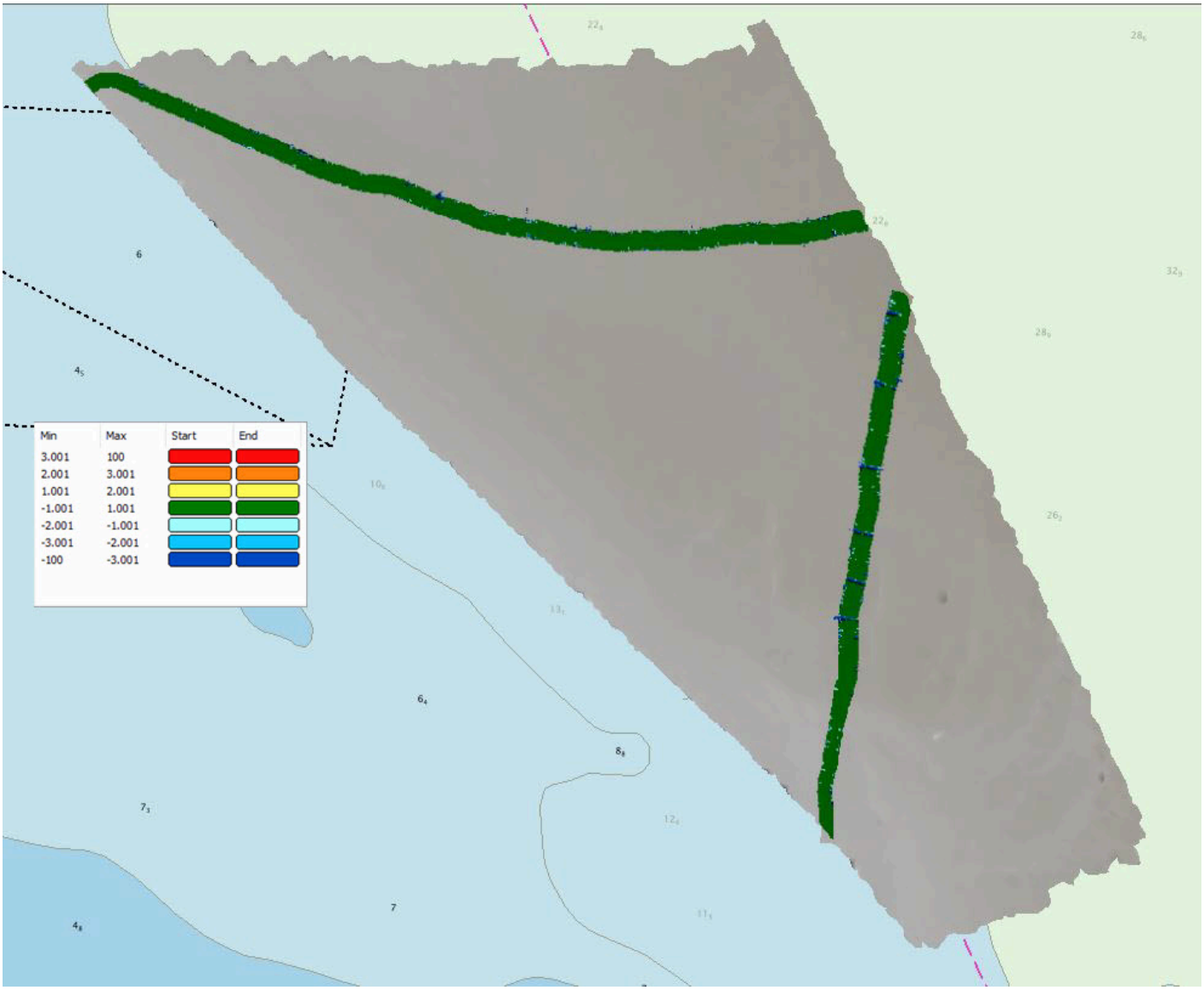
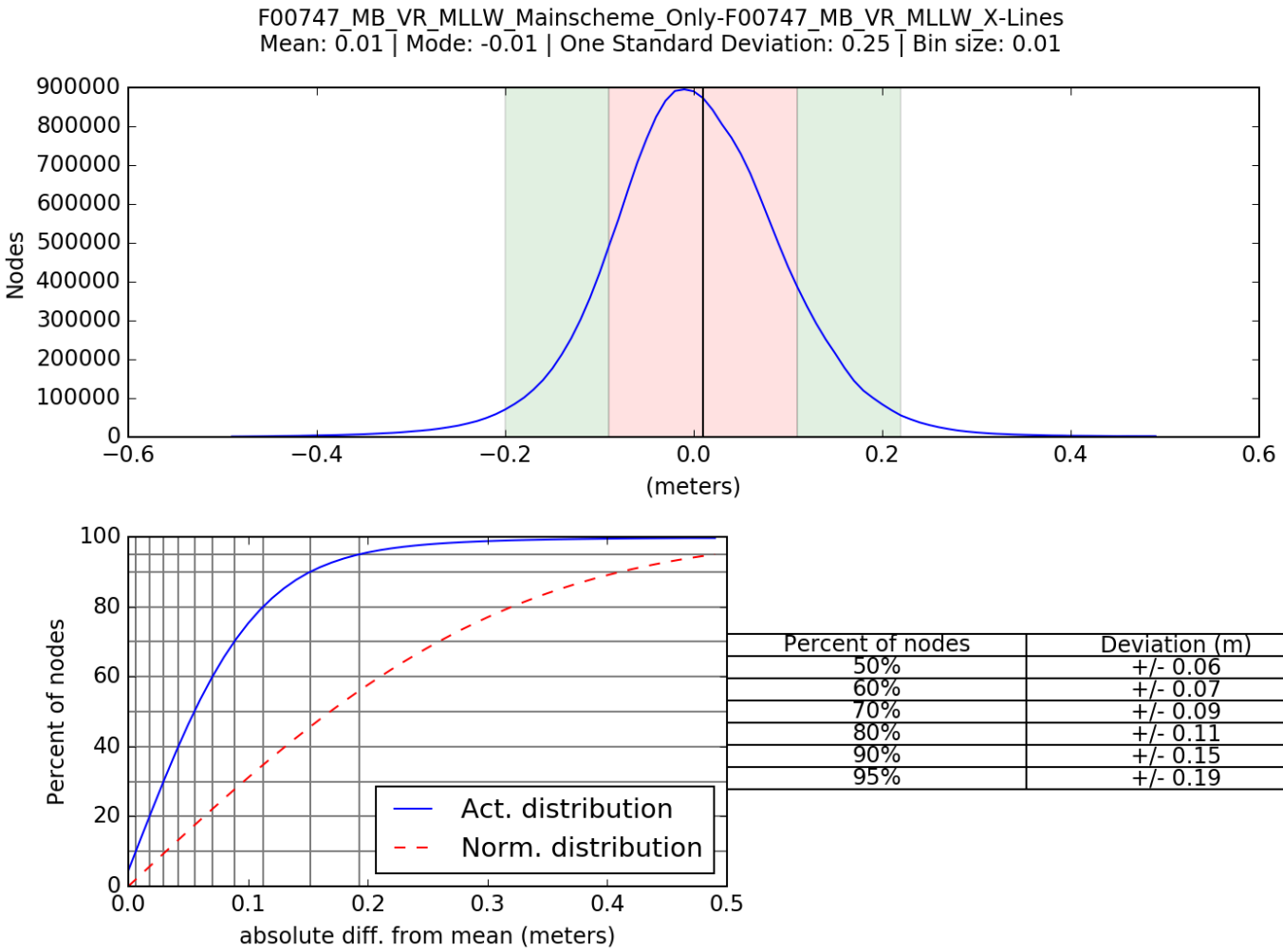


Figure 8: Depth differences between F00747 mainscheme (colored in gray) and F00747 crossline data in the proposed Breakwater Anchorage.



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.11
90%	+/- 0.15
95%	+/- 0.19

Figure 9: F00747 mainscheme to crossline difference statistics.

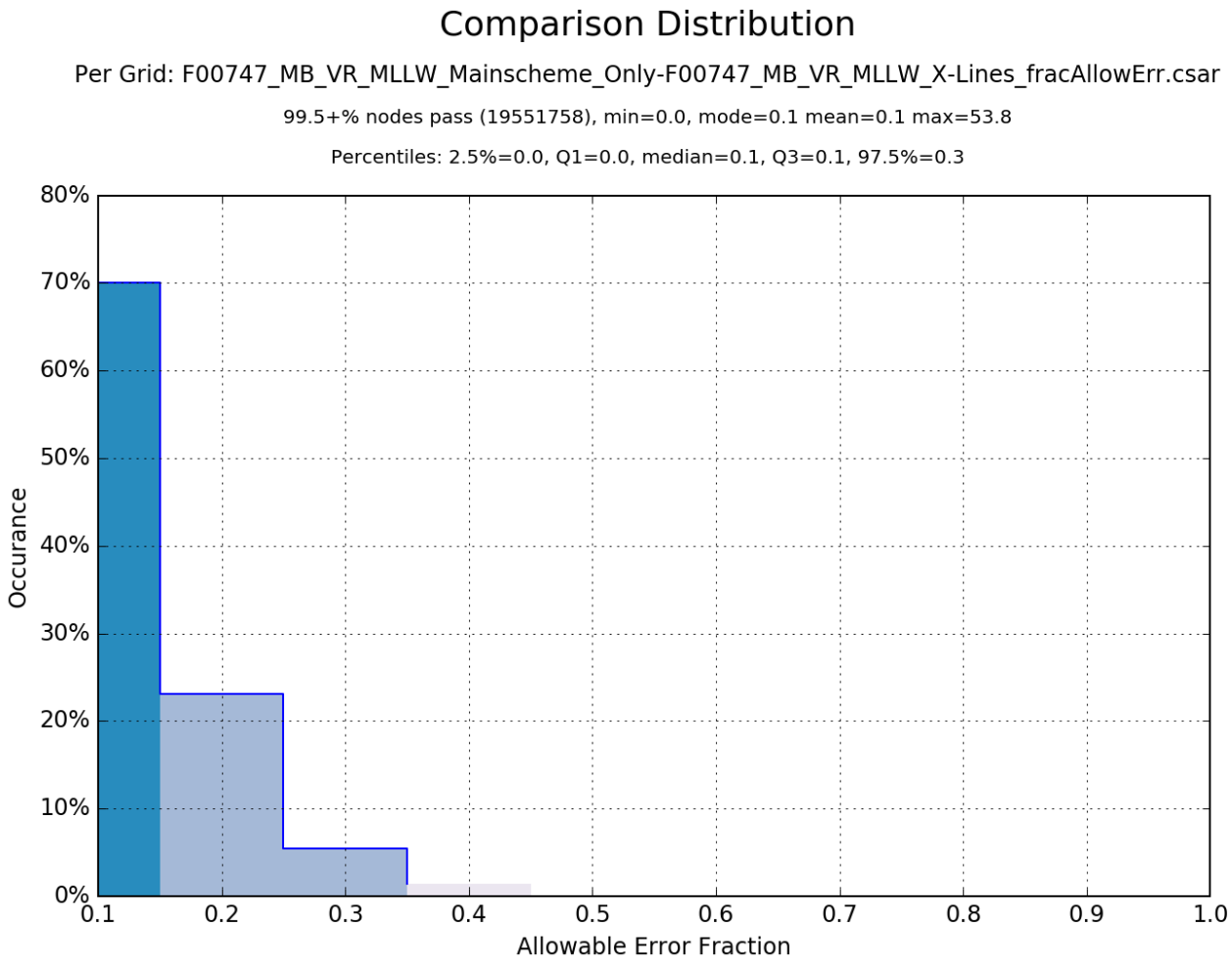


Figure 10: F00747 mainscheme and F00747 crossline NOAA allowable uncertainty statistics.

