H12859

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12859

LOCALITY

State(s):	North Carolina
General Locality:	Approaches to Chesapeake Bay
Sub-locality:	14 Miles East of Poyner Hill

2016

CHIEF OF PARTY
LCDR Briana J. Welton

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12859**

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):	**North Carolina**
General Locality:	**Approaches to Chesapeake Bay**
Sub-Locality:	**14 Miles East of Poyner Hill**
Scale:	**40000**
Dates of Survey:	**02/23/2016 to 03/23/2016**
Instructions Dated:	**02/03/2016**
Project Number:	**OPR-D304-FH-16**
Field Unit:	**NOAA Ship *Ferdinand R. Hassler***
Chief of Party:	**LCDR Briana J. Welton**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic 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 H12859

Project: OPR-D304-FH-16

Locality: Approaches to Chesapeake Bay

Sublocality: 14 Miles East of Poyner Hill

Scale: 1:40000

February 2016 - March 2016

NOAA Ship *Ferdinand R. Hassler*

Chief of Party: LCDR Briana J. Welton

A. Area Surveyed

Survey H12859 was conducted in the vicinity of the Approaches to Chesapeake Bay, with a sub-locality of 14 Miles East of Poyner Hill as shown in Figure 1.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
36° 25' 30" N 75° 38' 13.8" W	36° 11' 57" N 75° 29' 57" W

Table 1: Survey Limits

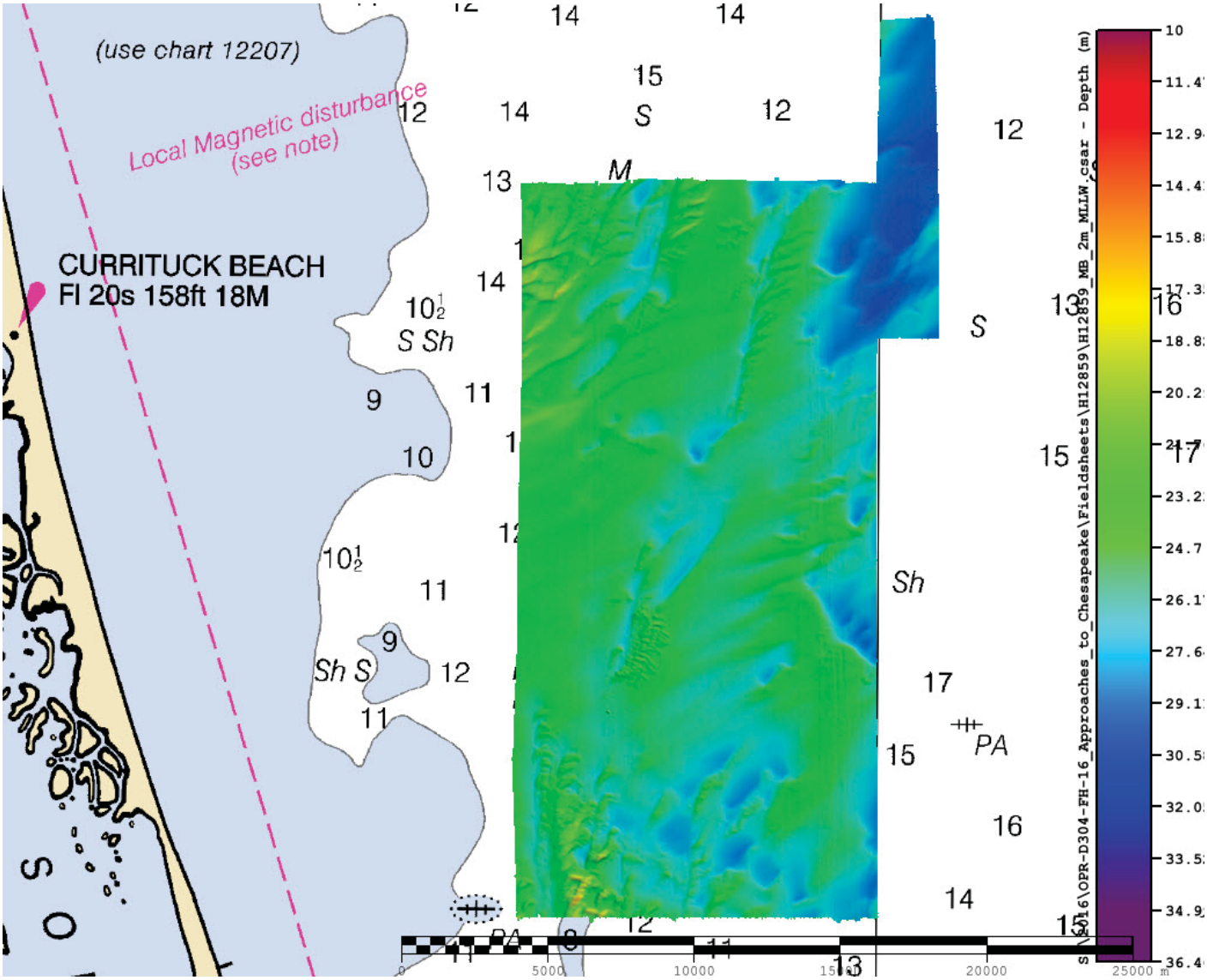


Figure 1: H12859 Survey Limits

Survey Limits were extended to the west to include the portion of H12860. Upon, completion of acquisition on H12859, the field unit continued west and included the data in H12859 for processing efficiency.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. Survey areas will address 403 SNM, of which 260 SNM are Critical Area and 143 SNM are Priority 1 in accordance with the National Hydrographic Survey Priorities Edition 2012. In addition, this project will improve the chart for traffic navigating the Atlantic Ocean Channel and will support BOEM research in the area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

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

Water Depth	Coverage Required
Greater than 8 meters water depth	Complete Coverage accomplished using either: A) complete coverage MBES depth and backscatter data, or B) 100% SSS coverage with concurrent set line spacing MBES depth and backscatter data.

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

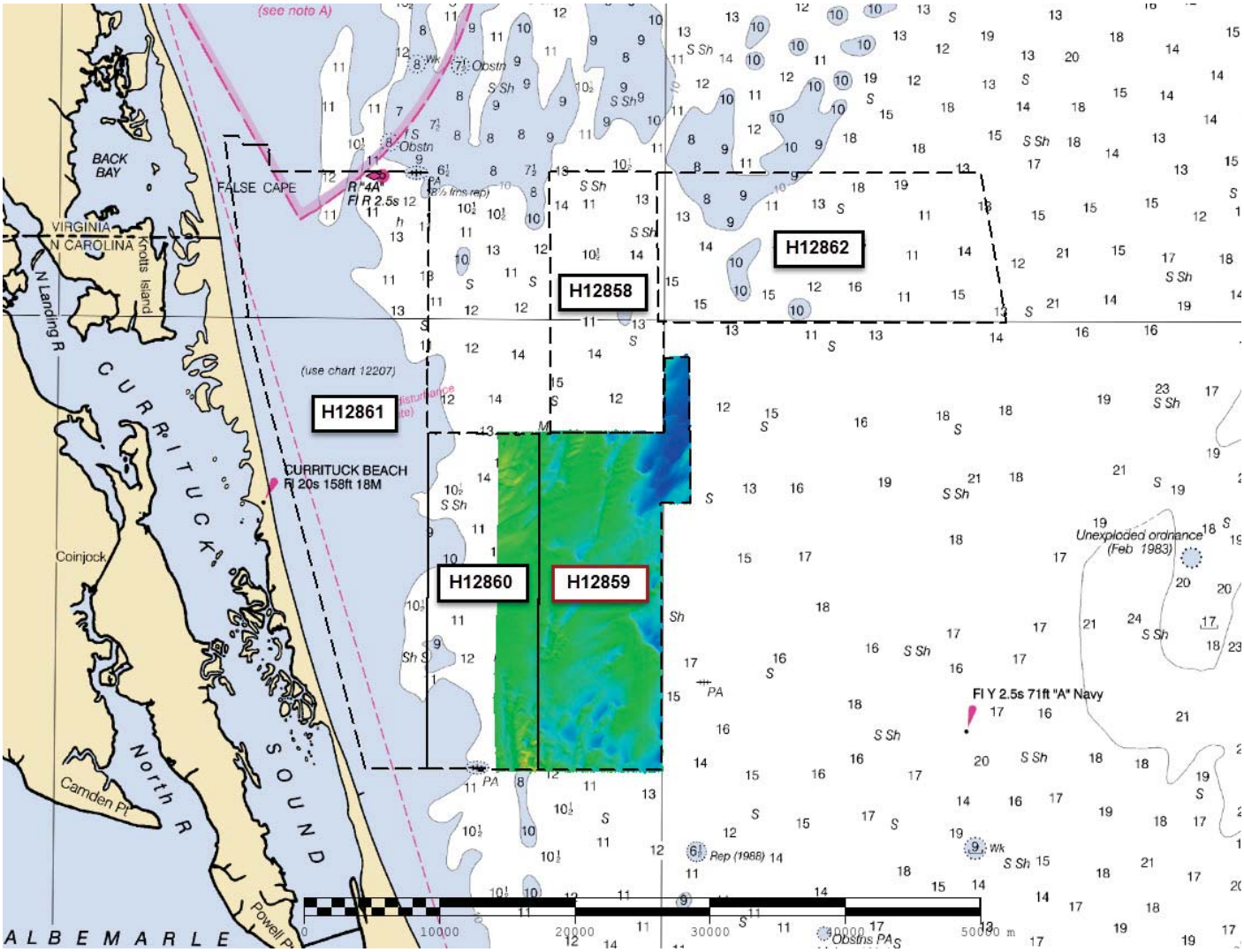


Figure 2: Survey layout for OPR-D304-FH-16 over raster chart 12200.

A.5 Survey Statistics

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

	HULL ID	*S250*	*Total*
LNM	SBES Mainscheme	0	0
	MBES Mainscheme	1791.9	1791.9
	Lidar Mainscheme	0	0
	SSS Mainscheme	0	0
	SBES/SSS Mainscheme	0	0
	MBES/SSS Mainscheme	0	0
	SBES/MBES Crosslines	74.8	74.8
	Lidar Crosslines	0	0
Number of Bottom Samples			7
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			96.7

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
02/23/2016	54
02/24/2016	55

Survey Dates	Day of the Year
03/02/2016	62
03/05/2016	65
03/06/2016	66
03/07/2016	67
03/08/2016	68
03/09/2016	69
03/10/2016	70
03/11/2016	71
03/18/2016	78
03/19/2016	79
03/22/2016	82
03/23/2016	83

Table 3: Dates of Hydrography

Mainscheme survey lines were run with a dual-head multibeam echosounder. Linear nautical miles were calculated using statistics from the port head.

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	*S250*
LOA	37.7 meters
Draft	3.77 meters

Table 4: Vessels Used

Figure 3: NOAA Ship FERDINAND R. HASSLER

NOAA Ship FERDINAND R. HASSLER (S250), shown in Figure 3, acquired all surveyed soundings during operation for H12859

B.1.2 Equipment

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

Manufacturer	Model	Type
Reson	7125	MBES
Applanix	POS M/V 320 V5	Positioning and Attitude System
Hemisphere	MBX-4	Positioning System
AML	MicroCTD	Conductivity, Temperature, and Depth Sensor
Brooke Ocean	MVP-200	Sound Speed System
Reson	SVP-70	Sound Speed System
SeaBird	SBE 19+	Conductivity, Temperature, and Depth Sensor

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 4.17% of mainscheme acquisition.

A geographic plot of crosslines is shown in Figure 4. The crosslines were filtered to reject data greater then 45 degrees from nadir. To evaluate crossline agreement, two 2-meter surfaces were created: one from crossline depths, the other from mainscheme depths. These two surfaces were differenced using CARIS HIPS/SIPS. The 2.3 million nodes have a difference value range from -0.55 meters and 0.45 meters. The statistical analysis of the differences between the mainscheme and crossline surfaces is shown in Figure 6. The average difference between the surfaces is 0.01 meters with a standard deviation of 0.07 meters; Ninety-five percent of nodes agree within +/- 0.13 meters of the mean.

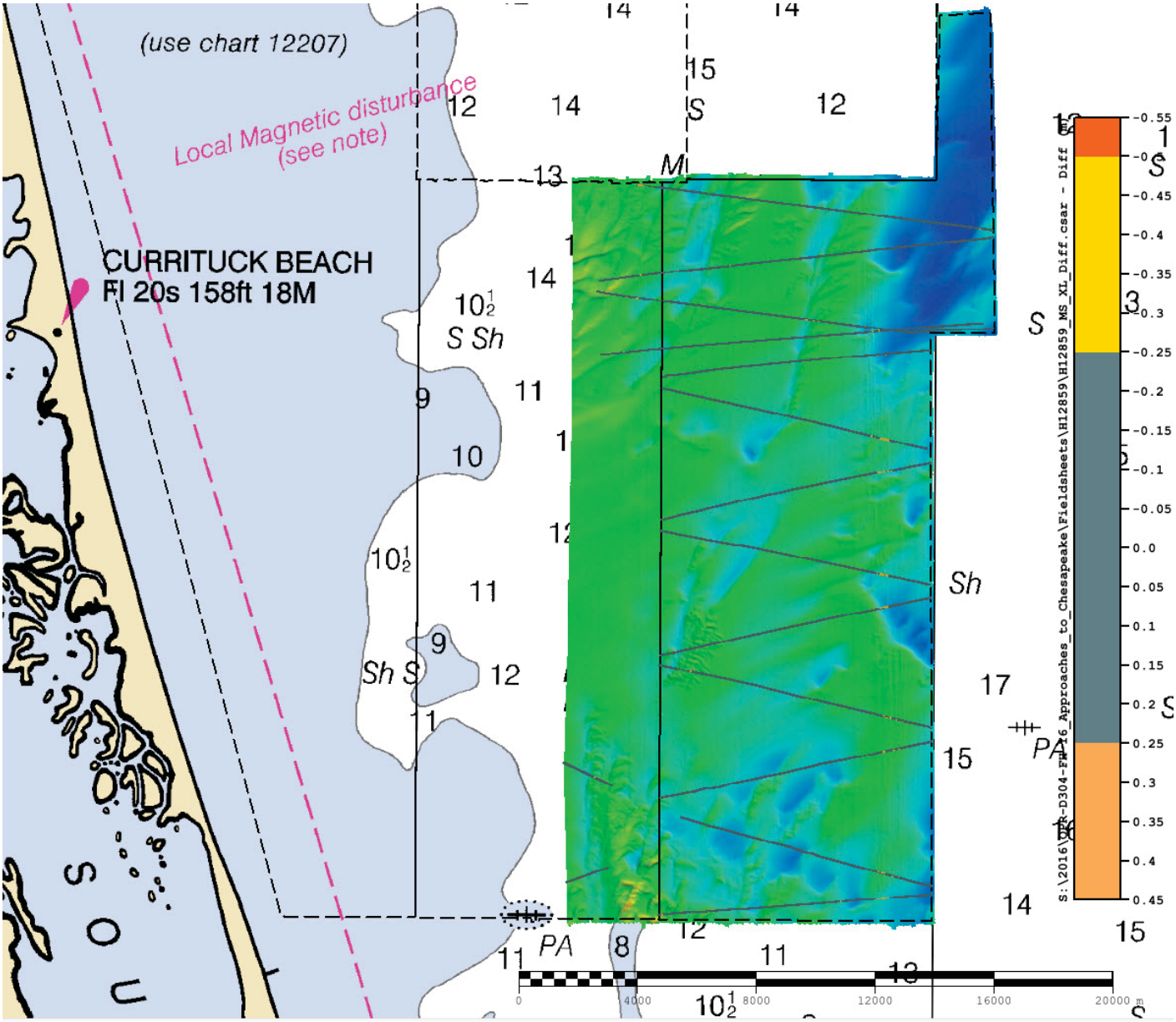


Figure 4: Location of crosslines for H12859.

