H12939

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12939

LOCALITY

State(s):	Alaska
General Locality:	Unalaska Island, AK
Sub-locality:	Vicinity of Eider Point and Wide Bay

2016

CHIEF OF PARTY
CDR Mark Van Waes, NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12939**

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):	**Alaska**
General Locality:	**Unalaska Island, AK**
Sub-Locality:	**Vicinity of Eider Point and Wide Bay**
Scale:	**20000**
Dates of Survey:	**08/12/2016 to 08/22/2016**
Instructions Dated:	**07/23/2016**
Project Number:	**OPR-Q328-FA-16**
Field Unit:	**NOAA Ship *Fairweather***
Chief of Party:	**CDR Mark Van Waes, NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
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 H12939

Project: OPR-Q328-FA-16

Locality: Unalaska Island, AK

Sublocality: Vicinity of Eider Point and Wide Bay

Scale: 1:20000

August 2016 - August 2016

NOAA Ship *Fairweather*

Chief of Party: CDR Mark Van Waes, NOAA

A. Area Surveyed

The survey area is located on the North Coast of Unalaska Island, AK, within the sub-locality near Eider Point and Wide Bay.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
53° 58' 51.08" N 166° 38' 43.42" W	53° 55' 36.93" N 166° 30' 59.04" W

Table 1: Survey Limits

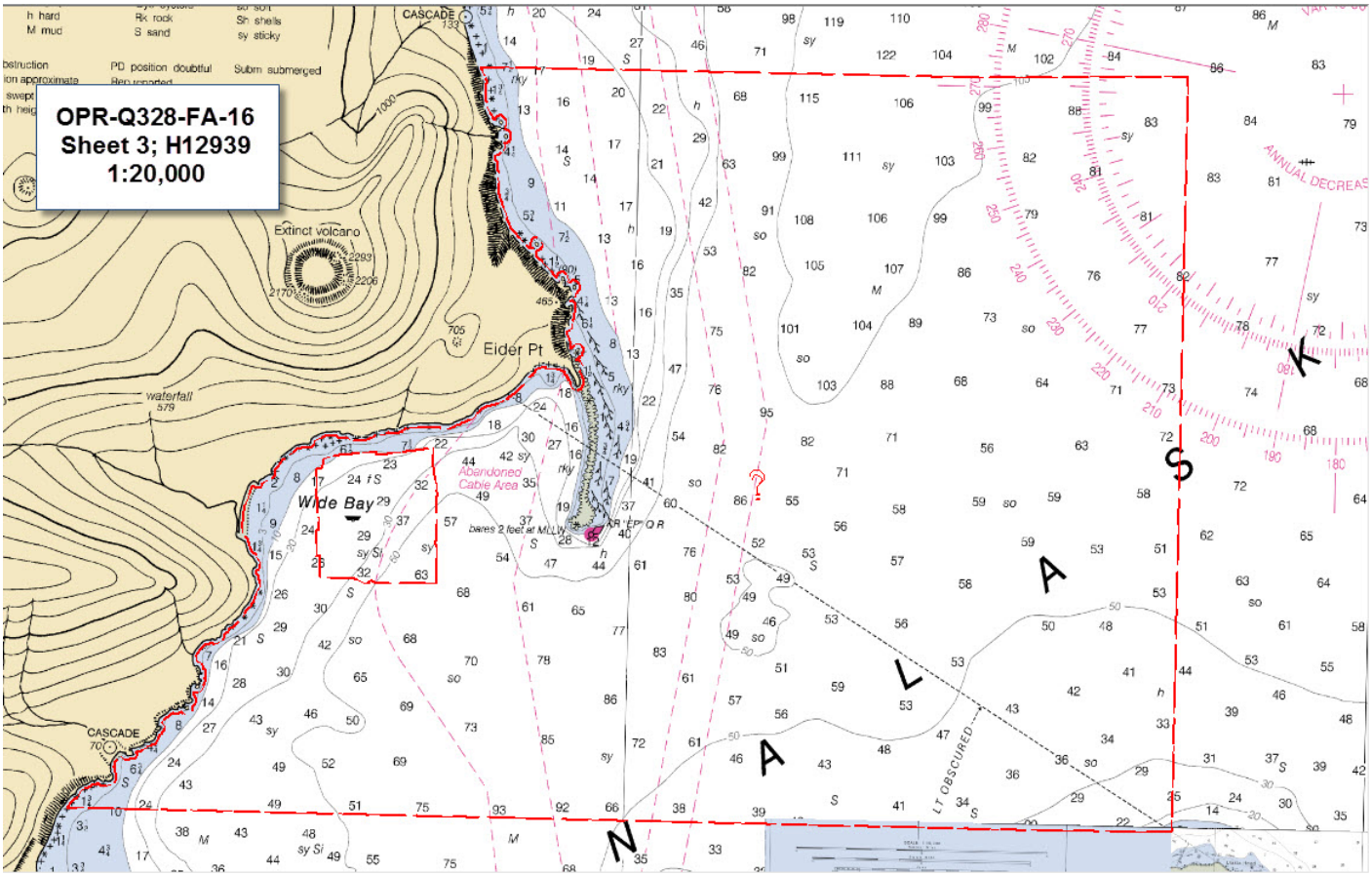


Figure 1: H12939 sheet limits (in red) overlaid onto Chart 16528

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2016 Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figure 1. In all areas where the 4-meter depth contour or the sheet limits were not met, the Navigable Area Limit Line (NALL) was defined by the inshore limit of safe navigation due to the risks of maneuvering the survey vessel in close proximity to the steep and rocky shoreline, particularly along the edges of the ledge that extends from Eider Point as shown in Figure 2.

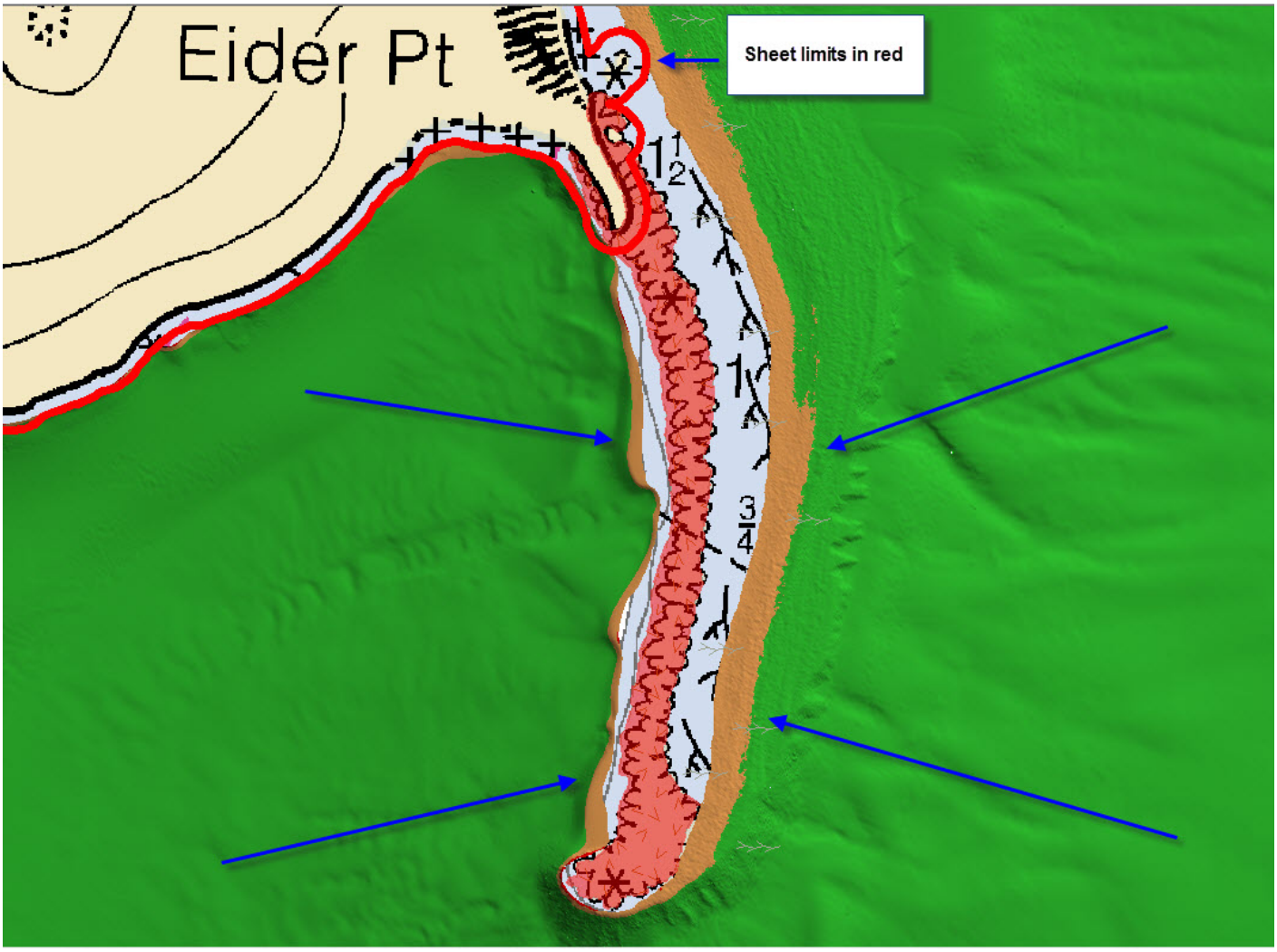


Figure 2: H12939 Area south of Eider Point where the NALL was defined by coverage to the extent of ledge

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service nautical charting products in a high commercial traffic area. This project covers 10.06 SNM and is a component of a survey that is a direct response to the USCG's request for a hydrographic survey after the July 2015 grounding of a polar ice class vessel, in addition to addressing local pilot requests for modern hydrography to support an increasing amount of vessel traffic in the area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H12939 meets multibeam echo sounder (MBES) coverage requirements for complete coverage, as required by the 2016 Hydrographic Surveys Specifications and Deliverables (HSSD). This

includes crosslines (see Section B.2.1), NOAA Allowable Uncertainty (see Section B.2.10), and density requirements (see Section B.2.11). Additional compliance statistics can be found in the Standards and Compliance Review 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
Inshore limit to 8 meters water depth	Either complete coverage or multibeam set line spacing at 25m, as identified in the PRF by CTNARE areas. Refer to HSSD Sections 5.2.2.3, 5.2.2.4, and 5.2.2.1
Greater than 8 meters water depth	Complete coverage. Refer to HSSD Section 5.2.2.3.

The entirety of H12939 was completed with MBES coverage with backscatter meeting the above listed requirements from the HSSD 2016. See Figure 3 for the coverage extent.

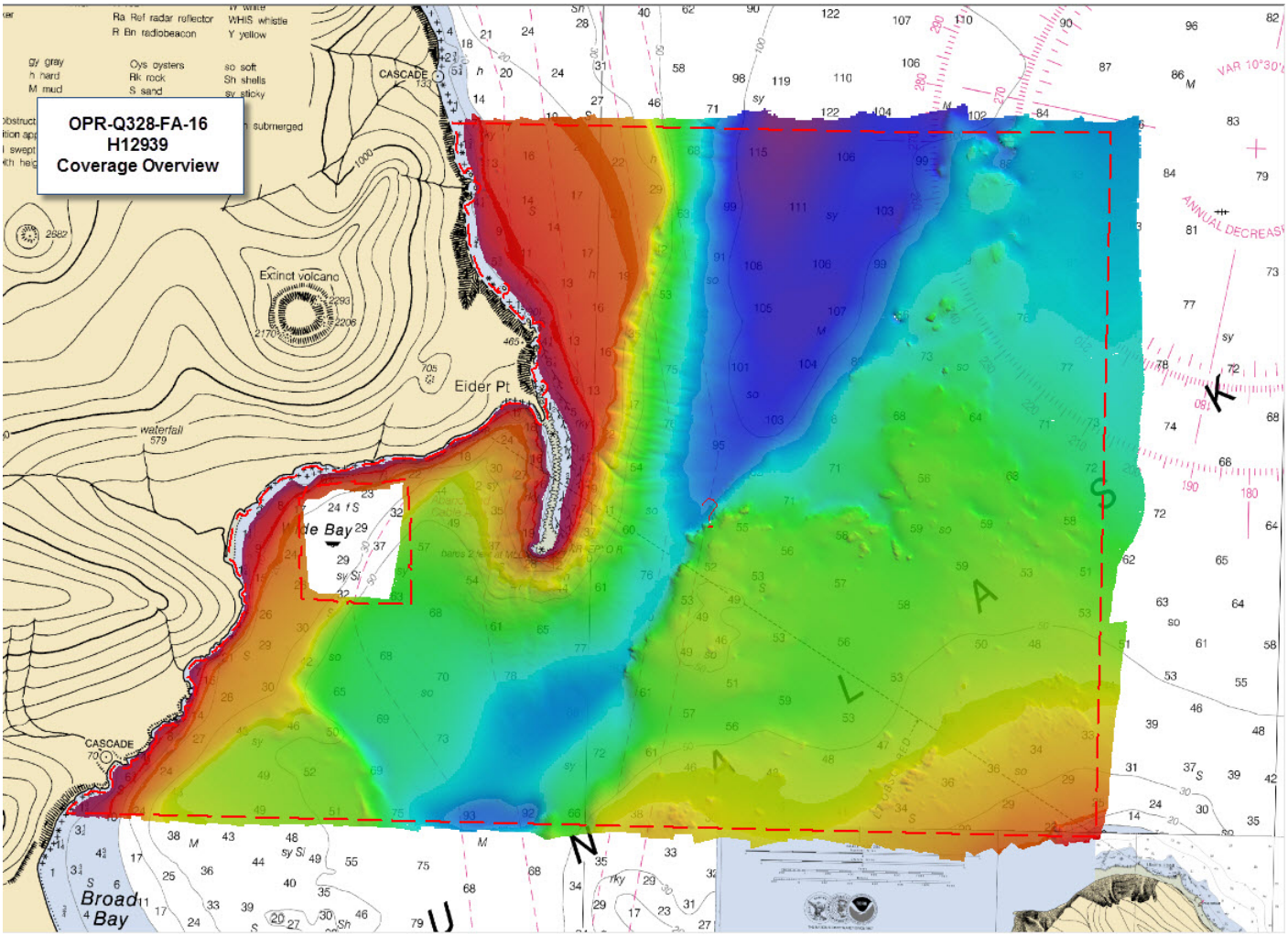


Figure 3: H12939 Coverage graphic

A.5 Survey Statistics

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

	HULL ID	*FA 2805*	*FA 2806*	*FA 2808*	*Total*
LNM	**SBES Mainscheme**	0	0	0	0
	MBES Mainscheme	50.41	25.53	32.21	108.15
	Lidar Mainscheme	0	0	0	0
	SSS Mainscheme	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0
	SBES/MBES Crosslines	4.57	3.17	0	7.74
	Lidar Crosslines	0	0	0	0
Number of Bottom Samples					4
Number Maritime Boundary Points Investigated					0
Number of DPs					4
Number of Items Investigated by Dive Ops					0
Total SNM					10.06

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/12/2016	225
08/15/2016	228

Survey Dates	Day of the Year
08/16/2016	229
08/18/2016	231
08/20/2016	233

Table 3: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	*2805*	*2806*	*2808*
LOA	8.64 meters	8.64 meters	8.64 meters
Draft	1.12 meters	1.12 meters	1.12 meters

Table 4: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
SeaBird	19plus	Conductivity, Temperature, and Depth Sensor
RESON	SVP71	Sound Speed System
Applanix	POS/MV V4	Positioning and Attitude System
RESON	7125	MBES

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 7.16% of mainscheme acquisition.

Crosslines were collected, processed, and compared in accordance with Section 5.3.4.3. To evaluate crosslines, a 16-meter CUBE surface using strictly mainscheme lines, and a 16-meter CUBE surface using strictly crosslines were created. From these two surfaces, a difference surface (mainscheme-cross line= difference surface) was generated at a 16-meter resolution (Figure 4), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference was -0.04 meters with 95% of nodes falling within 1.08 meters (Figure 5). For the respective depths, the difference surface was compared to the allowable NOAA accuracy standards (Figure 6). In total, 99.45% of the depth differences between H12939 mainscheme and crossline data are within allowable NOAA uncertainties (Figure 6, 7).

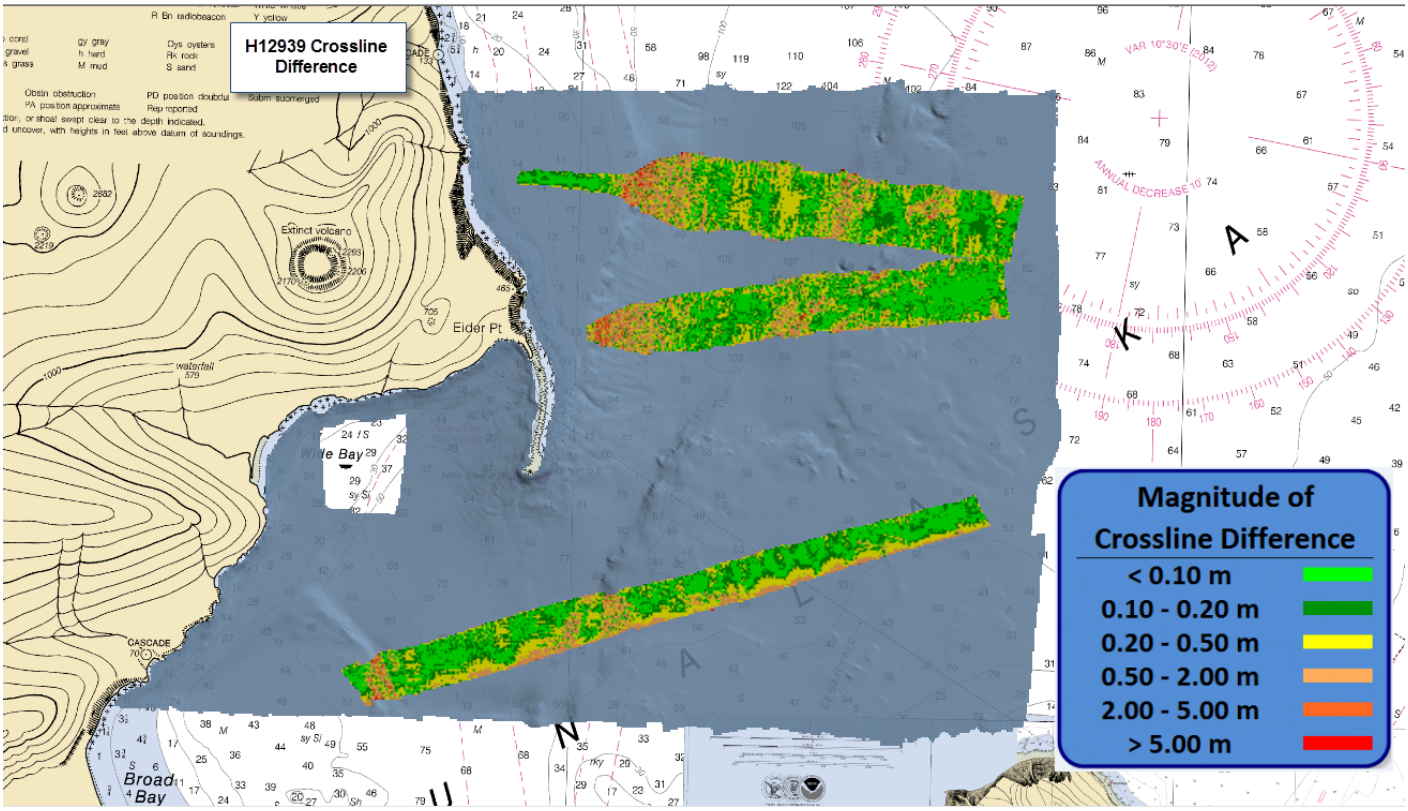
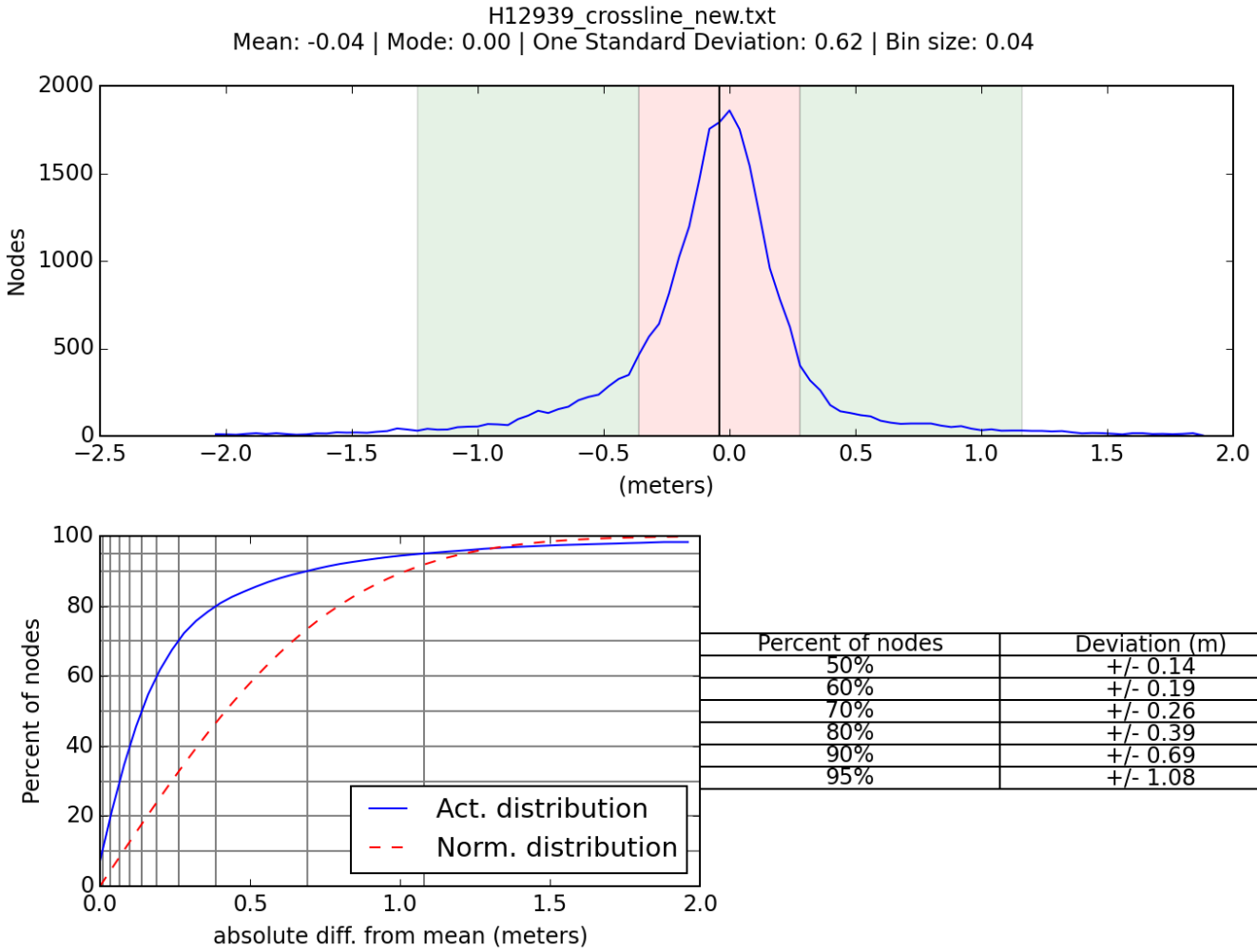