Statistics were not calculated appropriately during field review. This has been updated by the reviewer. The appropriate amount of crosslines were collected during acquisition.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0 meters	0.109 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S5401	2.0 meters/second	0.0 meters/second	0.0 meters/second	0.5 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 and VDATUM, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey F00747. Real-time uncertainties were provided via EM 2040 MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel roll, pitch, gyro, 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

F00747 junctions with two surveys from prior projects H11081 and H12605. H11081 was completed in 2001 and was deemed to be too old to junction to; therefore, a waiver was obtained to disregard this assigned junction analysis (see "Waiver S-D901-BH2-19 Junction Comparison.pdf" in Appendices II). The overlap between F00747 and prior project H12605 can be seen in Figure 011. Data overlap between F00747 and each adjacent survey was achieved. These areas of overlap between surveys were reviewed with CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement. The multibeam data were also examined in CARIS Subset Editor for consistency and agreement. The data from F00747 and Junction Survey H12605 had good depth agreement with 95% of the nodes being within +/-0.64m (see Figure 12). The junctions with F00747 are generally within the NOAA allowable uncertainty in their areas of overlap, with 97% of the nodes passing (see Figures 13 & 14). For all junctions with F00747, a negative difference indicates F00747 was shoaler, and a positive difference indicates F00747 was deeper.

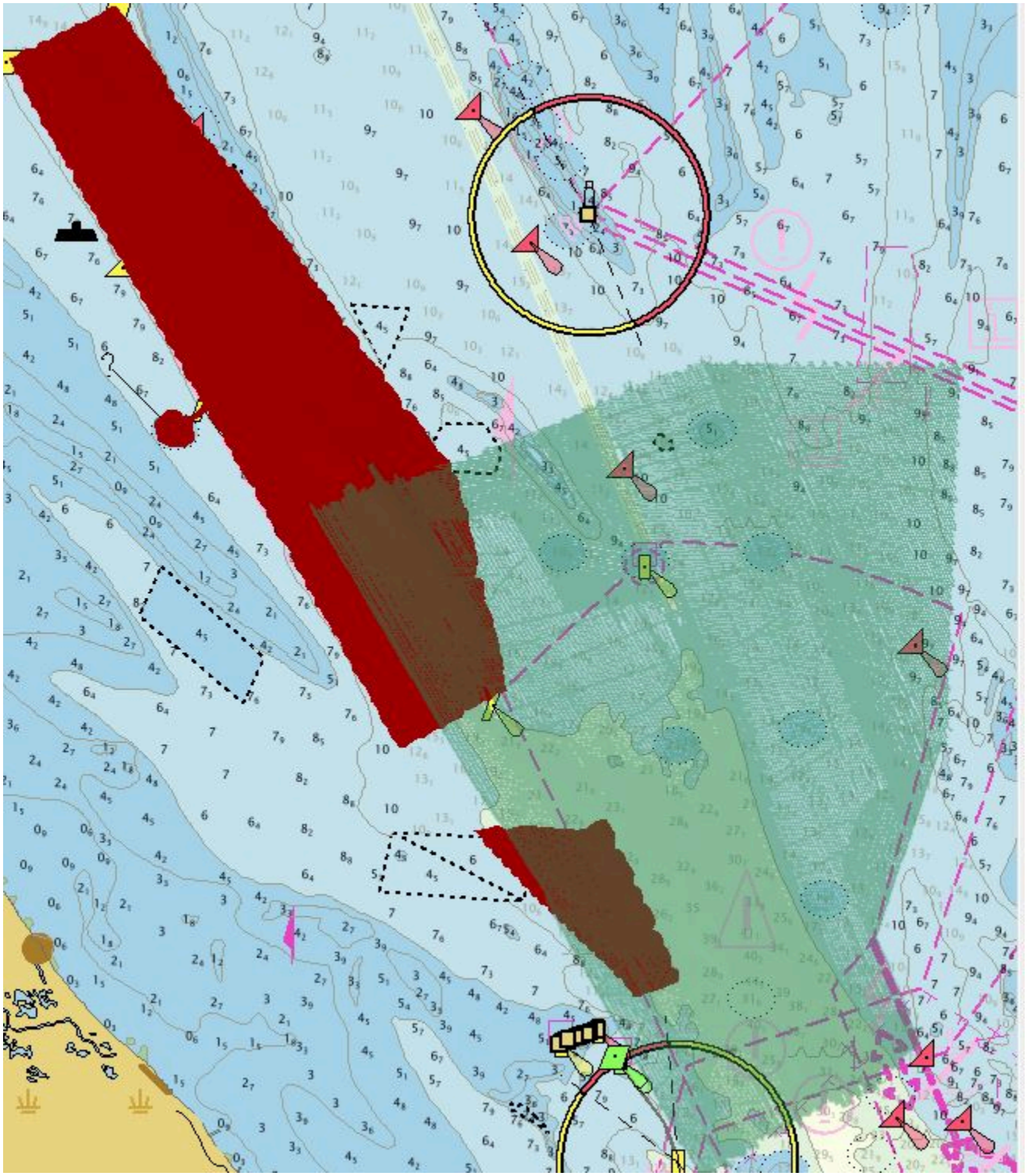


Figure 11: F00747 area of junction with H12605, with F00747 coverage in red and H12605 coverage in 50% transparency green.

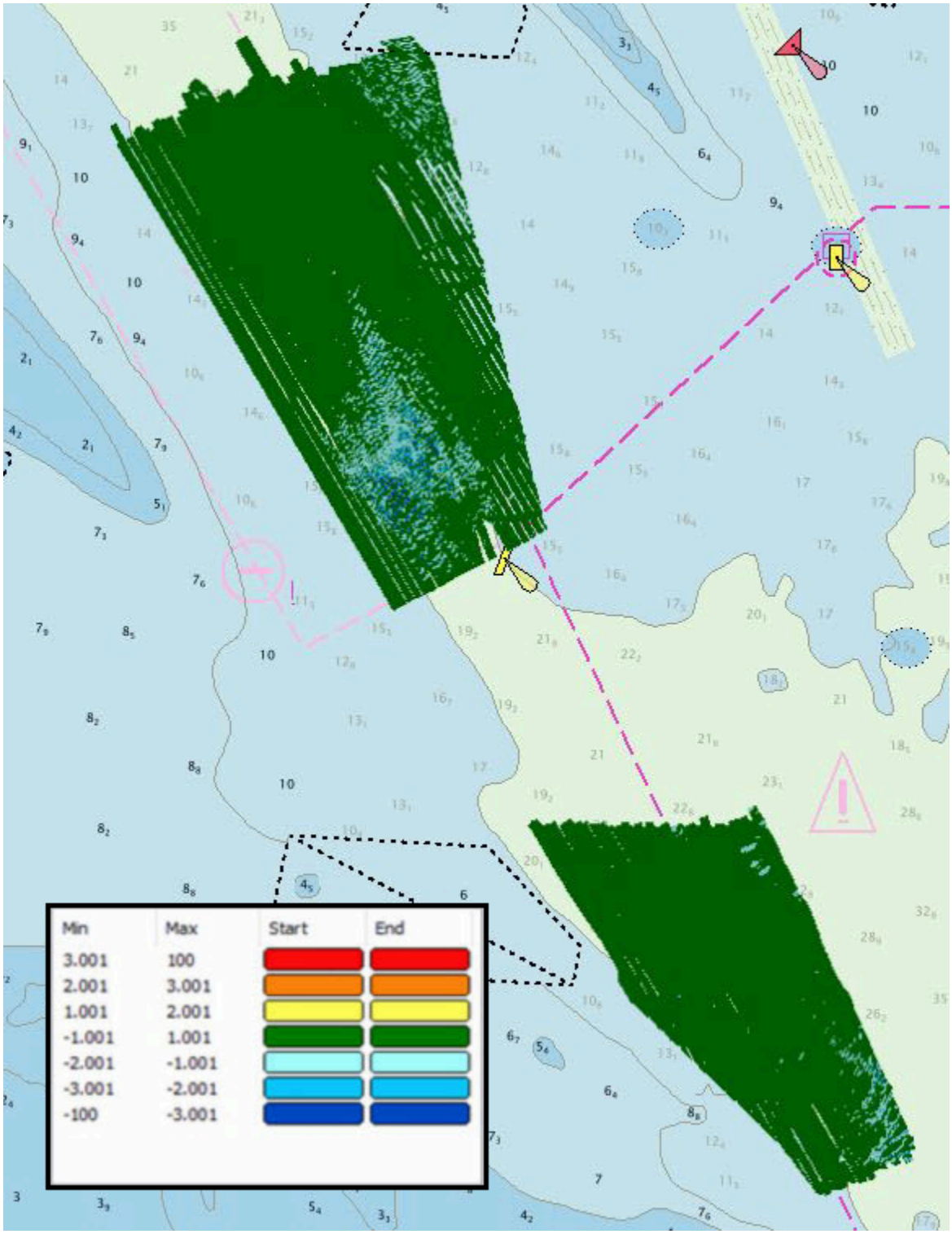
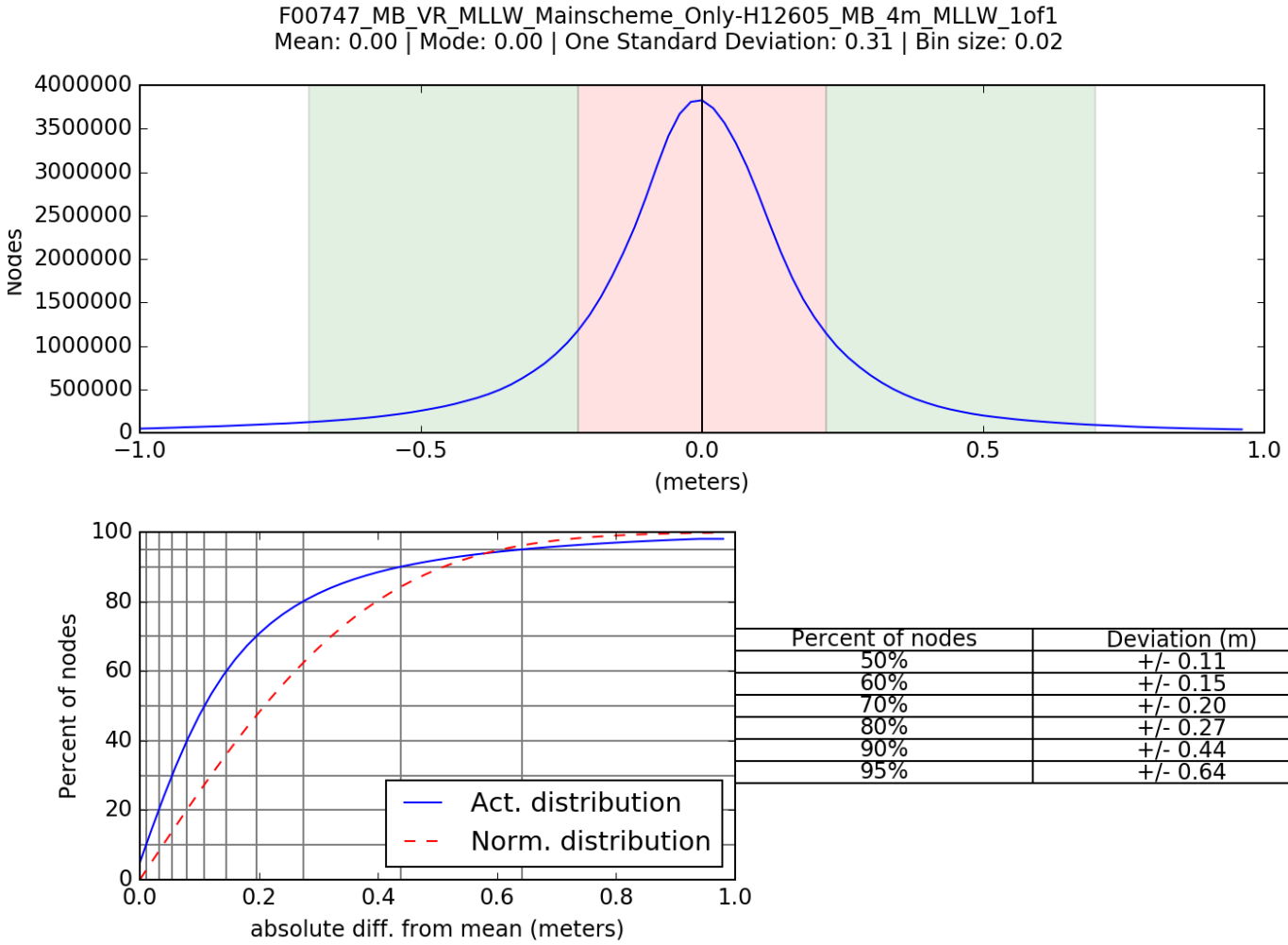