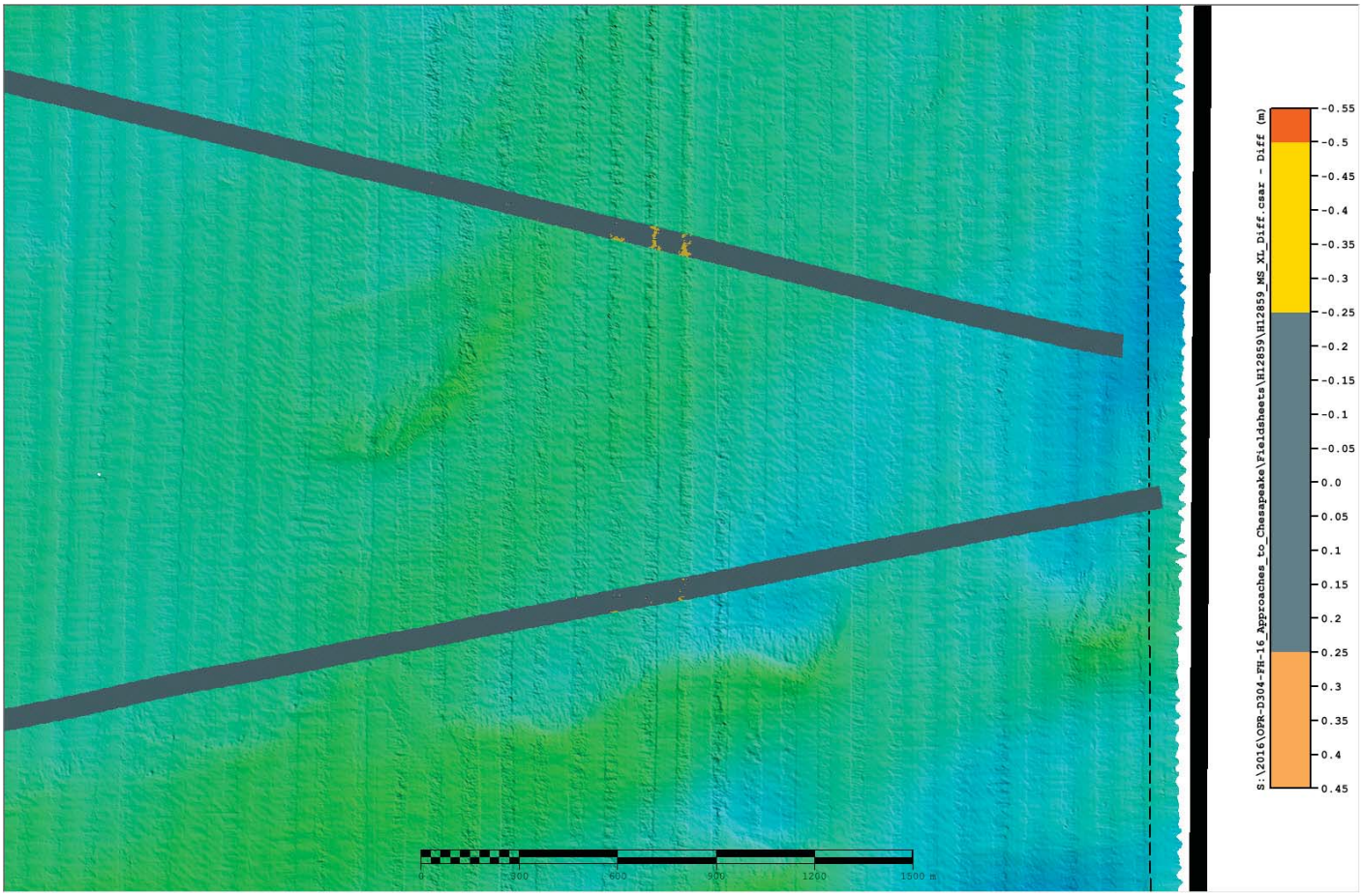
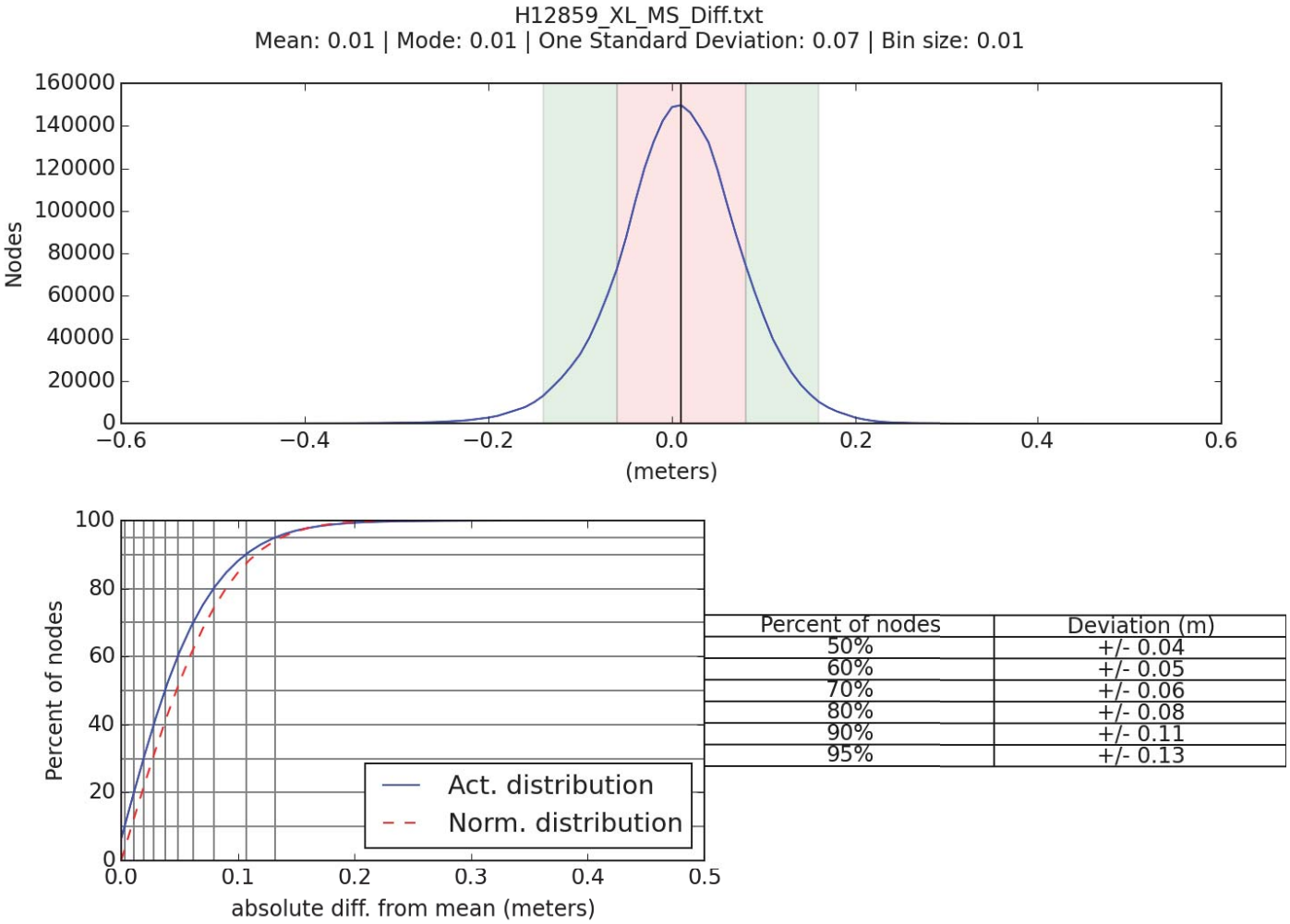


Figure 5: Closeup of area with sound speed refraction in mainscheme coverage.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.08
90%	+/- 0.11
95%	+/- 0.13

Figure 6: H12859 crossline difference statistics: mainscheme minus crosslines.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0.01 meters	0.102 meters	ERS via VDATUM

Table 6: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S250	1.0 meters/second	1.0 meters/second	0.5 meters/second

Table 7: Survey Specific Sound Speed TPU Values.

Two tidal models were available for water level corrections associated with survey H12859. A discrete tide zone file, produced by CO-OPS for project OPR-B304-FH-16, was provided to the field unit. Additionally, a vertical datum transformation (VDatum) model was delivered to the field unit in the project instructions. All data for survey H12859 were reduced to MLLW via VDatum. This model functioned as a gridded separation model for GPS tide computations with a 0.102 meter uncertainty. Final TPU calculations are derived from the following sources: VDatum separation model, sound velocity (MVP and surface sound velocimeter), HVF uncertainties, and SBET post processed uncertainty. Error data sources applied through CARIS processing software are listed in Figure 7.

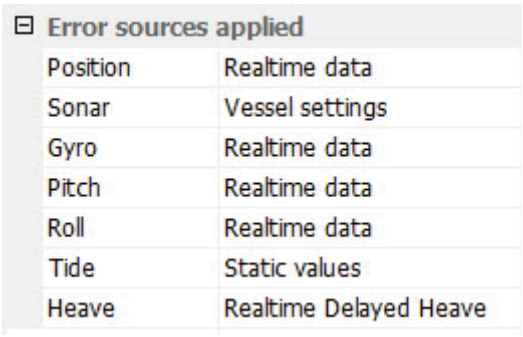


Figure 7: Image of the error sources applied when computing TPU in Caris HIPS

B.2.3 Junctions

Two junction surveys exists with H12859. The survey H12841 borders the entire eastern edge of the survey and H12858 borders the the majority of the northern edge.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12841	1:40000	2015	NOAA Ship FERDINAND R. HASSLER	E
H12858	1:40000	2016	NOAA Ship FERDINAND R. HASSLER	N

Table 8: Junctioning Surveys

H12841

Survey H12859 junctions with survey H12841 with nodes overlapping approximately 0 to 270 meters to the east (See Figure 8). The minimum and maximum depth difference between the two surveys is -3.17 meters and 1.01 meters respectively. Of the greater than 1.2 million overlapping nodes, the average difference is 0.09 meters with a standard deviation of 0.08 meters; Ninety-five percent of the differenced surface nodes are within +/- 0.15 meters of the mean, as shown in Figure 11.

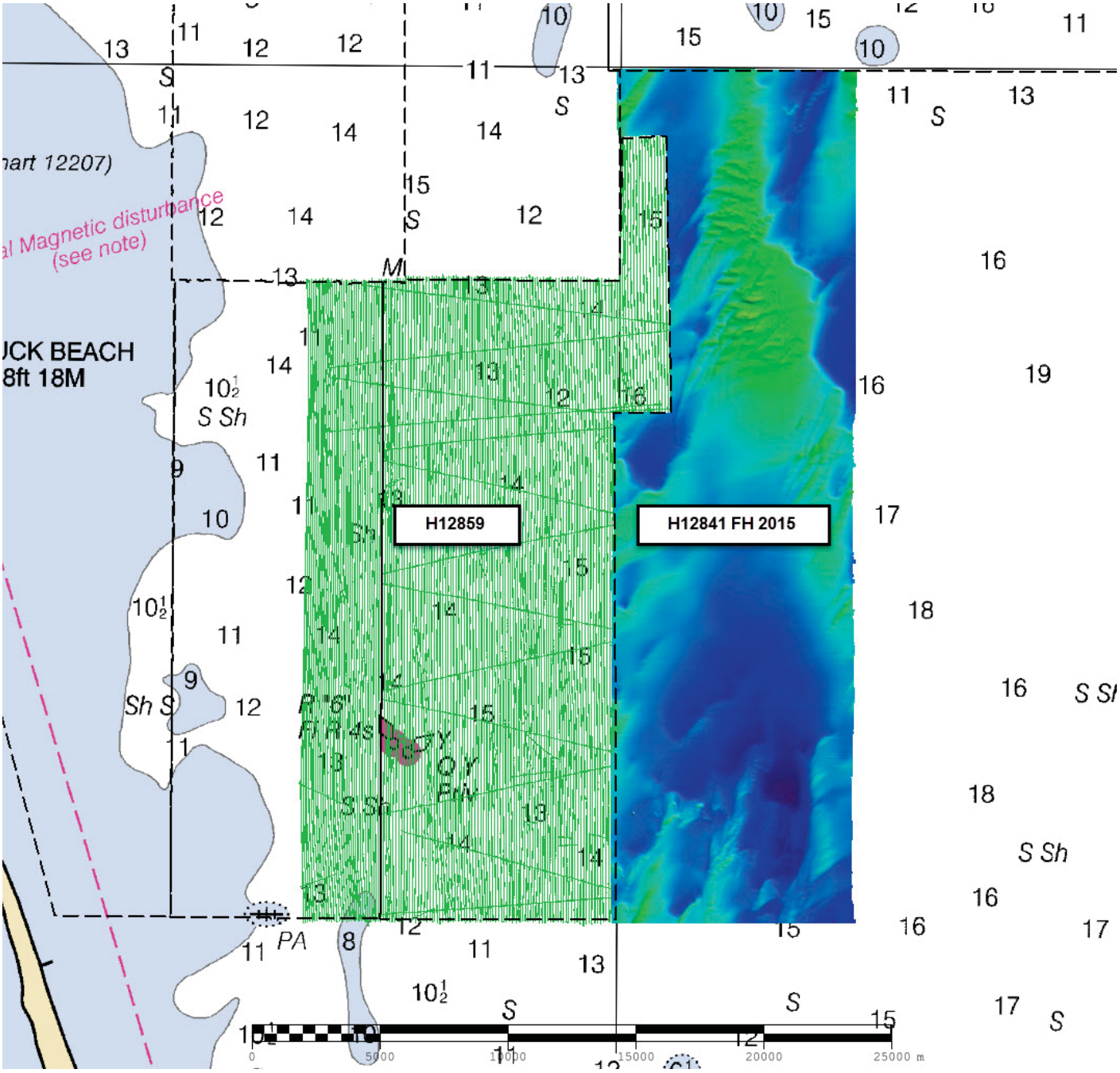


Figure 8: H12841 Junction Survey.

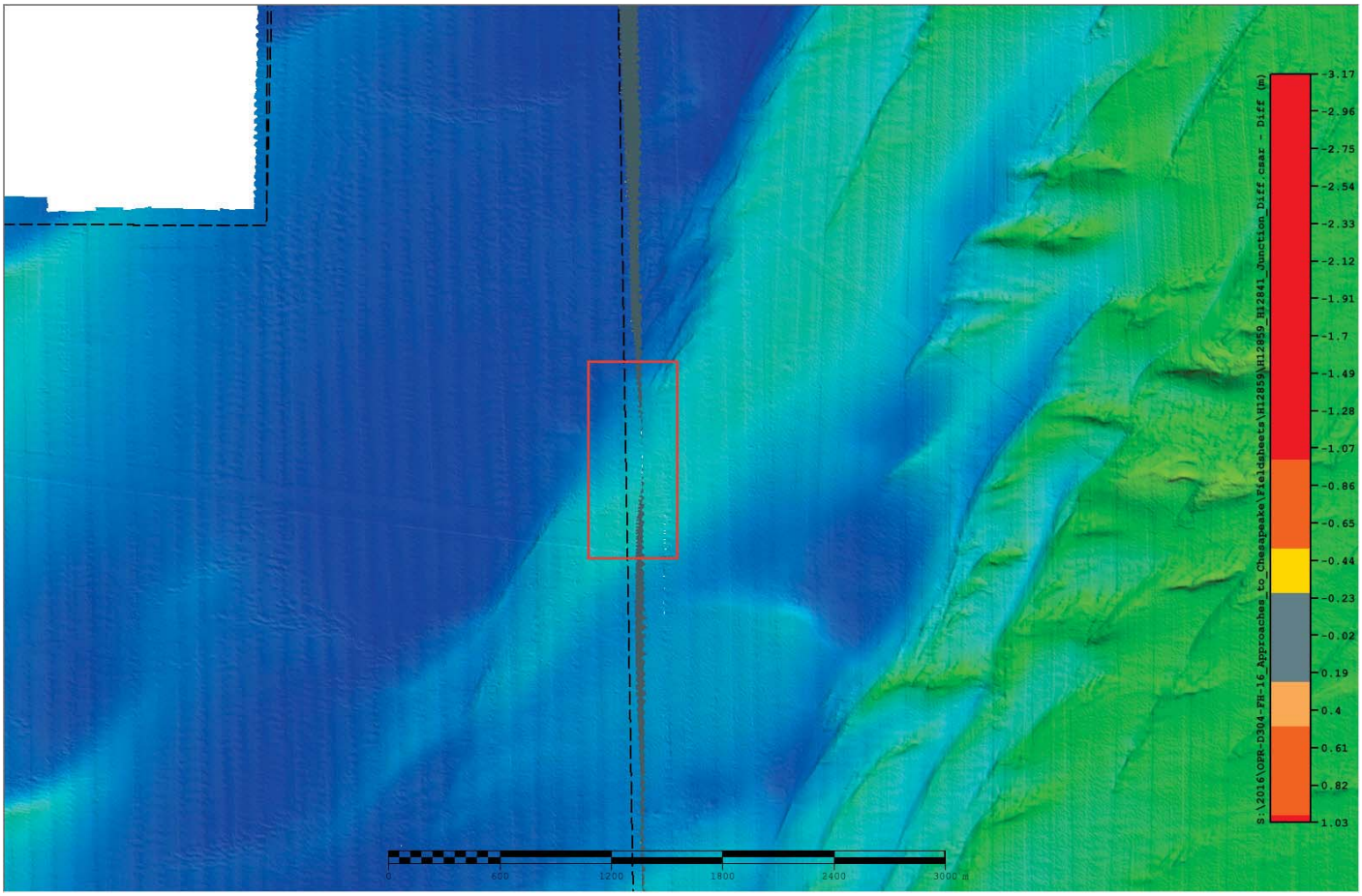


Figure 9: Sheet limits not drawn for proper overlap.