Figure 4: H12939 Mainscheme and crossline difference surface



Percent of nodes	Deviation (m)
50%	+/- 0.14
60%	+/- 0.19
70%	+/- 0.26
80%	+/- 0.39
90%	+/- 0.69
95%	+/- 1.08

Figure 5: H12939 Mainscheme and crossline difference statistics

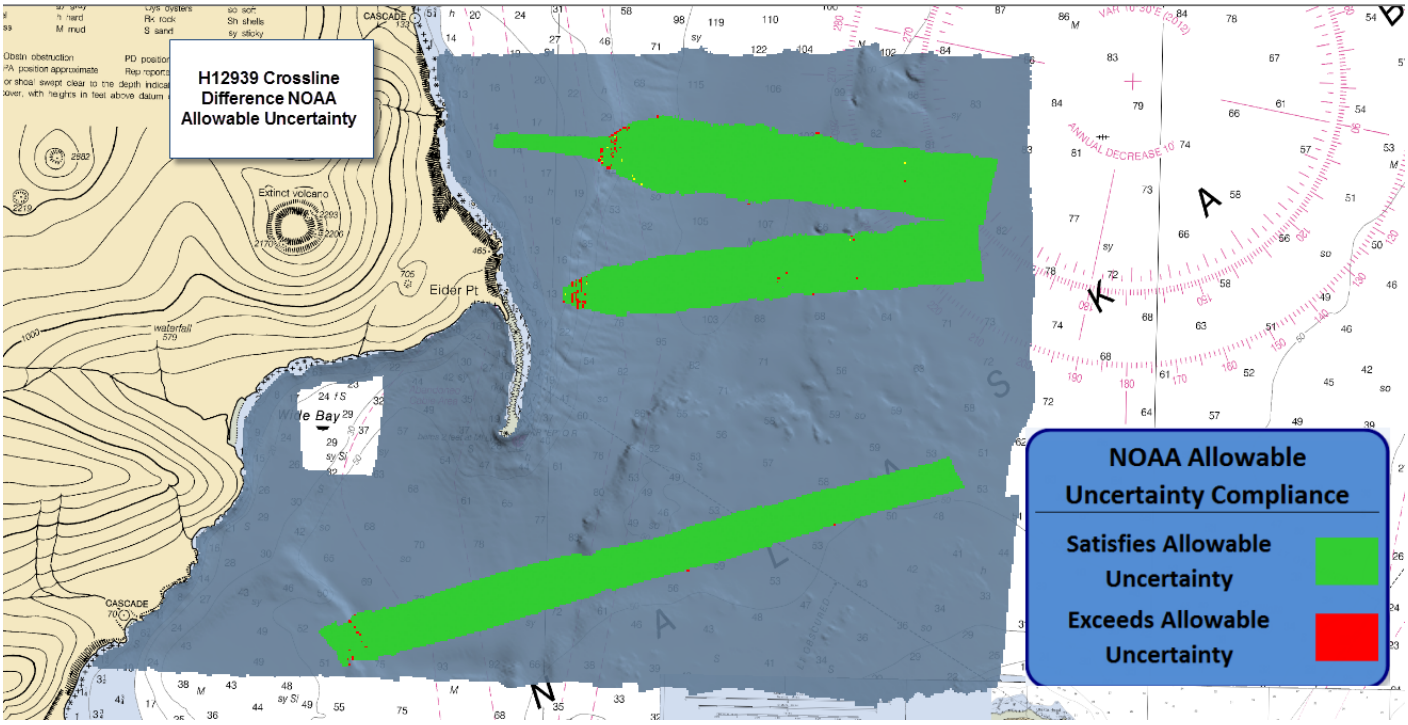


Figure 6: H12939 Crossline difference VS. Allowable NOAA Uncertainty

H12939 Crossline Differencing NOAA Allowable Uncertainty

Total Nodes	Passed Nodes	Failed Nodes
24,934	24,798	136
Percentage Nodes Passed		99.45%
Percentage Nodes Failed		0.54%

Figure 7: H12939 Crossline difference VS. Allowable NOAA Uncertainty statistics

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0 meters	0.06 meters	ERS via PMVD
0 meters	0.04 meters	ERS via PMVD

Table 6: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
2805	2 meters/second	N/A meters/second	0.5 meters/second
2806	2 meters/second	N/A meters/second	0.5 meters/second
2808	2 meters/second	N/A meters/second	0.5 meters/second

Table 7: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty provided via device models for vessel motion, discrete zoned tides, PMVD, and real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H12939. Real-time uncertainties were provided via Reson 7125 MBES data and Applanix Delayed Heave RMS. Following post-processing of vessel motion, real-time uncertainties of vessel roll, pitch, gyro, and navigation are applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac.

B.2.3 Junctions

H12939 junctions with three adjacent surveys from this project, H12937, H12938, H12940, and one survey from a prior project, F00601, as shown in Figure 8. Data overlap between H12939 and each adjacent survey was achieved. The areas of overlap between surveys were reviewed with CARIS HIPS and SIPS through surface differencing the 8 meter combined surface with F00601, H12937, and H12940, and with the the 16 meter combined surface for H12938 to assess surface agreement. The multibeam data was also examined in CARIS Subset Editor for consistency and agreement. All junctions with H12939 meet the NOAA Allowable Uncertainty in their areas of overlap. For all junctions with H12939, a positive difference indicates H12939 was deeper, and a negative difference indicates H12939 was shoaler.

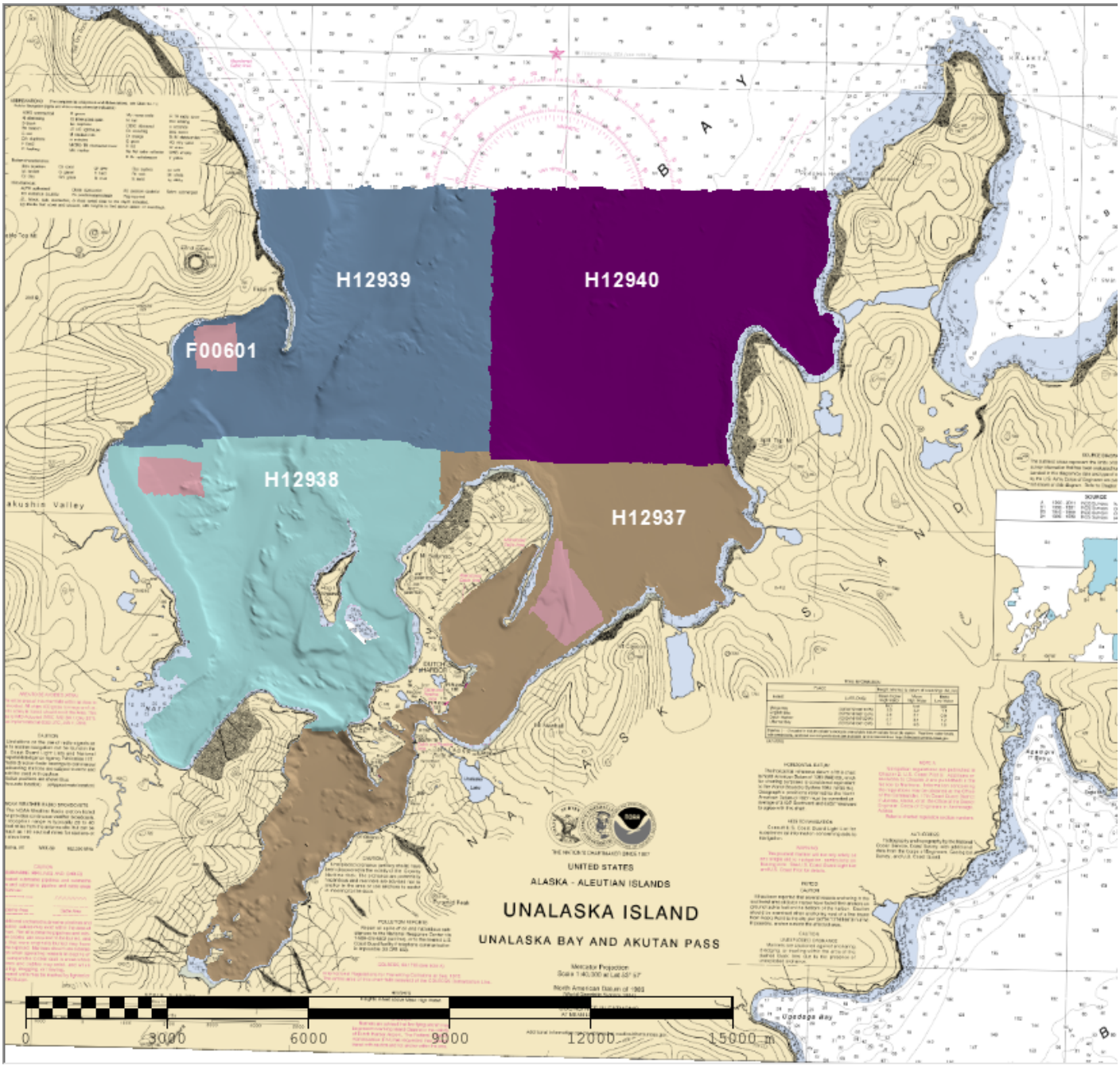


Figure 8: Junctions with H12940, H12938, H12937, and F00601

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
F00601	1:5000	2011	NOAA Ship FAIRWEATHER	N
H12937	1:5000	2016	NOAA Ship FAIRWEATHER	SE
H12938	1:5000	2016	NOAA Ship FAIRWEATHER	S
H12940	1:20000	2016	NOAA Ship FAIRWEATHER	E

Table 8: Junctioning Surveys

F00601

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between H12939 and survey F00601 that was conducted in July 2011 by the NOAA Ship Fairweather (Figure 9). The statistical analysis of the difference surface from H12939 and F00601 shows a mean difference of 0.18 meters with 95% of all nodes falling within a deviation of +/- 0.59 m. A detailed graphical overview can be seen in Figure 10. A comparison surface was created between the difference surface and the allowable NOAA uncertainty (Figure 11). The comparison showed that 98.47% of the nodes are within NOAA Allowable Uncertainty (Figure 12).

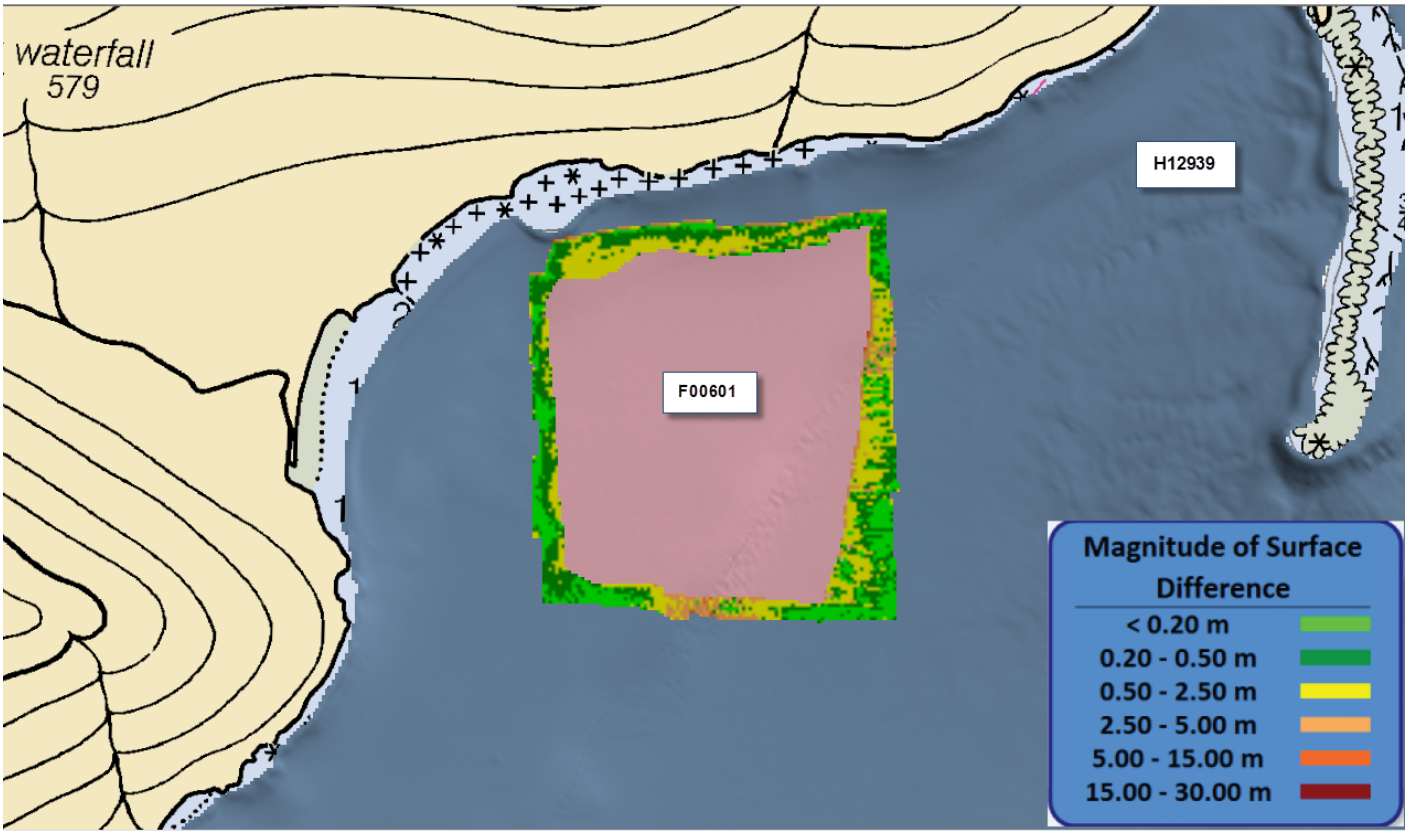
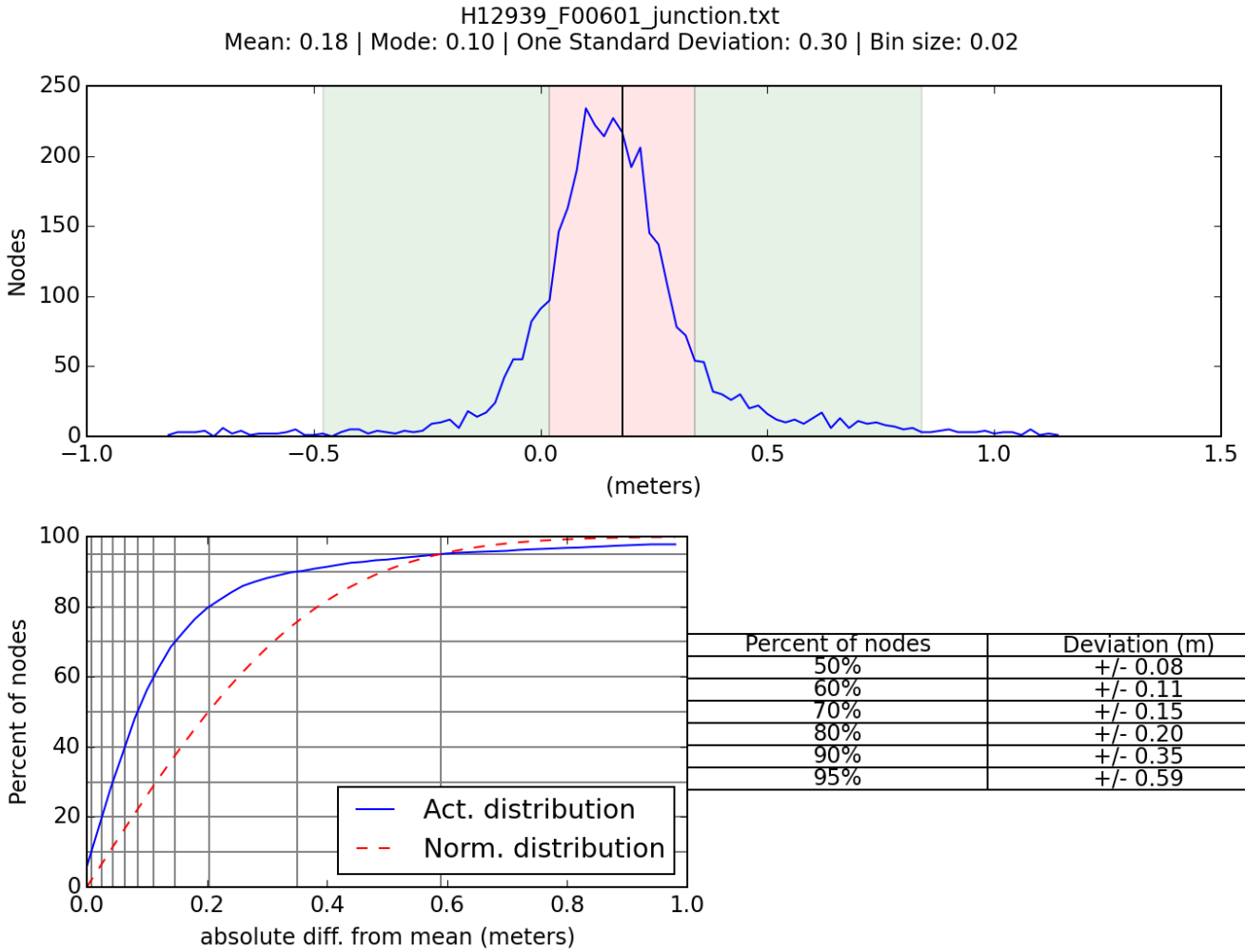


Figure 9: Difference surface between H12939 and F00601



Percent of nodes	Deviation (m)
50%	+/- 0.08
60%	+/- 0.11
70%	+/- 0.15
80%	+/- 0.20
90%	+/- 0.35
95%	+/- 0.59