Figure 12: Depth differences between F00747 mainscheme Junction Survey H12605 data.



Percent of nodes	Deviation (m)
50%	+/- 0.11
60%	+/- 0.15
70%	+/- 0.20
80%	+/- 0.27
90%	+/- 0.44
95%	+/- 0.64

Figure 13: F00747 mainscheme to Junction Survey H12605 difference statistics.

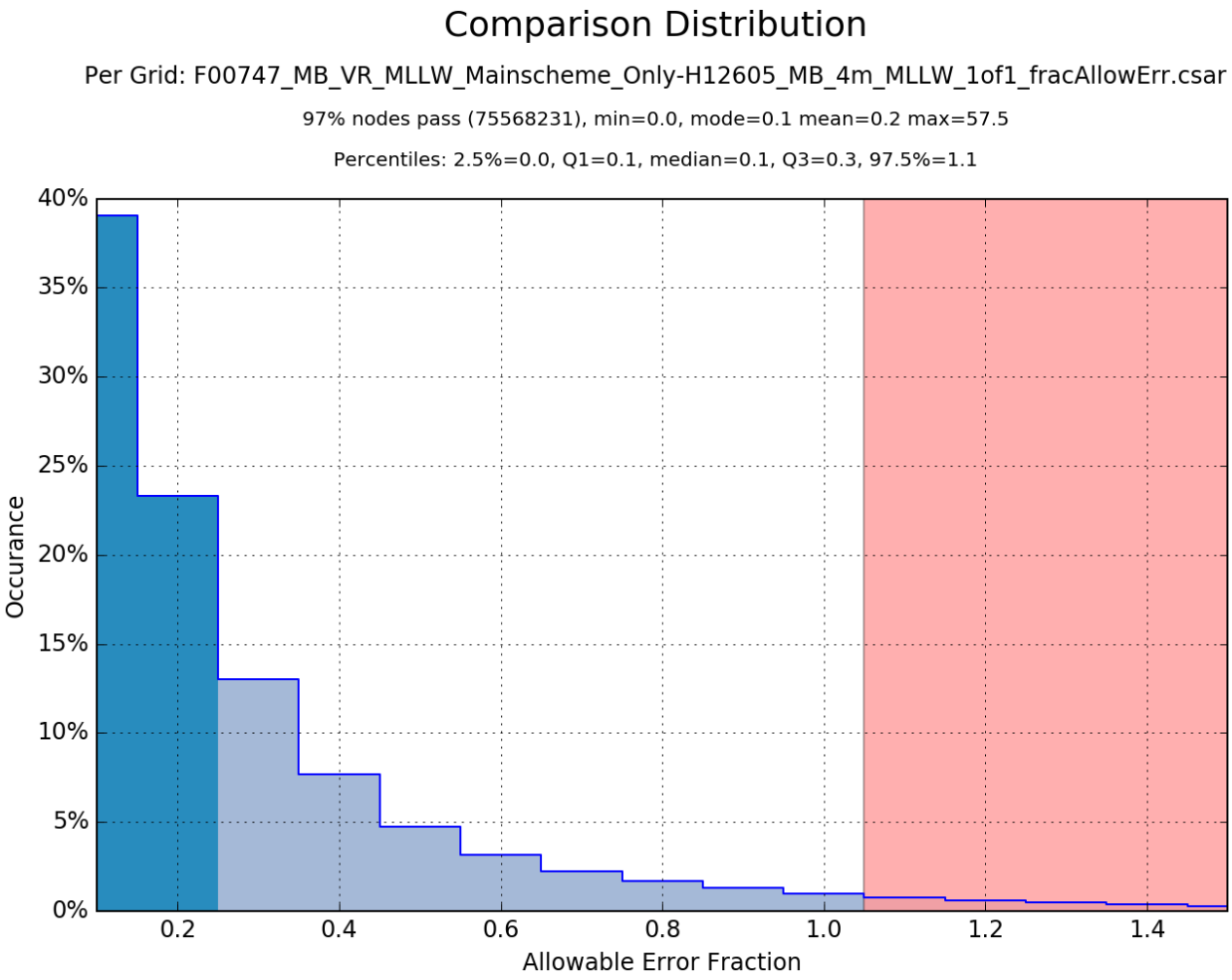


Figure 14: F00747 mainscheme and Junction Survey H12605 NOAA allowable uncertainty statistics.

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

Sand Waves

Sand waves were present throughout the survey area and at times, caused acoustic shadowing on one side of the sand wave due to its steep slope and the vessel and MBES being on the other side of the sand wave; refer to the "Holidays" discussion in the "Additional Quality Control" section of this document.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at a minimum of one every 4 hours during acquisition. Casts were conducted more frequently in areas where tidal shift caused variations in the make up of the water column or 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.

B.2.8 Coverage Equipment and Methods

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

B.2.9 SBET Issues

Multiple SBET issues were encountered while processing F00747 MBES data.

The first issue encountered was only seen in the SBET data for line 0393_20190724_181331_S5401.all, and was seen as a vertical offset between itself and adjacent MBES data with no visible spike in the SBET data. It was determined that the failure in this line's SBET was too extensive to overcome for the entire line, was flagged as rejected in Subset Editor, a new MBES line was collected and an associated SBET was created. The new line, 0867_20190802_143615_S5401.all, matched all the surrounding lines in a vertical direction, and was deemed an acceptable replacement.

The second issue was seen in lines 0341_20190722_133143_S5401.all, 0539_20190729_161939_S5401.all, 0614_20190730_190152_S5401.all, and 0615_20190730_190748_S5401.all and was also seen as a vertical offset between adjacent lines with no visible spike in the SBET data. However, in these lines, the SBET issues only impacted a small part of the line. Therefore, the portion of the line that was effected was flagged as rejected in CARIS and a new holiday line was acquired.

The third issue encountered was random spikes in the SBET data (See Figure 15). These spikes were found in data from DN205, DN210, DN211, DN212, and DN218, and were seen in the MBES data as offsets between subsequent survey lines. These spikes were removed in Pydro by interpolating the data in the spike between two areas of good data, saving the new SBET, coverting the SBET to NAD 83, and reprocessing the data with the new SBET. The resulting data matched all the surrounding lines in a vertical direction , and was deemed an acceptable replacement. See Figure 16 for the resulting, smoothed SBET.