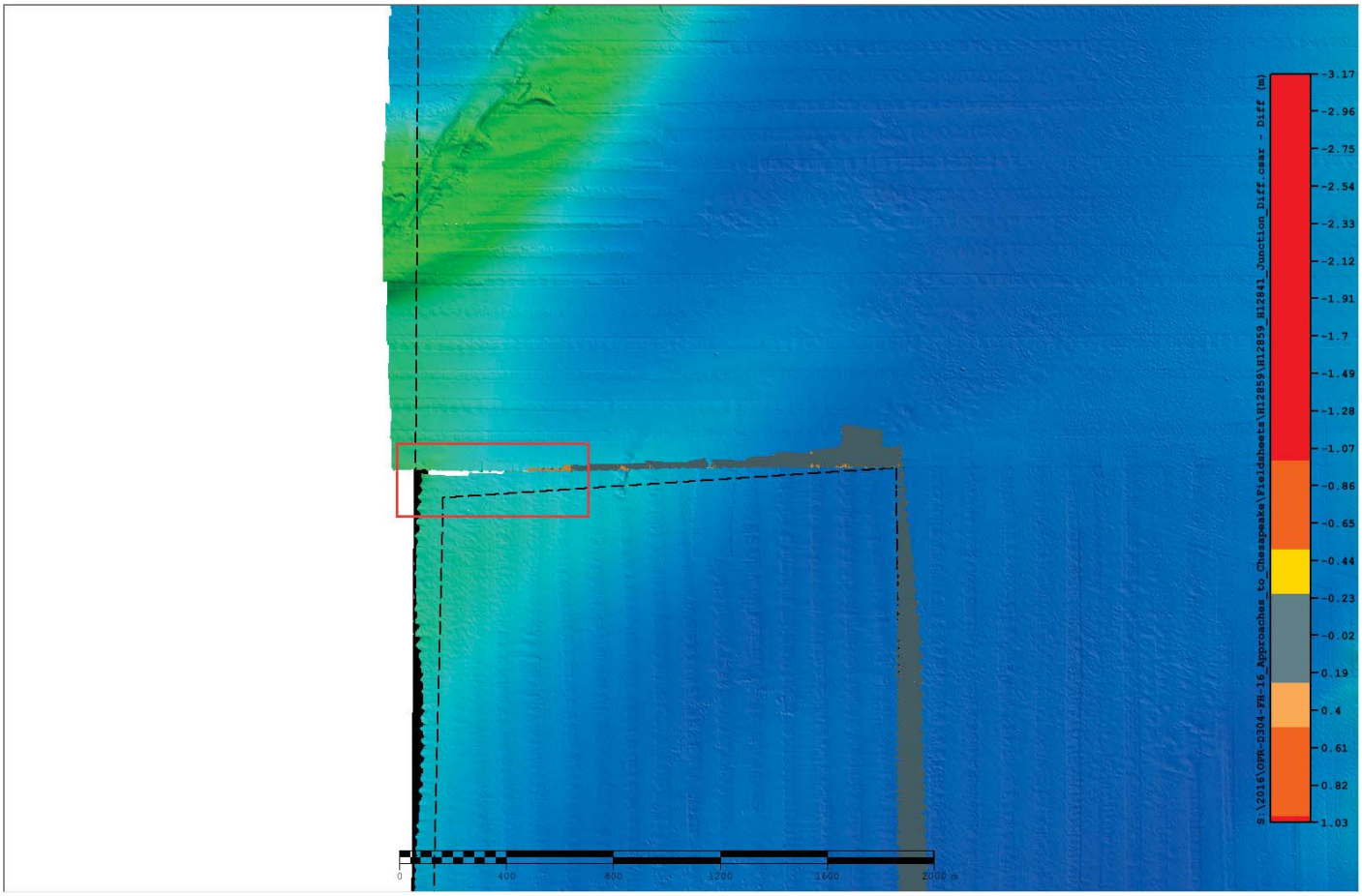
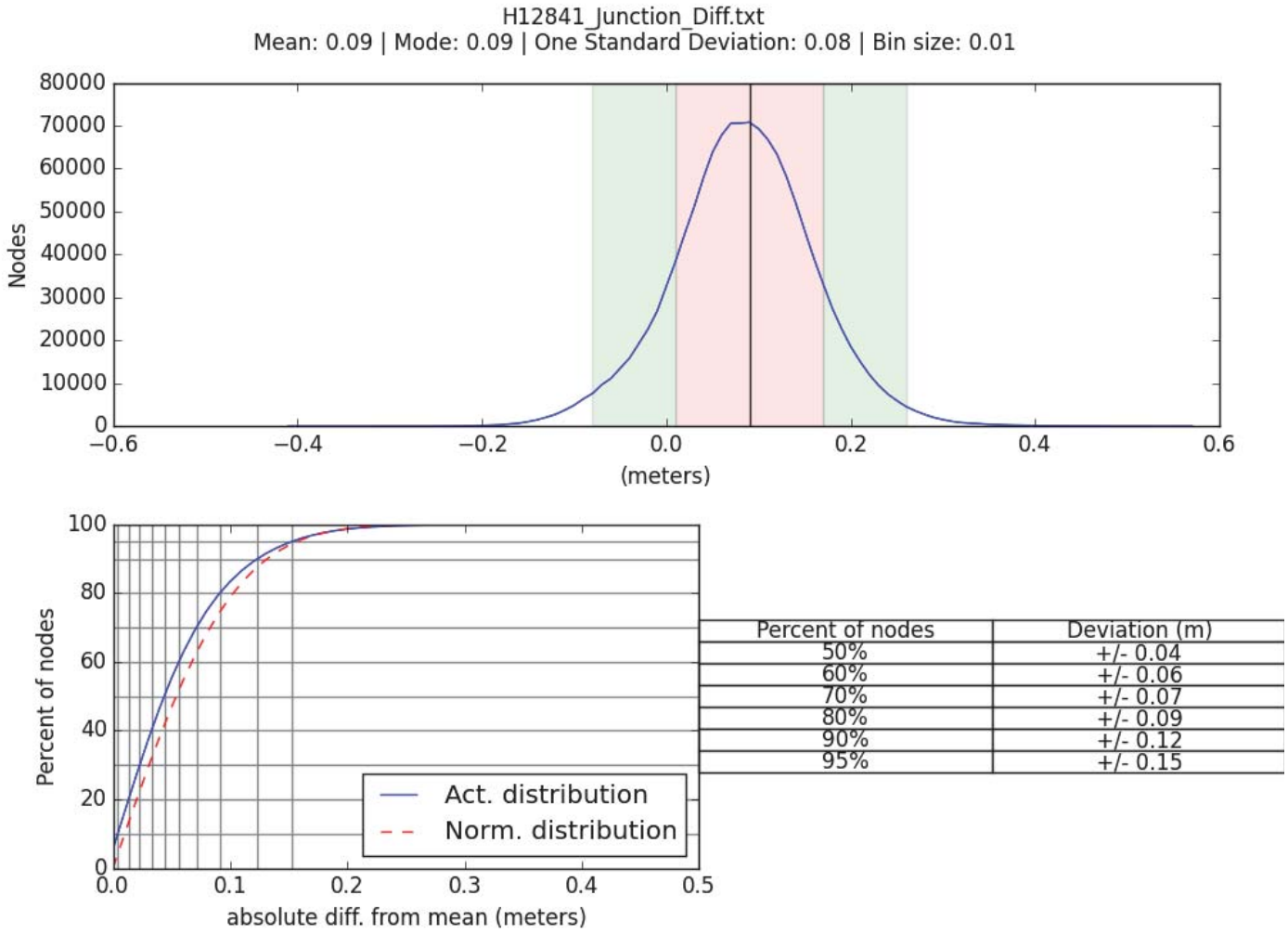


Figure 10: Sheet limits not drawn for proper overlap.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.06
70%	+/- 0.07
80%	+/- 0.09
90%	+/- 0.12
95%	+/- 0.15

Figure 11: Difference surface statistics for H12859 and H12841.

H12858

Survey H12859 junctions with survey H12858 with nodes overlapping approximately 45 to 230 meters to the north (See Figure 12). The minimum and maximum depth difference between the two surveys is -0.49 meters and 0.46 meters respectively. Of the greater than six-hundred thousand overlapping nodes, the average difference is -0.07 meters with a standard deviation of 0.07 meters; Ninety-five percent of the differenced surface nodes are within +/- 0.14 meters of the mean, as shown in Figure 13.

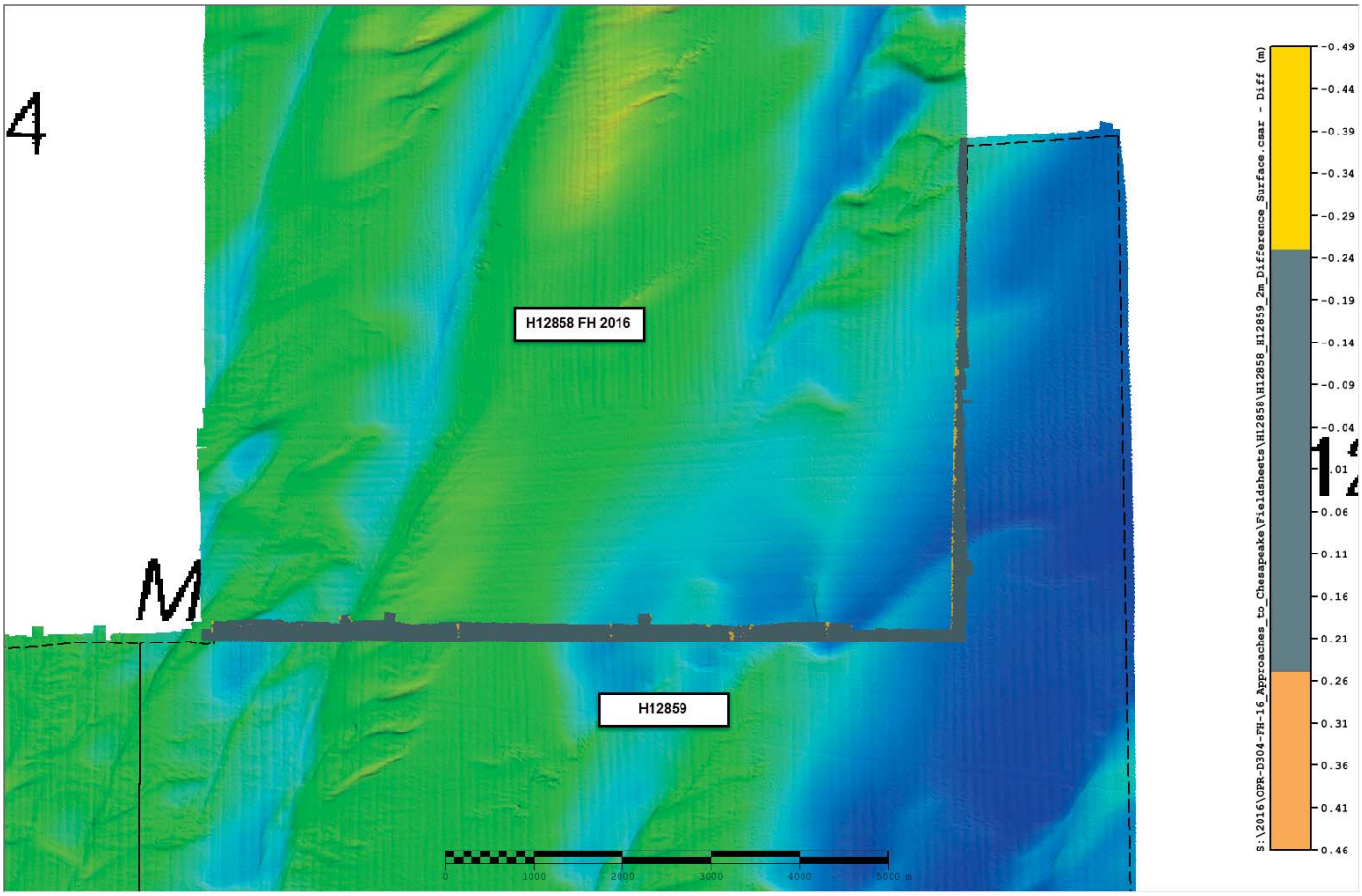
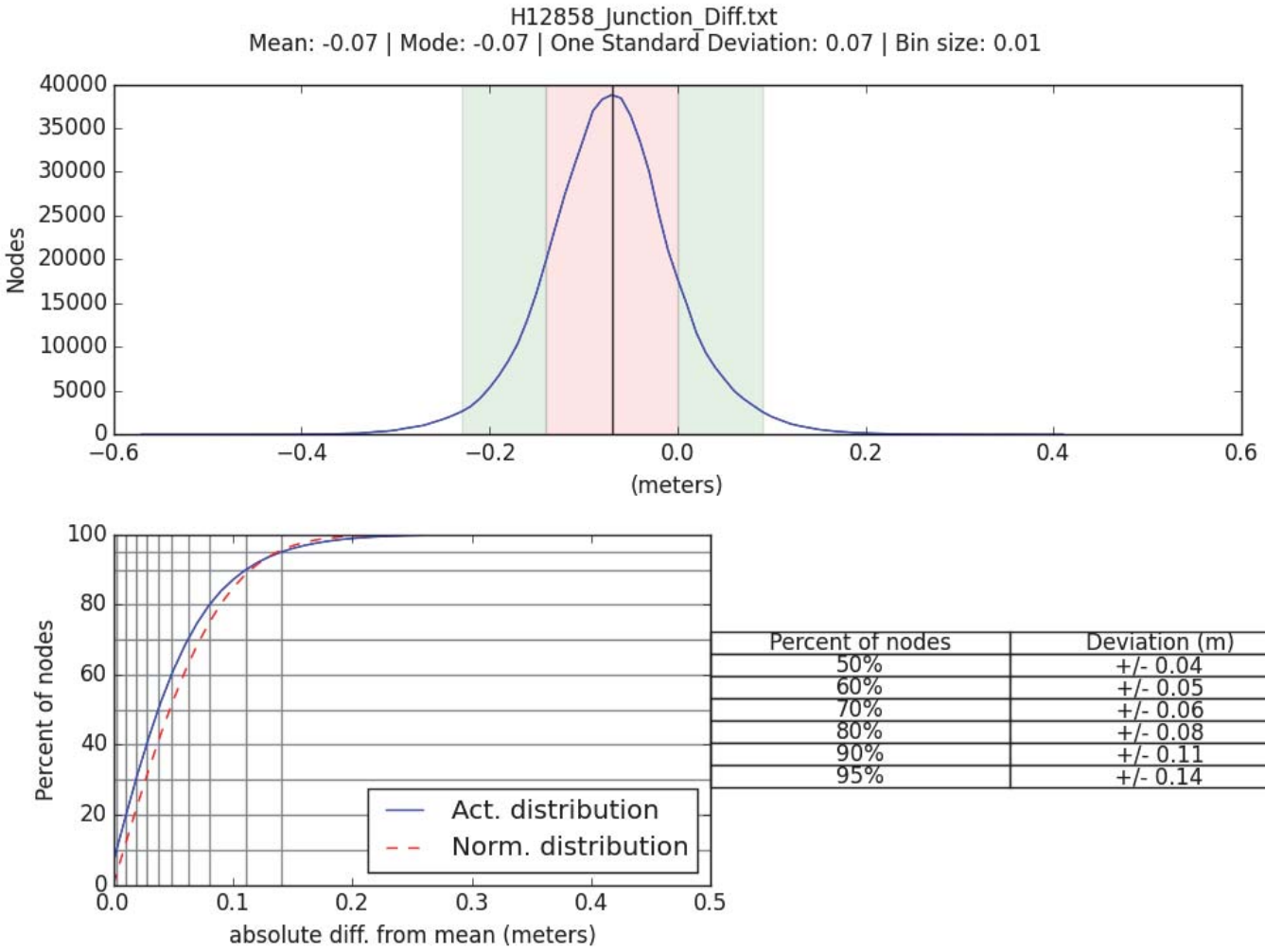


Figure 12: H12858 Junction Survey.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.08
90%	+/- 0.11
95%	+/- 0.14

Figure 13: Difference surface statistics for H12859 and H12858.

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

Sound Speed Refraction Artifacts

Sound speed refraction artifacts exist in some areas of H12859 and were particularly prevalent on DN062. Outer beams were manually rejected where data exceeded TVU limits and where sufficient overlap enabled the hydrographer to do so.

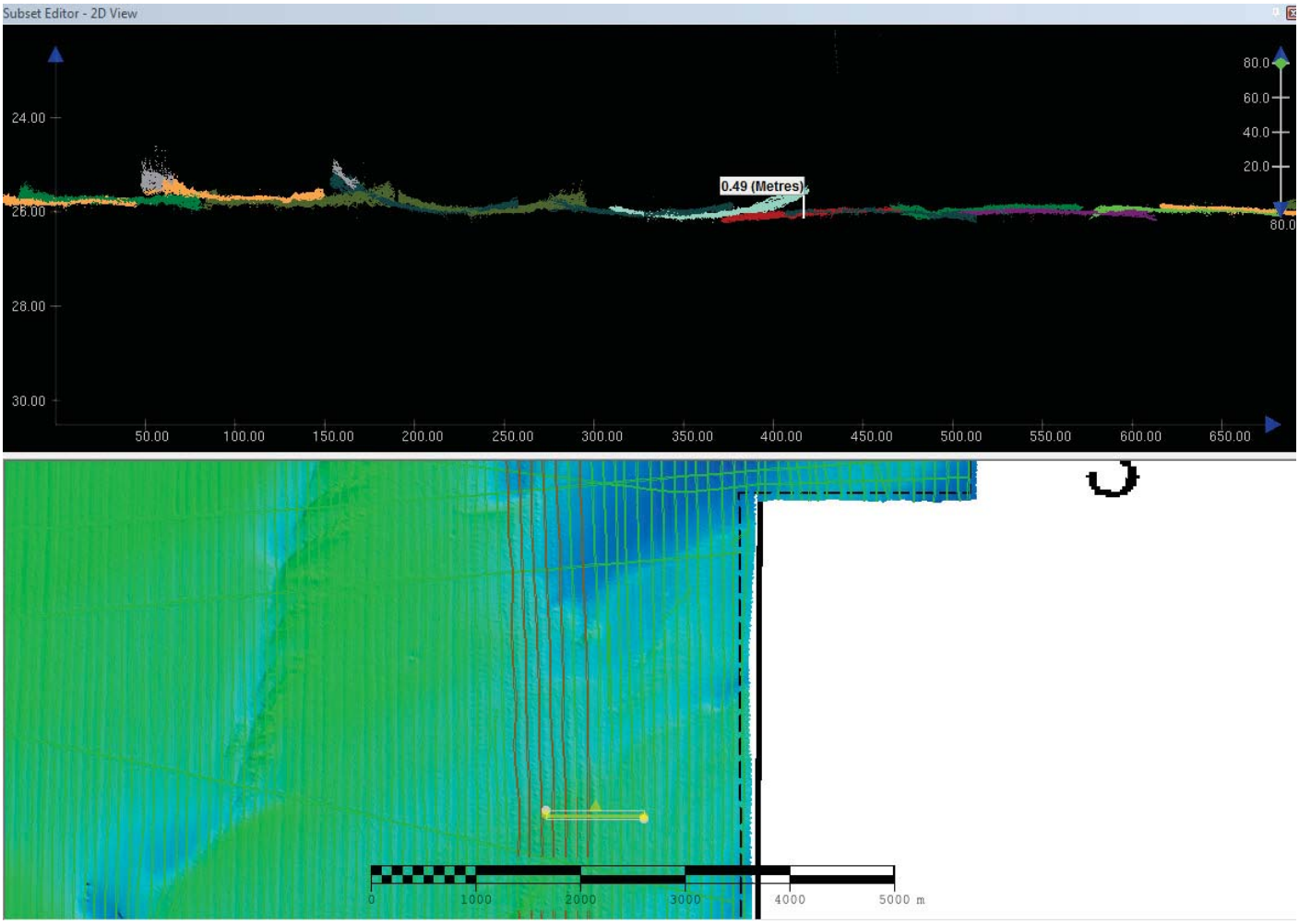


Figure 14: Example of sound speed refraction on DN062.