Figure 10: Difference statistics between H12939 and F00601

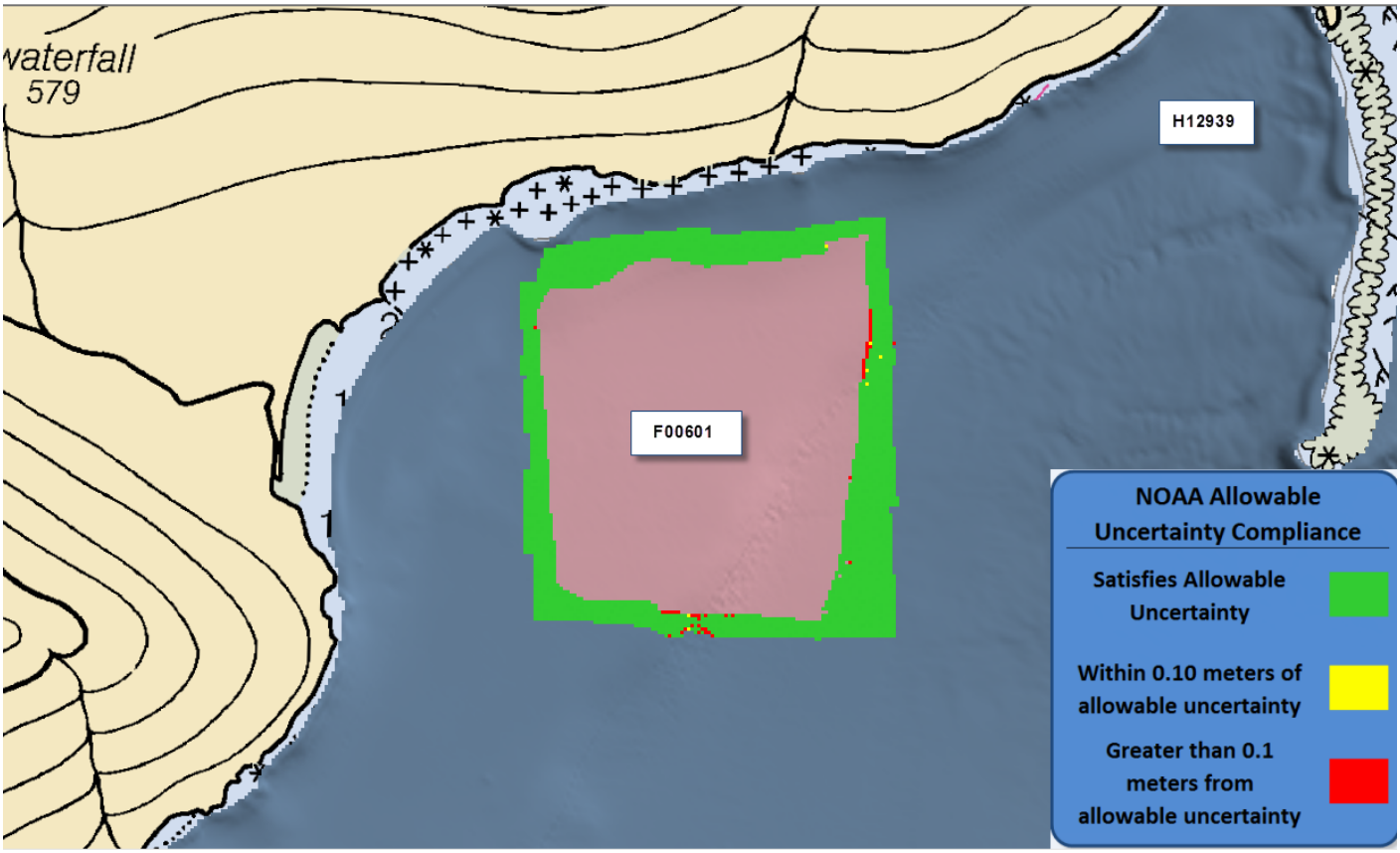


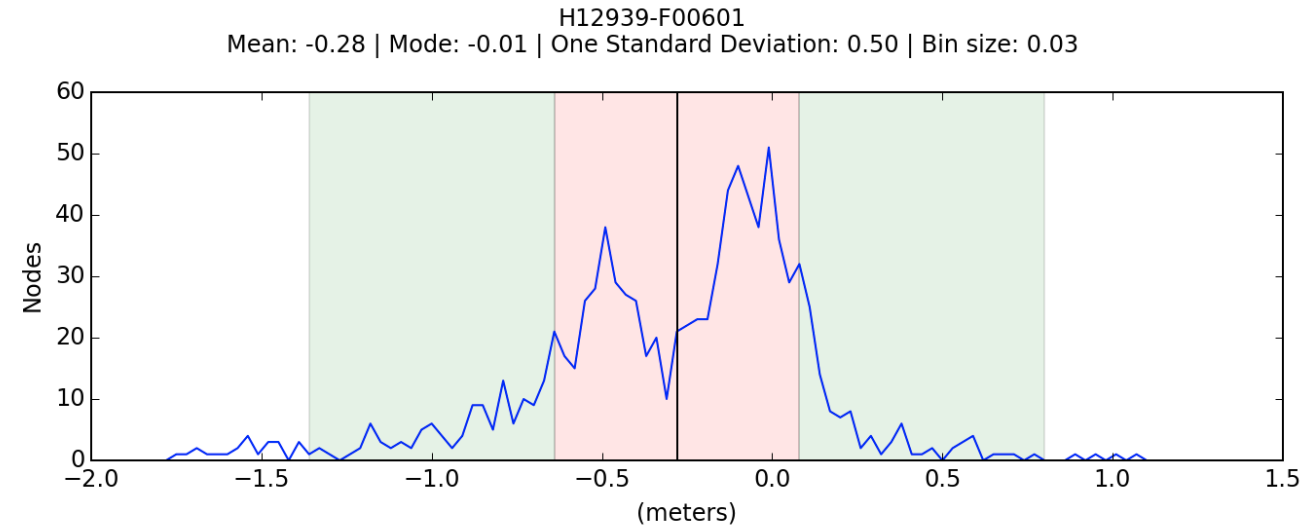
Figure 11: Junction H12939/F00601 VS. Allowable NOAA Uncertainty surface

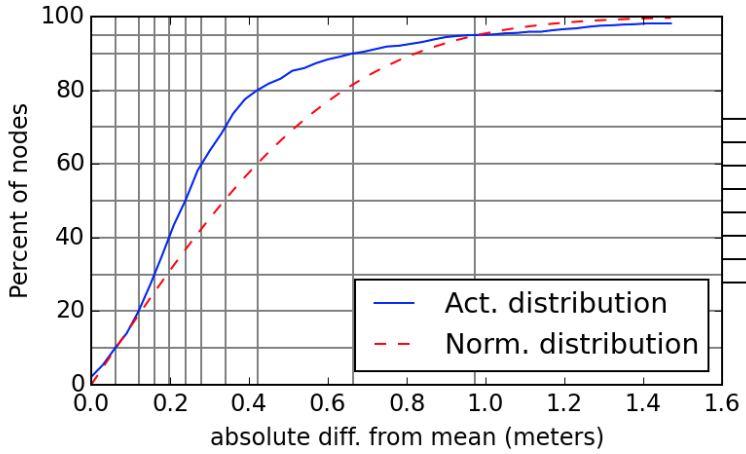
H12939 Junction Differencing with F00601 NOAA Allowable Uncertainty

Total Nodes	Passed Nodes	Failed Nodes
3,720	3,663	57
Percentage Nodes Passed		98.47%
Percentage Nodes Failed		1.53%

Figure 12: Statistics for junction H12939/F00601 VS. NOAA Allowable Uncertainty

During branch review discrepancies were found between the reported junction analysis and the junction analysis performed by the branch. The following figure captures the analysis performed at the branch. With that being said, H12939 agrees very well with its junctions.





Percent of nodes	Deviation (m)
50%	+/- 0.24
60%	+/- 0.28
70%	+/- 0.34
80%	+/- 0.42
90%	+/- 0.66
95%	+/- 0.97

Junction analysis between H12939 and F00601

H12937

Surface differencing in CARIS HIPS and SIPS was used to asses junction agreement between the 8 meter combined surfaces from H12939 and the 8 meter combined surface from survey H12937 (Figure 13). The statistical analysis of the difference surface shows a mean of 0.04 meters with 95% of all nodes having a maximum deviation of +/- 0.68 m. A detailed graphical overview can be seen in Figure 14. A comparison surface was created between the difference surface and the allowable NOAA uncertainty (Figures 15). It was found that 98.84% of the nodes are within allowable NOAA uncertainty (Figure 16).

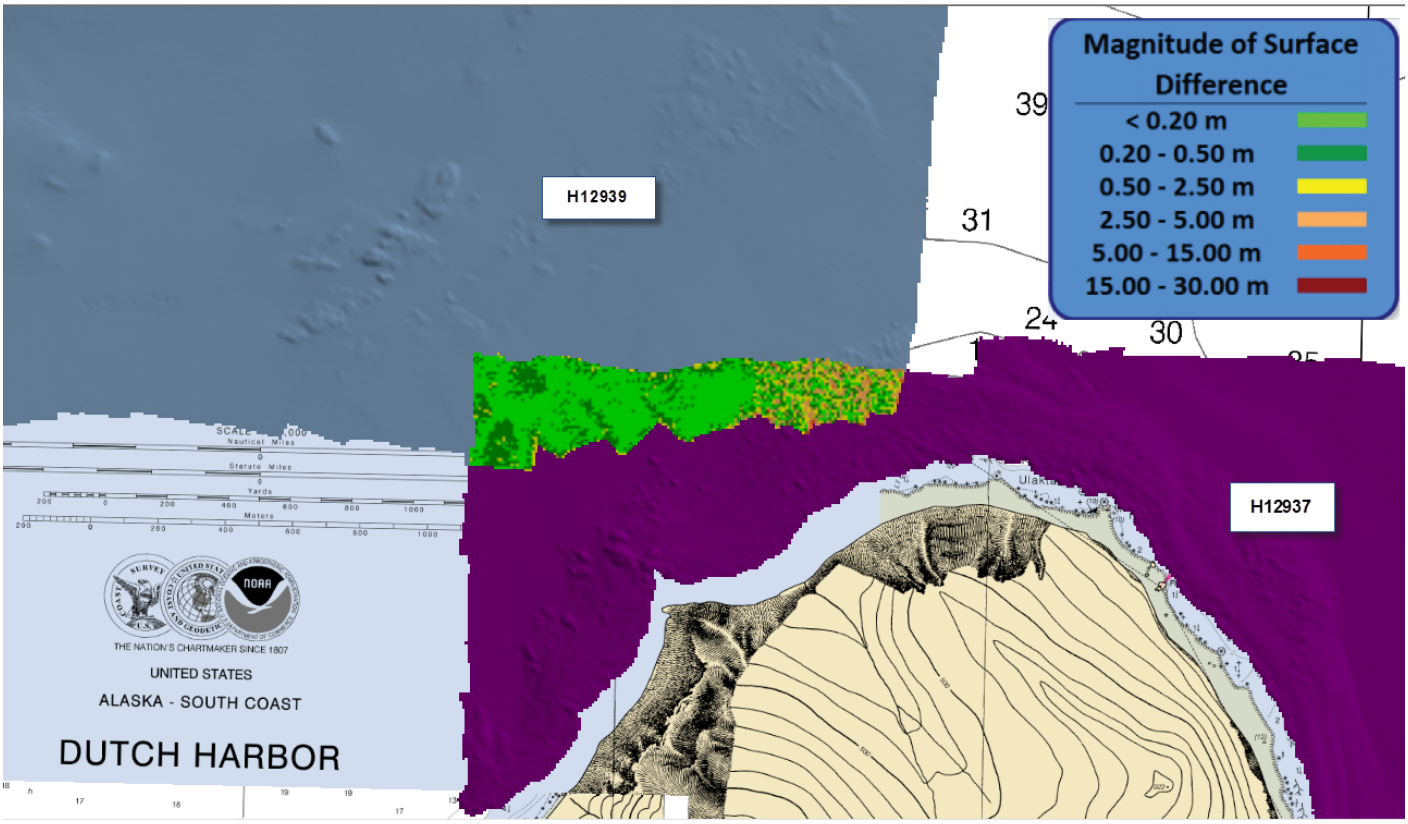
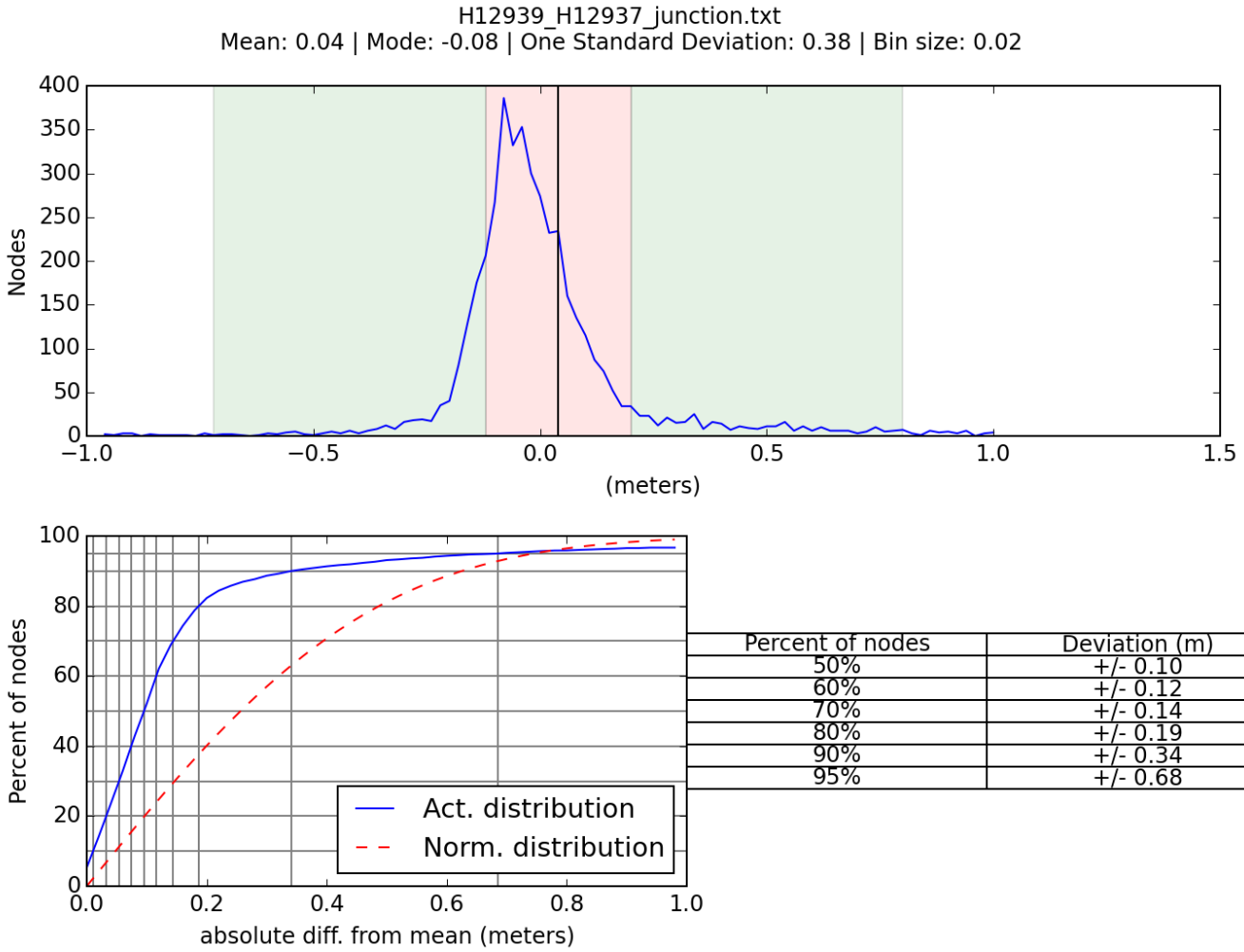


Figure 13: Difference surface between H12939 and H12937



Percent of nodes	Deviation (m)
50%	+/- 0.10
60%	+/- 0.12
70%	+/- 0.14
80%	+/- 0.19
90%	+/- 0.34
95%	+/- 0.68

Figure 14: Difference statistics between H12939 and H12937

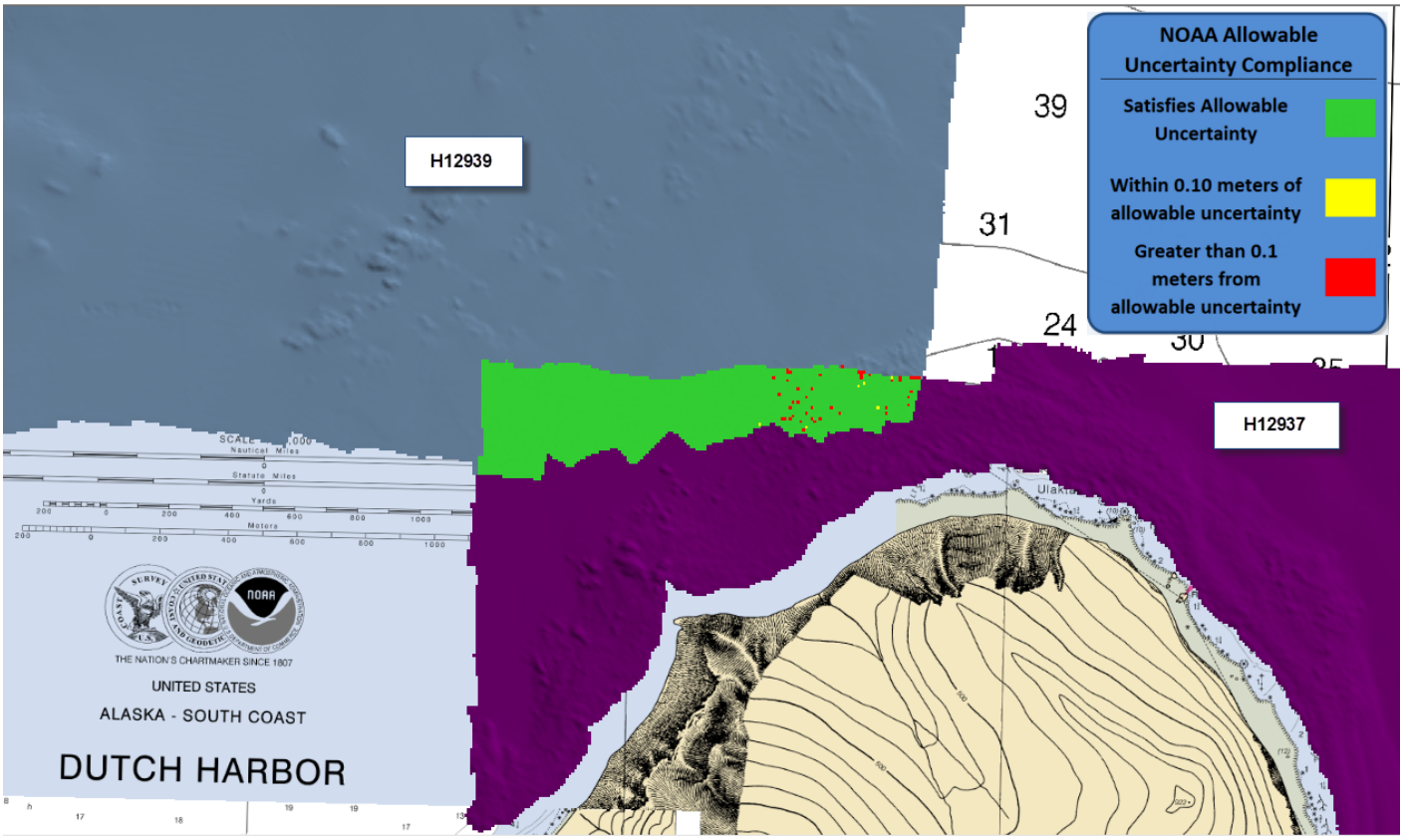


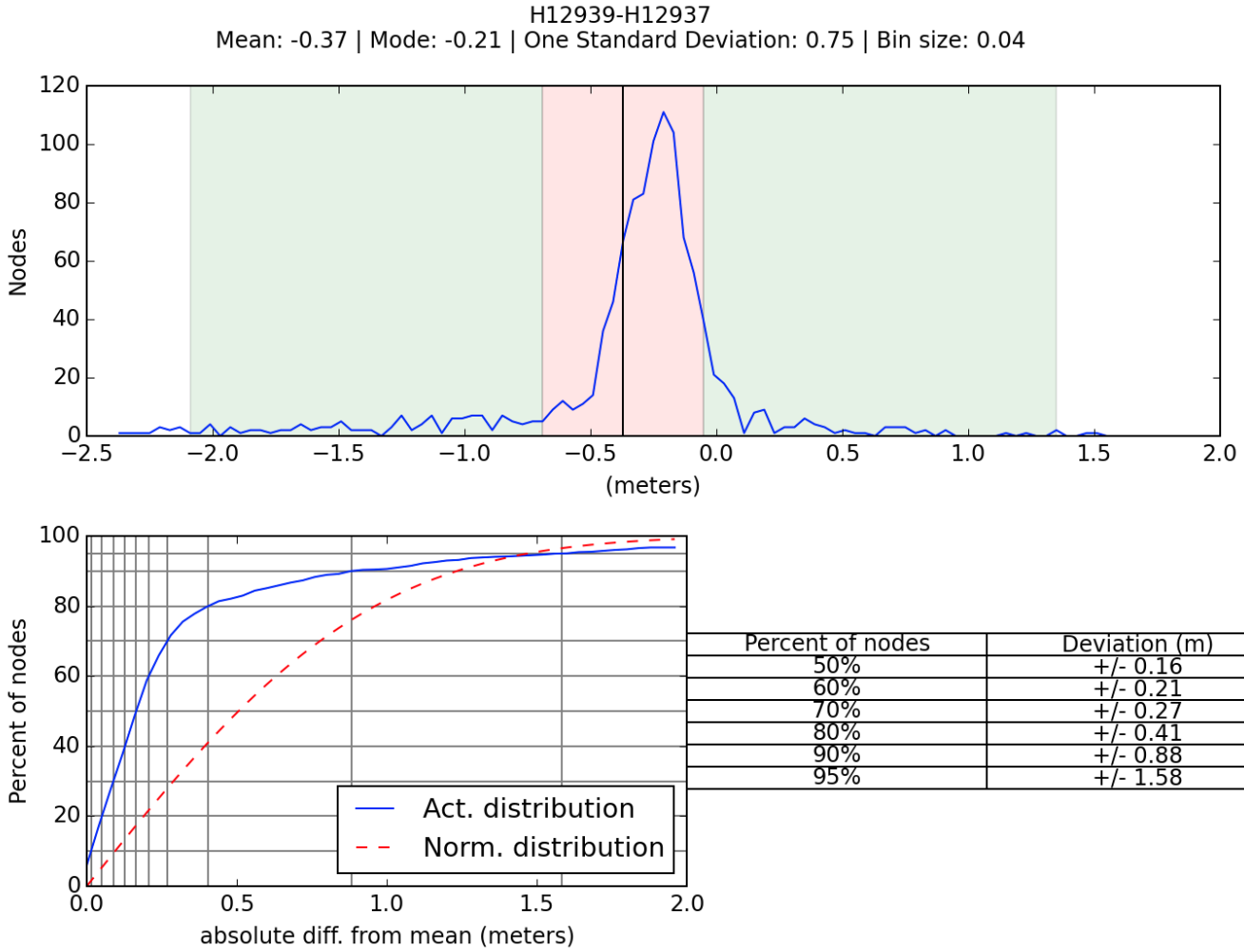
Figure 15: Junction H12939/H12937 VS. NOAA Allowable Uncertainty

H12939 Junction Differencing with H12937 NOAA Allowable Uncertainty

Total Nodes	Passed Nodes	Failed Nodes
4,405	4,354	57
Percentage Nodes Passed		98.84%
Percentage Nodes Failed		1.29%

Figure 16: Statistics for Junction H12939/H12937 VS. NOAA Allowable Uncertainty

During branch review discrepancies were found between the reported junction analysis and the junction analysis performed by the branch. The following figure captures the analysis performed at the branch. With that being said, H12939 agrees very well with its junctions.