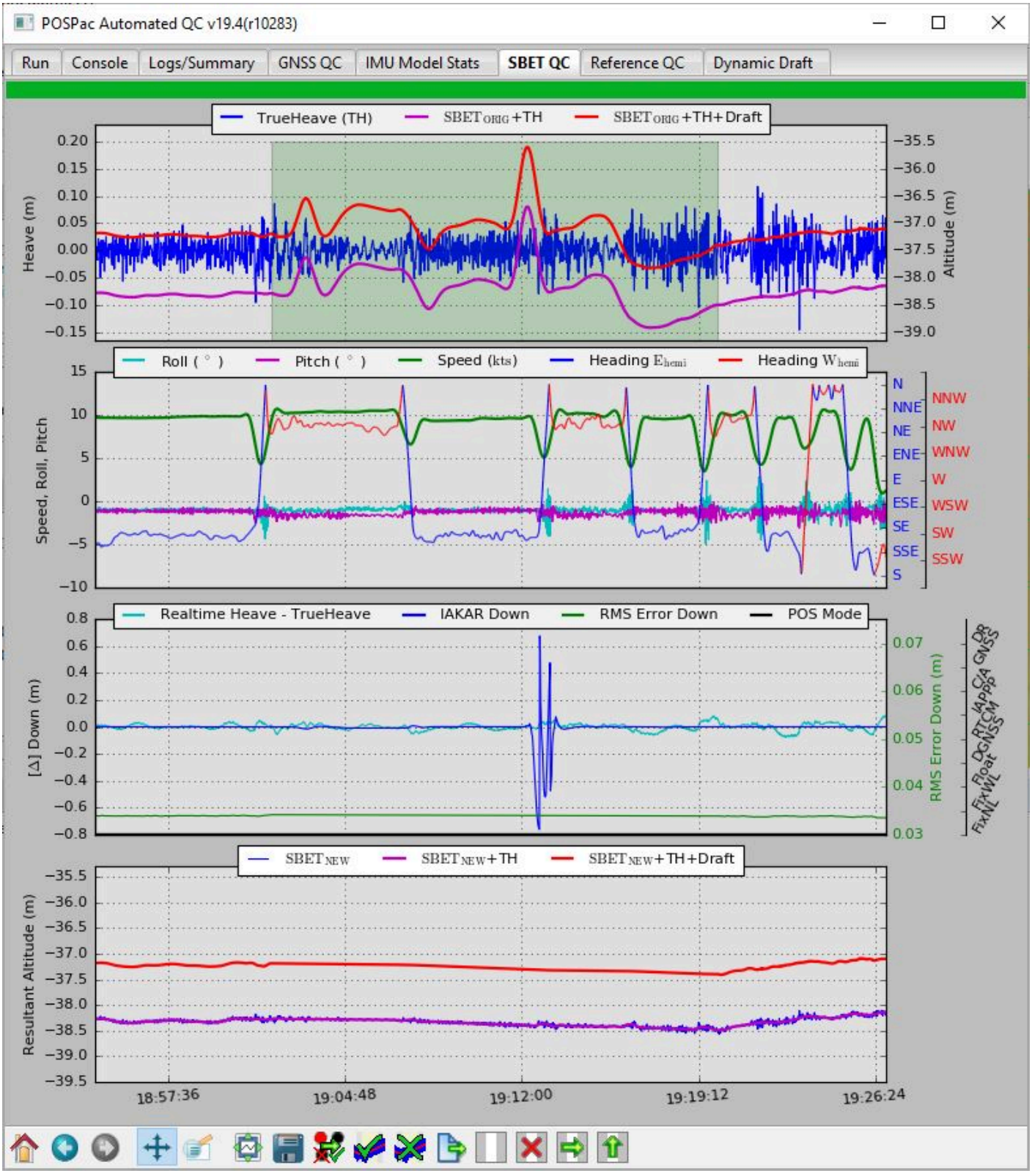


Figure 15: F00747 SBET spike from day number 211.

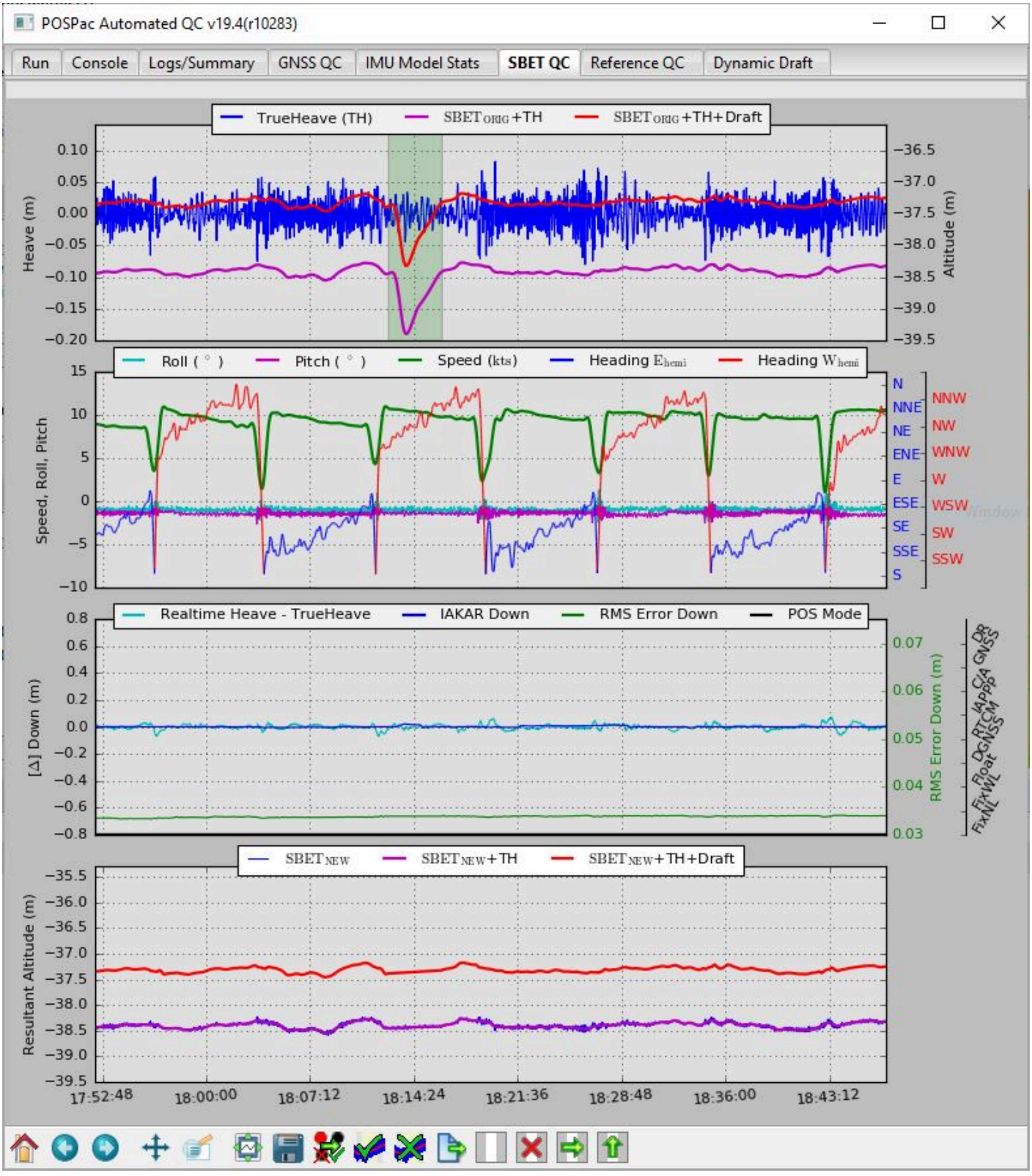


Figure 16: F00747 Interpolated SBET from day number 211.

B.2.10 Holidays

F00747 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.2 of the HSSD. 91 holidays which meet the 3 by 3 node definition were identified via Pydro QC Tools Holiday Finder tool, see the F00747_Holidays.hob in Appendix II: Supplemental_Survey_Records_Correspondence. This tool automatically scans finalized surfaces for holidays as defined in the HSSD and was run in conjunction with a visual inspection of all surfaces by the hydrographer.

While most of the holidays are due to acoustic shadowing in steep areas with high sand waves as seen in Figure 17, some of the holidays were small, lack of coverage areas that were not identified until Bay Hydro II was in her home port. These shadows are formed due to lack of coverage caused by rapid drops in the seafloor in conjunction with poor geometry from the sonar head. All areas with acoustic shadows were investigated in CARIS subset editor to verify that least depths were found.

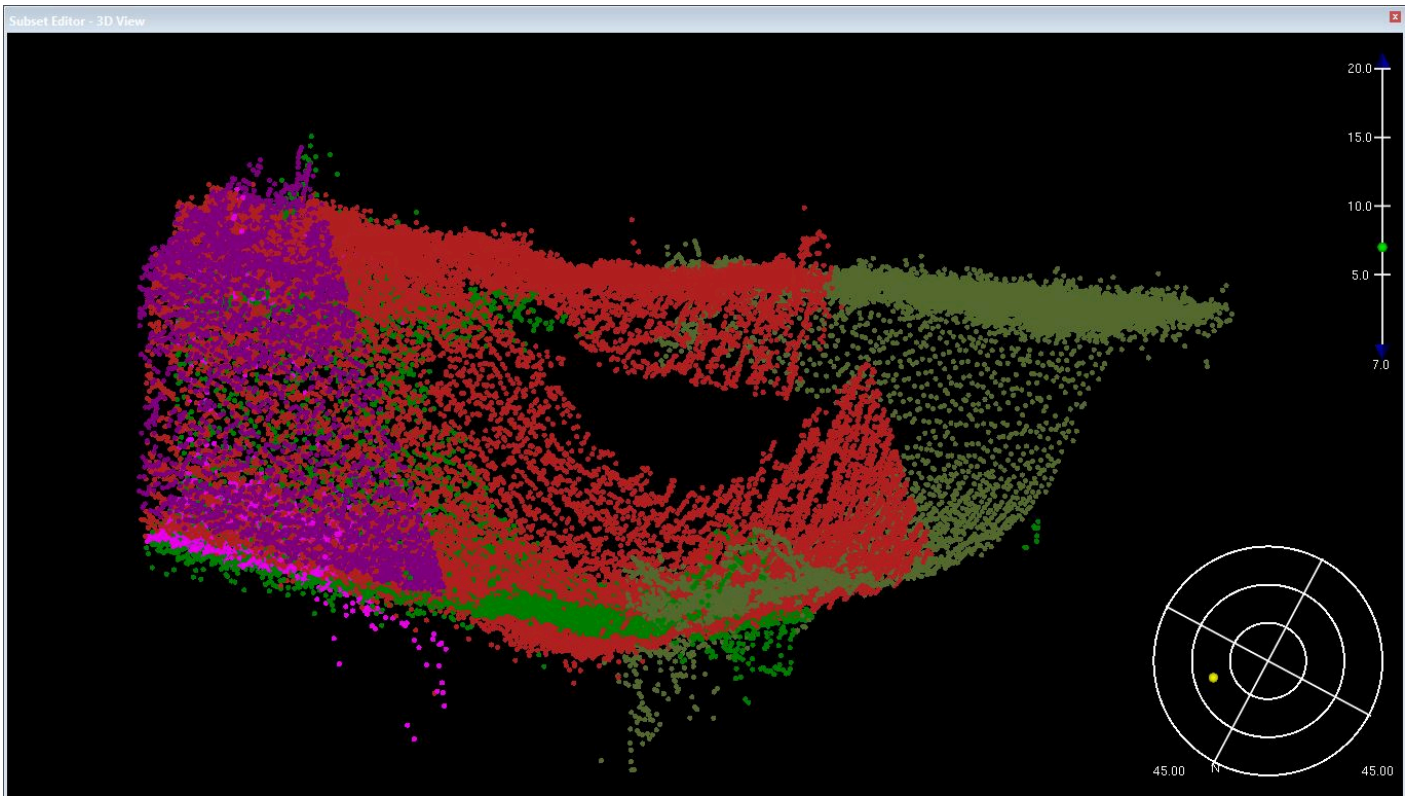


Figure 17: F00747 Holiday due to acoustic shadowing on slope.

The 91 holidays meeting the 3 by 3 node definition were identified via Pydro QC Tools Holiday Finder tool using the setting for "Object Detection" surveys as required for this survey based on the Project Instructions and in accordance with 2019 Hydrographic Survey Specifications and Deliverables. However, all but one of these holidays would not be considered a holiday under the "Complete Coverage" specification that requires as square 3x3 node definition. In conjunction with the verification that least depths were retained in all areas where holidays were identified, this survey still meets CATZOC A1 requirements; and features greater than 2m are identifiable.