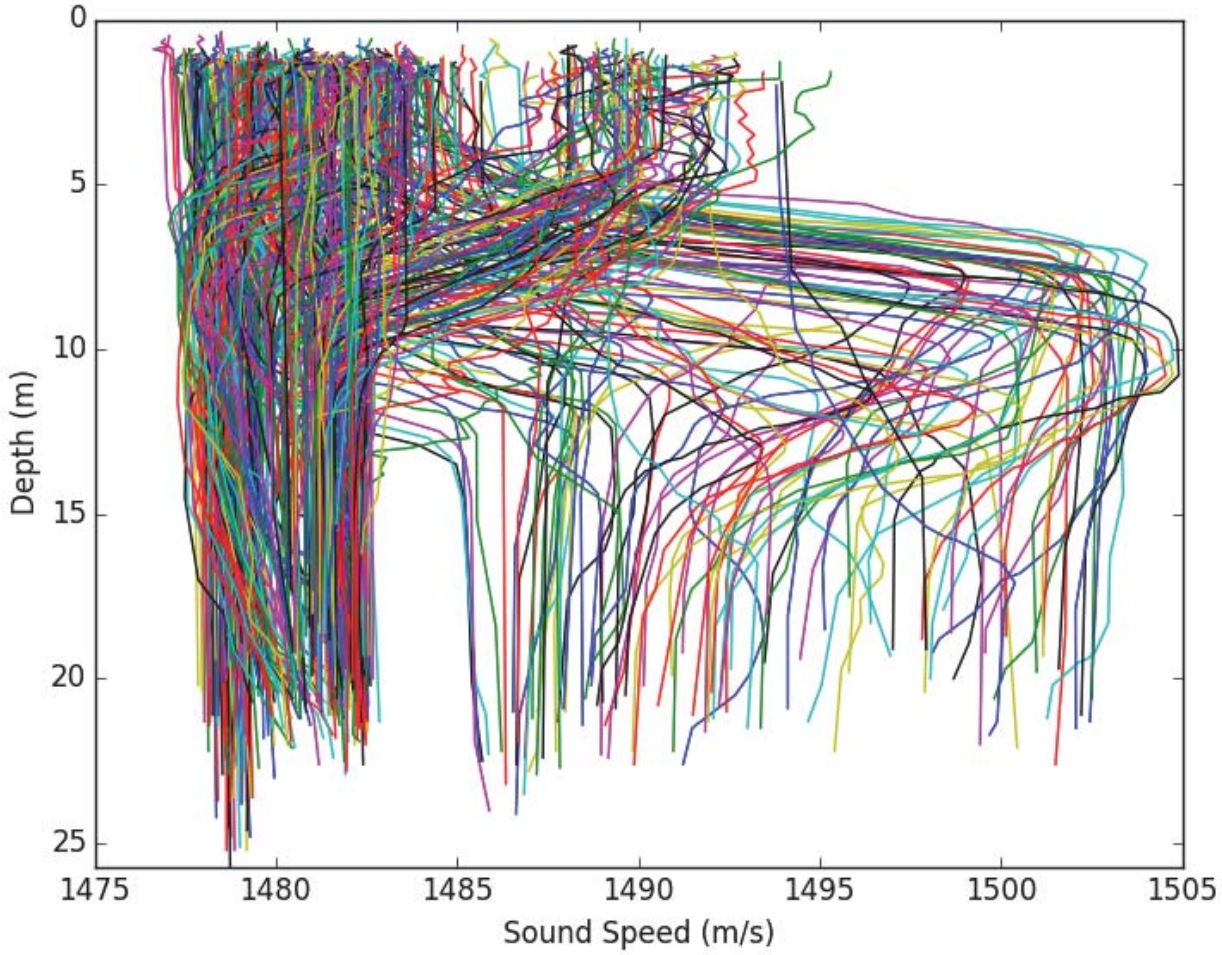


Figure 15: All sound speed profiles plotted for H12859.

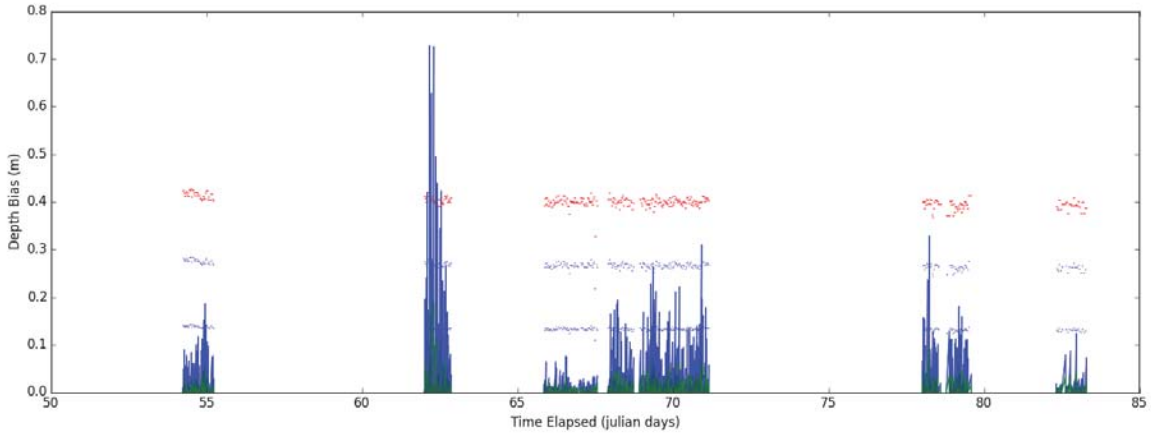


Figure 16: The ray tracing analysis shows DN062 temporarily exceeding uncertainty limits.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: A total of 433 sound speed measurements were taken within the boundaries of H12859 (See Figure 17). These sound speed measurements were collected using the MVP-200 on average every 30 minutes occasionally increasing the frequency to less than 10 minutes. Comparisons were made by the survey watch to assess sound speed variation in the water column.

Sound speed casts were applied to the data using Nearest in Distance Within Time (NIDWT) of 2 hours except for lines acquired after 1200 UTC on DN078 through DN079 which used NIDWT of 3hrs.

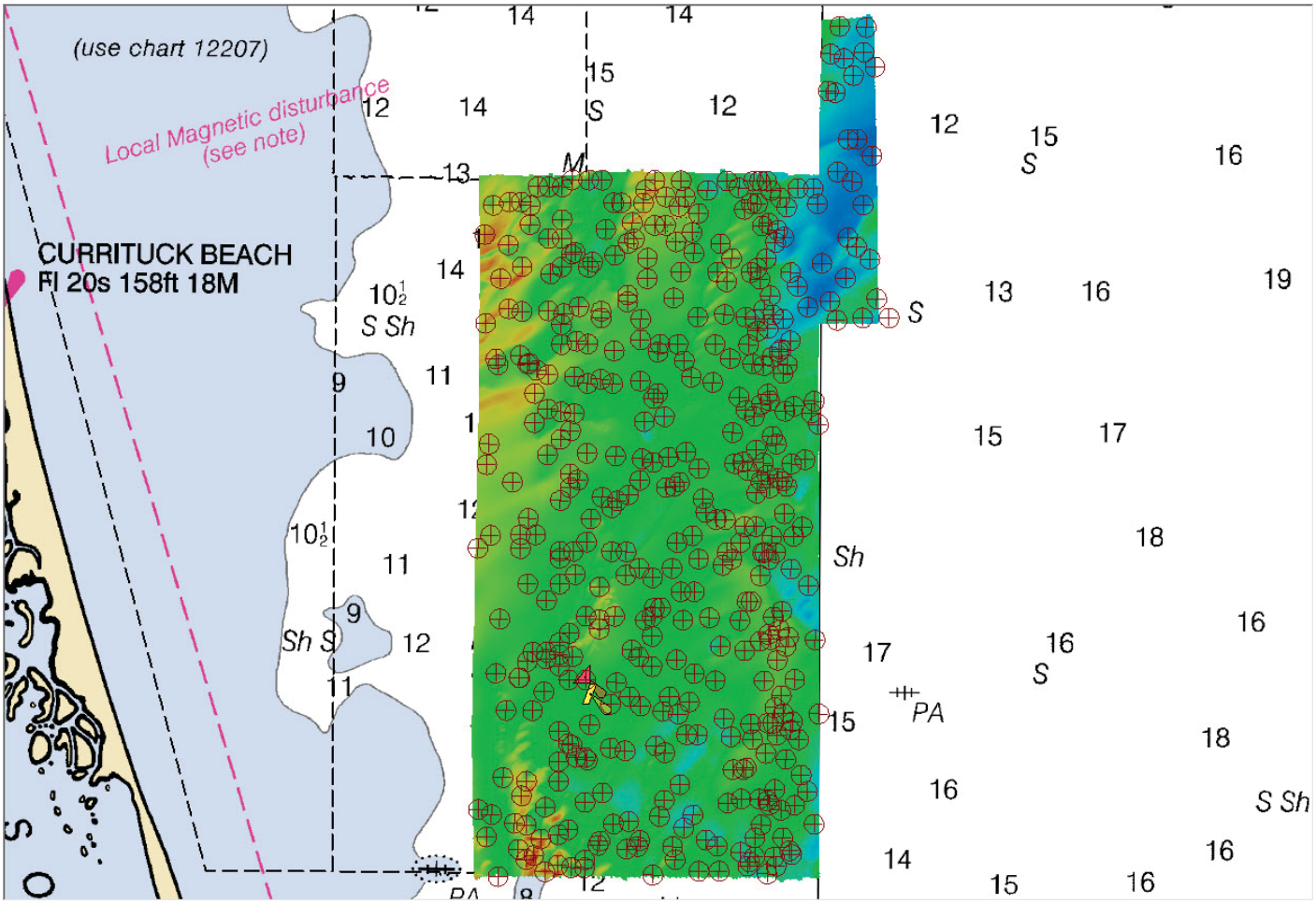


Figure 17: H12859 sound speed profile locations.

B.2.8 Coverage Equipment and Methods

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

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

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

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter was logged in RESON datagram 7008 snippets record in the raw .s7k files. The .s7k file also holds the navigation record and bottom detections for all lines of survey H12859. The files were paired with the CARIS HDCS data, imported, and processed using Fledermaus Geocoder Toolbox (FMGT). The FMGT projects and backscatter mosaic imagery is included in the field submission. The processed mosaic is formated as a geo-referenced tiff image per specifications. The following information is provided as metadata for the processing branch:

Backscatter data processing and mosaicing performed in Fledermaus FMGT version 7.5.3.
Backscatter data has a histogram range of 10 to -70dB
Backscatter data is provided in separate layers broken down by survey vessel hull number and sonar operating frequency.

H12859_S250P_400kHz | 4m resolution mosaic | Absorption Coefficient = 100dB/km
H12859_S250S_400kHz | 4m resolution mosaic | Absorption Coefficient = 100dB/km

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile V_5_4

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
H12859_MB_1m_MLLW	CUBE	1.0 meters	16.77 meters - 30.55 meters	NOAA_1m	Complete MBES
H12859_MB_1m_MLLW_Final	CUBE	1.0 meters	16.77 meters - 20.00 meters	NOAA_1m	Complete MBES
H12859_MB_2m_MLLW	CUBE	2.0 meters	16.79 meters - 39.48 meters	NOAA_2m	Complete MBES
H12859_MB_2m_MLLW_Final	CUBE	2.0 meters	18 meters - 39.52 meters	NOAA_2m	Complete MBES

Table 9: Submitted Surfaces

B.5.3 Data Density

A density analysis was run to calculate the number of soundings per surface node. The results determined that greater than 99.5% of all nodes contained five (5) or more soundings which meets the data density specifications (See Figure 18 and 19).

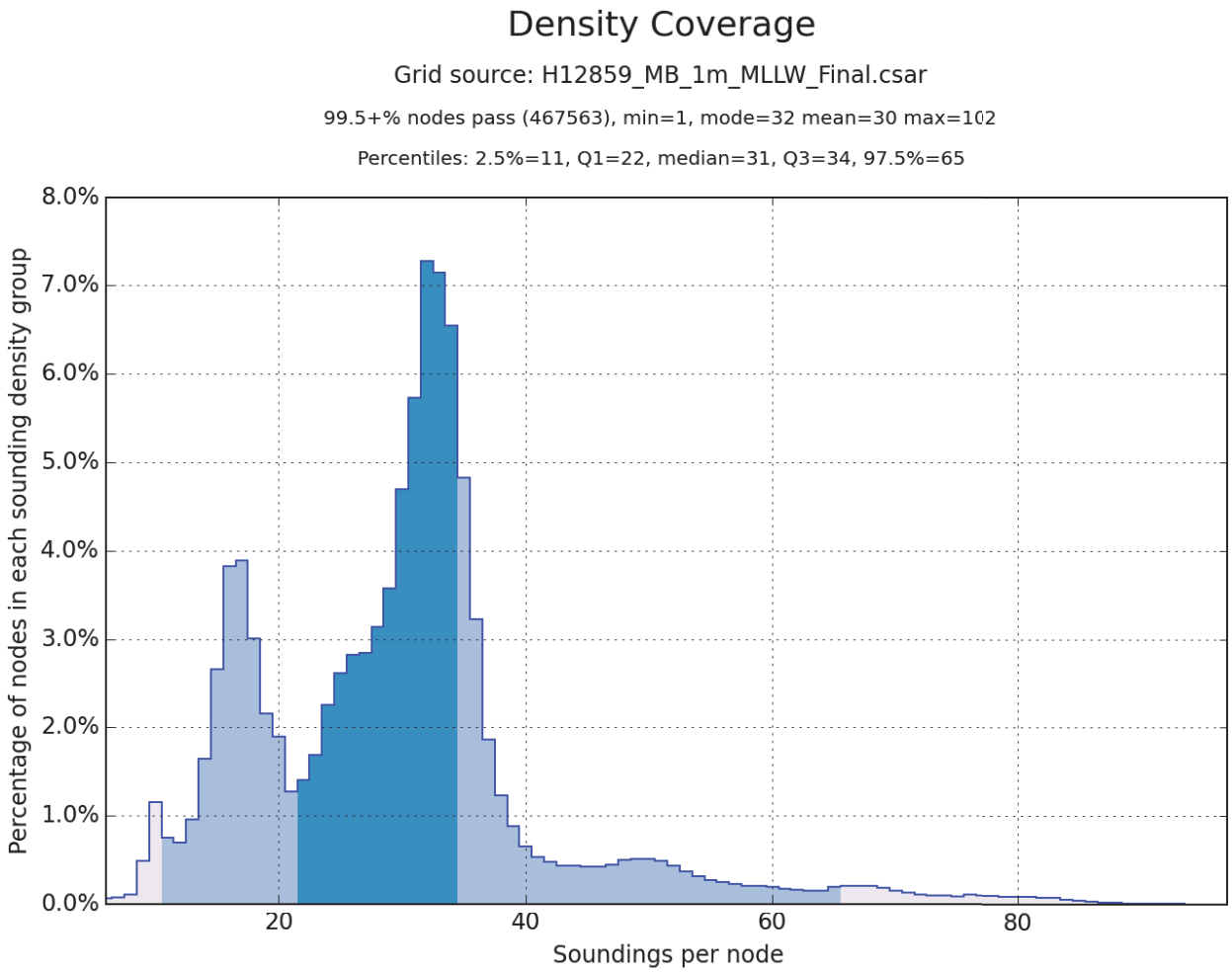


Figure 18: Data density of the 1-meter finalized surface.

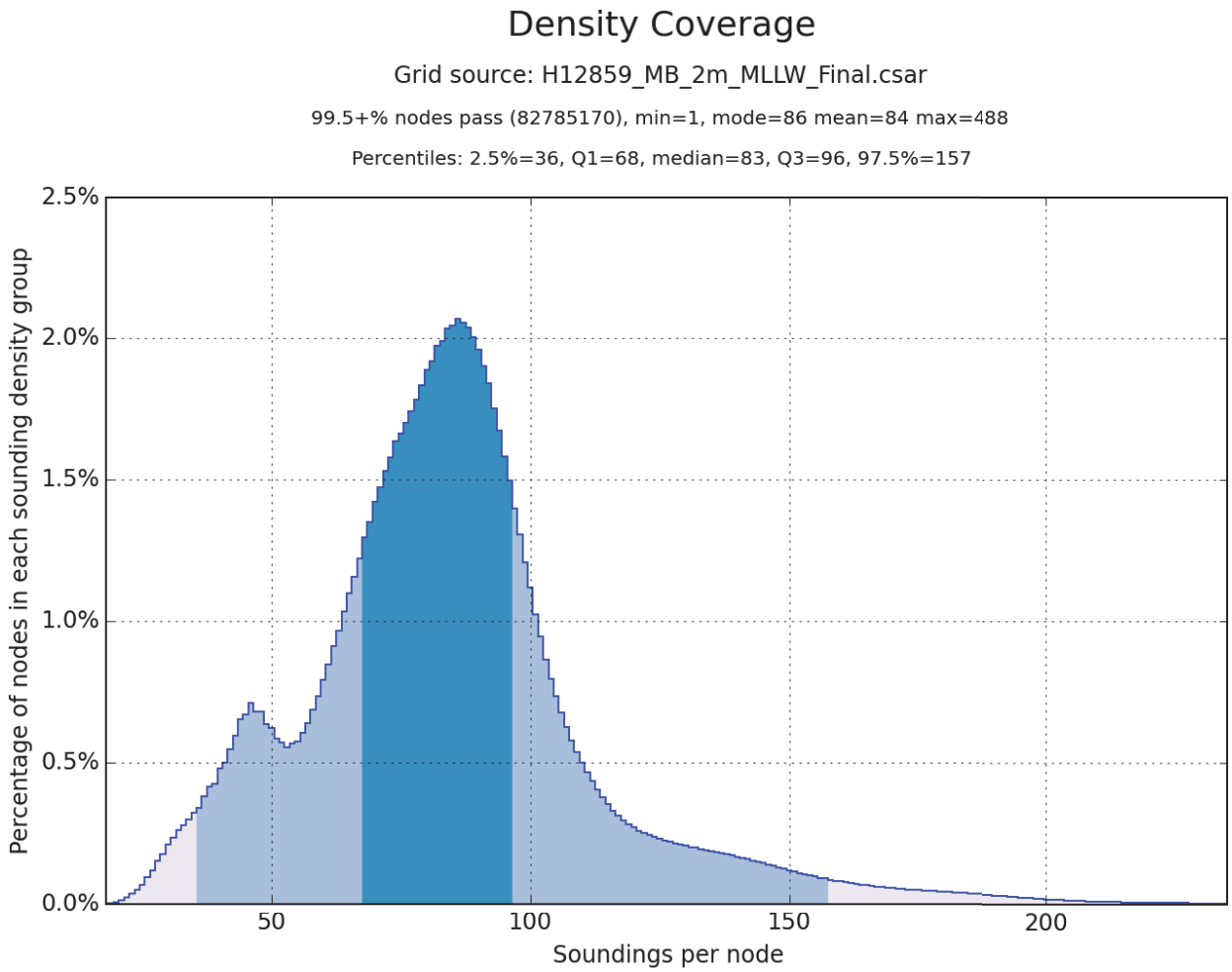


Figure 19: Data density of the 2-meter finalized surface.

B.5.4 Total Vertical Uncertainty Standards

Pydro's Finalized CSAR QA tool was used to calculate the percentage of nodes which meet total vertical uncertainty (TVU) specifications. The resulting statistical analysis yielded greater than 99.5% of all nodes meet TVU specifications (See Figure 20 and 21). In addition, a custom layer was created for the finalized surface submitted in correlation with H12859. The layer was derived from the difference between the calculated uncertainties of individual nodes and the allowable IHO uncertainty at the coupled node and scaled to a 95% confidence interval.