Percent of nodes	Deviation (m)
50%	+/- 0.16
60%	+/- 0.21
70%	+/- 0.27
80%	+/- 0.41
90%	+/- 0.88
95%	+/- 1.58

Junction analysis between H12939 and H12937.

H12938

Surface differencing in CARIS HIPS and SIPS was used to asses junction agreement between the 16 meter combined surfaces from H12939 and the 16 meter combined surface from survey H12938 (Figure 17). The statistical analysis of the difference surface shows a mean of -0.06 meters with 95% of all nodes having a maximum deviation of +/- 0.87 m. A detailed graphical overview of the difference statistics can be seen in Figure 18. A comparison surface was created between the difference surface and the allowable NOAA uncertainty (Figure 19). It was found that 99.92% of nodes fall within allowable NOAA uncertainty (Figure 20).

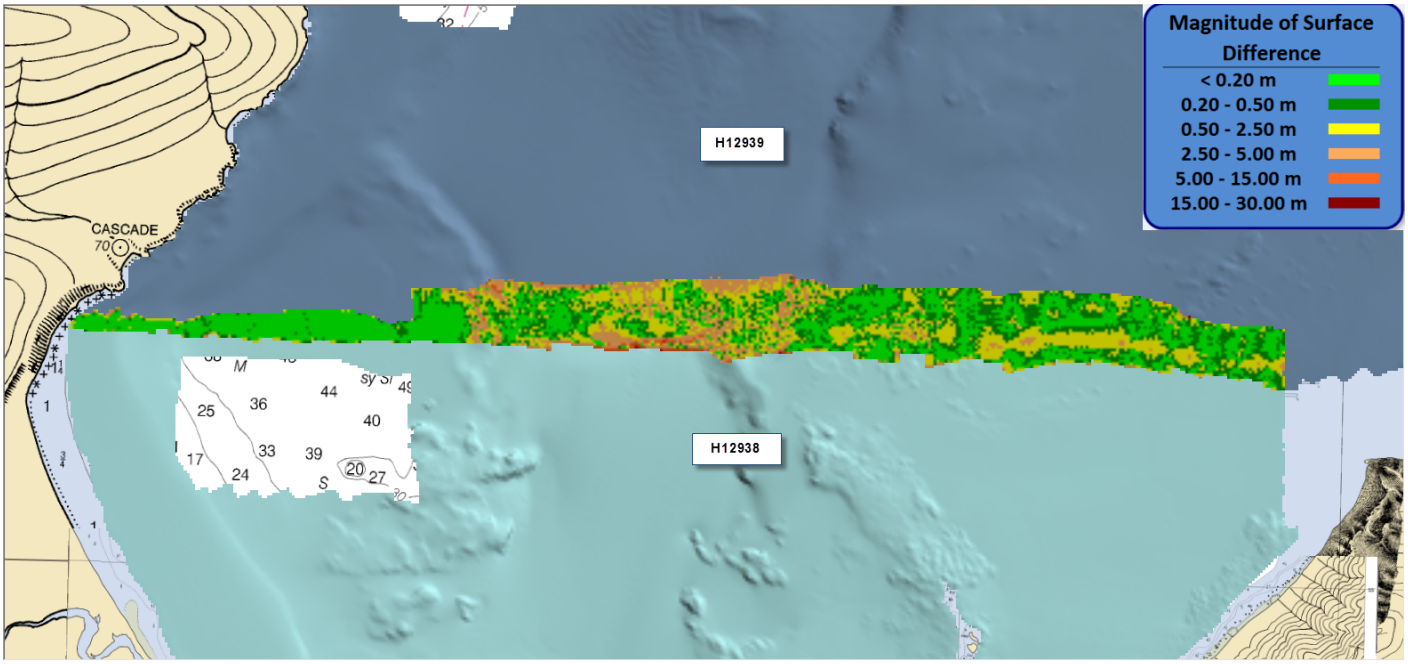
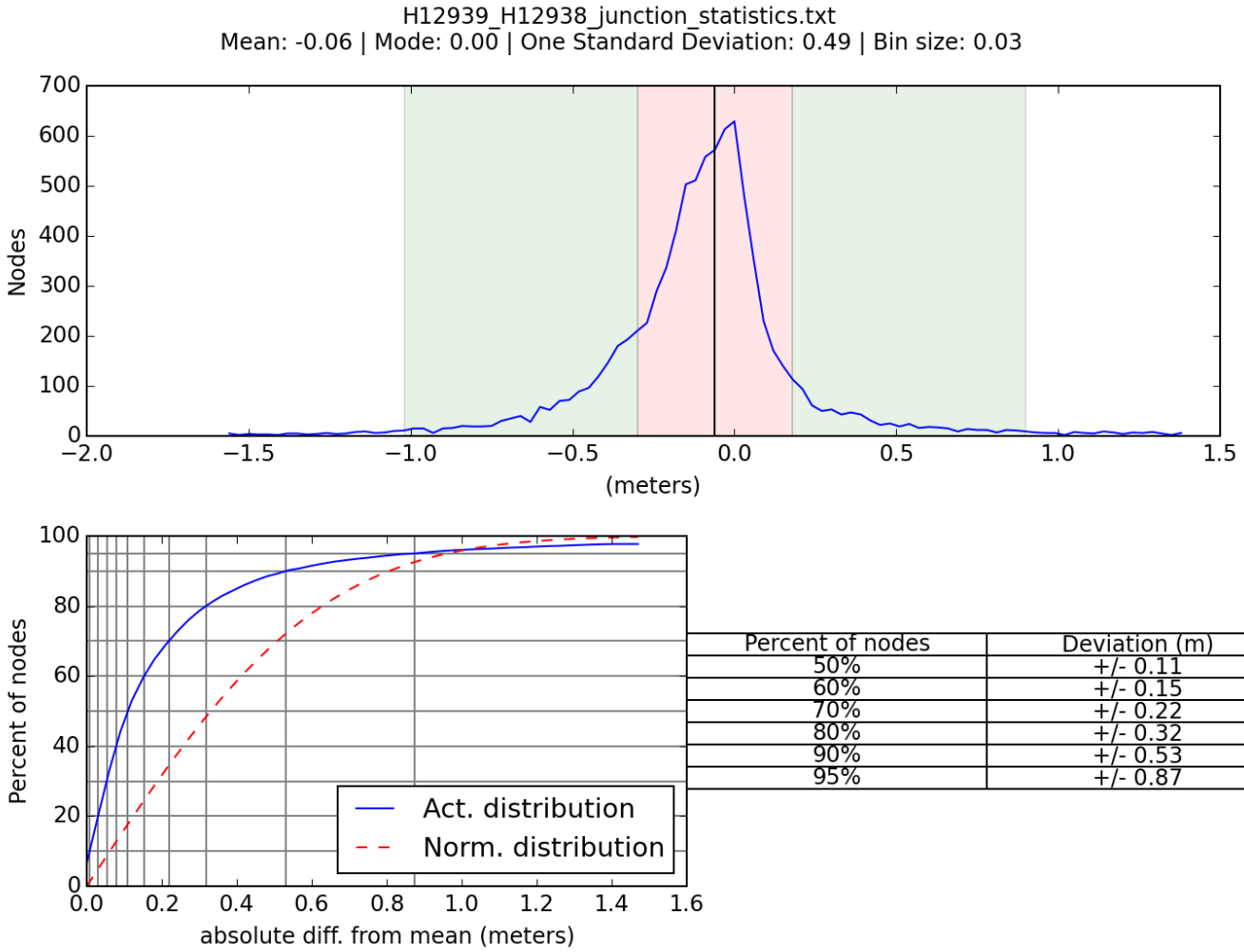


Figure 17: Difference surface between H12939 and H12938



Percent of nodes	Deviation (m)
50%	+/- 0.11
60%	+/- 0.15
70%	+/- 0.22
80%	+/- 0.32
90%	+/- 0.53
95%	+/- 0.87

Figure 18: Difference statistics between H12939 and H12938

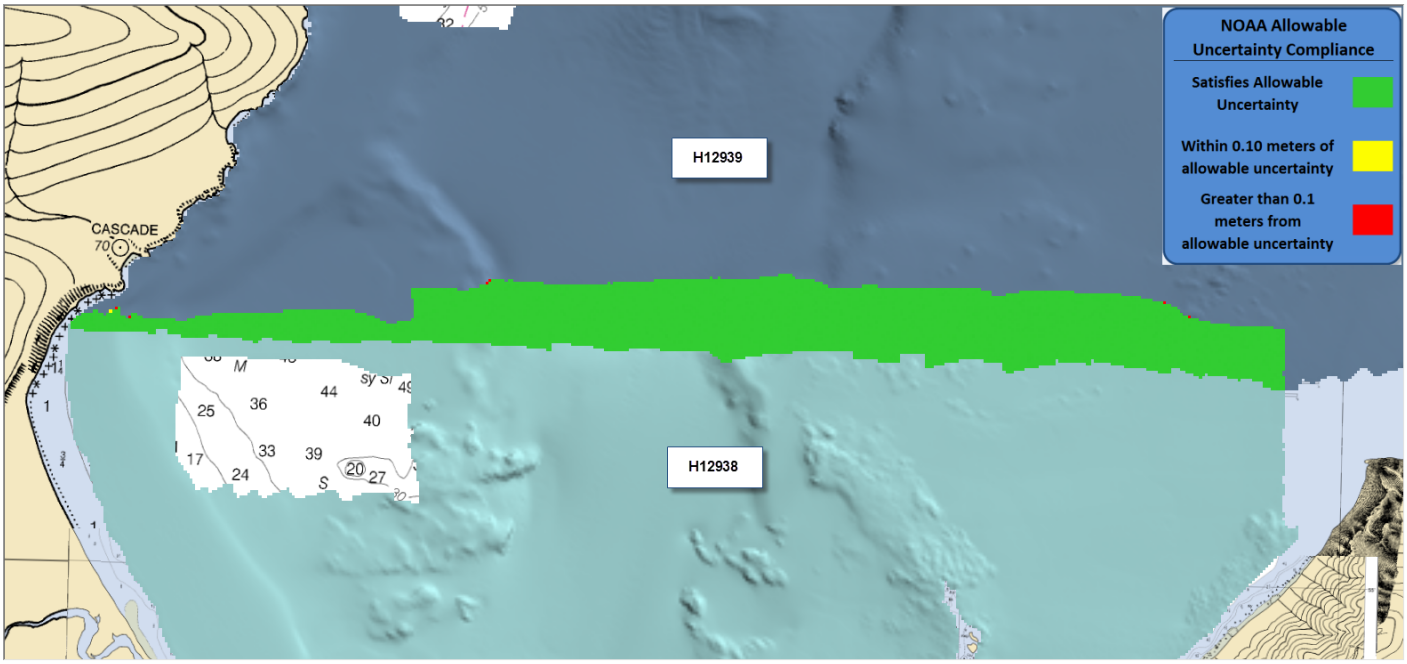


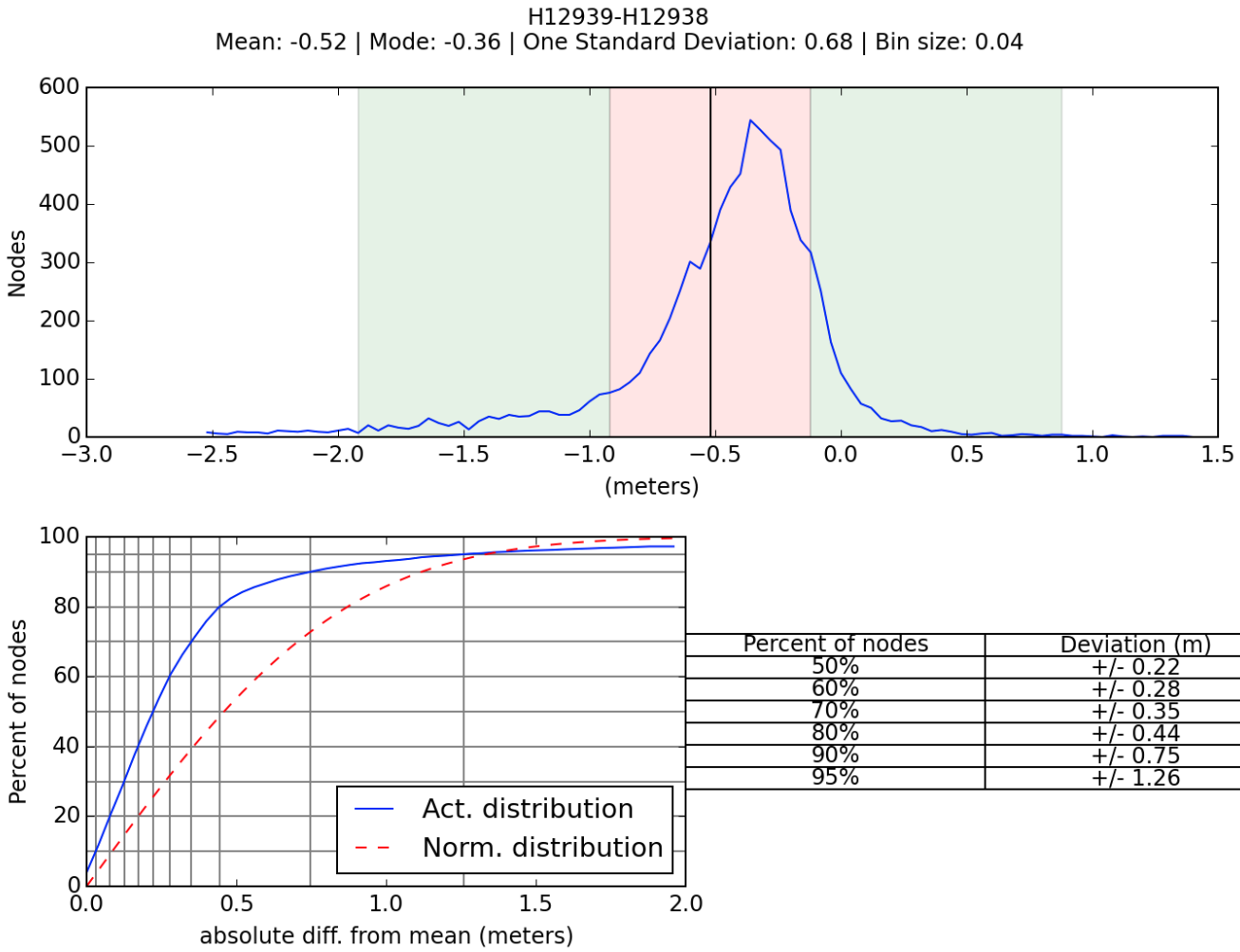
Figure 19: Junction H12939/H12938 VS. NOAA Allowable Uncertainty

H12939 Junction Differencing with H12938 NOAA Allowable Uncertainty

Total Nodes	Passed Nodes	Failed Nodes
8,742	8,735	7
Percentage Nodes Passed		99.92%
Percentage Nodes Failed		0.08%

Figure 20: Statistics for junction H12939/H12938 VS. NOAA Allowable Uncertainty

During branch review discrepancies were found between the reported junction analysis and the junction analysis performed by the branch. The following figure captures the analysis performed at the branch. With that being said, H12939 agrees very well with its junctions.



Percent of nodes	Deviation (m)
50%	+/- 0.22
60%	+/- 0.28
70%	+/- 0.35
80%	+/- 0.44
90%	+/- 0.75
95%	+/- 1.26

Junction analysis between H12939 and H12938.

H12940

Surface differencing in CARIS HIPS and SIPS was used to asses junction agreement between the 16 meter combined surfaces from H12939 and the 16 meter combined surface from survey H12940 (Figure 21). The statistical analysis of the difference surface shows a mean of -0.02 meters with 95% of all nodes having a maximum deviation of +/- 0.53 m. A detailed graphical overview can be seen in Figure 22. A comparison surface was created between the difference surface and the allowable NOAA uncertainty (Figure 23). It was found that 99.95% of nodes fall within allowable NOAA uncertainty (Figure 24).