B.2.11 NOAA Allowable Uncertainty

To verify that all data meets the accuracy specifications as stated in HSSD Section 5.1.3, a child layer titled "NOAA_Allowable_1" was created for each of the finalized surfaces using the equations stated in the HSSD section. These surfaces were then analyzed using the CARIS Compute Statistics tool to determine what percentage of each surface meets specifications. Figure 18 shows a graphical overview of the NOAA Allowable Uncertainty layer for the Big Stone Anchorage surface, while Figure 19 shows the corresponding statistics for that surface. Figure 20 shows a graphical overview of the NOAA Allowable Uncertainty layer for the Breakwater Proposed Anchorage surface, while Figure 21 shows the corresponding statistics for that surface. Figure 22 shows a graphical overview of the NOAA Allowable Uncertainty layer for the charted Wreck PA surface, while Figure 23 shows the corresponding statistics for that surface. Overall, 100% of nodes with all surfaces meet or exceed NOAA Allowable Uncertainty specifications for F00747.

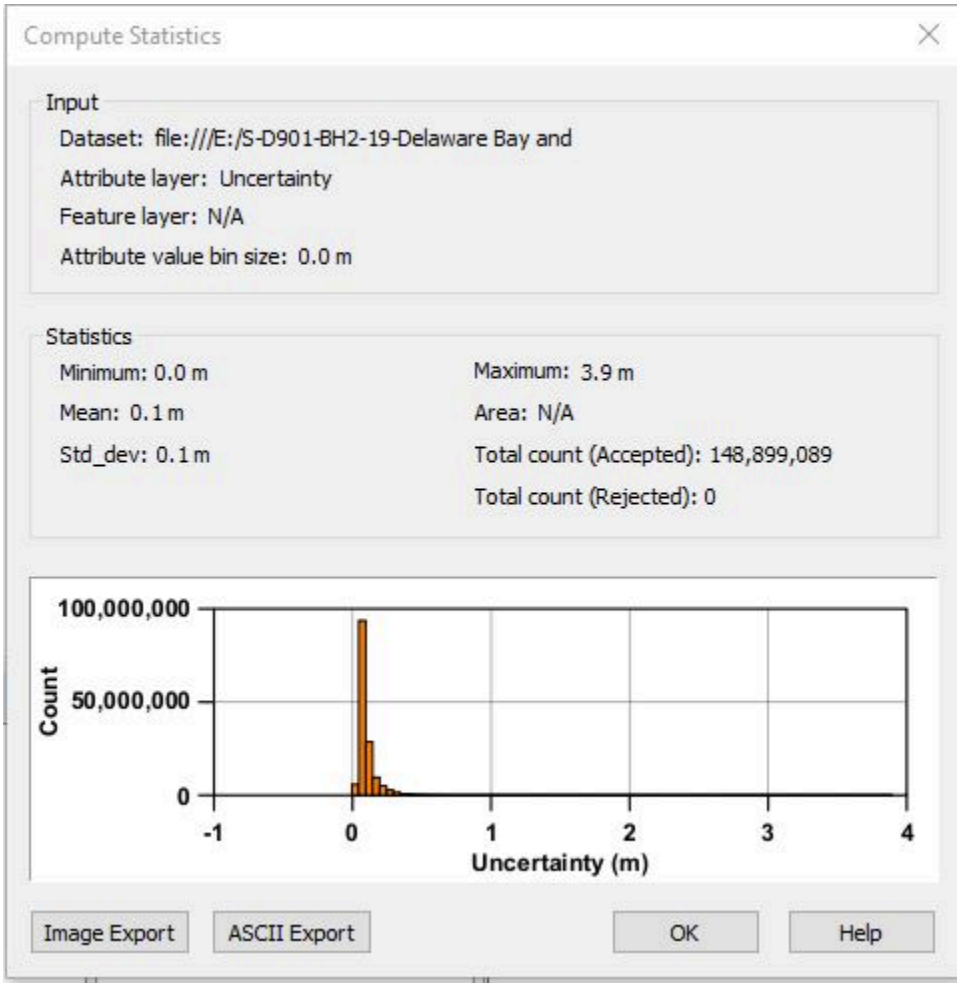


Figure 18: F00747 NOAA Allowable Uncertainty graph for Big Stone Anchorage.

F00747 NOAA Allowable Uncertainty Surface 1

148897636	**Total Nodes Passed**
148897636	**Total Nodes**
100	**% Nodes Passed**

Figure 19: F00747 NOAA Allowable Uncertainty statistics for Big Stone Anchorage.

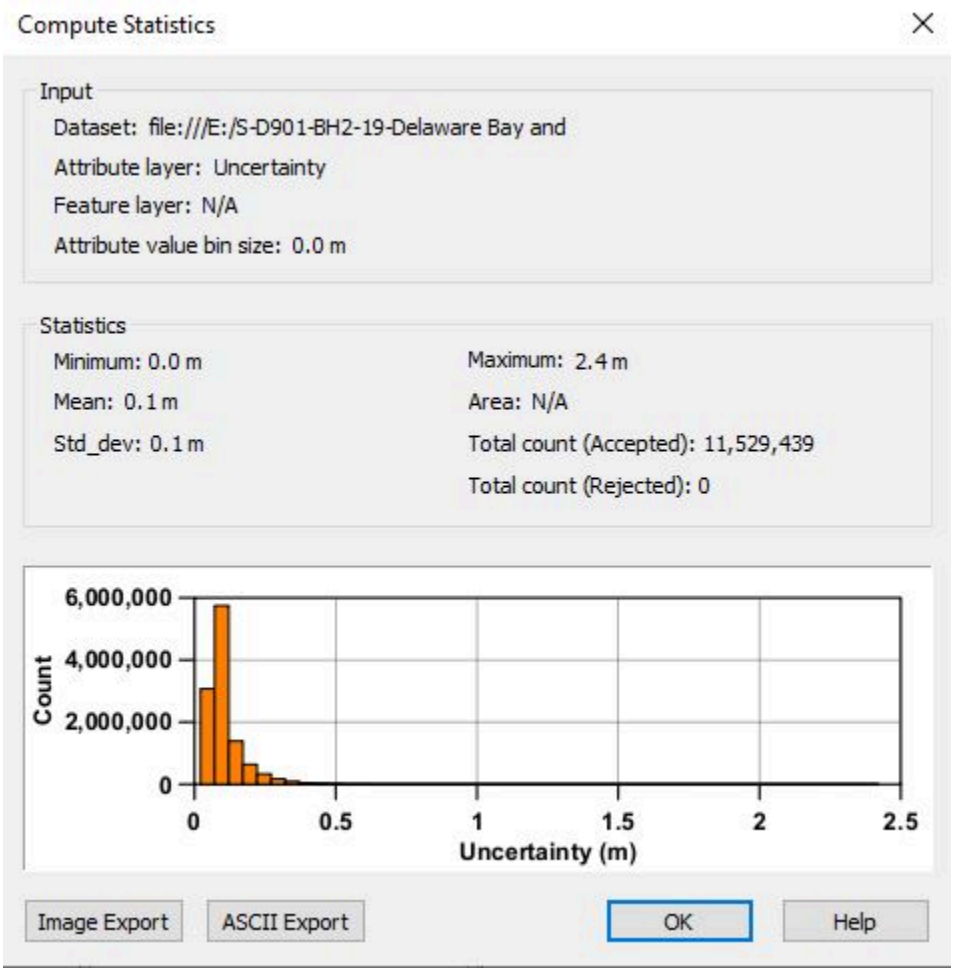


Figure 20: F00747 NOAA Allowable Uncertainty graph for Breakwater Proposed Anchorage.

F00747 NOAA Allowable Uncertainty Surface 2

11529317	**Total Nodes Passed**
11529317	**Total Nodes**
100	**% Nodes Passed**

Figure 21: F00747 NOAA Allowable Uncertainty statistics for Breakwater Proposed Anchorage.

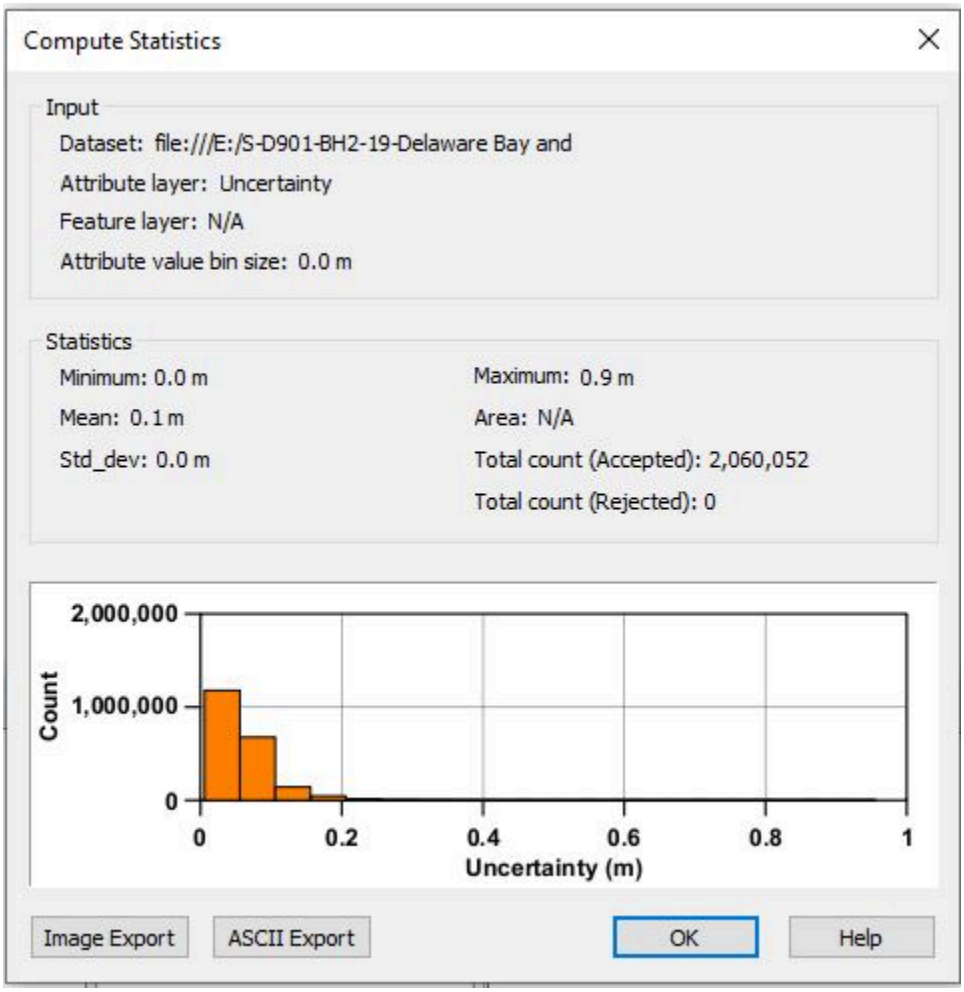


Figure 22: F00747 NOAA Allowable Uncertainty graph for the charted Wreck PA.