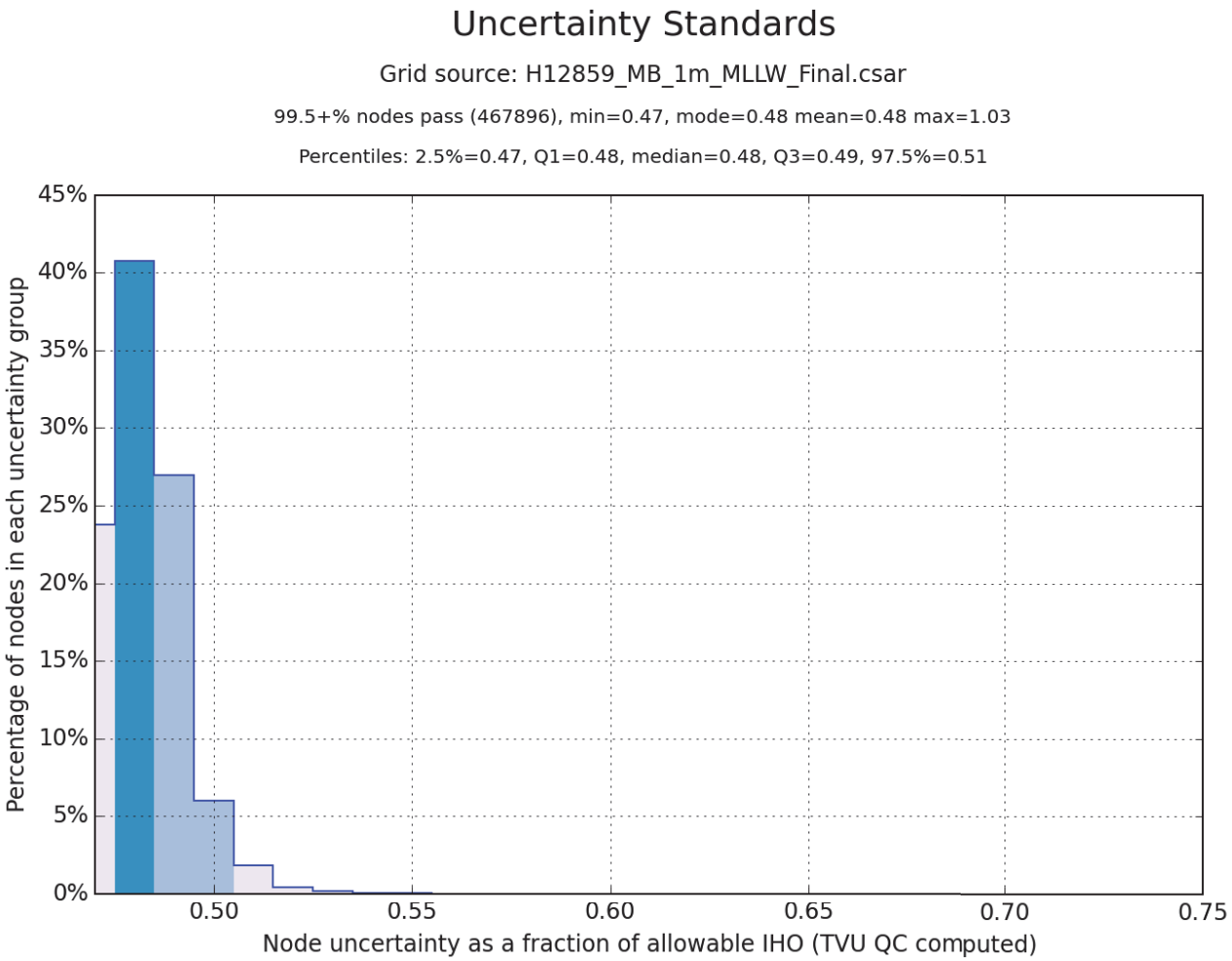


Figure 20: Total vertical uncertainty analysis for the 1-meter finalized surface.

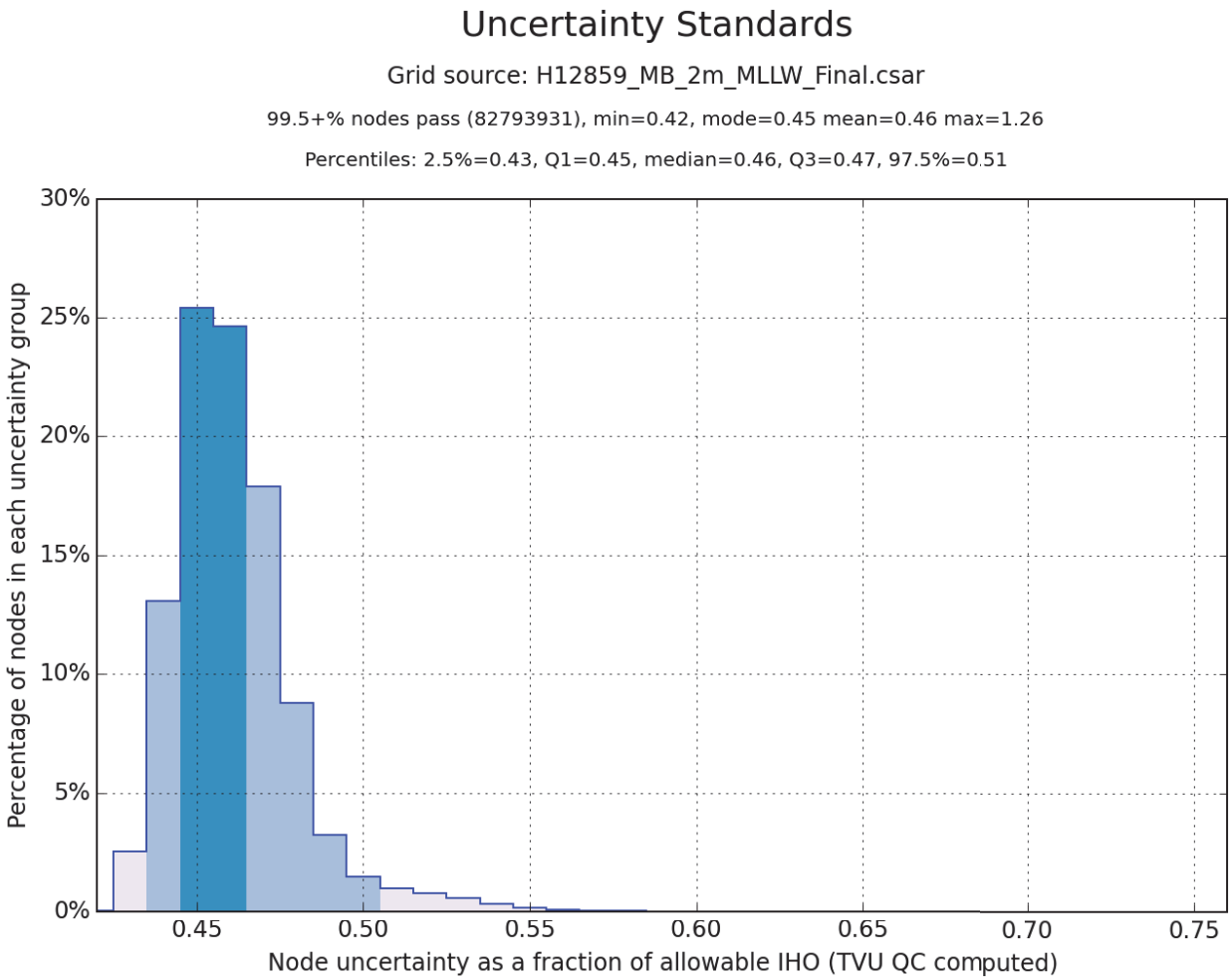


Figure 21: Total vertical uncertainty analysis for the 2-meter finalized surface.

B.5.5 Holidays

Thirteen (13) holidays exist within the survey survey limits of H12859. One (1) holiday occurs in the 1-meter finalized surface while the remaining twelve (12) occur in the 2-meter finalized surface. Most of the holidays were created after completion of acquisition on the project while rejecting suspect data. Areas around the holidays were inspected for signs of features or shoaling and no navigational dangers appear to exist.

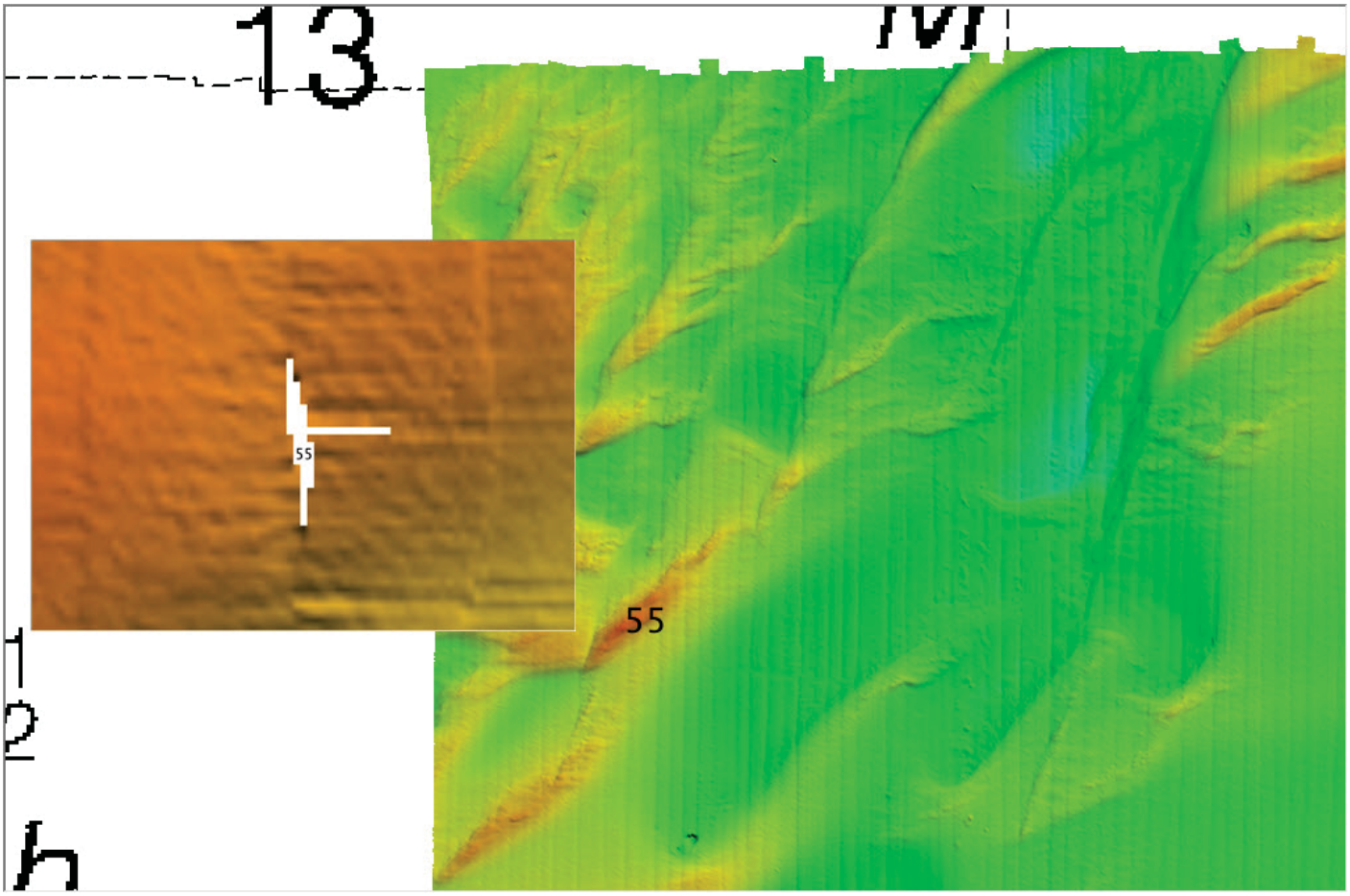


Figure 22: A holiday in the 1-meter finalized surface.

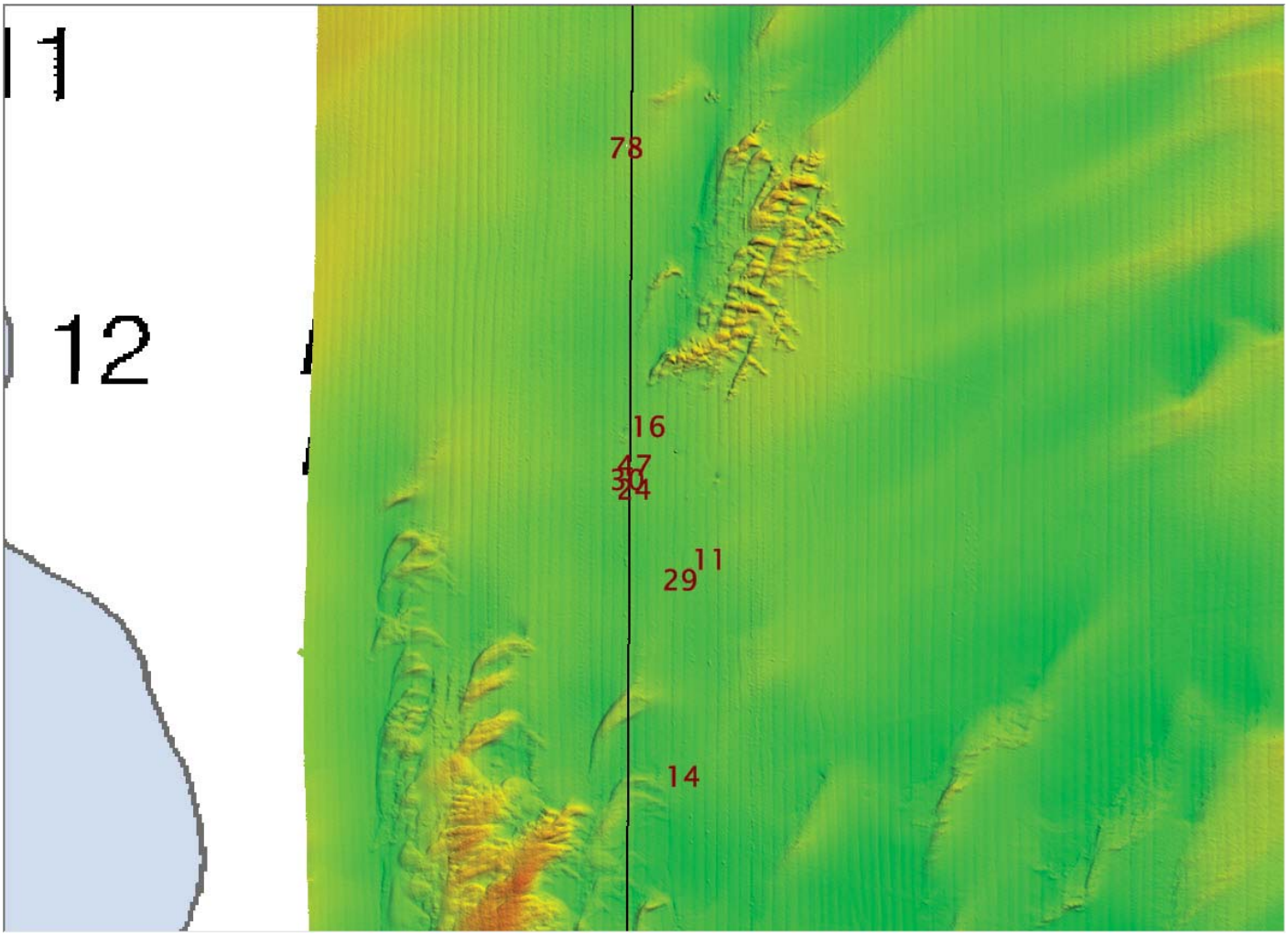


Figure 23: Eight (8) holidays in the 2-meter finalized surface.

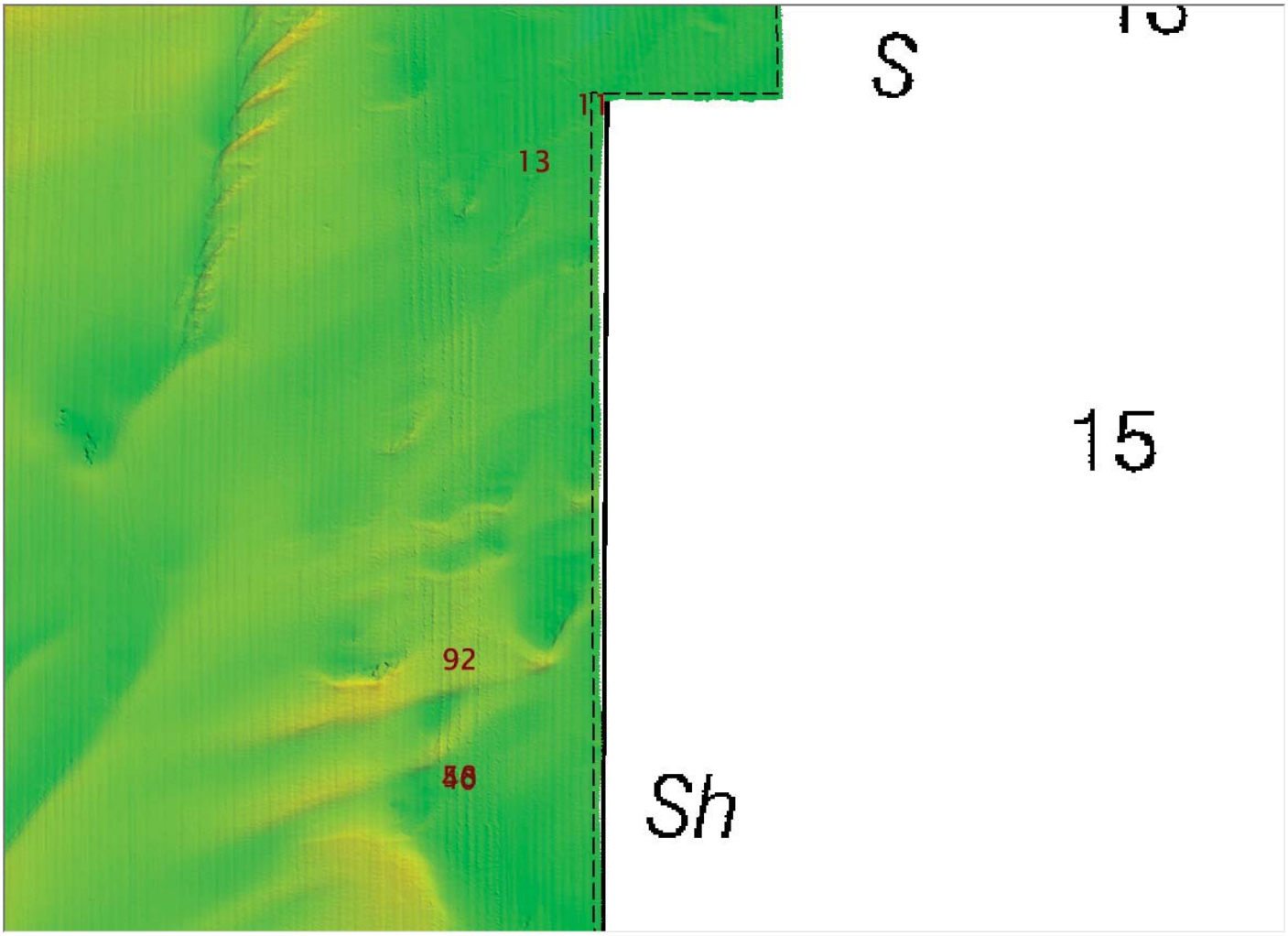


Figure 24: Four (4) holidays in the 2-meter finalized surface.