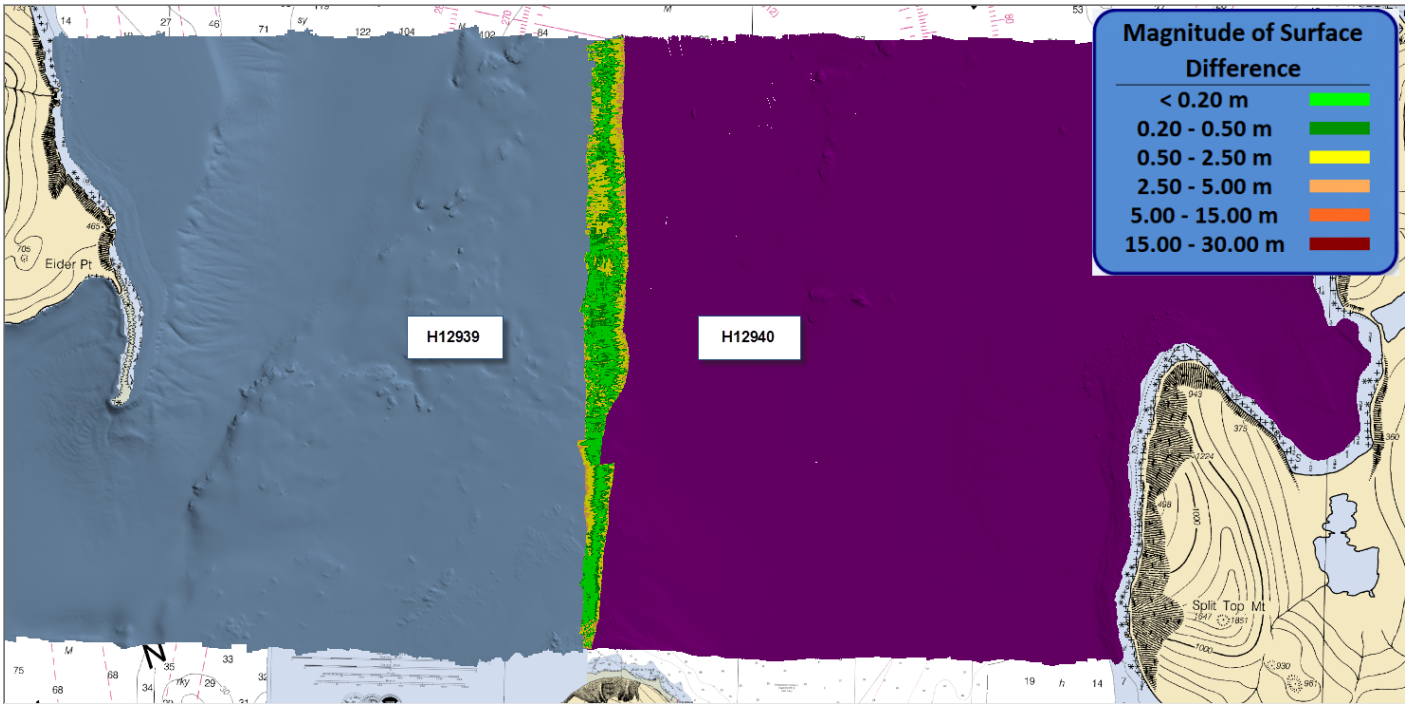
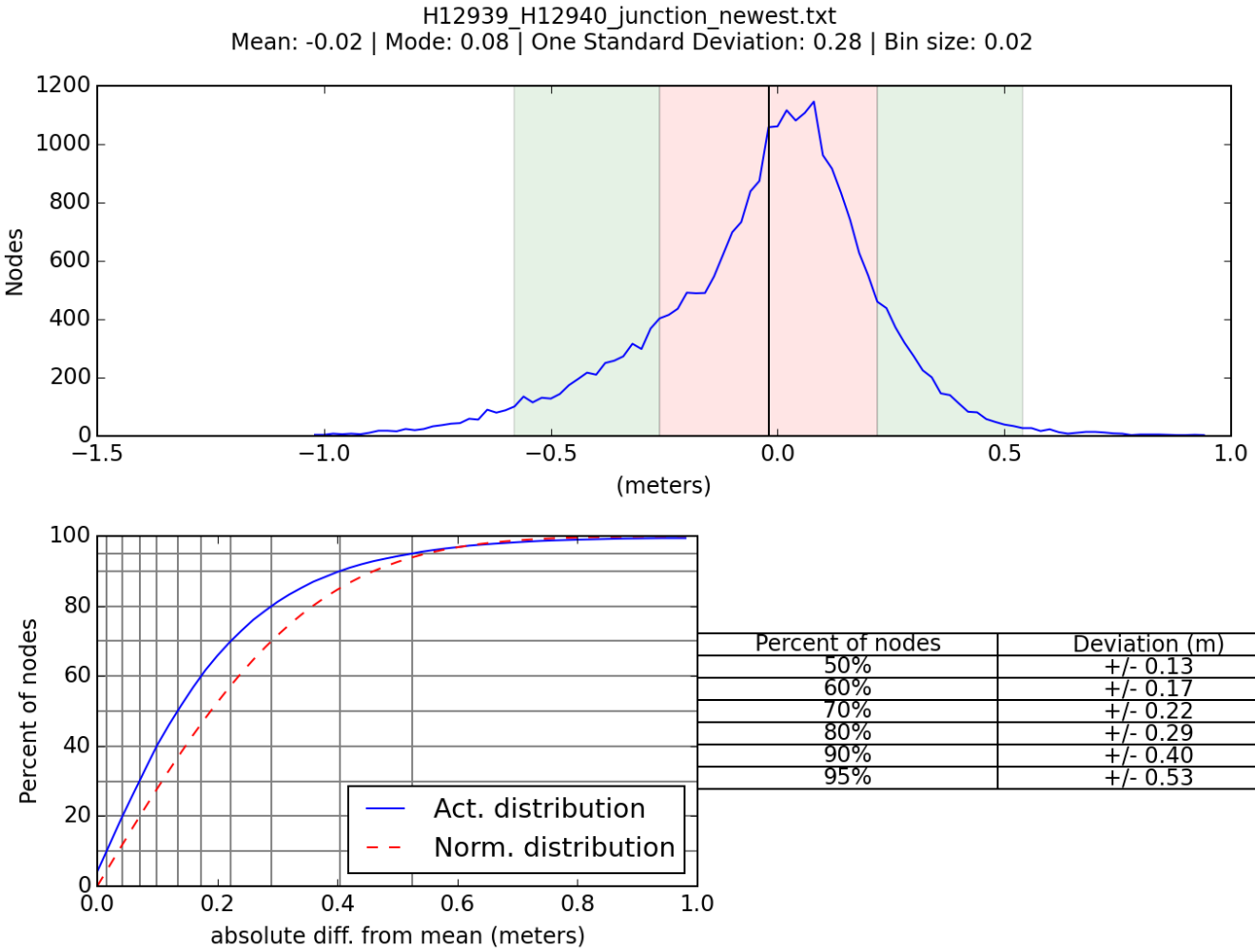


Figure 21: Difference surface between H12939 and H12940



Percent of nodes	Deviation (m)
50%	+/- 0.13
60%	+/- 0.17
70%	+/- 0.22
80%	+/- 0.29
90%	+/- 0.40
95%	+/- 0.53

Figure 22: Difference statistics between H12939 and H12940

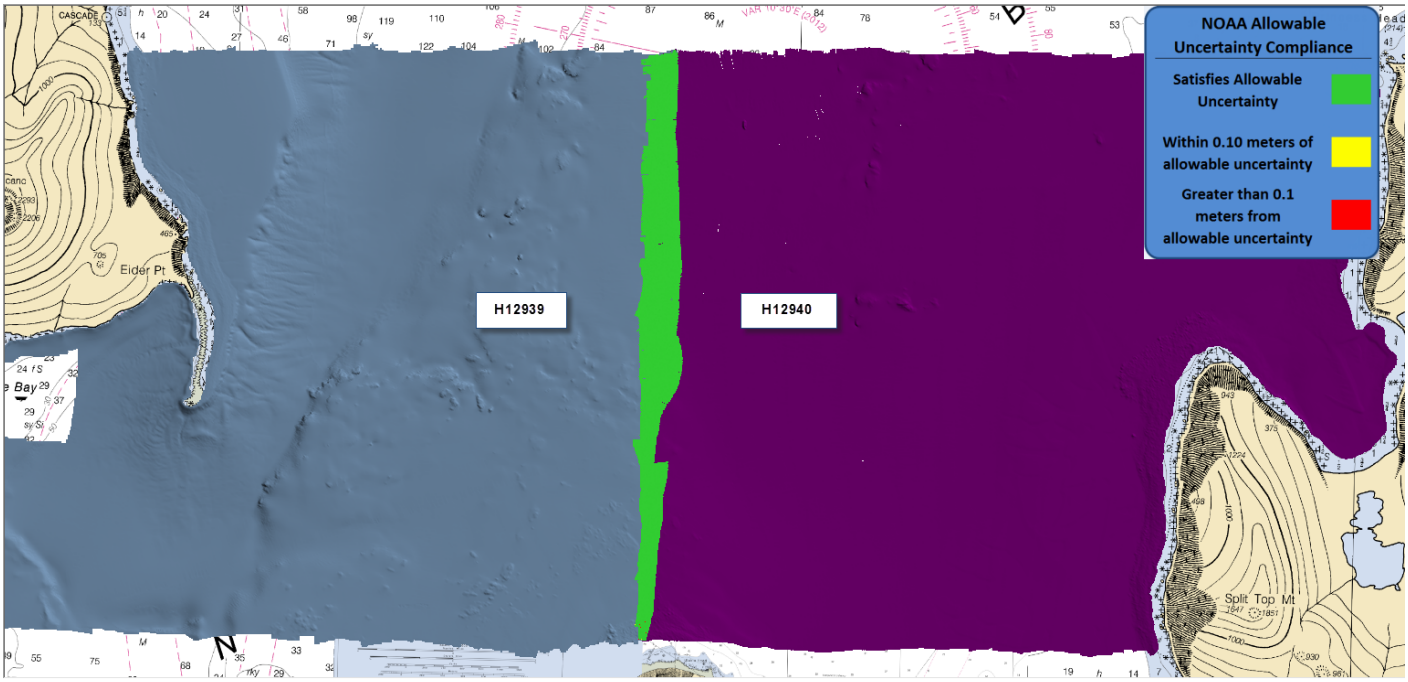


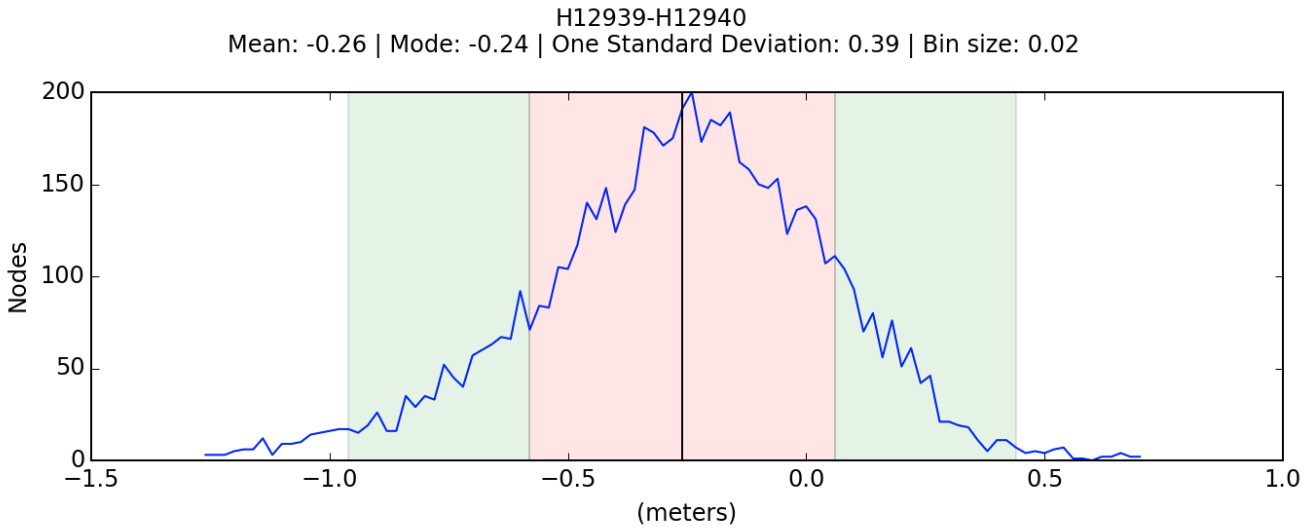
Figure 23: Junction H12939/H12940 VS. NOAA Allowable Uncertainty

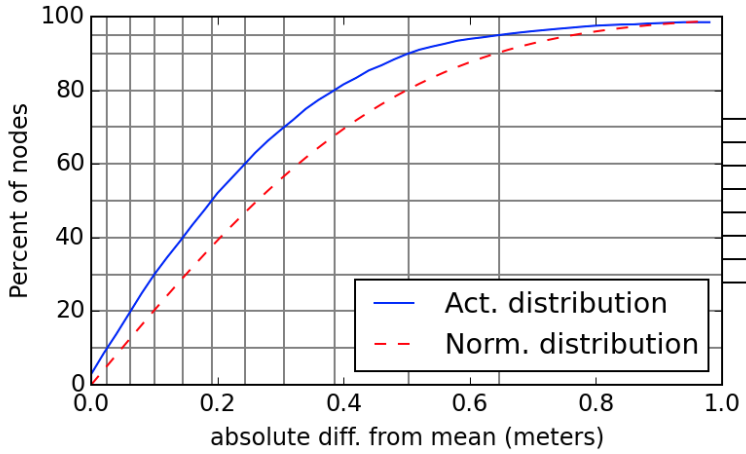
H12939 Junction Differencing with H12940 NOAA Allowable Uncertainty

Total Nodes	Passed Nodes	Failed Nodes
25,628	25,617	11
Percentage Nodes Passed		99.96%
Percentage Nodes Failed		0.04%

Figure 24: Statistics for junction H12939/H12940 VS. NOAA Allowable Uncertainty

During branch review discrepancies were found between the reported junction analysis and the junction analysis performed by the branch. The following figure captures the analysis performed at the branch. With that being said, H12939 agrees very well with its junctions.





Percent of nodes	Deviation (m)
50%	+/- 0.19
60%	+/- 0.24
70%	+/- 0.31
80%	+/- 0.39
90%	+/- 0.50
95%	+/- 0.65

Junction analysis between H12939 and H12940.

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

Sea State

There were some survey days during acquisition for survey H12939 with high sea state that caused excessive pitch and roll for the survey launches. On DN 225 Launch 2805 experienced excessive blow outs while acquiring cross lines. Vessel motion artifacts around the edges of crosslines are visible on the surface in Subset Editor of CARIS HIPS and SIPS. Figures 25 and 26 show an example of such an area below. Data remains within allowable uncertainties, however, and is adequate to supersede previous data.

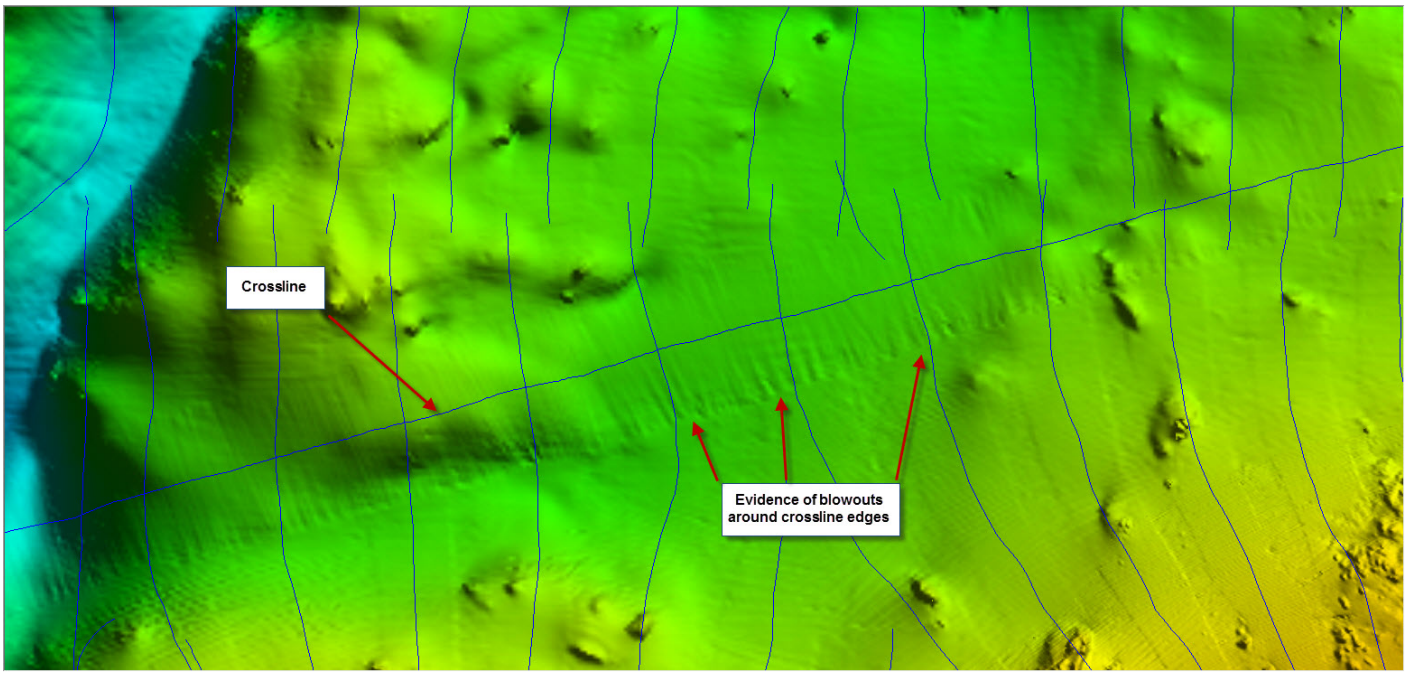


Figure 25: Example of blow outs around edges of crosslines (Vertical exaggeration x12)

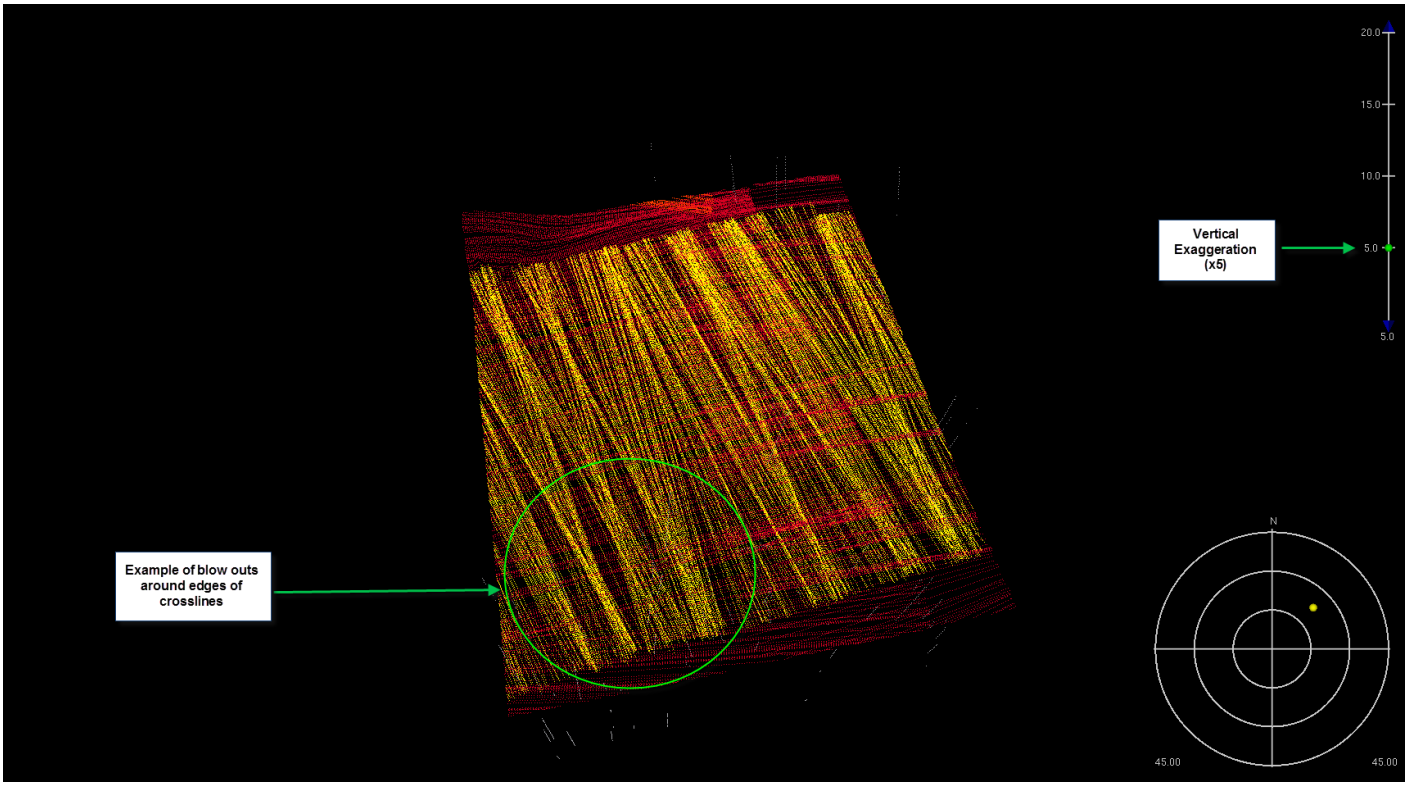


Figure 26: H12939 Data with evident blowouts on DN 225

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at a minimum of once every 4 hours during launch acquisition with a SeaBird 19Plus V2 profiler. Casts were conducted more often in areas where the influx of freshwater had an effect on the speed of sound in the water column and when there was a change in surface sound speed greater than two meters per second.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Holiday Assessment

H12939 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with section 5.2.2.3 of the HSSD. All finalized surfaces were scanned for holidays via Pydro QC Tools Holiday Finder tool in conjunction with a visual inspection by the hydrographer. One holiday was found northeast of Eider Point in a particularly rocky area (Figure 27). This dynamic seafloor caused an acoustic shadow due to lack of coverage on the "back" side of the rock due to poor geometry from the sonar head (Figure 28). The area was investigated in CARIS subset editor to verify that least depths were found.

Other apparent holidays were identified in the finalized surfaces by Holiday Finder and then examined and determined to be in areas where adjoining surfaces covered the gap (e.g. a holiday in a shoal area of the 2 meter finalized surfaces was covered by the depth bands in the 1 meter finalized surface), as shown in Figure 29.