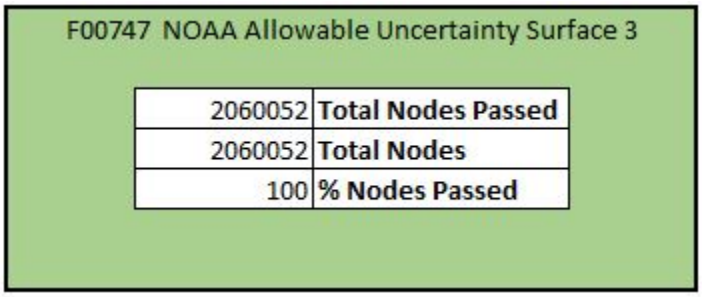


Figure 23: F00747 NOAA Allowable Uncertainty statistics for the charted Wreck PA.

B.2.12 Density

Finalized surfaces were analyzed using the Pydro QC Tools Grid QA feature and the results are shown in Figures 24, 25, and 26 below. Density requirements for F00747 were achieved with at least 99.5% of finalized surface nodes containing five or more soundings as required by HSSD Section 5.2.2.2. The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep slopes and areas of large sand waves where acoustic shadowing occurred, and at the edges of the survey limits.

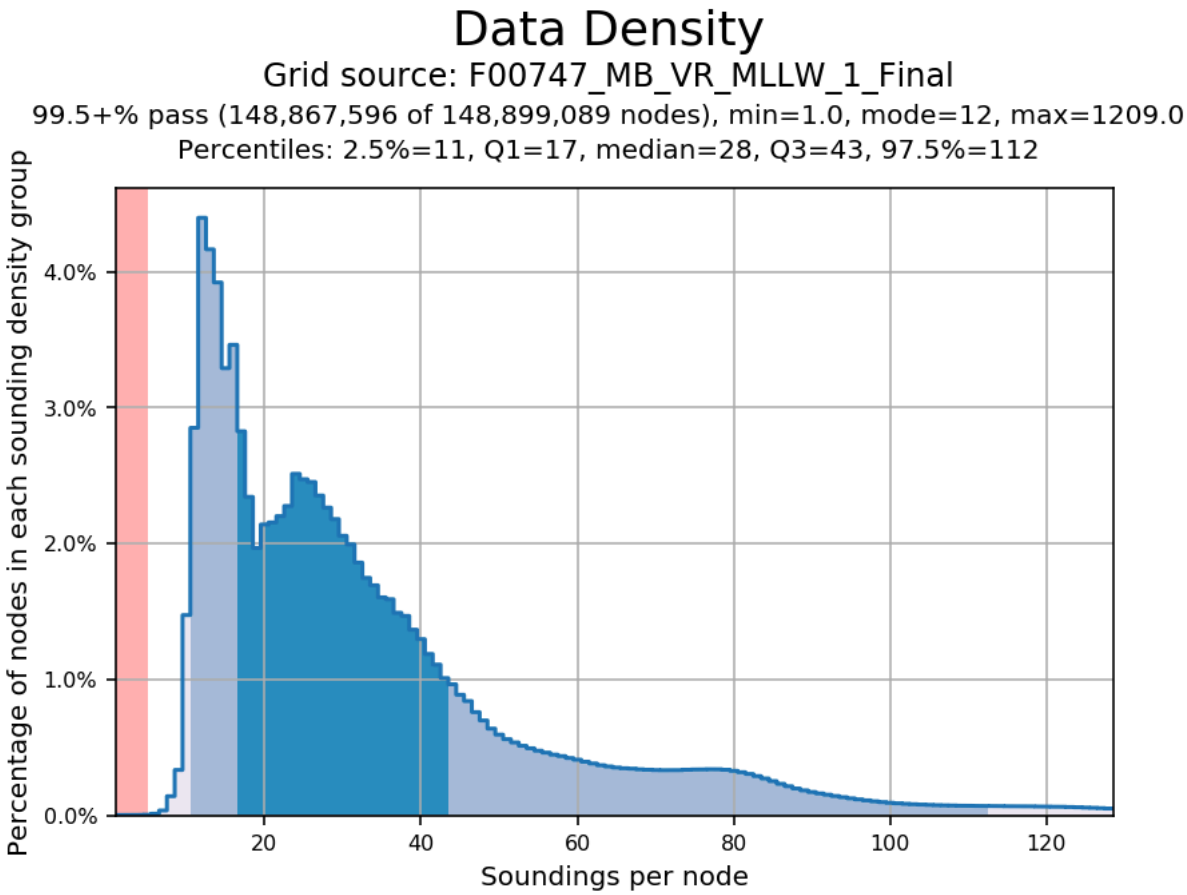


Figure 24: F00747 Big Stone Anchorage density statistics.

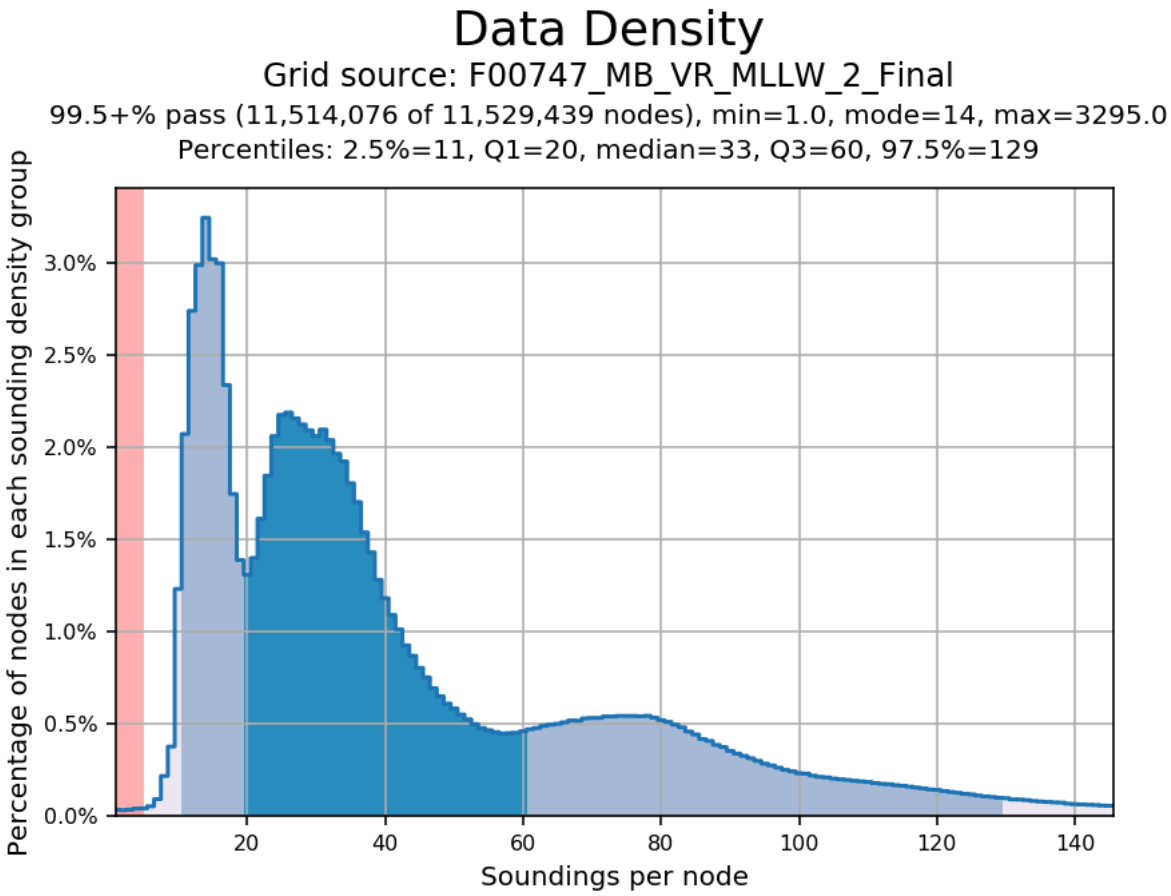


Figure 25: F00747 Breakwater Proposed Anchorage density statistics.

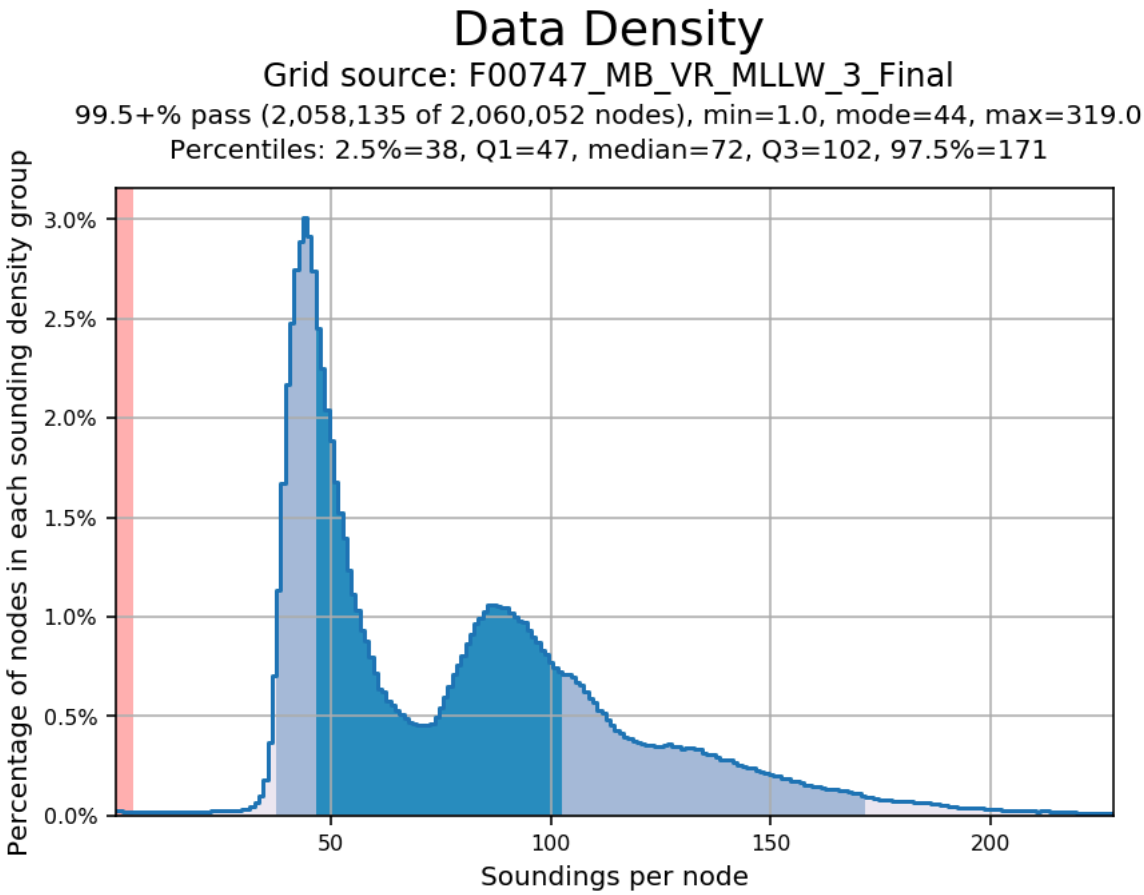


Figure 26: F00747 Charted Wreck PA density statistics.

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

Backscatter was acquired within the Kongsberg .all file and is being submitted for processing by the branch.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2019.