C. Vertical and Horizontal Control

All vertical and horizontal control activities conducted during the course of this survey are fully addressed in the following sections. No separate HVCR is submitted.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

ERS Methods Used:

ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

D304_VDatum_xyNAD83-MLLW.csar

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM 18N.

The following PPK methods were used for horizontal control:

Single Base

Single Base processing was the primary method used for for Post Processed Kinematics (PPK) processing of Applanix TrueHeave data for Smooth Best Estimate of Trajectory (SBET) production. SBET files have been loaded for all lines for survey H12859 and are used to reduce acquired soundings to MLLW via HSD Operations Branch provided separation model.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
DUCK 3, Duck, NC	NCDU
LOYOLA, Virginia Beach, VA	LS03
CHESAPEAKE LIGHT, Chesapeake Light, VA	COVX

Table 10: CORS Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations
Driver, VA (289 kHz)

Table 11: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 GPS Tide Vertical Offset

Some small instances of a vertical offset appear in the data with GPS Tides computed. These are likely due to altitude error in the applied SBETs. These errors are too small to pick out for interpolation and are left in the data. The offsets are still well within vertical TVU limits.

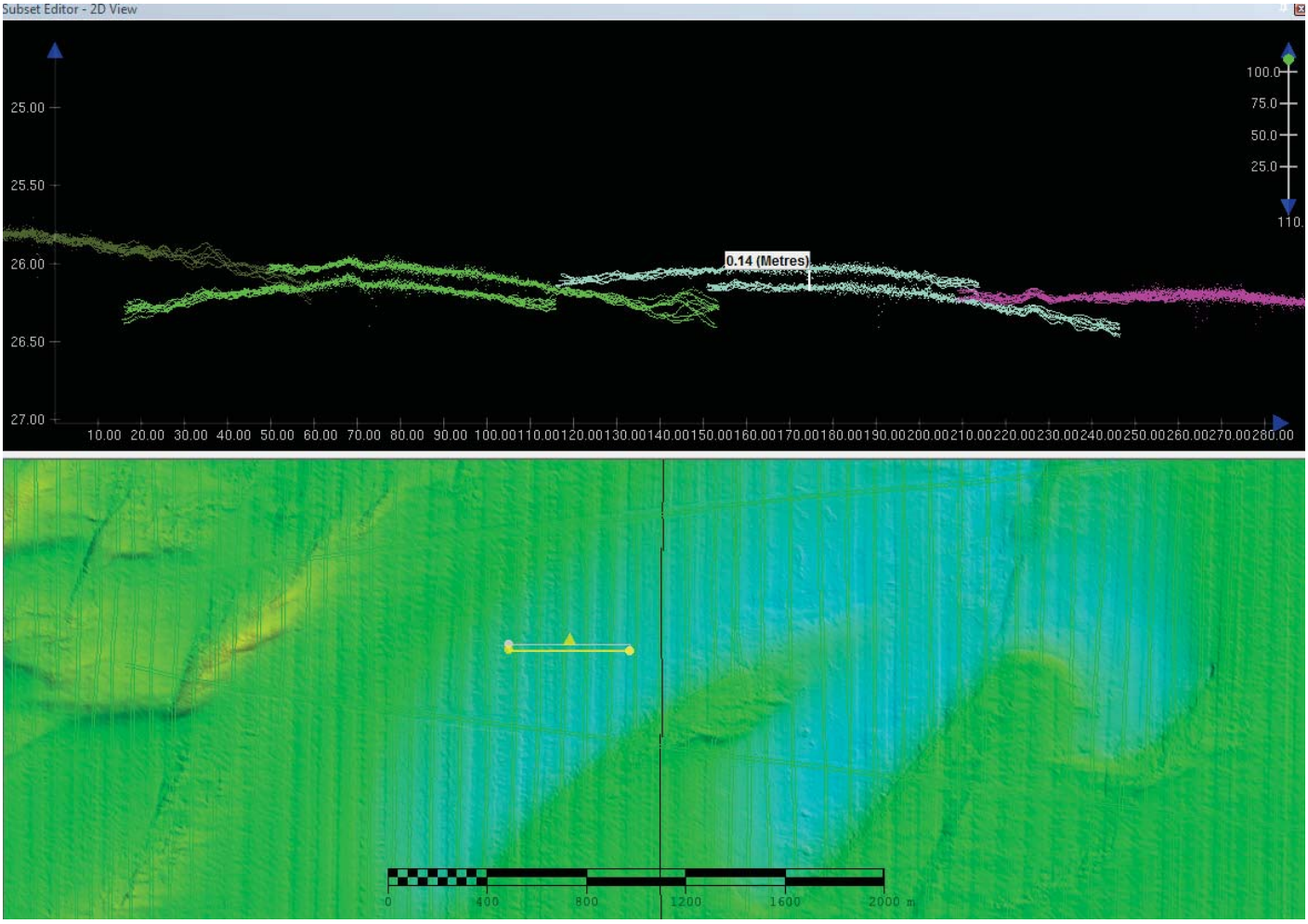


Figure 25: Example of a vertical offset on DN078 when GPS Tides are applied.

D. Results and Recommendations

D.1 Chart Comparison

A sounding plot was generated from the 2-meter surface to compare to the charted soundings. The Chart Comparison Tool contained in the QCTools utility in PydroExplorer, was run to compare the soundings extracted from ENCs US4NC31M, US4NC32M, US4NC53M and US3DE01M. The Chart Comparison Tool uses a triangulated irregular network (TIN) to interpolate in between charted soundings and searched for surveyed depths that are shallower than surrounding charted areas. Even when including soundings from all three charts, the overall density of charted soundings is sparse.

There are indications of some shoaling in between the charted soundings, however, none that pose any hazard to navigation. See figures 23, 24, and 25 for the output from the Chart Comparison Tool that highlights the shallower areas (the clusters of red cross hairs).

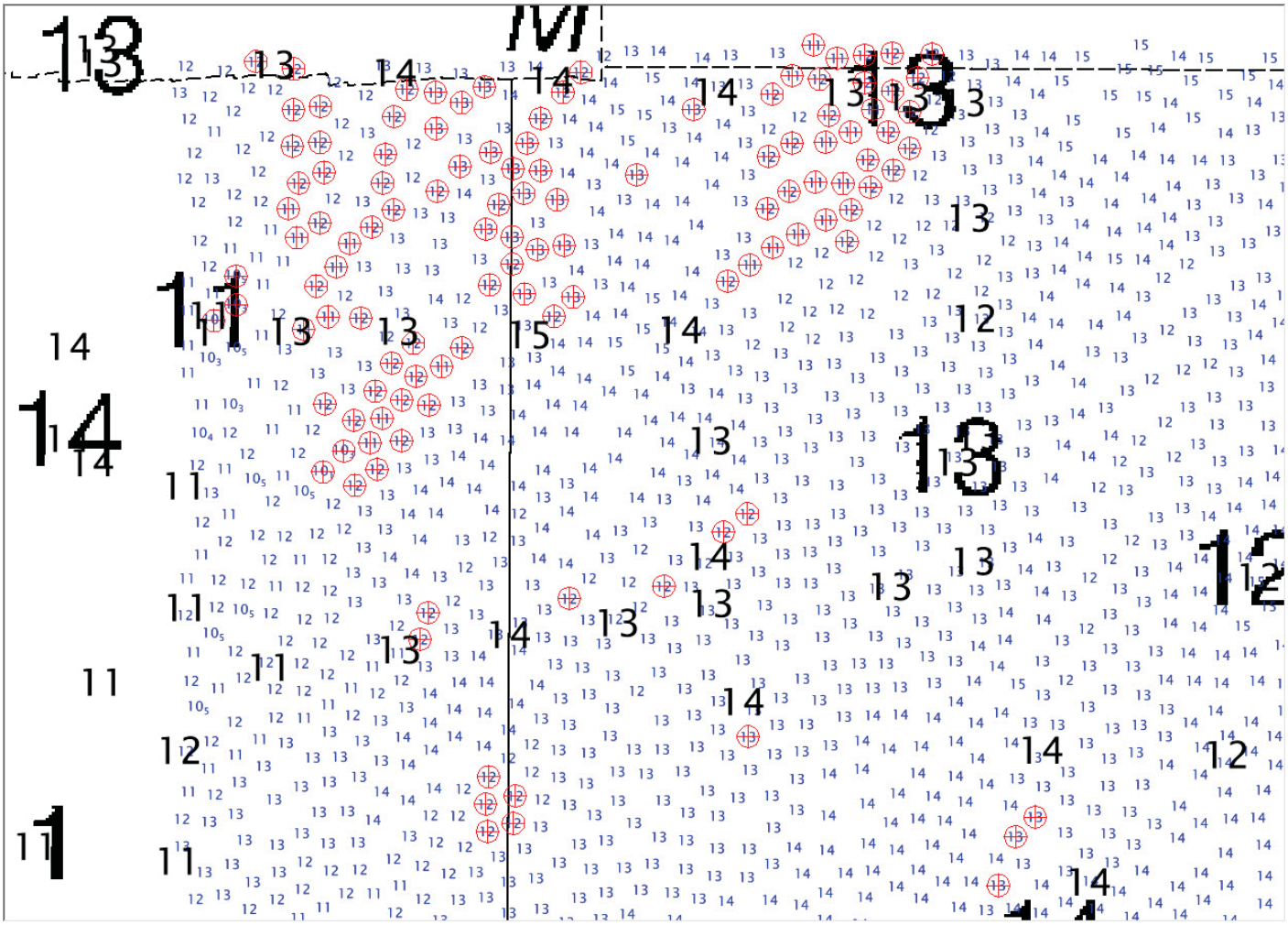


Figure 26: Areas indicating shoaling in comparison to charted soundings. Black soundings are from the ENC and RNC. Blue soundings are generated from surveyed depths.

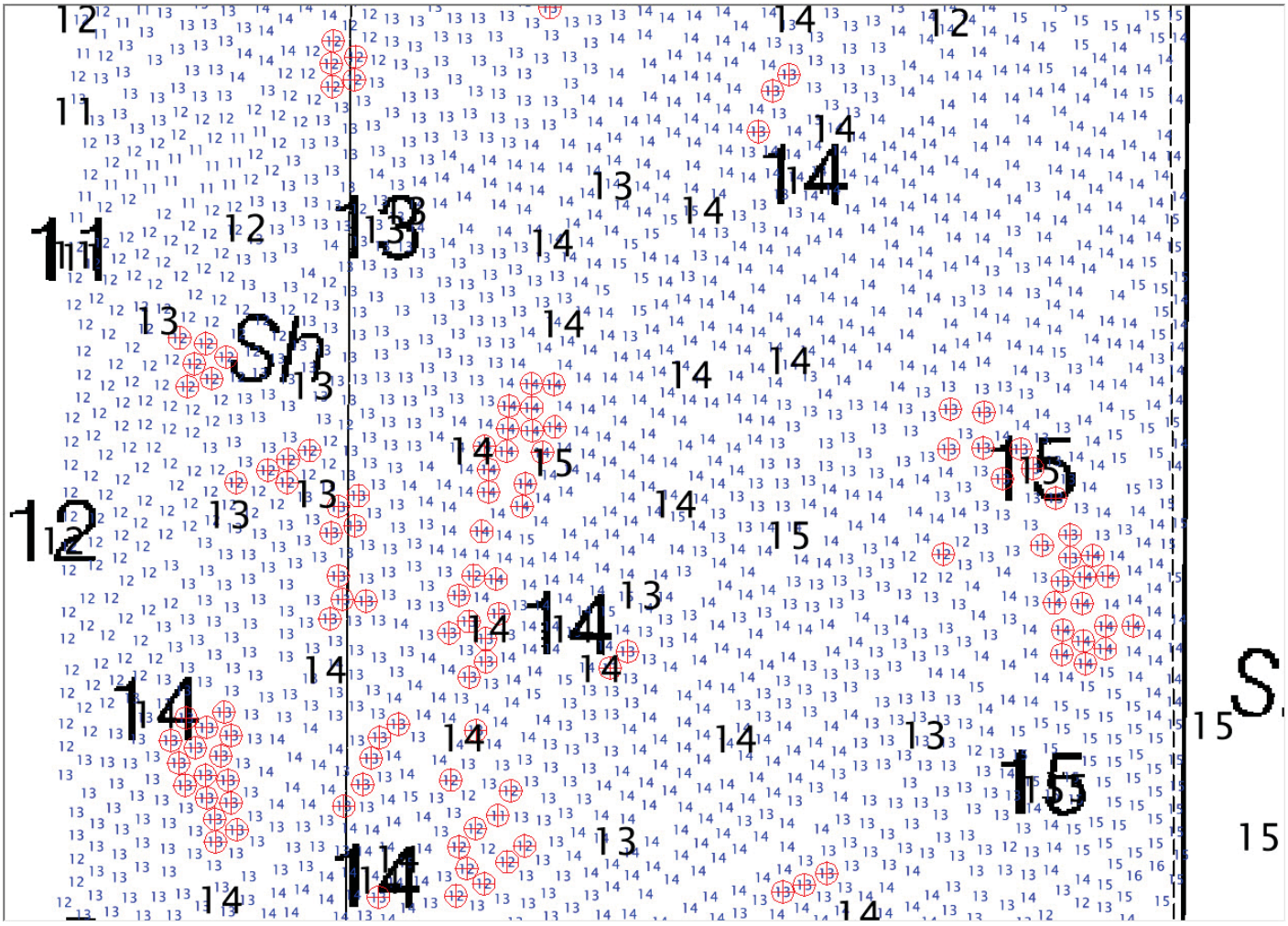


Figure 27: Areas indicating shoaling in comparison to charted soundings. Black soundings are from the ENC and RNC. Blue soundings are generated from surveyed depths.

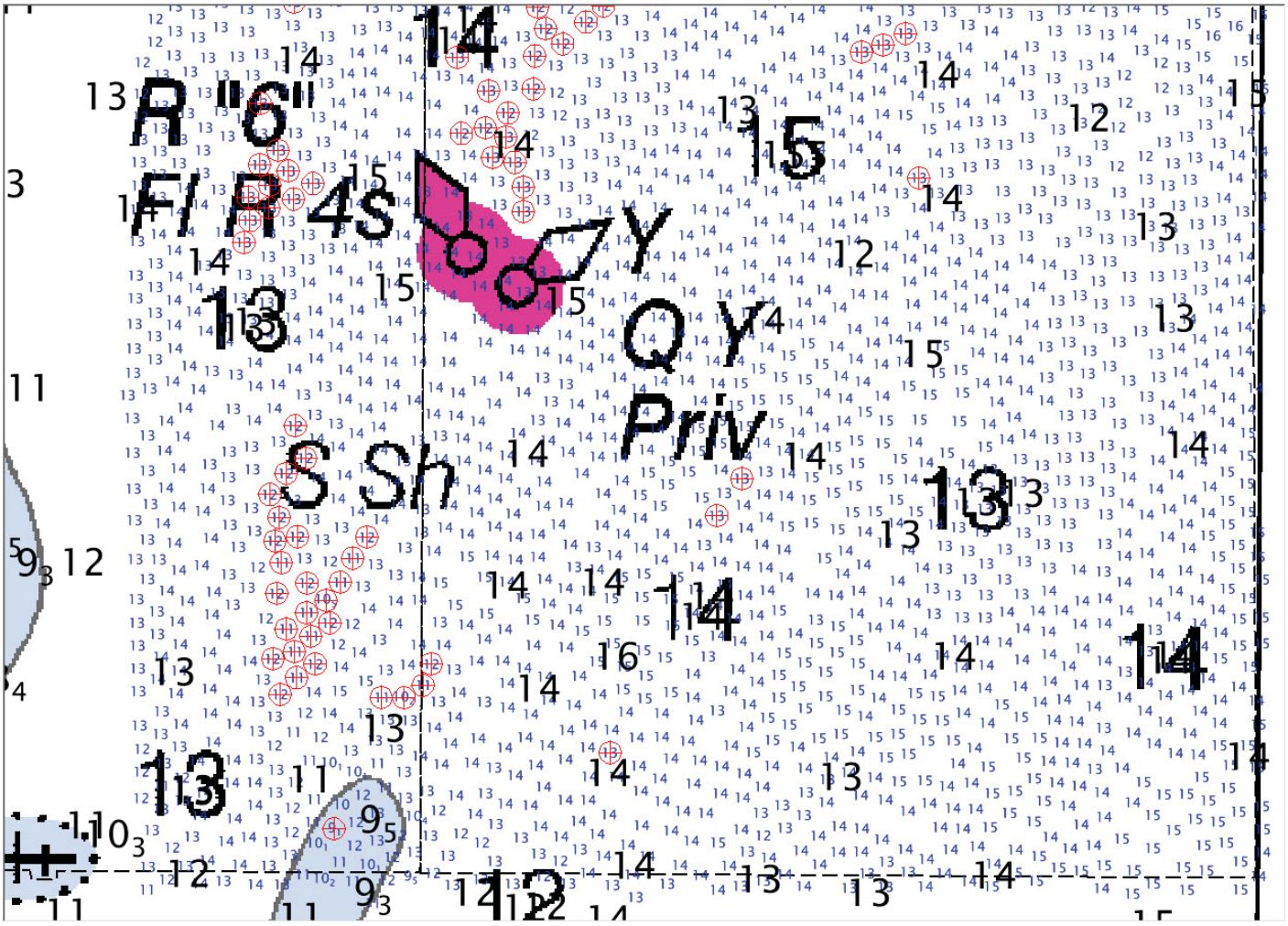


Figure 28: Areas indicating shoaling in comparison to charted soundings. Black soundings are from the ENC and RNC. Blue soundings are generated from surveyed depths.

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
12204	1:80000	38	12/2016	12/24/2016	12/24/2016
12207	1:80000	24	07/2014	12/10/2016	12/10/2016
12200	1:419706	51	05/2014	12/10/2016	12/10/2016

Table 12: Largest Scale Raster Charts

12204

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

12207

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

12200

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4NC53M	1:80000	27	10/07/2016	10/07/2016	NO
US4NC32M	1:80000	12	09/23/2016	09/23/2016	NO
US4NC31M	1:80000	20	09/07/2016	09/07/2016	NO
US3DE01M	1:80000	17	01/28/2016	04/07/2016	NO

Table 13: Largest Scale ENCs

US4NC53M

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

US4NC32M

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

US4NC31M

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

US3DE01M

Comparison was combined into the ENC/Survey soundings comparison shown section D.1.