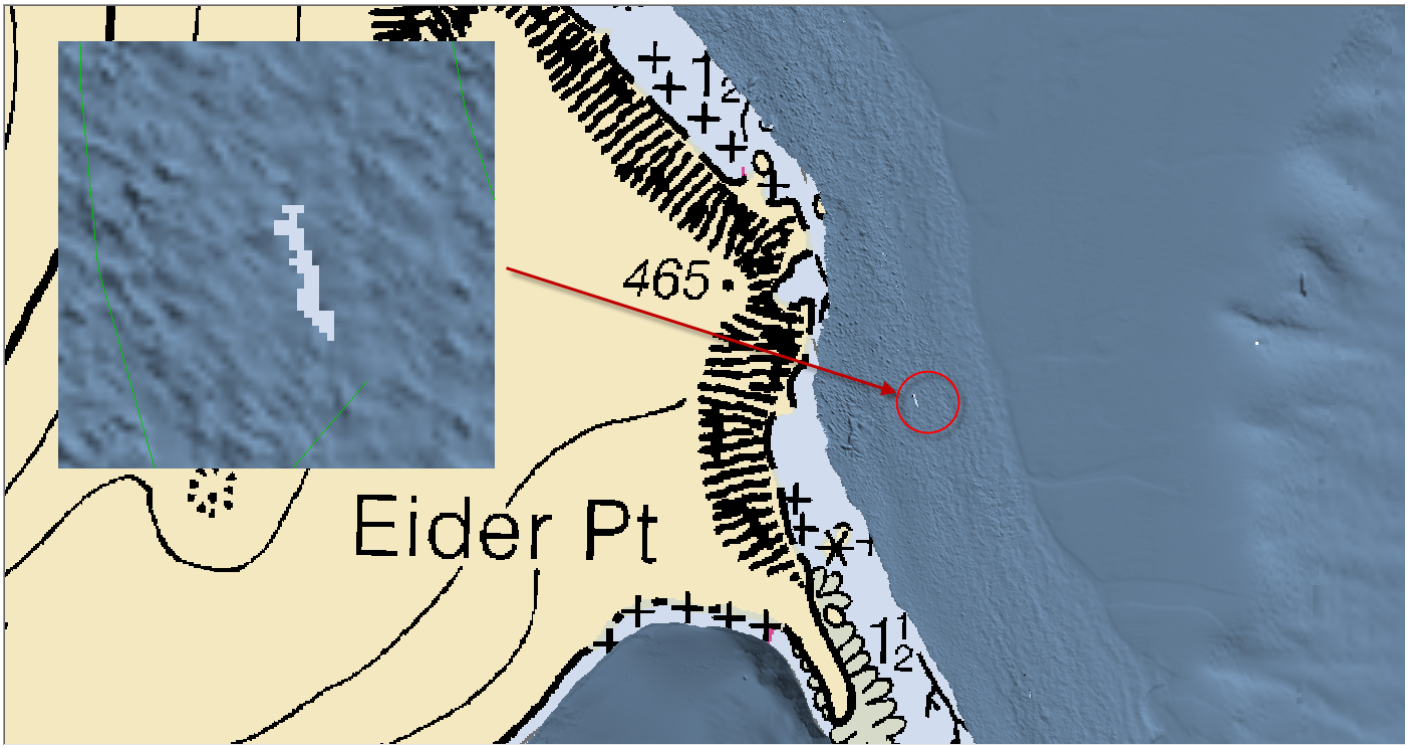


Figure 27: H12939 Holiday near Eider Point

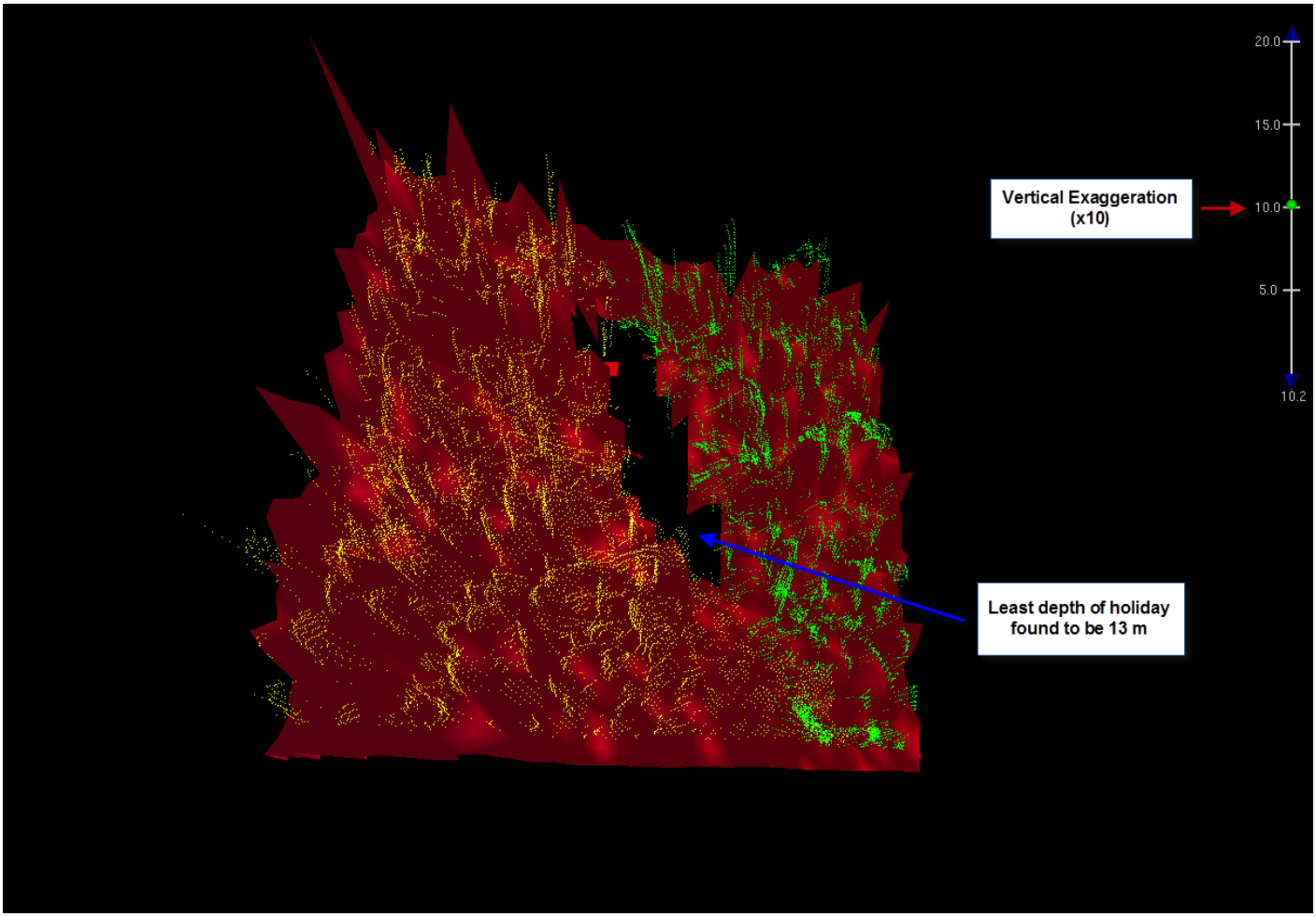


Figure 28: Holiday near Eider Point with least depth shown in 3D Subset Editor

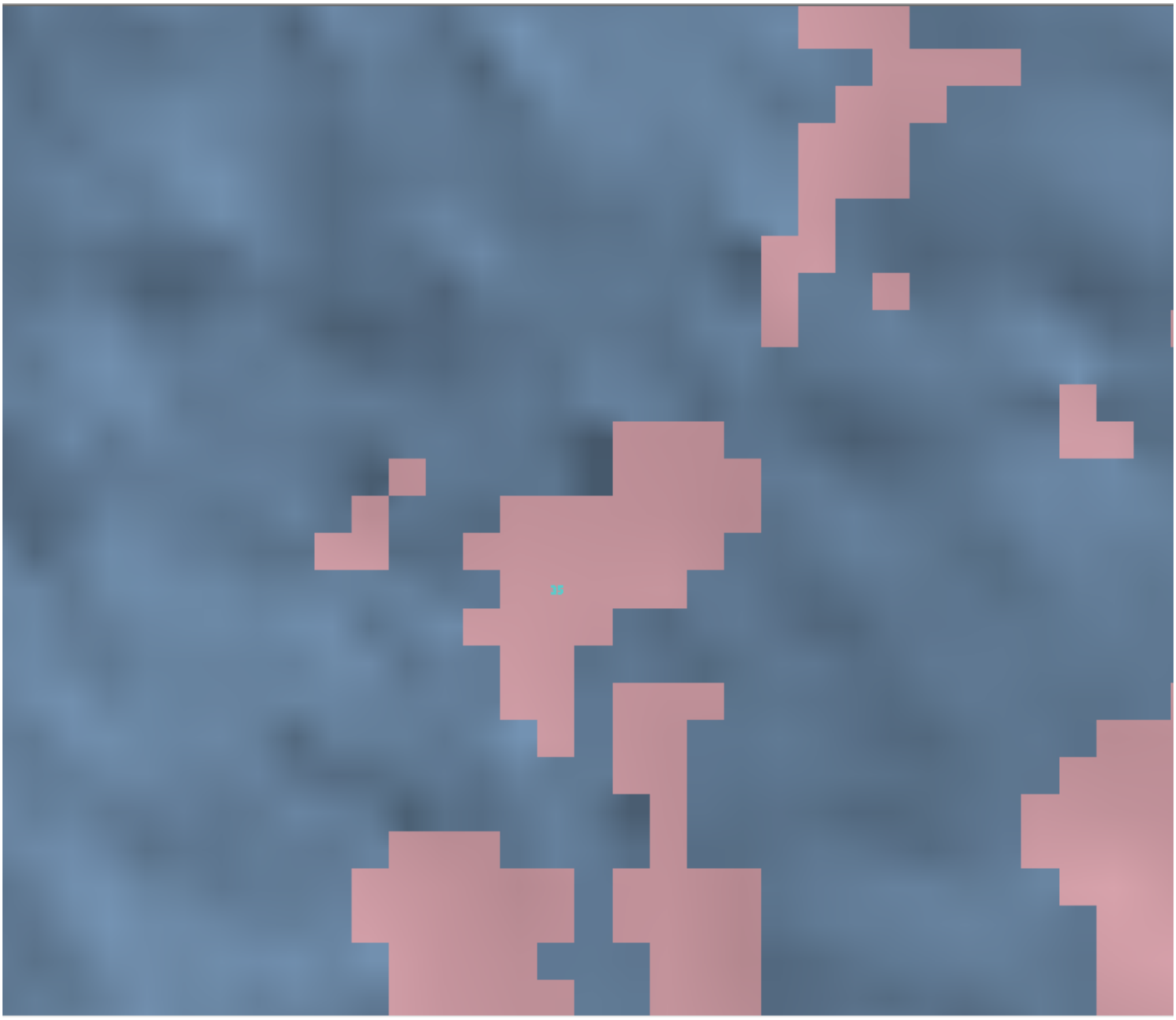


Figure 29: Area where adjoining finalized 1 meter surface (in grey) covers flagged holiday in the 2 meter finalized surface (in pink)

B.2.10 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 1-meter, 2-meter, 4-meter, and 8-meter (72-100) and "NOAA_Allowable_2" for the 8-meter (100-160m) and 16-m finalized surfaces using the equations stated in section C.2.1 of the DAPR. These surfaces were analyzed using Pydro QC Tools Grid QA feature to determine what percentage of each surface meets specifications. Figure 30 shows an overview of the NOAA Allowable Uncertainty layers for all surfaces. Figure 31 shows the corresponding statistics for each individual surface. Overall, 99.71% of the nodes with all surfaces meets or exceeds NOAA Allowable

Uncertainty specifications for H12939. For individual graphs per surface of density requirements, see the Standards and Compliance Review located in Appendix II.

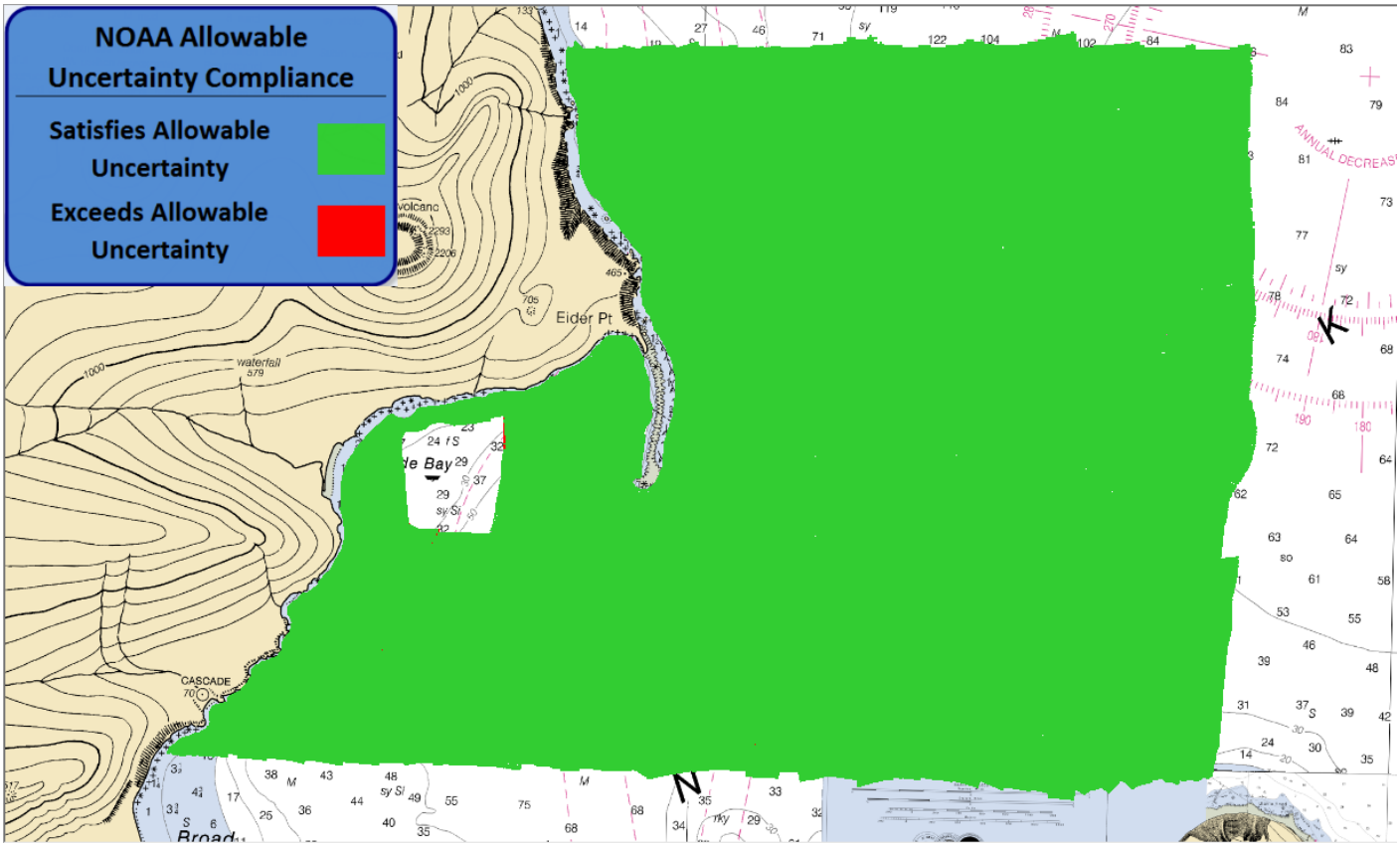


Figure 30: H12939 NOAA Allowable Uncertainty overview

H12939 NOAA Allowable Uncertainty			
	Total Nodes	Passed Nodes	Percent Pass
1m	1,089,472	1,087,919	99.86%
2m	653,741	652,248	99.77%
4m	373,934	372,780	99.69%
8m	355,621	352,798	99.21%
16m	32,928	32,786	99.57%
	Total Nodes		2,505,696.00
	Total Nodes Pass		2,498,531.00
	Total Percent Pass		99.71%

Figure 31: H12939 NOAA Allowable Uncertainty statistics

B.2.11 Density Compliance

Finalized surfaces were analyzed using Pydro QC Tools Grid QA feature and the results are shown in Figure 32 below. Density requirements for H12939 were achieved with at least 99.33% of finalized surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3 (Figure 33). For individual graphs (per surface) of density requirements, see the Standards and Compliance Review located in Appendix II.

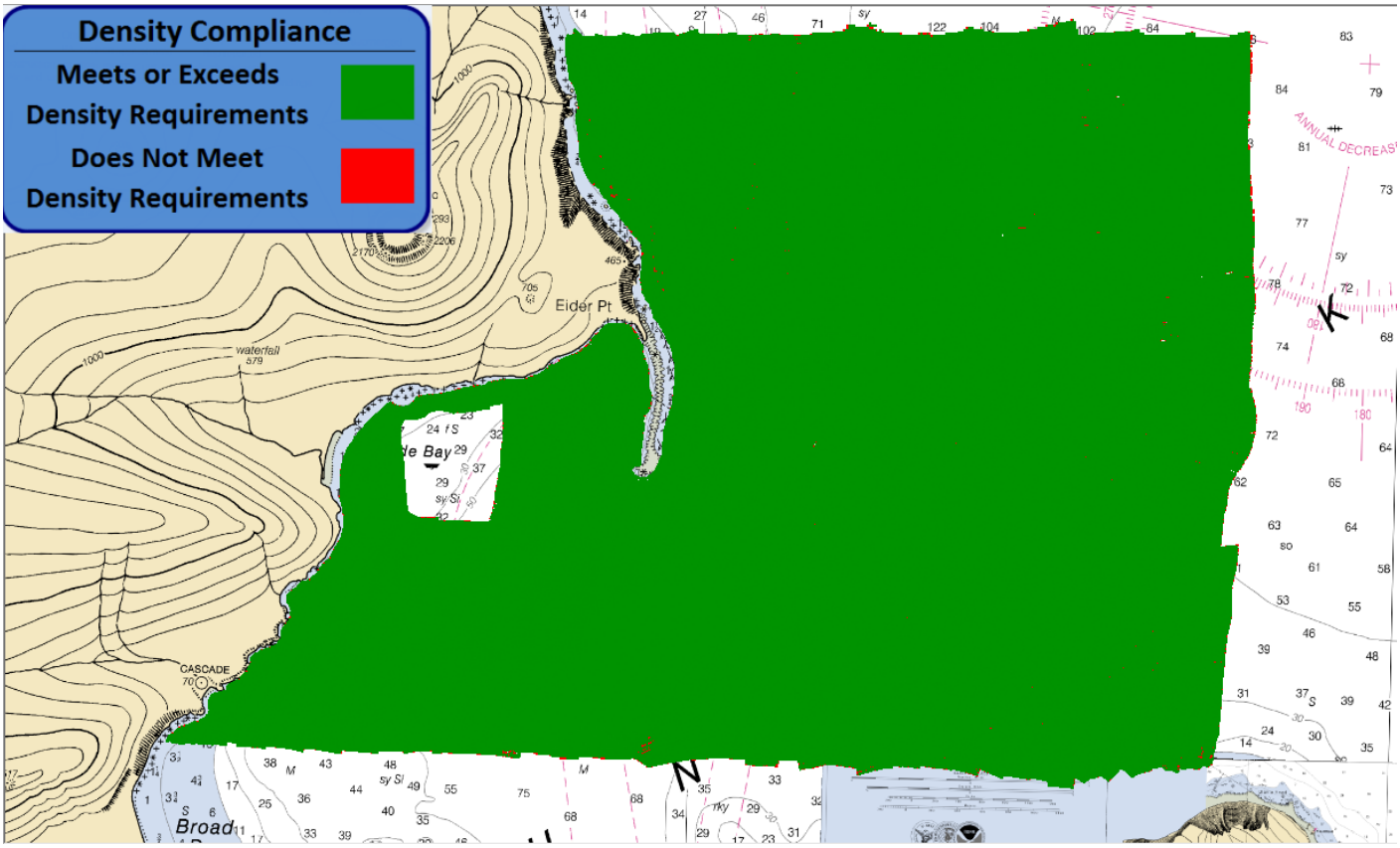


Figure 32: H12939 Density Compliance overview

H12939 Density Statistics			
	Total Nodes	Passed Nodes	Percent Pass
1m	1,089,472	1,086,505	99.73%
2m	653,741	652,960	99.88%
4m	373,934	372,559	99.63%
8m	366,621	354,951	96.82%
16m	32,928	32,865	99.81%
	Total Nodes		2,516,696
	Total Nodes Pass		2,499,840
	Total Percent Pass		99.33%

Figure 33: H12939 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

Raw Backscatter was logged as a 7k file for Reson 7125 data. Backscatter was processed in Fledermaus FMGT to choose bottom sample locations that provided a more diverse sample of bottom type. The corresponding mosaics, tiffs, projects, and GSF files have been sent to the Processing Branch. Figure 34 shows an overview of the mosaic created from H12939 survey data.