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
F00747_MB_VR_MLLW_1.csar	CARIS VR Surface (CUBE)	Variable Resolution	3.3 meters - 44.0 meters	NOAA_VR	Object Detection
F00747_MB_VR_MBES_1_Final.csar	CARIS VR Surface (CUBE)	Variable Resolution	3.3 meters - 44.0 meters	NOAA_VR	Object Detection
F00747_MB_VR_MLLW_2.csar	CARIS VR Surface (CUBE)	Variable Resolution	14.7 meters - 28.8 meters	NOAA_VR	Object Detection
F00747_MB_VR_MLLW_2_Final.csar	CARIS VR Surface (CUBE)	Variable Resolution	14.7 meters - 28.8 meters	NOAA_VR	Object Detection
F00747_MB_VR_MLLW_3.csar	CARIS VR Surface (CUBE)	Variable Resolution	5.9 meters - 9.4 meters	NOAA_VR	Object Detection
F00747_MB_VR_MLLW_3_Final.csar	CARIS VR Surface (CUBE)	Variable Resolution	5.9 meters - 9.4 meters	NOAA_VR	Object Detection

Table 9: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces in Survey F00747. 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 v8, part of the QC Tools package within Pydro, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run multiple times for each surface, reducing the flier height value for each consecutive run. This allowed Flier Finder to accurately and quickly identify gross fliers, but as the flier height was reduced the effectiveness of the tool diminished. With smaller heights, Flier Finder began to incorrectly flag dynamic aspects of the seafloor such as steep drop offs and large sand wave areas, resulting in hundreds of false positives. At this point, the hydrographer ceased using the tool and returned to manual cleaning for these dynamic regions of seafloor.

C. Vertical and Horizontal Control

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

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	S-D901_SEP Model_xyNAD83-MLLW_geoid12b.csar

Table 10: ERS method and SEP file

Following the successful application of SBETs, ERS methods using VDATUM were used for reducing data to MLLW. ERS methods were used as the final means of reducing F00747 to MLLW for submission.

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

Vessel kinematic data were post-processed using Applanix POSPac processing software and Smart Base Positioning methods using Charlene as described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all MBES data in CARIS HIPS and SIPS. For further details regarding the processing and quality control checks performed, see the F00747 POSPAC Processing Logs located in the Separates folder.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
Millsboro	DEMI
DELDOT SOUTH 2	DED2
MIDDLE TOWNSHIP	NJCM
DOVER DNRC	DNRC
HORN POINT ENVIRO	HNPT
NJGC	NJGC

Table 11: CORS Base Stations

WAAS

During real-time acquisition, S5401 received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to USCG DGPS stations. WAAS and SBETs were the sole methods of positioning for F00747.

D. Results and Recommendations

D.1 Chart Comparison

A sounding set was created from all F00747 variable resolution finalized surfaces using CARIS HIPS and SIPS Sounding Selection and compared to ENCs US4DE11M and US5DE10M using Pydro's CA Tools V2.2.2. The same CARIS sounding set was then overlaid onto the ENCs to visually inspect the differences between the surveyed soundings and the charted depths that CA Tools indicated.

All data from F00747 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion of the disagreements follows below.

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	Preliminary?
US4DE11M	1:80000	3511	11/14/2019	11/14/2019	NO
US5DE10M	1:40000	205	11/25/2019	11/25/2019	NO

Table 12: Largest Scale ENCs

US4DE11M

Soundings from F00747 are in a general agreement with charted depths on ENC US4DE11M, with all depths agreeing to 1 meter with the survey data being deeper than the charted depths on the ENC. .

To more accurately visualize trends within these differences, CA Tool's parameters were set so that CA Tools would flag possible DtoNs greater than 1.0m in 20m of water or less and 5.0m in 20m of water or more, and a Discrepancy Threshold of 1.0m in all waters. The results indicated a 5.0% chance of 1.0m DToNs and a 1.0% chance of discrepancies of 1.0m or more, see Figure 27. Based on these findings by CA Tools, the hydrographer re-reviewed the MBES data but no DToN were identified or submitted.

Contours from F00747 are in a general agreement with charted contours on ENC US4DE11M with the surveyed contours being a few meters inshore of those charted. The only exception to this general agreement can be seen in the 18m contour in the center of Big Stone Anchorage, southwest of the "Tanker Anchorage Buoy F" (see figure 28).

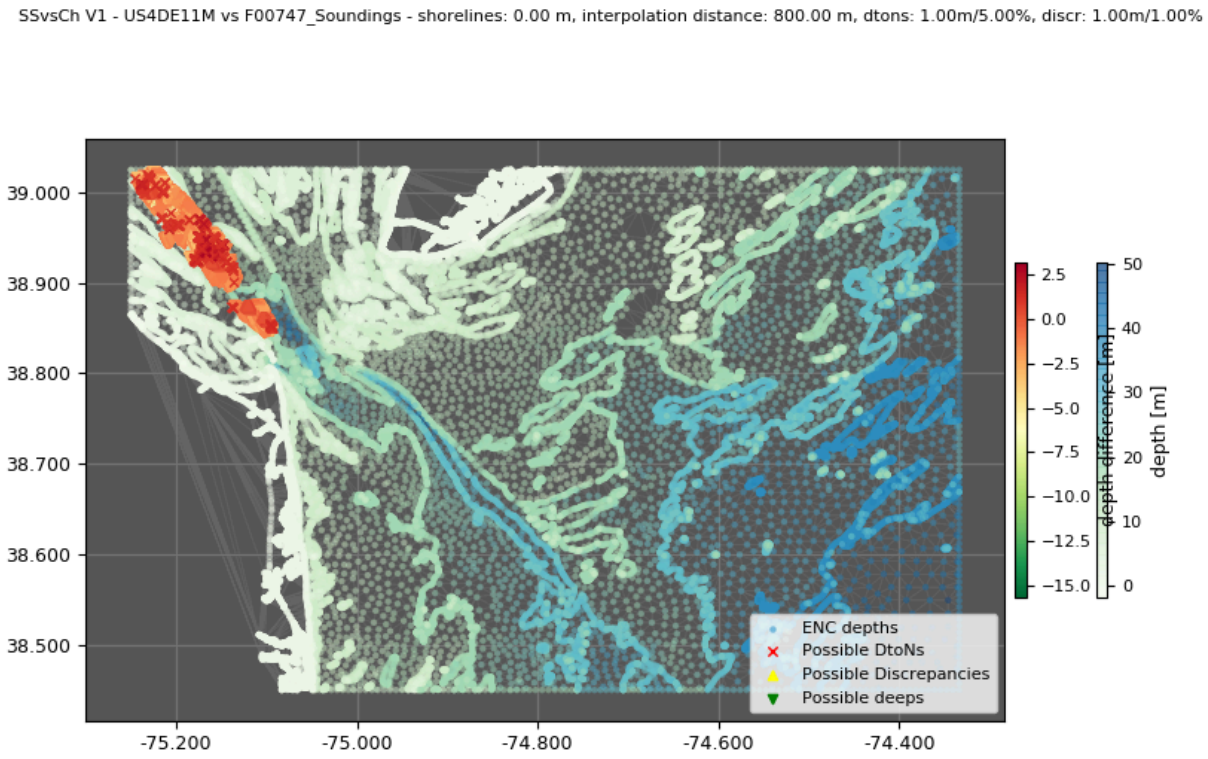


Figure 27: F00747 to ENC US4DE11M CA Tools Comparison.

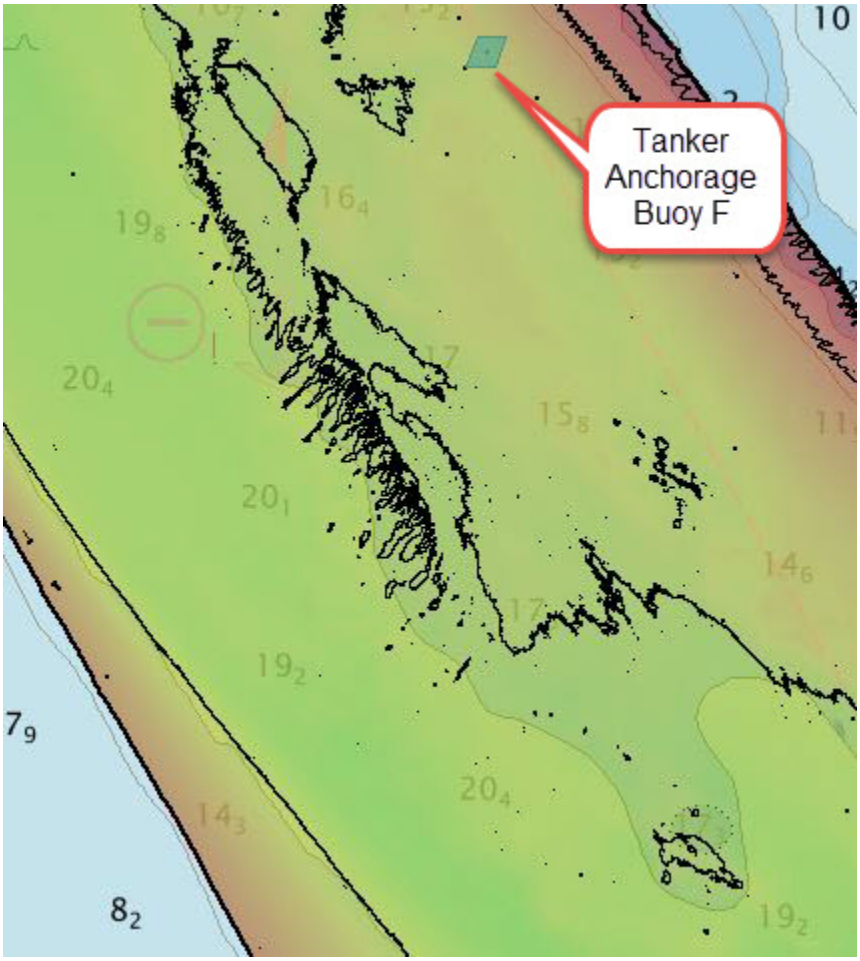


Figure 28: F00747 18m contour difference with ENC US4DE11M with F00747 derived contour in black and the ENC contour in gray.

US5DE10M

Soundings from F00747 are in a general agreement with charted depths on ENC US5DE10M, with all depths agreeing to 1 meter with the survey data being deeper than the charted depths on the ENC.

To more accurately visualize trends within these differences, CA Tool's parameters were set so that CA Tools would flag possible DtoNs greater than 1.0m in 20m of water or less and 5.0m in 20m of water or more, and a Discrepancy Threshold of 1.0m in all waters. The results indicated a 5.0% chance of 1.0m DToNs and a 1.0% chance of discrepancies of 1.0m or more, see Figure 29. Based on these findings by CA Tools, the hydrographer re-reviewed the MBES data but no DToN were identified or submitted.

There are no charted contours on ENC US5DE10M that intersect F00747 data.