D.1.3 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.4 Charted Features

No charted features exist for this survey.

D.1.5 Uncharted Features

One uncharted wreck was found within survey H12859. Information on the wreck is included in the Final Feature File.

D.1.6 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.7 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.8 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.1.9 Bottom Samples

Seven (7) bottom samples were attempted. Of the seven attempted, five returned with positive samples. and two yielded no samples after three attempts. Per section 7.5 of the 2015 HSSD, the negative samples have been included in the final feature file with NATSUR (nature of surface) attribution of "unknown." Consult the H12859_Final_Feature_File.hob file for more information about the bottom samples in the survey area.

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 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

One red navigational buoy exists in H12859 but was not assigned. The buoy appeared well positioned visually and is serving it's intended purpose.

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 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No Significant Features 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 Recommendation

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

D.2.11 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 then Commanding Officer, LCDR Briana J. Welton's 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 and Specifications Deliverables Manual, 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
LCDR Matthew J. Jaskoski	Commanding Officer	01/31/2017	Digitally signed by JASKOSKI.MATTHEW.J.1275636262 Date: 2017.02.02 14:24:26 -05'00'
LT Nicholas C. Morgan	Field Operations Officer	01/31/2017	Digitally signed by MORGAN.NICHOLAS.CHARLES.1292288138 Date: 2017.02.06 18:46:34 -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	Continually Operating Reference Staiton
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
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
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
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	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	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
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPE	Total Propagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

APPENDIX I

TIDES AND WATER LEVELS

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : March 31, 2016

HYDROGRAPHIC BRANCH: Atlantic
HYDROGRAPHIC PROJECT: OPR-D304-FH-2016
HYDROGRAPHIC SHEET: H12859

LOCALITY: 14 Miles East of Poyner Hill
TIME PERIOD: February 23 - March 23, 2016

TIDE STATION USED: 8651370 Duck, NC
Lat. 36° 11.0'N Long. 75° 44.8' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.027 meters

REMARKS: RECOMMENDED ZONING

Preliminary zoning is accepted as the final zoning for project OPR-D304-FH-2016, H12859, during the time period between February 23 and March 23, 2016.

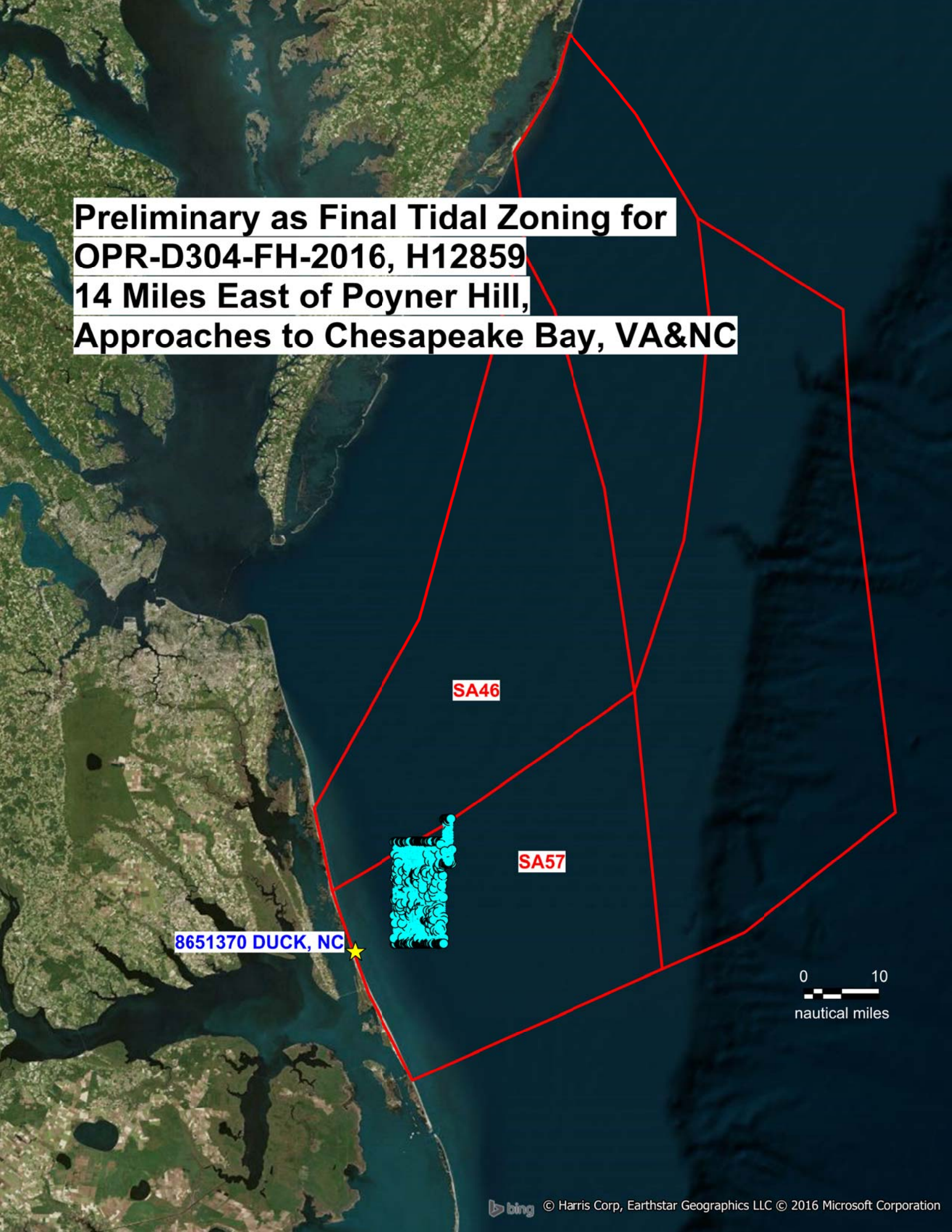
Please use the zoning file D304FH2016CORP submitted with the project instructions for D304-FH-2016. Zones SA46 and SA57 are the applicable zones for H12859.

Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

MICHALSKI.MICHAEL.PAUL.1280465174
Digitally signed by MICHALSKI.MICHAEL.PAUL.1280465174
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=MICHALSKI.MICHAEL.PAUL.1280465174
Date: 2016.04.01 15:57:41 -04'00'

ACTING CHIEF, PRODUCTS AND SERVICES BRANCH


Preliminary as Final Tidal Zoning for
OPR-D304-FH-2016, H12859
14 Miles East of Poyner Hill,
Approaches to Chesapeake Bay, VA&NC
SA46
SA57
8651370 DUCK, NC
0
10
nautical miles
bing
© Harris Corp, Earthstar Geographics LLC © 2016 Microsoft Corporation

Melody Ovard - NOAA Federal <melody.ovard@noaa.gov>

Fwd: Final Tide Notes for OPR-D304-FH-2016, Registry Nos. H12858 & 12859

2 messages

Paul Turner - NOAA Federal <paul.turner@noaa.gov> Fri, May 5, 2017 at 1:16 PM
To: Melody Ovard - NOAA Federal <melody.ovard@noaa.gov>
Cc: Castle Parker <castle.e.parker@noaa.gov>, "nicholas.morgan" <nicholas.morgan@noaa.gov>

The Tide Note for H12858 is attached.

Paul
---------- Forwarded message ----------
From: **Michael Gonsalves - NOAA Federal** <michael.gonsalves@noaa.gov>
Date: Fri, Apr 1, 2016 at 6:32 PM
Subject: Fwd: Final Tide Notes for OPR-D304-FH-2016, Registry Nos. H12858 & 12859
To: Paul Turner - NOAA Federal <Paul.Turner@noaa.gov>
Cc: Corey Allen - NOAA Federal <corey.allen@noaa.gov>

This was your project, correct Paul?
FYI - prelim. accepted as final.

~~ mog

---------- Forwarded message ----------
From: **Hua Yang - NOAA Affiliate** <hua.yang@noaa.gov>
Date: Fri, Apr 1, 2016 at 4:05 PM
Subject: Final Tide Notes for OPR-D304-FH-2016, Registry Nos. H12858 & 12859
To: "CO.Ferdinand Hassler - NOAA Service Account" <co.ferdinand.hassler@noaa.gov>, "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Corey Allen - NOAA Federal <Corey.allen@noaa.gov>, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Castle Parker - NOAA Federal <Castle.E.Parker@noaa.gov>, AHB Chief - NOAA Service Account <ahb.chief@noaa.gov>, Michael Michalski - NOAA Federal <Michael.Michalski@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

DATE: 04/01/2016

MEMORANDUM FOR: LCDR Briana Welton
Commanding Officer, Ferdinand Hassler

FROM: Michael Michalski
Acting Chief, Products and Services Branch, N/OPS3

SUBJECT: Delivery of Tide Requirements for Hydrographic Surveys

This is notification that the preliminary zoning is accepted as the final zoning for survey project OPR-D304-FH-2016, Registry Nos. H12858 & 12859, during the time period between February 17 and March 23, 2016. The accepted reference station for Registry Nos. H12858 & 12859 is Duck, NC (8651370).

Included with this memo are Tide Notes in PDF format, stating the preliminary zoning has been accepted as the final zoning.

Thanks,

Hua Yang

Hydrographic Planning Team
NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
Station 7128
1305 East West Highway, SSMC4
Silver Spring, MD 20910
Office: 240-533-0612
Email: Hua.Yang@noaa.gov
Web: http://tidesandcurrents.noaa.gov/

Hydro Hot List: http://tidesandcurrents.noaa.gov/hydro.shtml

--
Paul Turner
NOAA's Office of Coast Survey
1315 East West Hwy, SSMC3 Rm.6747
Silver Spring, MD 20910

301-713-2698 ext 113
Paul.Turner@noaa.gov

2 attachments

H12858.pdf
546K

H12859.pdf
615K

Melody Ovard - NOAA Federal <melody.ovard@noaa.gov> Fri, May 5, 2017 at 1:55 PM
To: Paul Turner - NOAA Federal <paul.turner@noaa.gov>

Thank you Paul.

[Quoted text hidden]
--
Melody Ovard
Physical Scientist
National Oceanic and Atmospheric Administration
Atlantic Hydrographic Branch
439 W. York St
Norfolk, VA 23510
757-441-6746 x 209

APPENDIX II

SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

ERS Checkline Analysis and VDatum ERZT comparison

OPR-D304-FH-15 Approaches to Chesapeake Bay

NOAA Ship *Ferdinand R. Hassler*

ERS checklines were run spanning the total project area of OPR-D304-FH-15. Bathymetry was collected, SBETs applied, and an ERZT separation model was created and a difference surface was created using the datum height of the separation model and Vdatum model. A preliminary .tid file was used with the project .zdf file.

SBETs were colored by RMS position error (both vertical and horizontal) and the highest RMS value was less than or equal to 0.07 m. This maximum uncertainty value was seen on the checkline that was run furthest away from the base station assigned for the project (DUCK). All of the other SBETs that were processed have yielded a position RMS value of less than or equal to 0.05 m This is lower than our zoned tide uncertainty value of 0.16 m, suggesting it would be beneficial to use SBETs in processing. The ERZT Vdatum difference surface was exported to ASCII and the statistics utility was used giving a mean of -0.03 m and a deviation of 0.09 m.

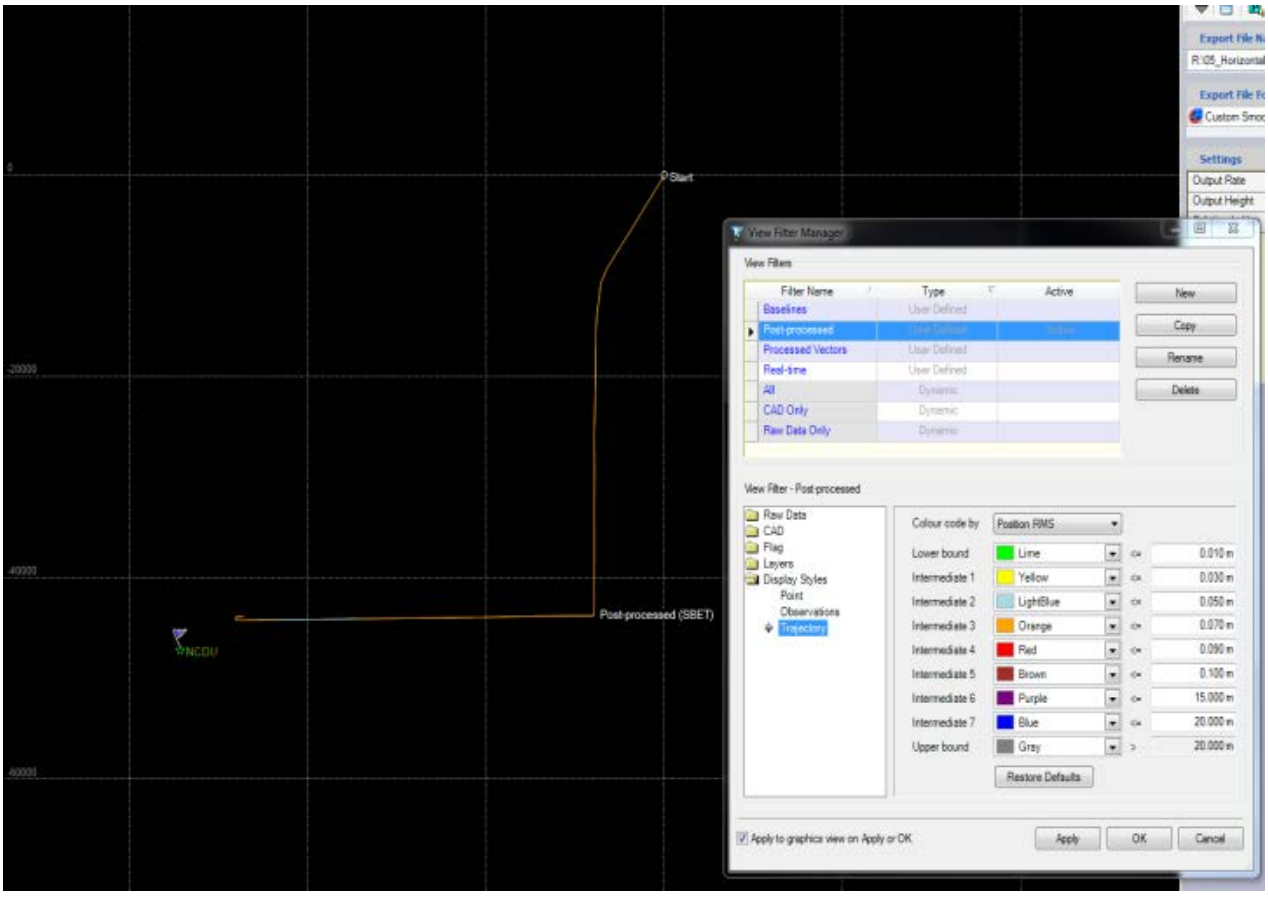


Figure 1: Day 210 Port SONAR SBET position RMS

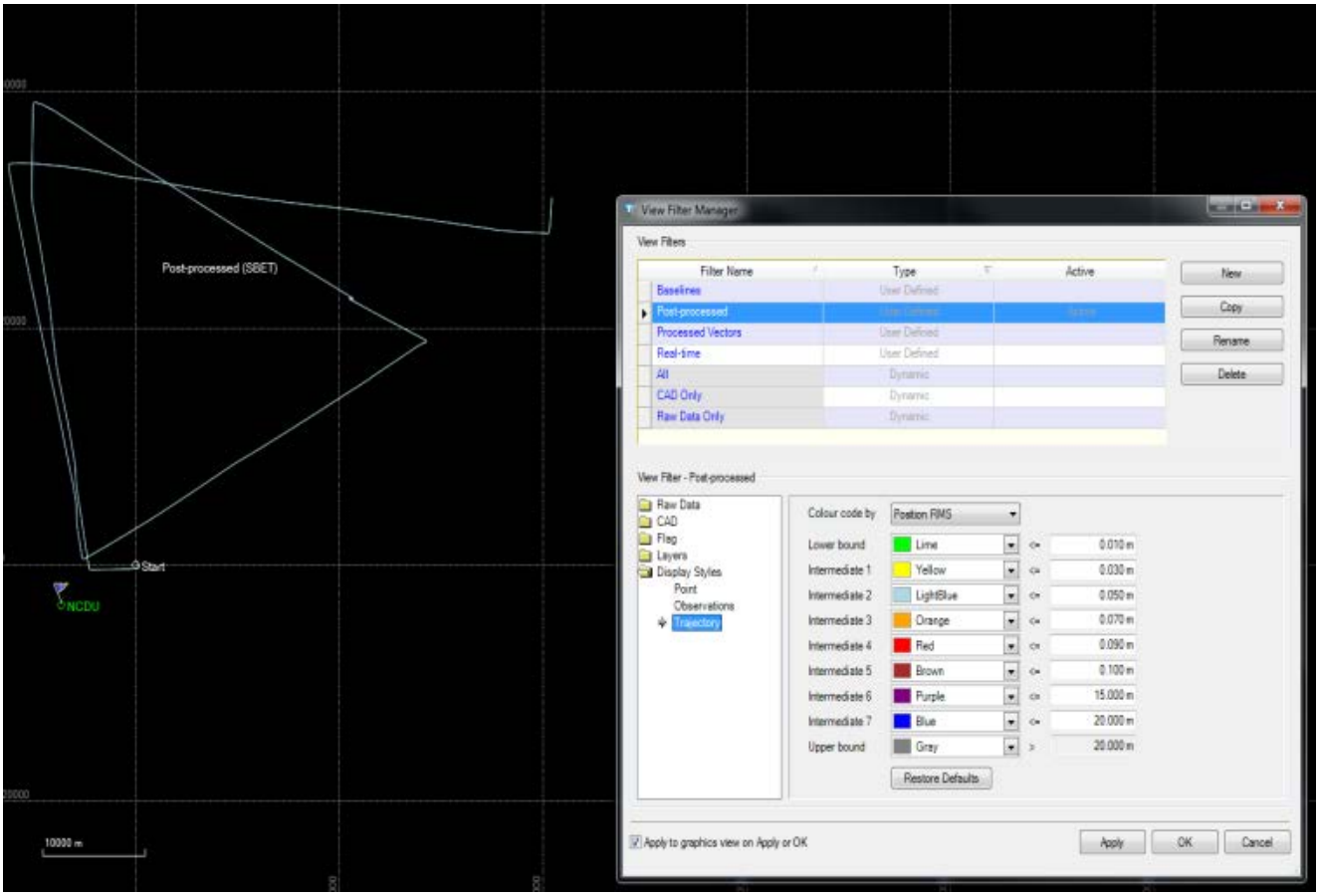


Figure 2: Day 210 Port SONAR position RMS Continued

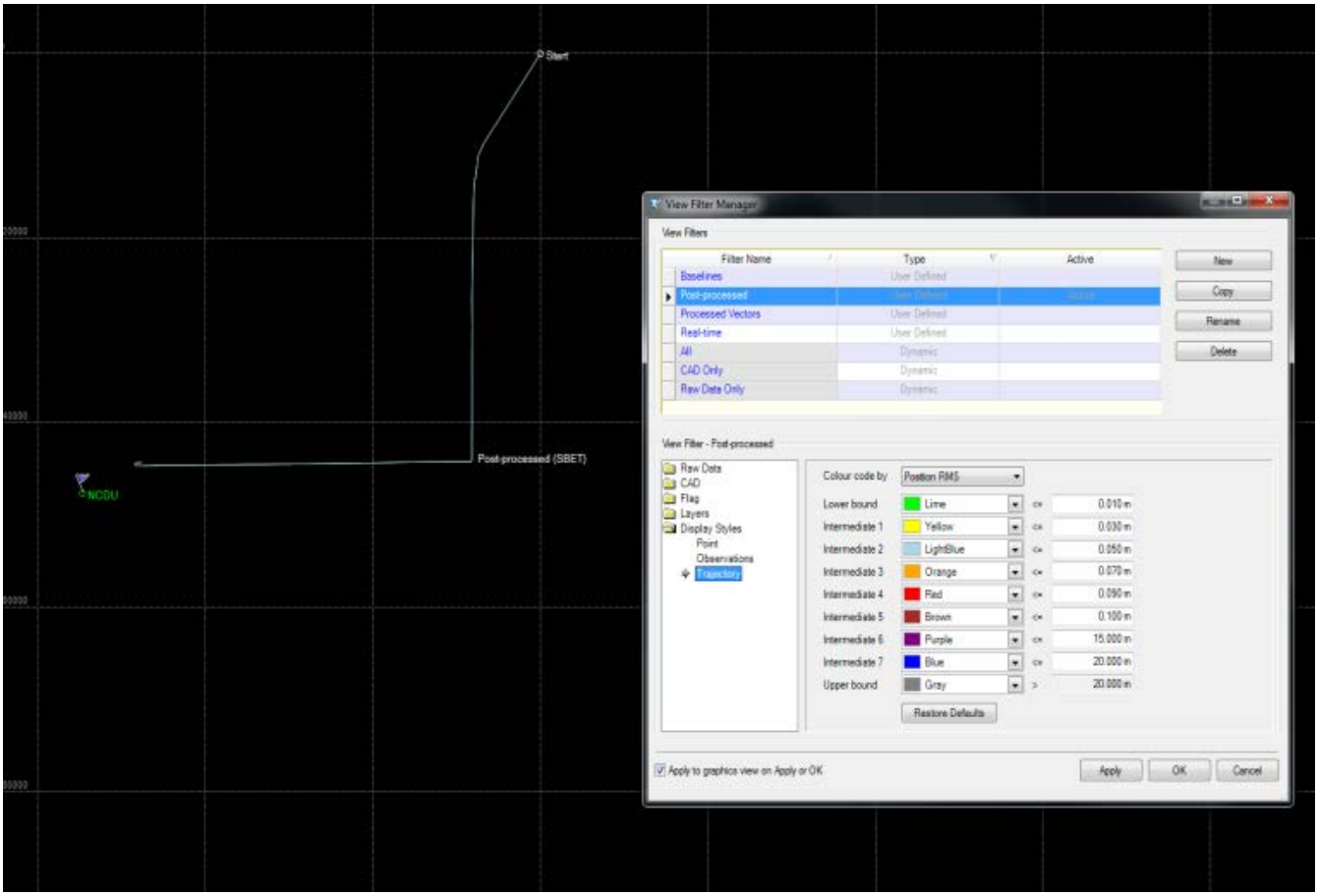


Figure 3: Day 20 Starboard SONAR SBET positon RMS

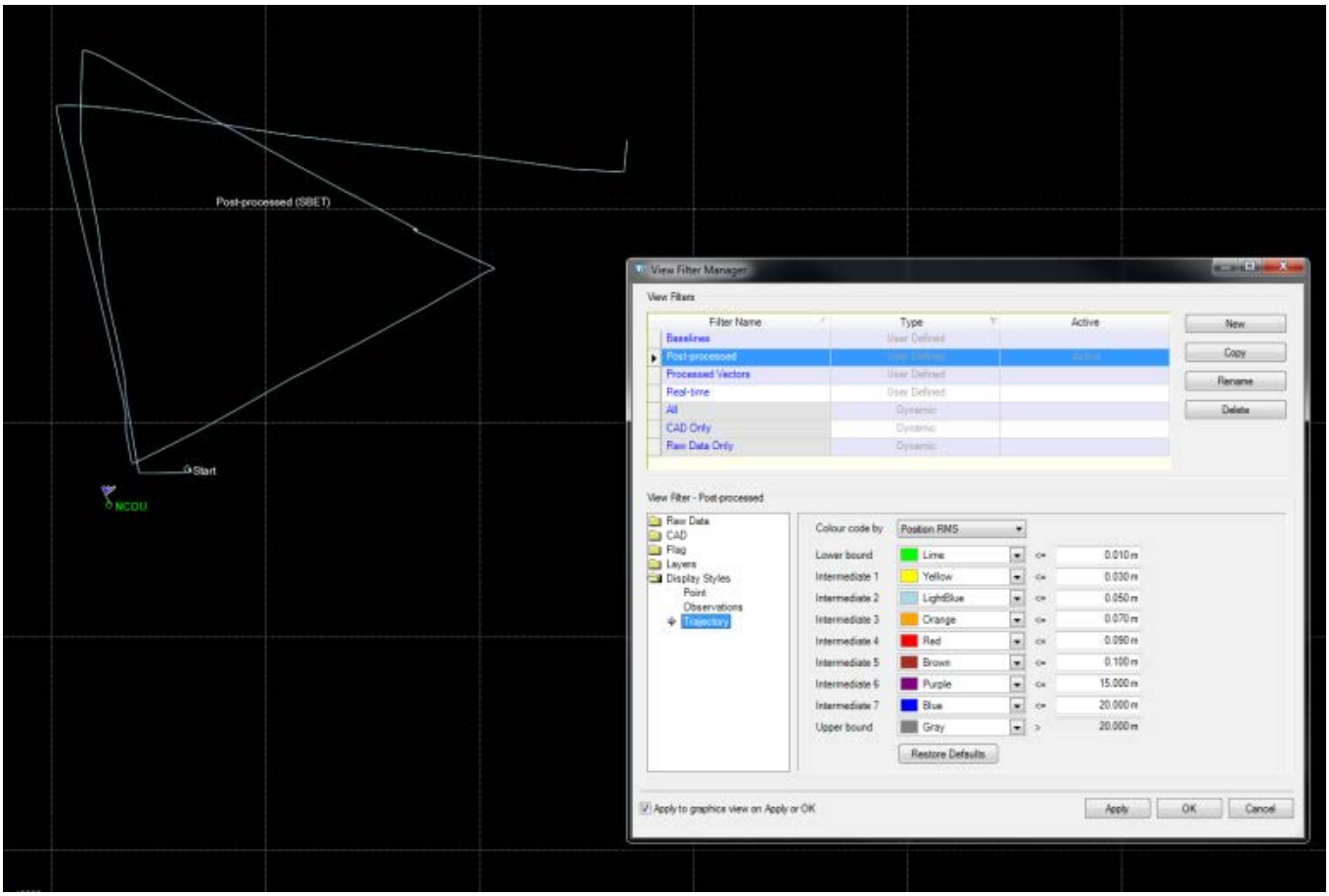
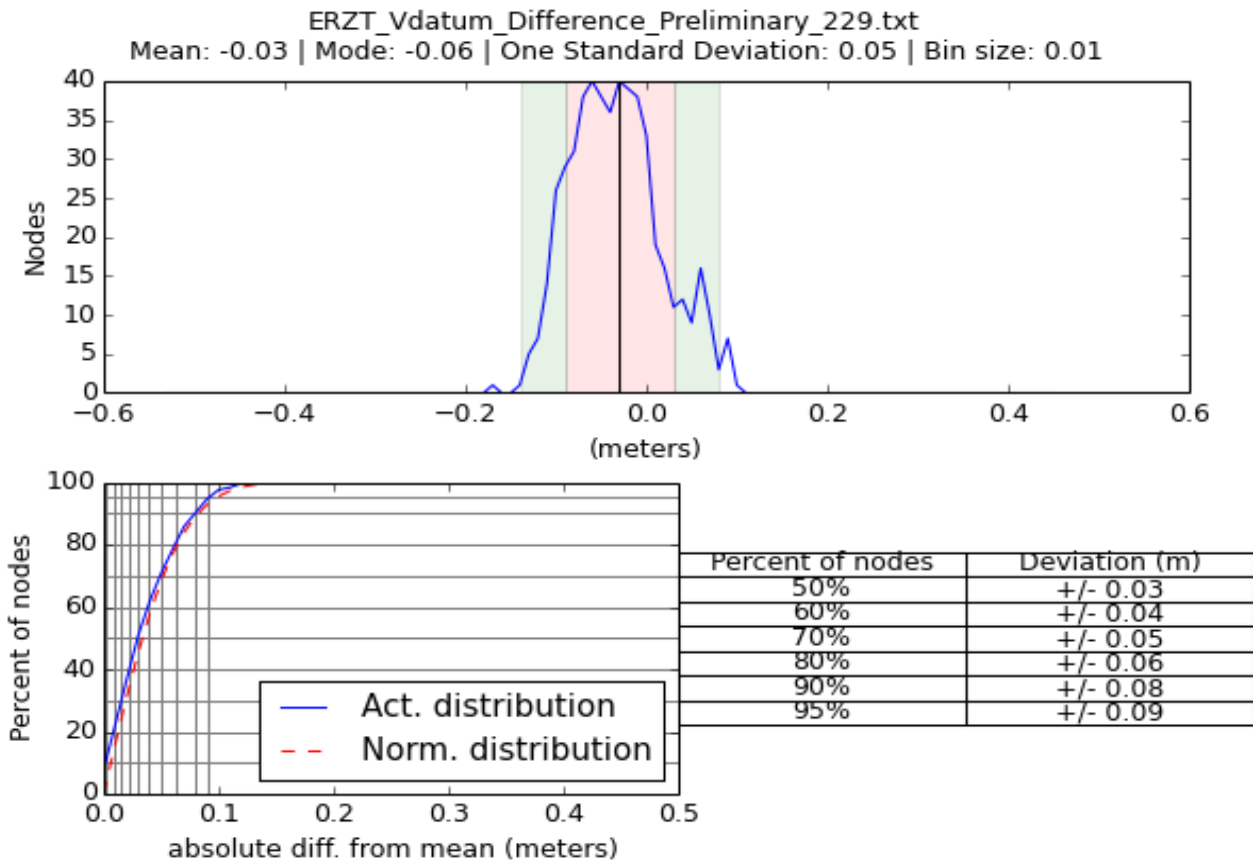


Figure 4: Day 210 Starboard SONAR SBET position RMS continued



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.09

Figure 5: ERZT Vdatum difference surface statistics

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov>

Request for Final Tides, OPR-D304-FH-16; H12859

6 messages

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> Tue, Mar 29, 2016 at 2:26 PM
To: ": Final Tides - NOAA Service Account" <Final.Tides@noaa.gov>
Cc: Patrick Berube - NOAA Federal <patrick.j.berube@noaa.gov>, Jon Andvick - NOAA Federal <jon.andvick@noaa.gov>

Good Morning,

Please find attached the final tide request for OPR-D304-FH-16,survey H12859.

Thank you,
LT Nick Morgan

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

2 attachments

H12859_Final_Tide_Request.pdf
35K

H12859_Final_Tide_Request.zip
359K

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> Wed, Jul 20, 2016 at 11:10 AM
To: ": Final Tides - NOAA Service Account" <Final.Tides@noaa.gov>
Cc: Kimberly Glomb - NOAA Federal <kimberly.glomb@noaa.gov>, Rita Bowker - NOAA Federal <rita.s.bowker@noaa.gov>

Hello,

I would just like to check in on the Final Tides Request for this survey. I don't believe we have gotten any response.

Thank you,
LT Morgan

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

[Quoted text hidden]

Final Tides - NOAA Service Account <final.tides@noaa.gov> Wed, Jul 20, 2016 at 11:55 AM
To: "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Kimberly Glomb - NOAA Federal <kimberly.glomb@noaa.gov>, Rita Bowker - NOAA Federal <rita.s.bowker@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

Hi LT Morgan,

We have sent the two completed final tide notes (H12858 and H12859) on April 04, 2016.

Below please find the forwarded email.

Thank you for your inquiry.

---------- Forwarded message ----------
From: **Hua Yang - NOAA Affiliate** <hua.yang@noaa.gov>
Date: Fri, Apr 1, 2016 at 4:05 PM
Subject: Final Tide Notes for OPR-D304-FH-2016, Registry Nos. H12858 & 12859
To: "CO.Ferdinand Hassler - NOAA Service Account" <co.ferdinand.hassler@noaa.gov>, "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Corey Allen - NOAA Federal <Corey.allen@noaa.gov>, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Castle Parker - NOAA Federal <Castle.E.Parker@noaa.gov>, AHB Chief - NOAA Service Account <ahb.chief@noaa.gov>, Michael Michalski - NOAA Federal <Michael.Michalski@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

Inline image 1

DATE: 04/01/2016

MEMORANDUM FOR: LCDR Briana Welton
Commanding Officer, Ferdinand Hassler

FROM: Michael Michalski
Acting Chief, Products and Services Branch, N/OPS3

SUBJECT: Delivery of Tide Requirements for Hydrographic Surveys

This is notification that the preliminary zoning is accepted as the final zoning for survey project OPR-D304-FH-2016, Registry Nos. H12858 & 12859, during the time period between February 17 and March 23, 2016. The accepted reference station for Registry Nos. H12858 & 12859 is Duck, NC (8651370).

Included with this memo are Tide Notes in PDF format, stating the preliminary zoning has been accepted as the final zoning.

Thanks,

Hua Yang

Hydrographic Planning Team
NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
Station 7128
1305 East West Highway, SSMC4
Silver Spring, MD 20910
Office: 240-533-0612
Email: Hua.Yang@noaa.gov
Web: http://tidesandcurrents.noaa.gov/

Hydro Hot List: http://tidesandcurrents.noaa.gov/hydro.shtml

[Quoted text hidden]

2 attachments

H12858.pdf
546K

H12859.pdf
615K

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov> Wed, Jul 20, 2016 at 12:01 PM

To: Final Tides - NOAA Service Account <final.tides@noaa.gov>
Cc: Kimberly Glomb - NOAA Federal <kimberly.glomb@noaa.gov>, Rita Bowker - NOAA Federal <rita.s.bowker@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

My apologies, I missed it in my archived emails. Thank you for the quick response.

-Nick

Field Operations Officer, NOAA Ship *Ferdinand R. Hassler*
29 Wentworth Road
New Castle, NH, 03854

[Quoted text hidden]

Final Tides - NOAA Service Account <final.tides@noaa.gov> Wed, Jul 20, 2016 at 12:07 PM
To: "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Kimberly Glomb - NOAA Federal <kimberly.glomb@noaa.gov>, Rita Bowker - NOAA Federal <rita.s.bowker@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

Not a problem. Have a good day!
[Quoted text hidden]

Rita Bowker - NOAA Federal <rita.s.bowker@noaa.gov> Wed, Sep 28, 2016 at 8:09 AM
To: "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>

Hi Lt Morgan
I have not had a chance to work on the survey while up at the yard since we did not have netapps. The other problem is I have been unable to TPU the data. After working with AHB, we decided I would need to delete the data I've been working on off our netapps and redownload the data from the drive you sent. As TJ is about to start our season this coming Monday, TJ surveys are priority. In this regard, what would you like me to do with the H12859- I imagine you do not want it just sitting around on our ship not being worked on.

If you want your survey back, I can send you copies of the logs I updated with the problems I found as well as the updated svp file (that now includes the mvp file Hassler missed).

Please let me know how you would like to proceed.

Sincerely,
Rita Bowker
[Quoted text hidden]

OPS.Ferdinand Hassler - NOAA Service Account <ops.ferdinand.hassler@noaa.gov>

Final Tide Notes for OPR-D304-FH-2016, Registry Nos. H12858 & 12859

1 message

Hua Yang - NOAA Affiliate <hua.yang@noaa.gov> Fri, Apr 1, 2016 at 4:05 PM
To: "CO.Ferdinand Hassler - NOAA Service Account" <co.ferdinand.hassler@noaa.gov>, "OPS.Ferdinand Hassler - NOAA Service Account" <ops.ferdinand.hassler@noaa.gov>
Cc: Corey Allen - NOAA Federal <Corey.allen@noaa.gov>, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Castle Parker - NOAA Federal <Castle.E.Parker@noaa.gov>, AHB Chief - NOAA Service Account <ahb.chief@noaa.gov>, Michael Michalski - NOAA Federal <Michael.Michalski@noaa.gov>, "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

DATE: 04/01/2016

MEMORANDUM FOR: LCDR Briana Welton
Commanding Officer, Ferdinand Hassler

FROM: Michael Michalski
Acting Chief, Products and Services Branch, N/OPS3

SUBJECT: Delivery of Tide Requirements for Hydrographic Surveys

This is notification that the preliminary zoning is accepted as the final zoning for survey project OPR-D304-FH-2016, Registry Nos. H12858 & 12859, during the time period between February 17 and March 23, 2016. The accepted reference station for Registry Nos. H12858 & 12859 is Duck, NC (8651370).

Included with this memo are Tide Notes in PDF format, stating the preliminary zoning has been accepted as the final zoning.

Thanks,

Hua Yang

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NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
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Hydro Hot List: http://tidesandcurrents.noaa.gov/hydro.shtml

2 attachments

H12858.pdf
546K

H12859.pdf
615K

APPROVAL PAGE

H12859

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

- H12859_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12859_GeoImage.pdf

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.

Digitally signed by HILLSTROM.BRIANA.WELTON.1267667531
Date: 2017.10.26 11:09:43 -04'00'

Approved: _____

Lieutenant Commander Briana Welton Hillstrom, NOAA
Chief, Atlantic Hydrographic Branch