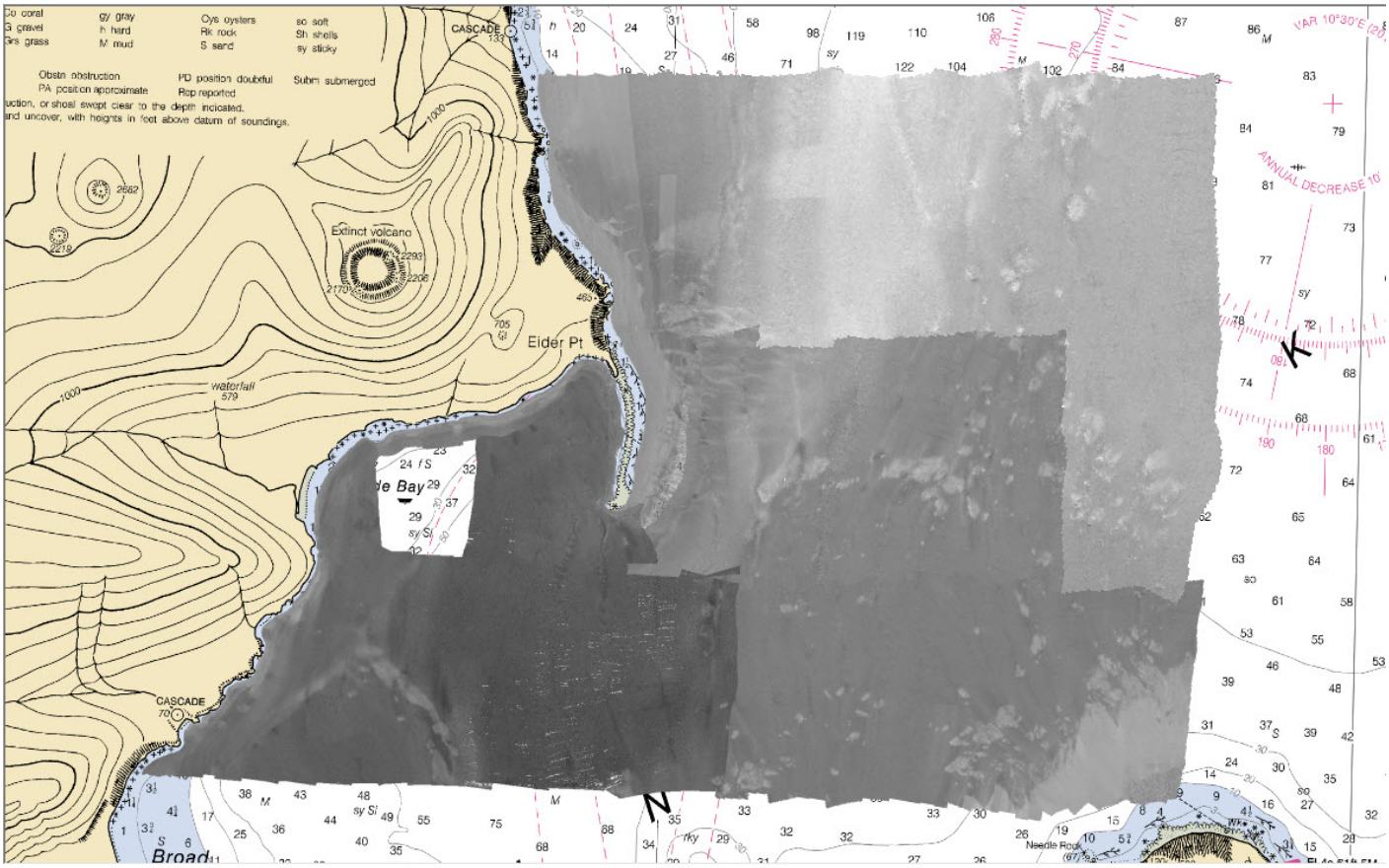


Figure 34: H12939 Backscatter mosaic

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

Manufacturer	Name	Version
Teledyne Caris	HIPS and SIPS	9.1

Table 9: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus FMGT	7.5.3

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Extended Attribute Files version 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
H12939_MB_1m_MLLW	CUBE	1 meters	-	NOAA_1m	Complete MBES
H12939_MB_2m_MLLW	CUBE	2 meters	-	NOAA_2m	Complete MBES
H12939_MB_4m_MLLW	CUBE	4 meters	-	NOAA_4m	Complete MBES
H12939_MB_8m_MLLW	CUBE	8 meters	-	NOAA_8m	Complete MBES
H12939_MB_16m_MLLW	CUBE	16 meters	-	NOAA_16m	Complete MBES
H12939_MB_1m_MLLW_Final	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12939_MB_2m_MLLW_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12939_MB_4m_MLLW_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12939_MB_8m_MLLW_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES
H12939_MB_16m_MLLW_Final	CUBE	16 meters	144 meters - 320 meters	NOAA_16m	Complete MBES

Table 11: Submitted Surfaces

The NOAA CUBE parameters mandated in the HSSD March 2016 were used to create all of the CUBE surfaces in Survey H12939. 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 v3, 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 rocky areas as fliers resulting in some false positives. At this point, the hydrographer ceased using the tool and returned to manual cleaning for these dynamic regions of seafloor.

B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final tides and sound speed application is noted in the H12939 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

C. Vertical and Horizontal Control

No control stations were installed by the field party, and as such, no Horizontal and Vertical Control Report (HVCR) is submitted with this report. All relevant discussion regarding horizontal and vertical control may be found in the discussion below.

C.1 Vertical Control

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

Traditional Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Unalaska, AK	9462620

Table 12: NWLON Tide Stations

File Name	Status
9462620.tid	Final Approved

Table 13: Water Level Files (.tid)

File Name	Status
Q328FA2016CORP.zdf	Final

Table 14: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 08/26/2016. The final tide note was received on 09/08/2016.

Initial reduction of acquired data to the MLLW was accomplished via traditional tidal means using the discrete zoning provided by HSD-OPS. Following the successful application of SBETs and computation of an Ellipsoidally Referenced Zone Tide (ERZT) separation model, ERS methods were used for reducing data to MLLW.

Preliminary zoning was accepted as the final zoning for project OPR-Q328-FA-16.

ERS Methods Used:

ERS via Poor Mans VDATUM

Ellipsoid to Chart Datum Separation File:

Q328FA2016CORP_PMVDERZT_UTM-WGS84-8N_WGS84-MLLW_100m.csar

ERS methods were used as the final means of reducing H12939 to MLLW for submission. Data were initially reduced via traditional tidal means until an ERZT separation model could be calculated. This empirically derived model was then checked for consistency and compared to the Poor Man's VDatum (PMVD) separation model provided with the Project Instructions. The PMVD separation model was then vertically shifted such that the average difference between these two separation models is zero. This vertical shift de-biases the PMVD separation model, correcting for local offsets that cannot be effectively modeled by the PMVD. In areas where the PMVD model did not have sufficient coverage such as near shore areas, the ERZT separation model was appended to the PMVD model creating the composite ERZT/ PMVD separation model listed above and used to reduce H12939 to MLLW. For further information see the ERS Capability Memo, submitted under a separate cover.

C.2 Horizontal Control

The horizontal datum for this project is World Geodetic System of 1984 (WGS84).

The projection used for this project is UTM Zone 3 North.

The following PPK methods were used for horizontal control:

Single Base

Vessel kinematic data was post-processed using Applanix POSPac processing software with Single Base positioning methods as described in the DAPR. Smooth Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all MBES data in CARIS HIPS.

For further details regarding the processing and quality control checks performed see the H12939 POSPAC Processing Logs spreadsheet located in the Separates folder. See also the OPR-Q328-FA-16 Horizontal and Vertical Control Report, submitted under separate cover.

Hydrographic Technical Directive (HTD) 2016-3, which revises the horizontal datum requirement was released after the Project Instructions were issued for OPR-Q328-FA-16. A waiver to maintain WGS84 as the datum for submission was granted by the Hydrographic Survey Division Operations Branch. This correspondence has been included in Appendix II.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
AV09	Haystack_AK2004

Table 15: CORS Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations

Table 16: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 WAAS

During real-time acquisition launches 2805, 2806, and 2807 received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to the USCG DGPS stations. WAAS and SBETs were the sole methods of positioning for survey H12939. No DGPS stations were available for real-time horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H12939 and Chart 16528 as well as US5AK6CM using CARIS HIPS and SIPS sounding and contour layers derived from the 16 meter combined surface. The contours and soundings were overlaid on the chart to assess differences between the surveyed soundings and charted depths. ENCs were compared to a 16 meter combined grid by extracting all soundings from the chart and creating an interpolated TIN surface which could be differenced from the 16 meter combined surface from H12939.

All data from H12939 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths however there are some areas within H12939 that have large discrepancies. A full discussion of the disagreements follows below.

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
16528	1:40000	18	09/2012	04/05/2016	04/09/2016

Table 17: Largest Scale Raster Charts

16528

The charted depths and contours of Chart 16528 are identical to those found on ENC US5AK6CM. As such, all discussions regarding the comparisons between surveyed soundings and charted depths are covered under the ENC US5AK6CM discussion below.

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?
US5AK6CM	1:40000	13	11/25/2015	11/25/2015	NO

Table 18: Largest Scale ENCs

US5AK6CM

Soundings from H12939 are in general agreement with charted depths on ENC US5AK6CM within one to two fathoms as shown in Figure 36. The largest differences are seen around the ledge extending from Eider Point, and in the central basin, where ENC soundings are up to 10 fathoms shoaler than surveyed soundings (Figure 35).

To more accurately visualize trends within these differences, a 16 meter TIN surface was interpolated from the ENC sounding layer. This surface was then differenced with a corresponding 16 meter surface from

H12939 and visualized in Figure 35. In this difference surface red colors indicate H12939 was shoaler than the ENC US5AK6CM, green colors indicate agreement, and blue colors indicate H12939 was deeper than ENC US5AK6CM. Soundings from H12939 agree with charted depths on ENC US5AK6CM with a mean difference of 0.25 meters and 95% of all soundings having a maximum deviation of 12.55 meters (Figure 37). The most significant differences observed were up to 20 fathoms in the southwest corner of H12939. Large differences are seen in a few nearshore areas, particularly on the western edge of the ledge that extends south from Eider Point, that are much shoaler (up to 10 fathoms shoaler) than previously charted. The other areas where surveyed soundings are shoaler than charted are clustered along the 100 fathom contour in the north central part of the survey.

Contours from H12939 are in general agreement with charted contours on ENC US5AK6CM as shown in Figure 38. The largest differences are seen in the 3 and 10 fathom contours where surveyed and charted contours differ by over 100 meters as seen in Figure 39. The Hydrographer recommends that the contours be retained as charted, and although nearshore contours appear clustered, they mark a rapidly shoaling slope that is significant for navigation.

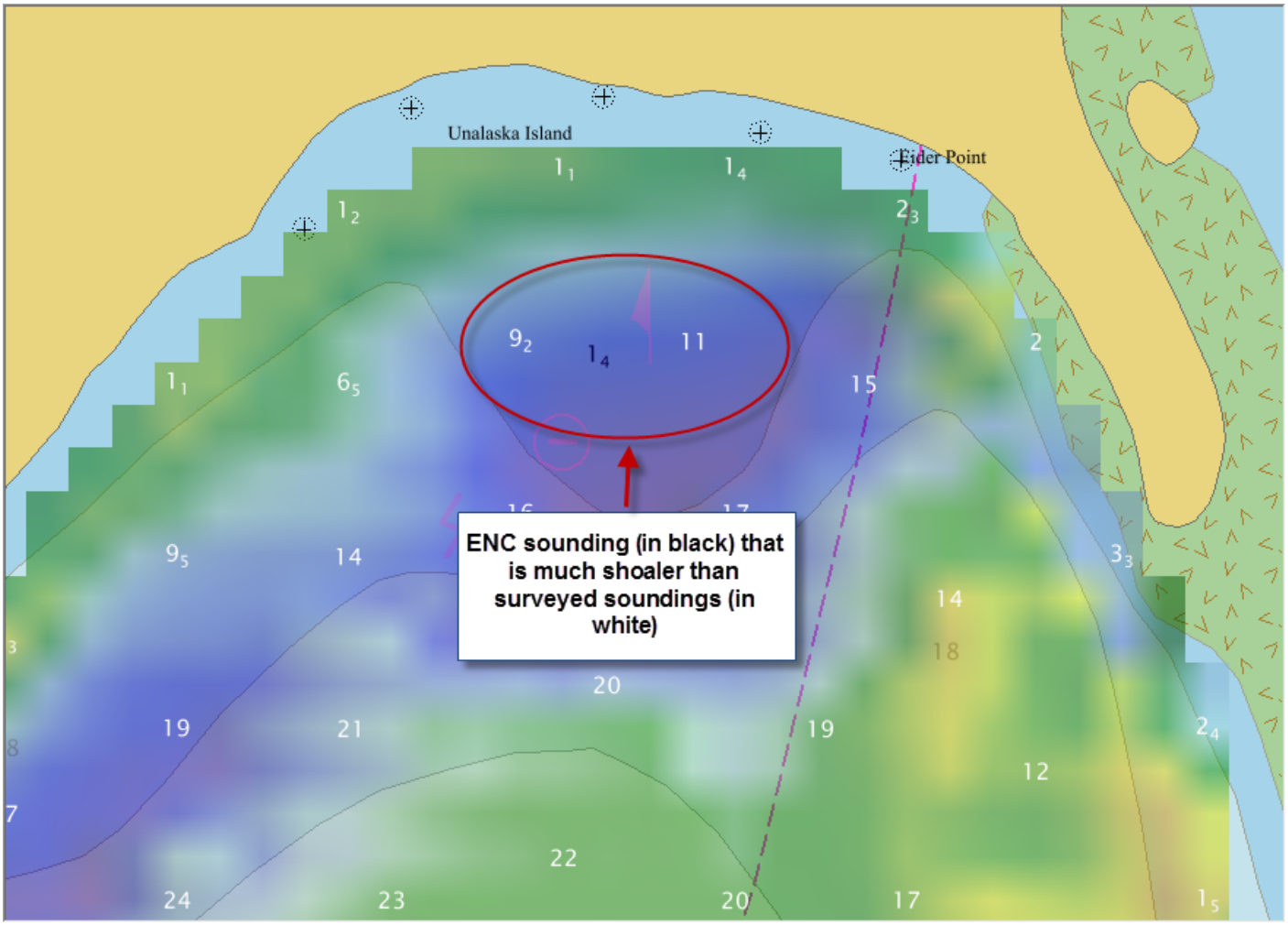


Figure 35: H12939 soundings in fathoms (in white) compared to ENC US5AK6CM depths in fathoms (in black)

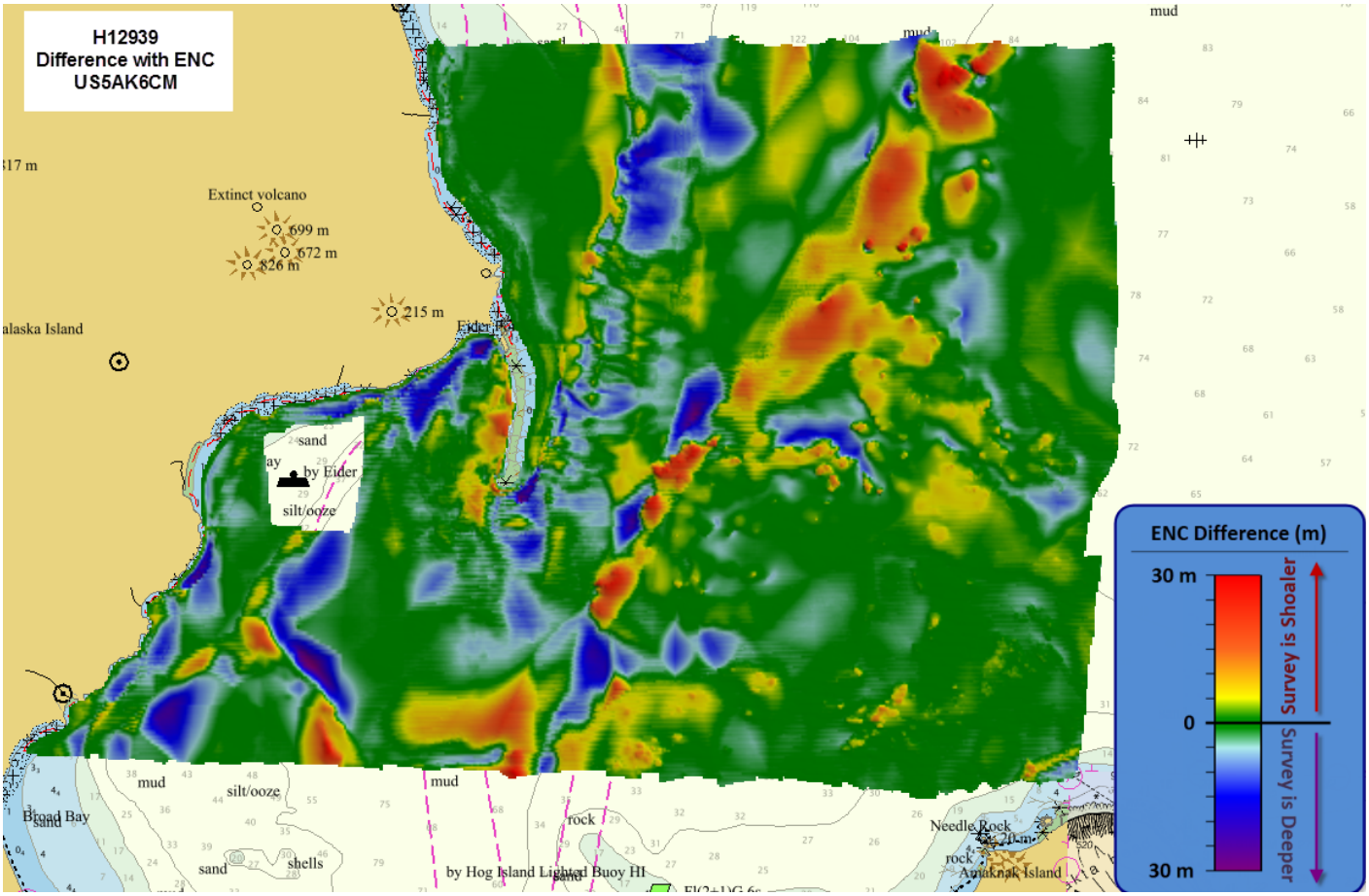
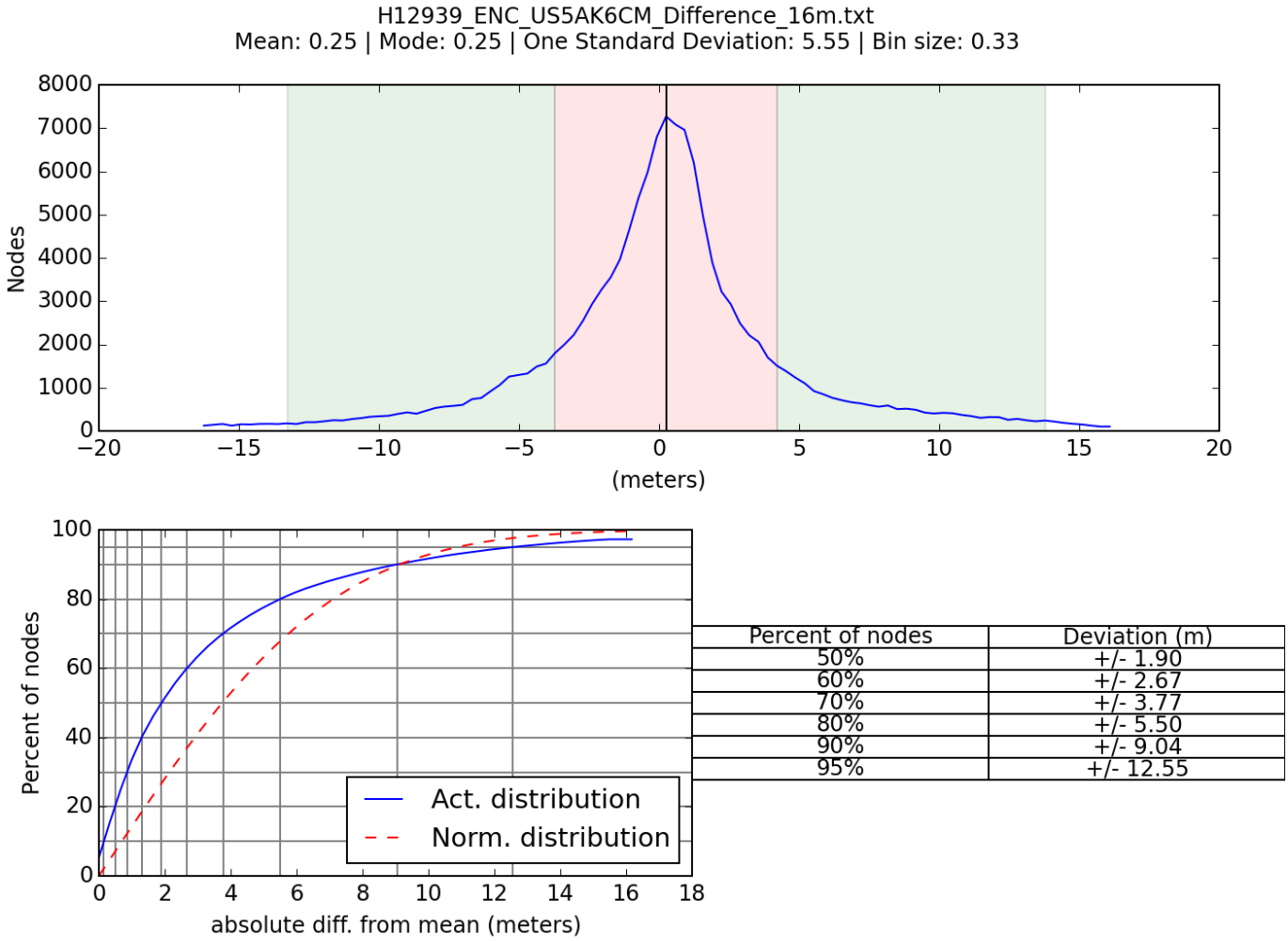


Figure 36: Overview of H12939 and US5AK6CM surface difference



Percent of nodes	Deviation (m)
50%	+/- 1.90
60%	+/- 2.67
70%	+/- 3.77
80%	+/- 5.50
90%	+/- 9.04
95%	+/- 12.55

Figure 37: Difference surface statistics between H12939 and interpolated TIN surface from US5AK6CM

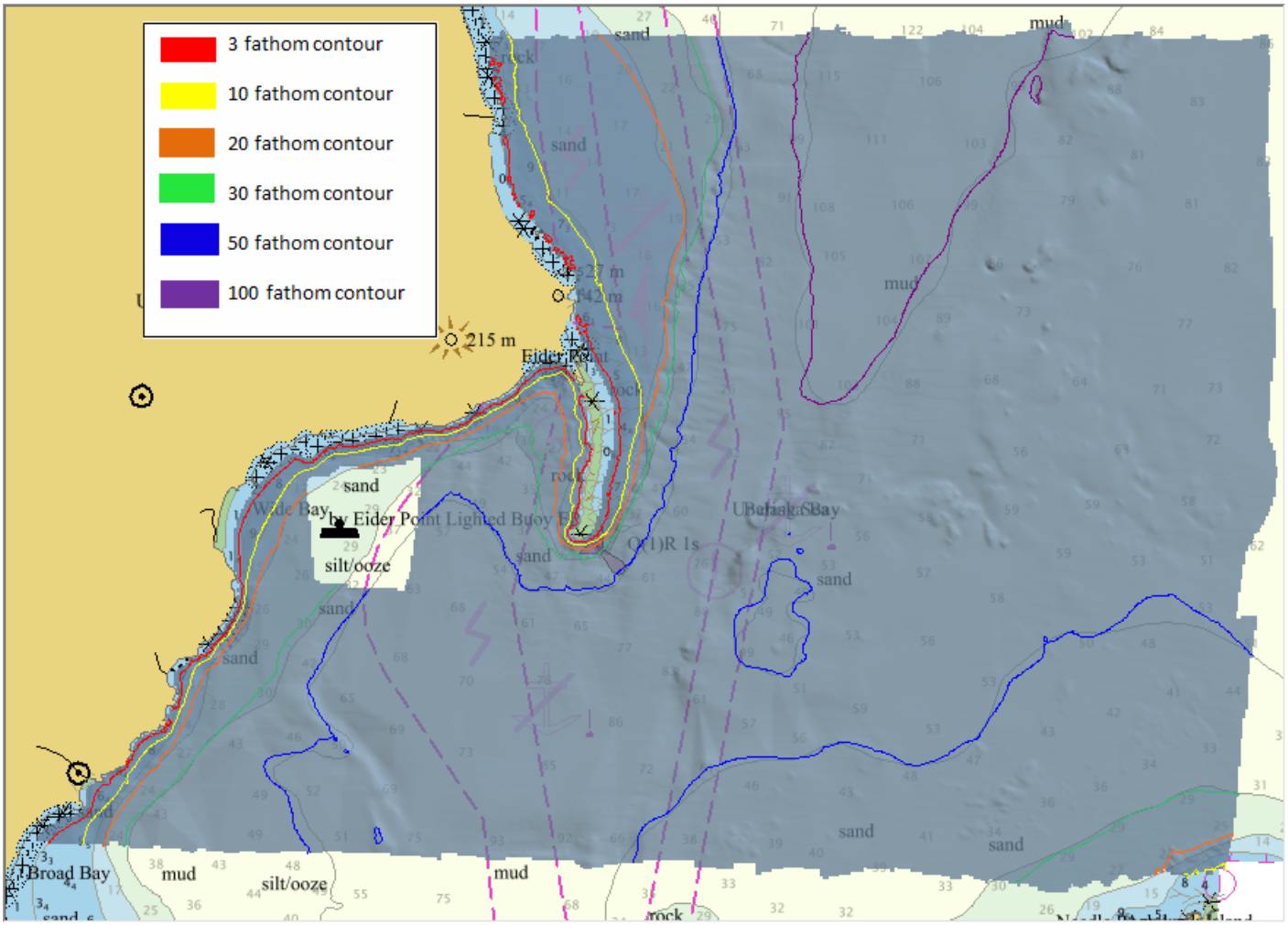


Figure 38: Overview of H12939 contours overlaid on US5AK6CM

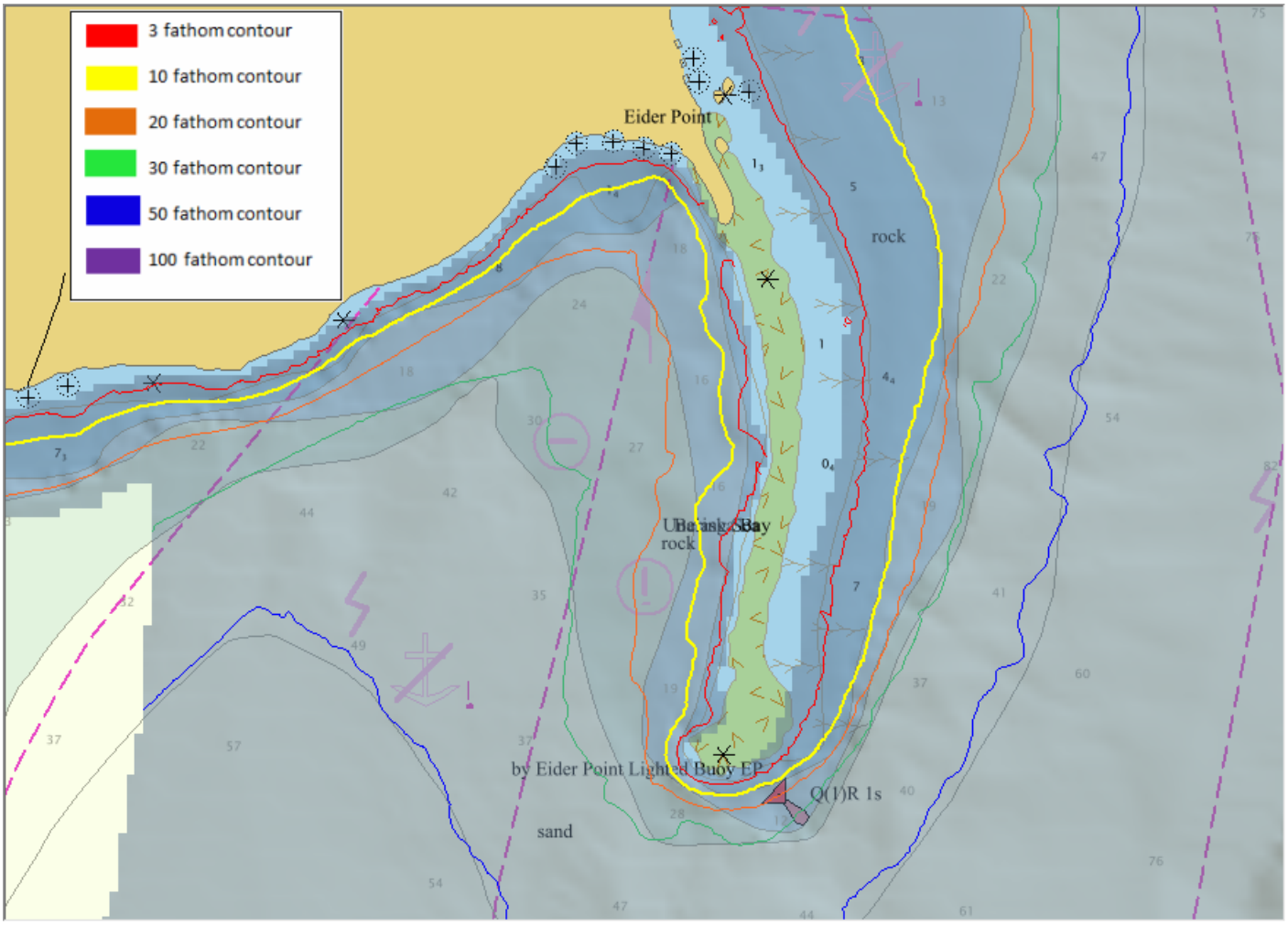


Figure 39: Contour differences near Eider Point between H12939 and US5AK6CM

D.1.3 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.4 Charted Features

All assigned features within the NALL were addressed and are included in the H12939 Final Feature File. Assigned features inshore of the NALL were 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.

D.1.5 Uncharted Features

Survey H12939 has 4 new features that are addressed in the H12939 Final Feature File. All 4 new features are Seabed Areas.

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

Four bottom samples were acquired for survey H12939. After backscatter was processed for H12939, bottom sample locations were changed from the assigned locations in the Project Instructions to more accurately reflect changes in seafloor type. All bottom samples were entered in the H12939 Final Feature File. See Figure 40 for a graphical overview of sample locations.

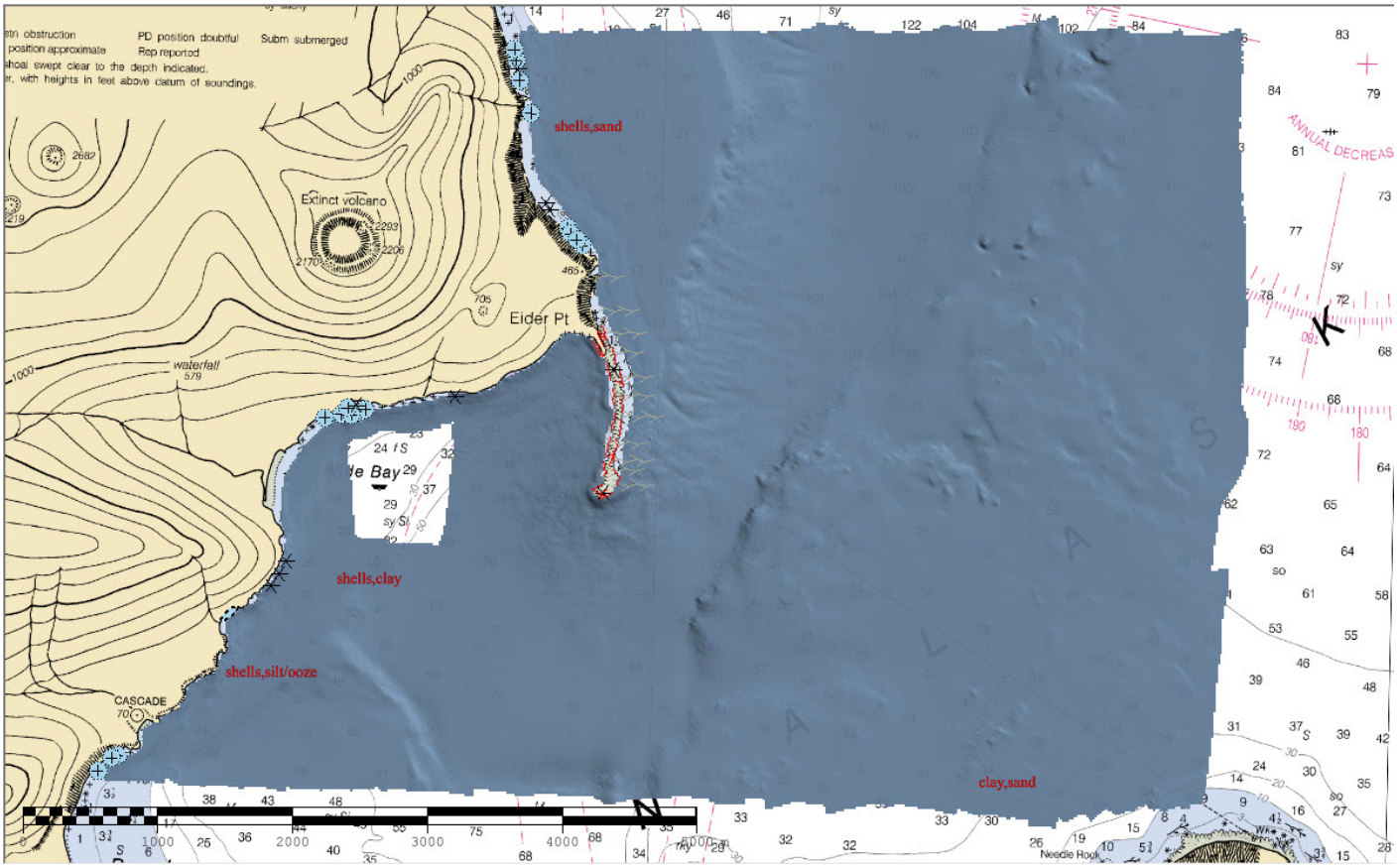


Figure 40: H12939 Bottom samples

D.2 Additional Results

D.2.1 Shoreline

H12939 survey limits extended to the NALL (see Section A.1) and all features within these limits were addressed and attributed in H12939 Final Feature File. All features inshore of the NALL were attributed in the Final Feature File with the description of "Not Addressed" and remarks of "Retain as charted, not investigated due to being inshore of NALL" as per HSSD Section 7.3.1. Annotations, information, and diagrams collected on DP forms and boat sheets during field operations are scanned and included in the Separates I Detached Positions folder.

D.2.2 Prior Surveys

No prior survey comparisons were assigned for this survey.

D.2.3 Aids to Navigation

Aids to navigation (ATONs) exist for this survey, but were not investigated.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Three abandoned cable areas run the length survey H12939 from NW to S. The cable areas are not visible in the data and no dangers were found during acquisition of survey H12939.

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 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, except as noted in the Descriptive Report. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required unless otherwise noted herein.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2016-10-25
Coast Pilot Report	2016-10-26

Approver Name	Approver Title	Approval Date	Signature
CDR Mark Van Waes, NOAA	Chief of Party	12/01/2016	VAN WAES.MARK.1240076329 2016.12.12 16:09:45 -08'00'
LT Bart Buesseler, NOAA	Field Operations Officer	12/01/2016	Digitally signed by BUESSELER.BART.OWEN.1396600559 Date: 2016.12.08 09:52:51 +01'00'
HCST Douglas Bravo	Chief Survey Technician	12/01/2016	Douglas Bravo 2016.12.07 18:03:50 -06'00'
HST Hannah Marshburn	Sheet Manager	12/01/2016	2016.12.06 16:00:58 -08'00'

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

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : September 07, 2016

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-Q328-FA-2016
HYDROGRAPHIC SHEET: H12939

LOCALITY: Vicinity of Eider PT and Wide Bay, Unalaska Island
TIME PERIOD: August 12, 2016 to August 20, 2016

TIDE STATION USED: 9462620 Unalaska, AK
Lat. 53° 52.8'N Long. 166° 32.2'W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.011

REMARKS: RECOMMENDED ZONING

Preliminary zoning for this project was provided under project OPR-Q328-FA-2016. Preliminary zoning is accepted as the final zoning for Registry No. H12939 for the time period of August 12, 2016 to August 20, 2016.

Please use the zoning file Q328FA2016CORP submitted with the project instructions for OPR-Q328-FA-2016. Zones BGS89 and BGS92 are the applicable zones for H12939.

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).

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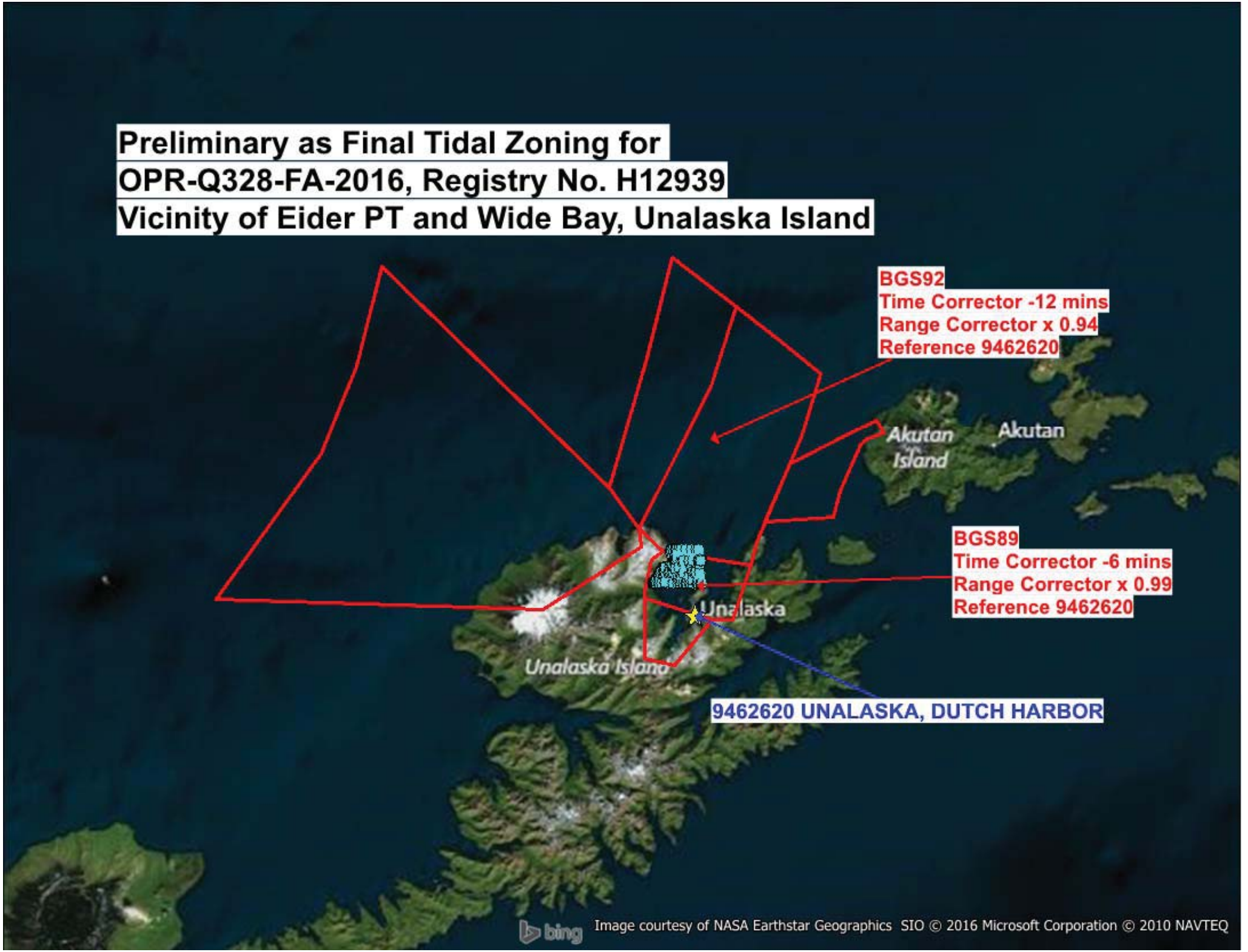
CHIEF, PRODUCTS AND SERVICES BRANCH


Preliminary as Final Tidal Zoning for
OPR-Q328-FA-2016, Registry No. H12939
Vicinity of Eider PT and Wide Bay, Unalaska Island
BGS92
Time Corrector -12 mins
Range Corrector x 0.94
Reference 9462620
Akutan Island
Akutan
BGS89
Time Corrector -6 mins
Range Corrector x 0.99
Reference 9462620
Unalaska
Unalaska Island
9462620 UNALASKA, DUTCH HARBOR
bing
Image courtesy of NASA Earthstar Geographics SIO © 2016 Microsoft Corporation © 2010 NAVTEQ

APPROVAL PAGE

H12939

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 NGDC for archive

- H12939_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12939_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

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Date: 2017.07.28 10:12:16 -07'00'

Approved:_____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

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Date: 2017.07.28 13:29:18 -07'00'

Approved:_____

Cecelia Linder
Acting Chief, Pacific Hydrographic Branch