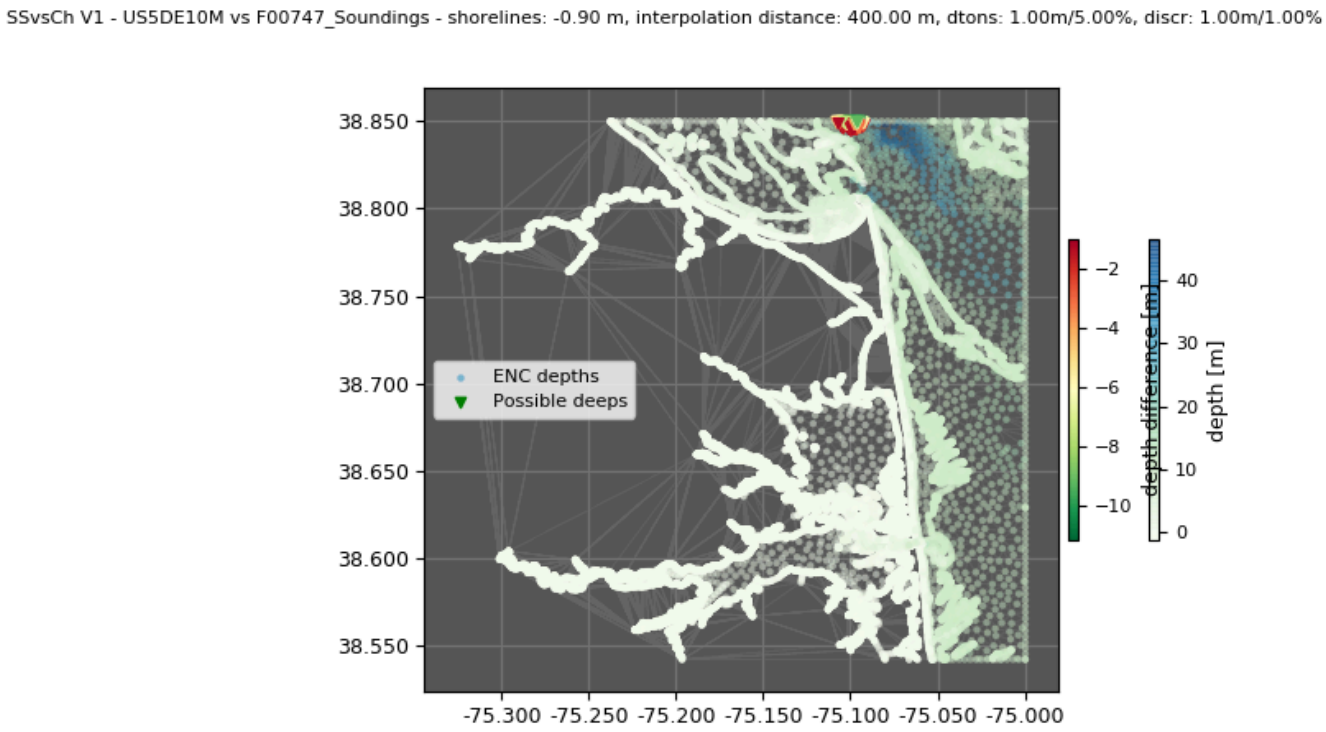


Figure 29: F00747 to ENC US5DE10M CA Tools Comparison.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

Twenty one features are assigned with F00747, see F00747_FFF.000

Two of these assigned features are "Obstruction Areas" (Fish Havens), one of which is only partially covered by the sheet limits, while the other one completely lays outside the sheet limits. Due to time restraints and the needs of the requesting Pilots Association for the Bay and River Delaware, the project manager waived the assignment of these features (see F00747 Fish Haven Feature Question.pdf in Appendices II of this project submission).

Another one of the assigned features is a wreck that sits on The Lower Middle Shoal and is located in 0.9m of water. The mast of this wreck was visible above the waterline when we approached it, but since the wreck is inside the NALL, Bay Hydro II could not get close enough to full investigate this feature and therefore

was given the description of "Not Addressed" with remarks "Retain as charted, not investigated due to being inshore of NALL" in accordance with HSSD 7.3.1.

In total, F00747 had one wreck feature with a label containing PA on the associated chart that was addressed in the FFF.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

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

D.1.7 Bottom Samples

Four bottom samples were acquired in accordance with the Project Instructions for survey F00747. All bottom samples were entered into the F00747 Final Feature File. See Figure 30 for a graphical overview of sample locations.

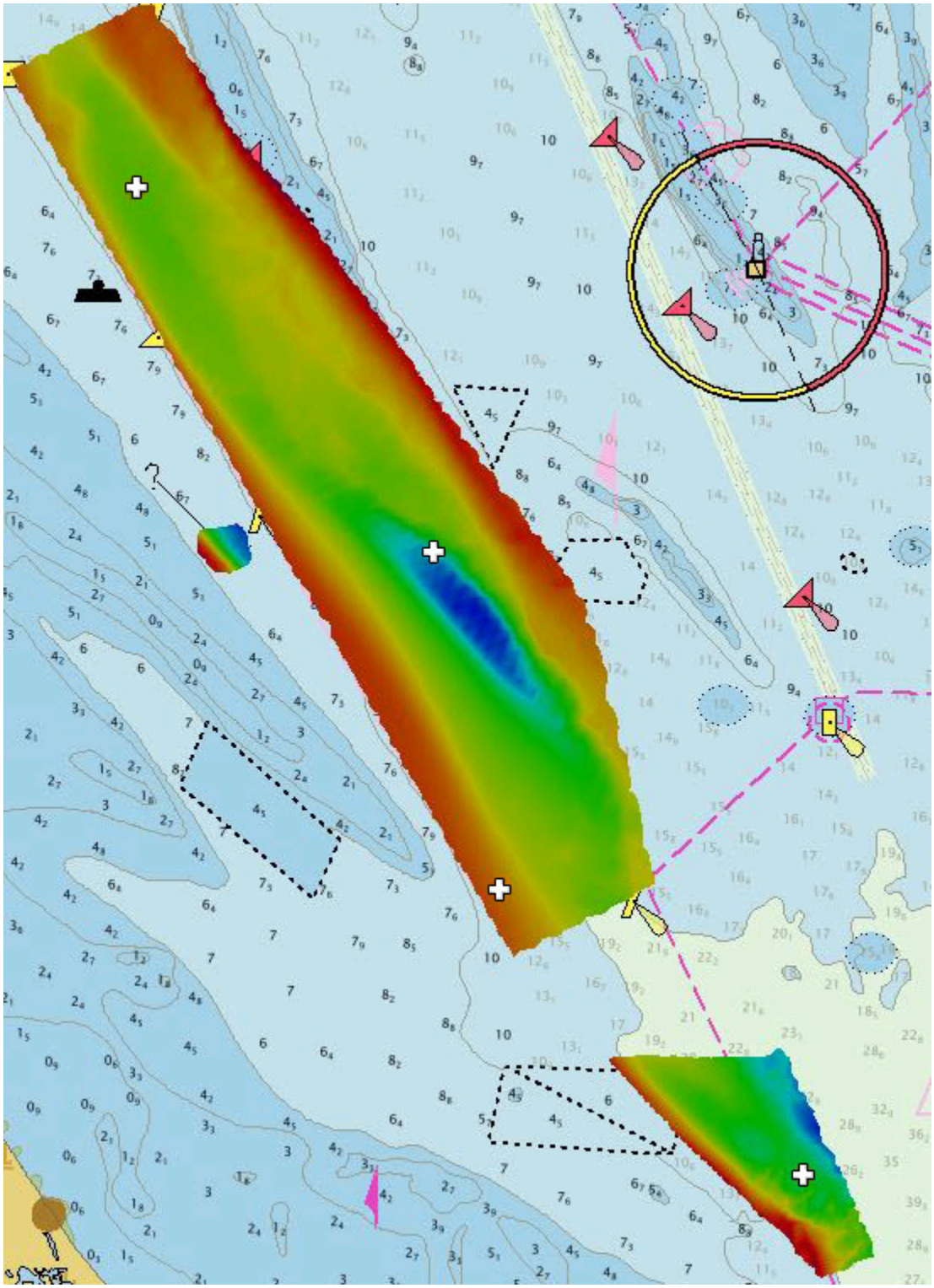


Figure 30: F00747 Bottom Sample overview with bottom samples indicated with a white cross.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

D.2.2 Aids to Navigation

ATONS were investigated to the best of the field unit's ability to determine proper placement and to confirm they are serving their intended purpose, see the Final Feature File (F00747_FFF.000) for more details.

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

No submarine features exist for this survey.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

Although, the Cape May-Lewes Ferry route does not bisect the Breakwater Proposed Anchorage area of F00747, the ferry does occasionally enter this area while avoiding vessel traffic. F00747 indicates that there is nothing present on the seafloor in that area that would impede their safe transit.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

D.2.8 Construction and Dredging

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

D.2.9 New Survey Recommendation

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

D.2.10 Inset Recommendation

No new insets 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
Lieutenant Patrick J. Debroisse	Chief of Party	12/10/2019	DEBROISSE.PATRICK.JOSEPH.1501248670
Robert W. Mowery	Sheet Manager	12/10/2019	MOWERY.ROBERT.WILLIAM.1379754488 Digitally signed by MOWERY.ROBERT.WILLIAM.1379754488 Date: 2019.12.13 08:15:19 -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

Robert Mowery - NOAA Federal <robert.mowery@noaa.gov>

Waiver S-D901-BH2-19 Junction Comparison

2 messages

Christopher Hare - NOAA Federal <christopher.hare@noaa.gov> Wed, Nov 20, 2019 at 9:29 AM
To: OCS BHII - NOAA Service Account <ocs.bhii@noaa.gov>
Cc: Robert Mowery <Robert.Mowery@noaa.gov>, Chief NRB OCS - NOAA Service Account <chief.nrb.ocs@noaa.gov>

For the Bay Hydro II project in the Delaware River and Bay, S-D901-BH21-9, a junction survey comparison for H11801 does not need to be performed due to the age of the prior survey.

Chris Hare

--
Chris Hare
Project Manager
Navigation Response Branch
NOAA's Office of Coast Survey
240-533-0065

Officer in Charge - BHII <ocs.bhii@noaa.gov> Wed, Nov 20, 2019 at 9:35 AM
To: Christopher Hare - NOAA Federal <christopher.hare@noaa.gov>
Cc: Robert Mowery <Robert.Mowery@noaa.gov>, Chief NRB OCS - NOAA Service Account <chief.nrb.ocs@noaa.gov>

Thank you, Chris.

Lt Debroisse
[Quoted text hidden]
--
LT Patrick Debroisse
Officer in Charge
R/V *Bay Hydro II*
14485 Dowell Road
Solomons, MD 20688
Work cell: 240.638.6637
OCS.BHII@noaa.gov

APPROVAL PAGE

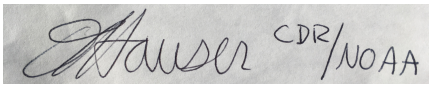
F00747

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- Bottom samples
- GeoPDF of survey products

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.



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Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch