

H12548

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

**DESCRIPTIVE REPORT**

Type of Survey: Navigable Area

Registry Number: H12548

**LOCALITY**

State(s): Alaska

General Locality: Krenitzin Islands

Sub-locality: Reef Point to North Head

**2013**

CHIEF OF PARTY  
Dean Moyles

LIBRARY & ARCHIVES

Date:

**HYDROGRAPHIC TITLE SHEET**

**H12548**

**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: **Krenitzin Islands**

Sub-Locality: **Reef Point to North Head**

Scale: **40000**

Dates of Survey: **06/28/2013 to 07/20/2013**

Instructions Dated: **05/15/2013**

Project Number: **OPR-Q191-KR-13**

Field Unit: **Fugro Pelagos, Inc.**

Chief of Party: **Dean Moyles**

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. Revisions and notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via <http://www.ngdc.noaa.gov/>.*

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## Descriptive Report to Accompany Survey H12548

Project: OPR-Q191-KR-13

Locality: Krenitzin Islands

Sublocality: Reef Point to North Head

Scale: 1:40000

June 2013 - July 2013

**Fugro Pelagos, Inc.**

Chief of Party: Dean Moyles

### A. Area Surveyed

H12548 is located in the area from Reef Point to North Head.

#### A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
54° 16' 32.02" N 165° 53' 21.01" E	54° 4' 53" N 166° 12' 58" E

*Table 1: Survey Limits*

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

#### A.2 Survey Purpose

The purpose of this work is to provide NOAA with modern and accurate hydrographic survey data for the area from Reef Point to North Head. The survey covered 22.24 square nautical miles of critical survey area as designated in the NOAA Hydrographic Survey Priorities, 2012 edition.

#### A.3 Survey Quality

The entire survey is adequate to supersede previous data.

### A.4 Survey Coverage

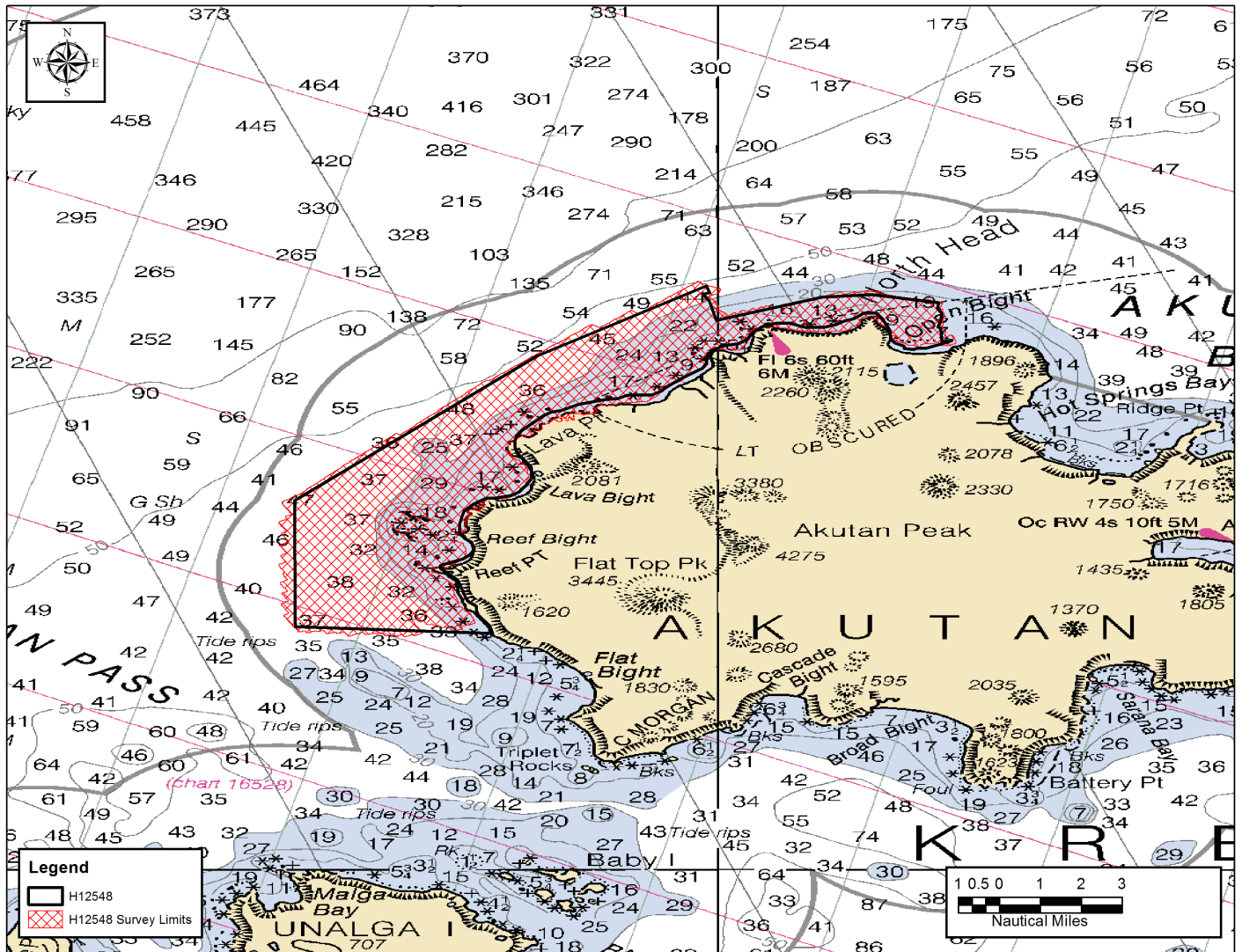


Figure 1: H12548 Survey Limits

Survey Coverage was in accordance with the requirements in the Project Instructions and the HSSD.

### A.5 Survey Statistics

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

	<b>HULL ID</b>	<i>Ocean Pioneer</i>	<i>R2</i>	<i>D2</i>	<i>Total</i>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	0	0
	<b>MBES Mainscheme</b>	208.8	35.96	312.3	557.06
	<b>Lidar Mainscheme</b>	0	0	0	0
	<b>SSS Mainscheme</b>	0	0	0	0
	<b>SBES/SSS Mainscheme</b>	0	0	0	0
	<b>MBES/SSS Mainscheme</b>	0	0	0	0
	<b>SBES/MBES Crosslines</b>	8.98	0	17.05	26.03
	<b>Lidar Crosslines</b>	0	0	0	0
<b>Number of Bottom Samples</b>					5
<b>Number of AWOIS Items Investigated</b>					0
<b>Number Maritime Boundary Points Investigated</b>					0
<b>Number of DPs</b>					0
<b>Number of Items Investigated by Dive Ops</b>					0
<b>Total SNM</b>					22.24

Table 2: Hydrographic Survey Statistics

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

<b>Survey Dates</b>	<b>Day of the Year</b>
06/28/2013	179
06/29/2013	180
06/30/2013	181
07/01/2013	182
07/06/2013	187
07/11/2013	192
07/12/2013	193
07/14/2013	195
07/15/2013	196
07/17/2013	198
07/18/2013	199
07/19/2013	200
07/20/2013	201

*Table 3: Dates of Hydrography*

*There were 3 bottom samples and 40 DPs collected for the survey.*

## **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	<i>Ocean Pioneer</i>	<i>R2</i>	<i>D2</i>
LOA	205 feet	29 feet	29 feet
Draft	14 feet	3 feet	3 feet

*Table 4: Vessels Used*

Due to an inoperable davit, production for vessel R2 was limited for the OPR-Q191-KLR-13 survey. The last day of survey for vessel R2 was JD 181.

*JD 181 2013 equates to June 30, 2013.*

### B.1.2 Equipment

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

Manufacturer	Model	Type
--------------	-------	------

*Table 5: Major Systems Used*

WaterLOG H3611 (Radar Water Level Sensors) were installed on the port and starboard gunwales of M/V Ocean Pioneer to obtain a more precise static draft measurement. Samples were taken over a 10 minute period and averaged to determine the vessel's draft. Traditional static draft measurement techniques were also employed as a substitute for the WaterLOG H3611 measurements when required.

*Refer to DAPR for major systems used.*

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines acquired for this survey totaled 5% of mainscheme acquisition.

Crosslines were planned and well distributed throughout the survey to ensure adequate quality control. Total crossline length surveyed was 26.03 nautical miles or 4.67 percent of the total mainscheme line length. Each crossline was compared to the entire mainscheme line plan through a 2m CUBE surface using the CARIS HIPS QC report routine. If the crossline covered an area with significantly rocky topography, the crossline was compared to a 1m CUBE surface of the entire mainscheme line plan.

The majority of the QC Reports fall well within the required accuracy specifications. However, several crosslines run by survey vessel D2 in the area from Reef Point to North Head contain beams in the QC report that fall below the 95% confidence level due to significantly rocky topography as illustrated in the crossline profile from H12548. Good conformity was still seen between the mainscheme lines and the crosslines.

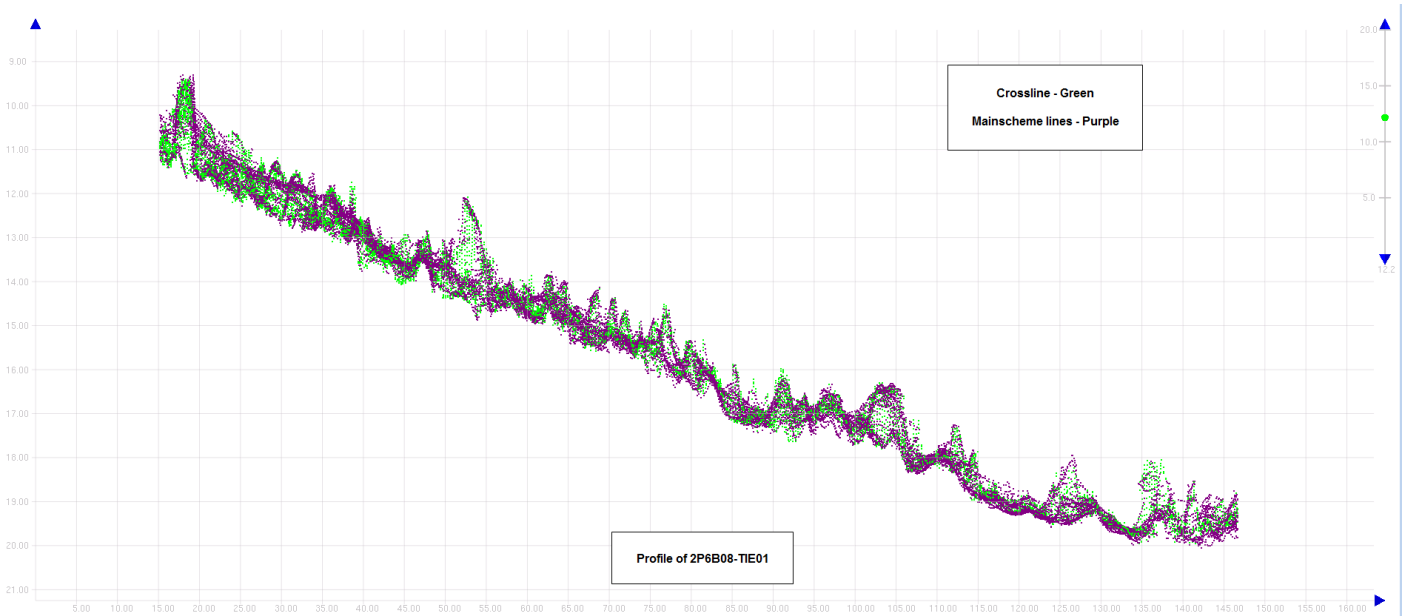


Figure 2: H12548 Crossline Profile

**B.2.2 Uncertainty**

The following survey specific parameters were used for this survey:

Measured	Zoning
0.1 meters	0.2 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
Ocean Pioneer	1.797 meters/second	0 meters/second	0.250 meters/second
R2	0 meters/second	0.439 meters/second	0.250 meters/second
D2	0 meters/second	1.101 meters/second	0.250 meters/second

Table 7: Survey Specific Sound Speed TPU Values

The majority of the data fell within IHO Order 1a accuracy specifications. Nodes that exceeded the allowable specifications were located in rough or rapidly changing topography or areas where the outer beams of the coverage boundaries were the single contributor to the surface. Despite the higher uncertainty values in these areas, agreement between adjacent lines and co-linearity between soundings was good.

Note: The percentage of nodes within IHO Order 1a, were computed by CARIS using the Surface QC Report utility and are as follows:

#### CUBE Surface Uncertainty Report

Surface Depth Range (m) % of nodes within IHO Order 1a

H12548-1m_Final	0 - 20	95.37%
H12548-2m_Final	18 - 40	99.62%
H12548-4m_Final	36 - 80	99.99%
H12548-8m_Final	72 - 160	100.00%

As illustrated in the uncertainty errors graphic, the uncertainty is generally lowest near the sonar nadir beams and increases toward the outside of each swath. This is expected and primarily a result of the sonar's device model used within CARIS HIPS for TPU calculations. In general, total propagated uncertainty varies proportionally to water depth. Outer beams also have higher uncertainty values as a function of the bottom-detection algorithms within the sonar. Data met project specifications.

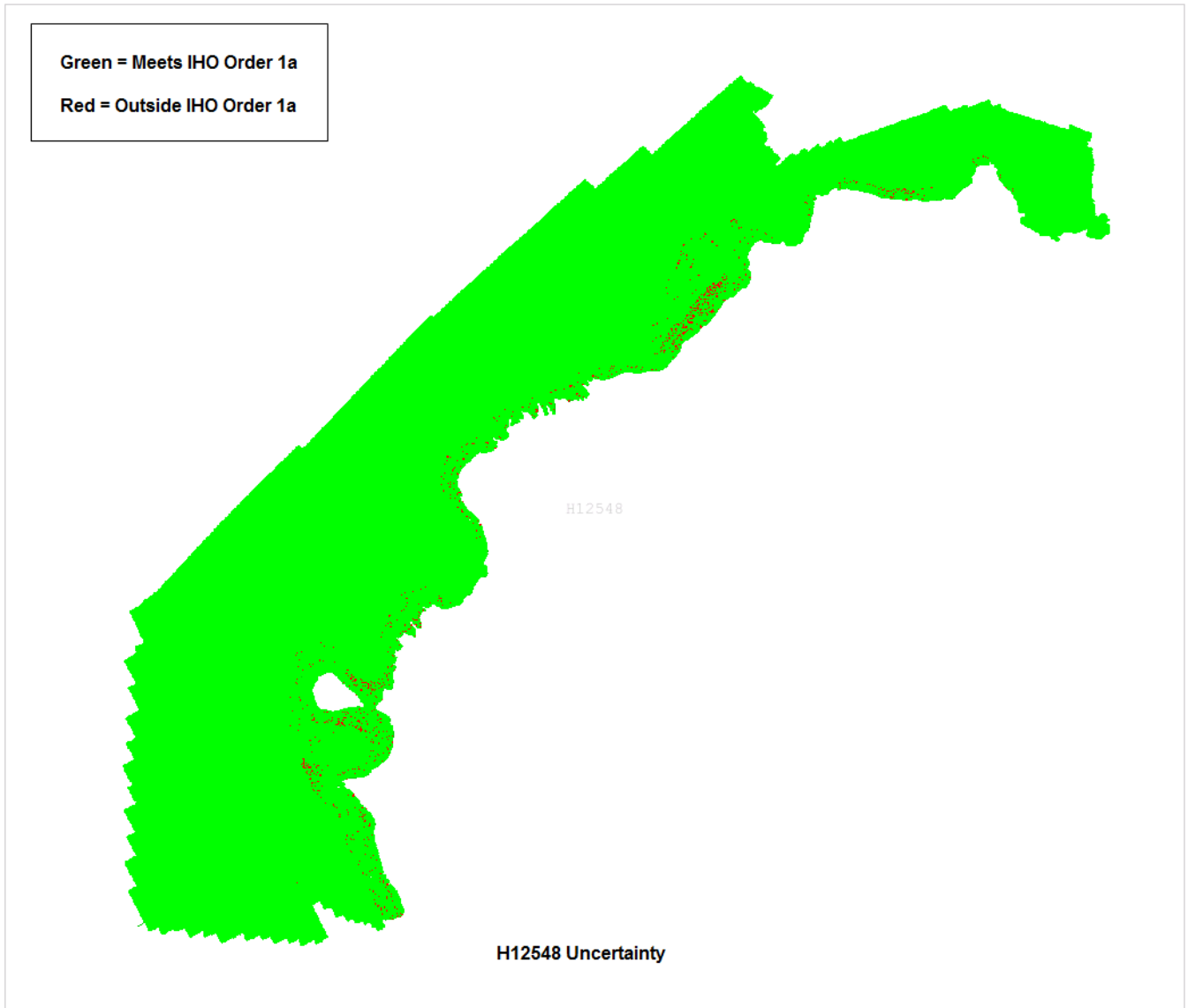


Figure 3: H12548 Uncertainty

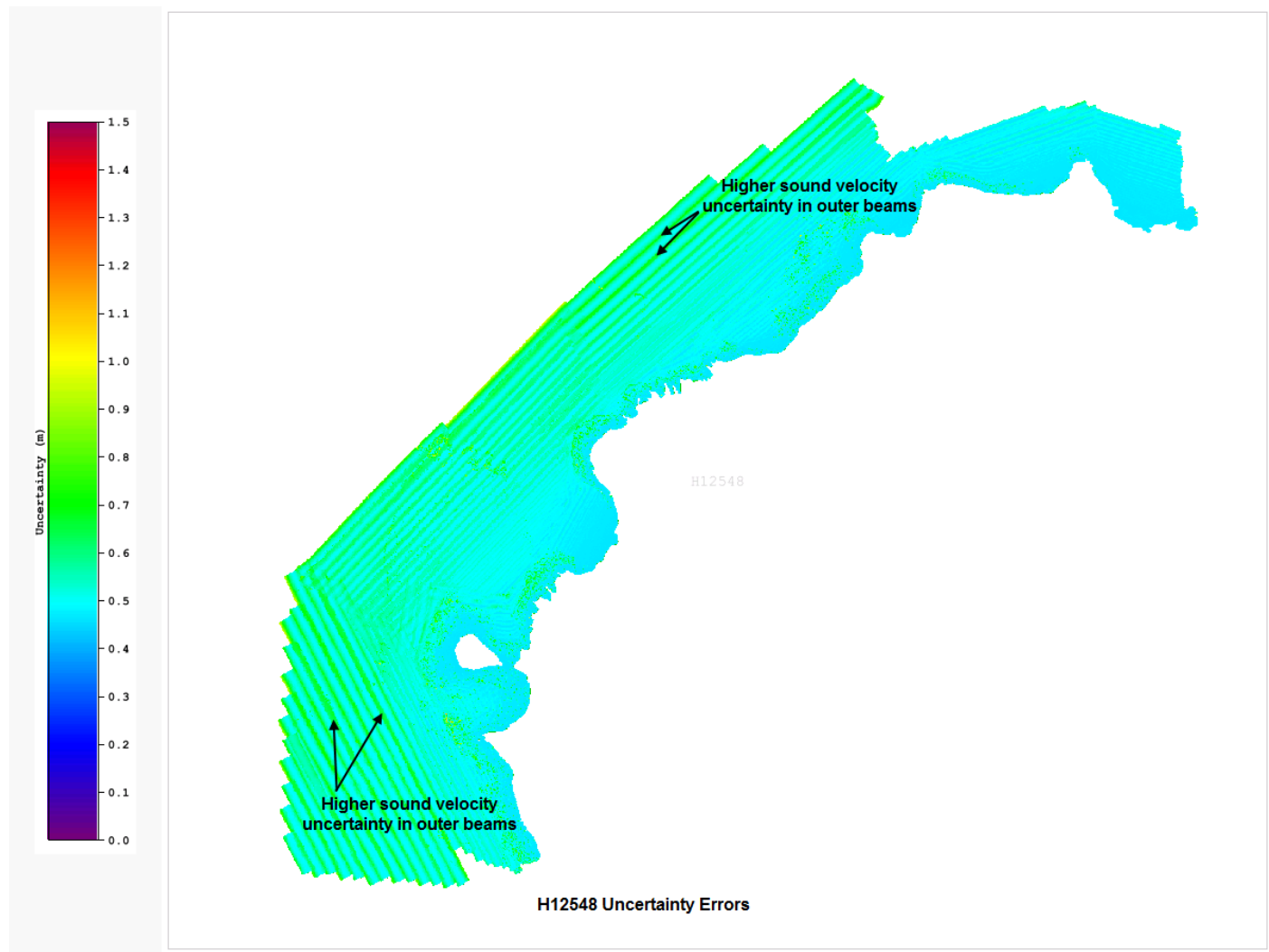


Figure 4: H12548 Uncertainty Errors

*TVU values exceed IHO budgets in nearshore areas with higher frequency than usual. In the DAPR, section B, the surveyor indicates that the following values were entered into the CARIS 'Compute TPU box: Measured Tidal Uncertainty: 0.1m and Tidal Zoning Uncertainty: 0.2m. It is also indicated that these values were based on the HSSD 2012 which itself states that "An estimate for a typical processing error is 0.10 m at the 95% confidence level...." and ... "Estimates for typical errors associated with tidal zoning are 0.20 m at the 95% confidence level." Since CARIS expects these values to be input at the 68% CI level, the surveyor has effectively doubled the TVU associated with tides. This doubling of the tidal constituent of TVU is consistent with frequency with which the TVU budget was exceeded in nearshore areas. In review - and without any re-evaluation of TVU values based on the above findings - the number of nodes in the 1m surface meeting IHO order 1a TVU budget was found to be 95.25%. This acceptable percentage disagrees with the documented uncertainty report.*

### B.2.3 Junctions

The surveys are in agreement along their common borders. The conformity between H12548 and the bordering survey area (H12549) was inspected during processing, using CARIS HIPS' Subset Editor routine and finalized BASE Surfaces. Difference surfaces were also created at a 4-meter resolution between H12548 and the junction with survey area H12361 (2011), the junction with survey area W00225 (2011), and the junction with the 5-meter surface from H11713 (2007). The data were well within the IHO Order 1a allowable error.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12361	1:10000	2011	Fugro Pelagos, Inc.	E
W00225	1:40000	2011	Fugro Pelagos, Inc.	NE
H11713	1:10000	2007	Fugro Pelagos, Inc.	S

*Table 8: Junctioning Surveys*

#### H12361

A difference surfaces was created at a 4-meter resolution between H12548 and the junction with survey area H12361 (2011), confirming that approximately 68.57% of the nodes agree to within +/-0.50m. The other 31.43% were on the outer edges of the swath at the coverage boundaries or were in areas with dynamic topography. The data were well within the IHO Order 1a allowable error.

The southern portion of the junction area between H12548 and H12361 exhibited characteristics of a dynamic bottom. From the 2011 survey of H12361 to the 2013 survey of H12548, sediment appears to have eroded and deposited in specific sub-localities, as shown in the image provided. The hydrographer attempted to locate rocks or other fixed features in the junction area exhibiting this dynamic bottom; however, no rocks or fixed features were available to provide support for the claim that the differences between the two surveys are indeed due to a dynamic bottom. However, the hydrographer believes the differences are caused by dynamic bottom due to a) the sandy bottom type, b) the tide rips in the area, as indicated on NOAA's raster chart 16531, and c) the strong agreement between the survey data in the northern portion of the survey junction area.

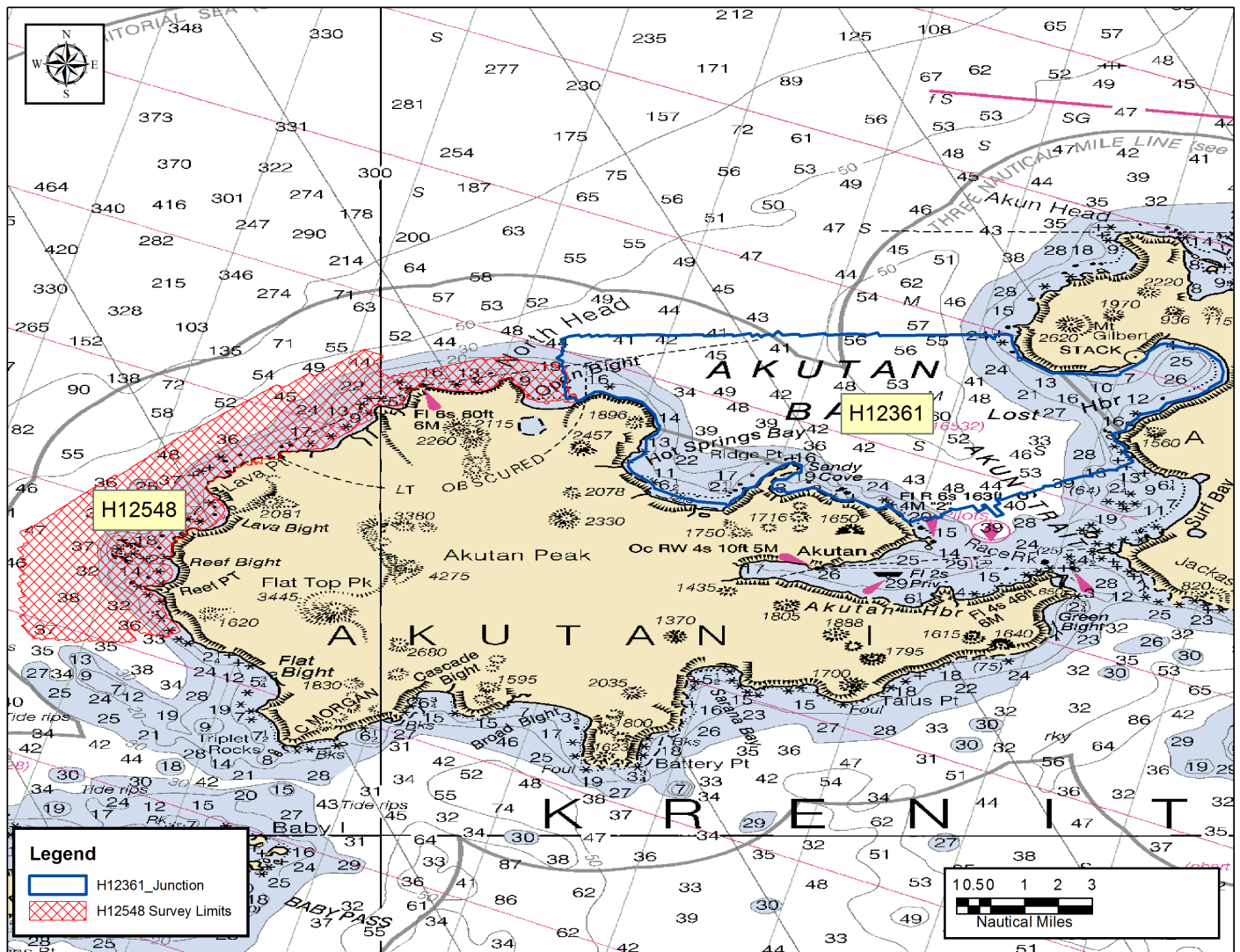


Figure 5: H12548 Junctions with H12361

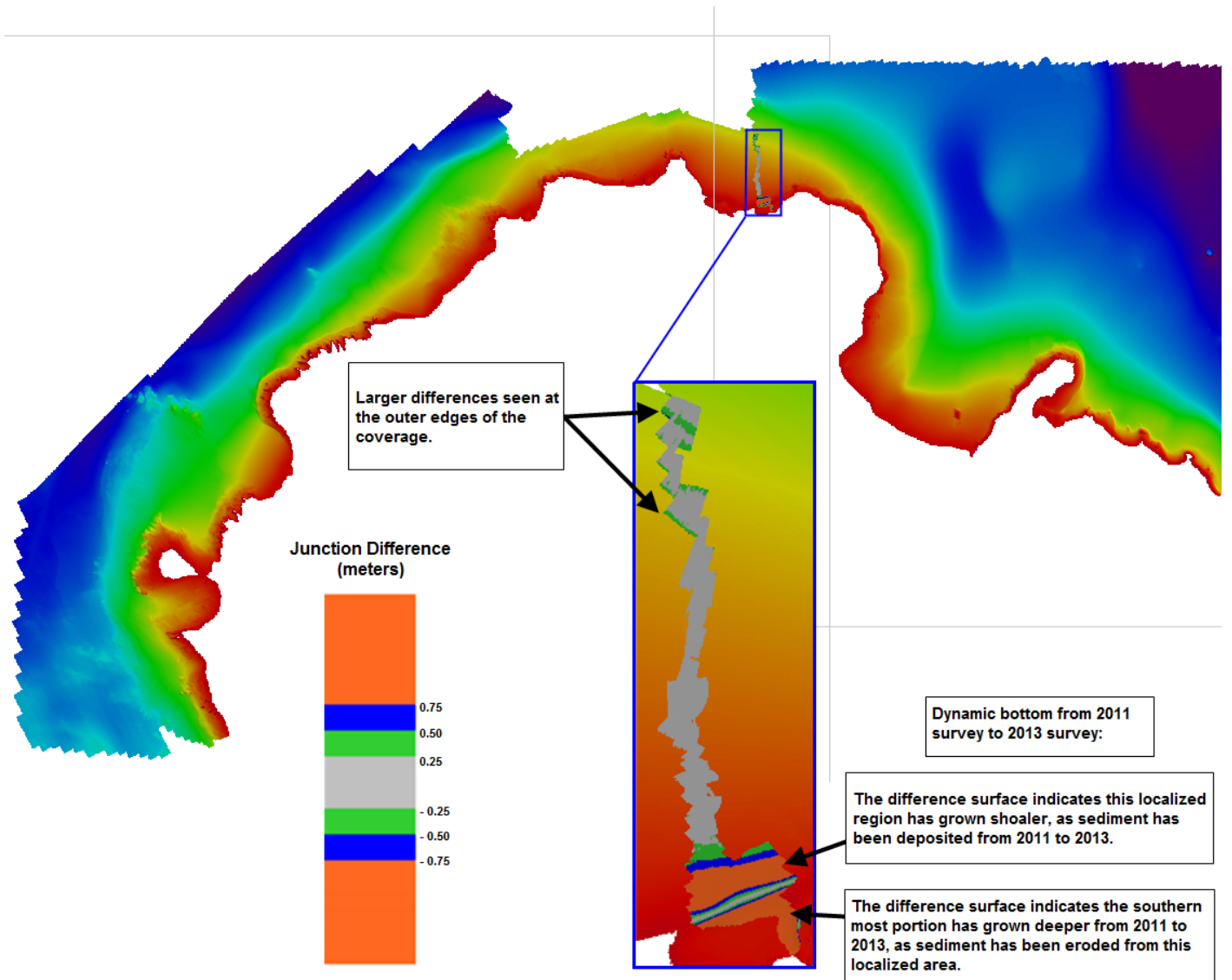
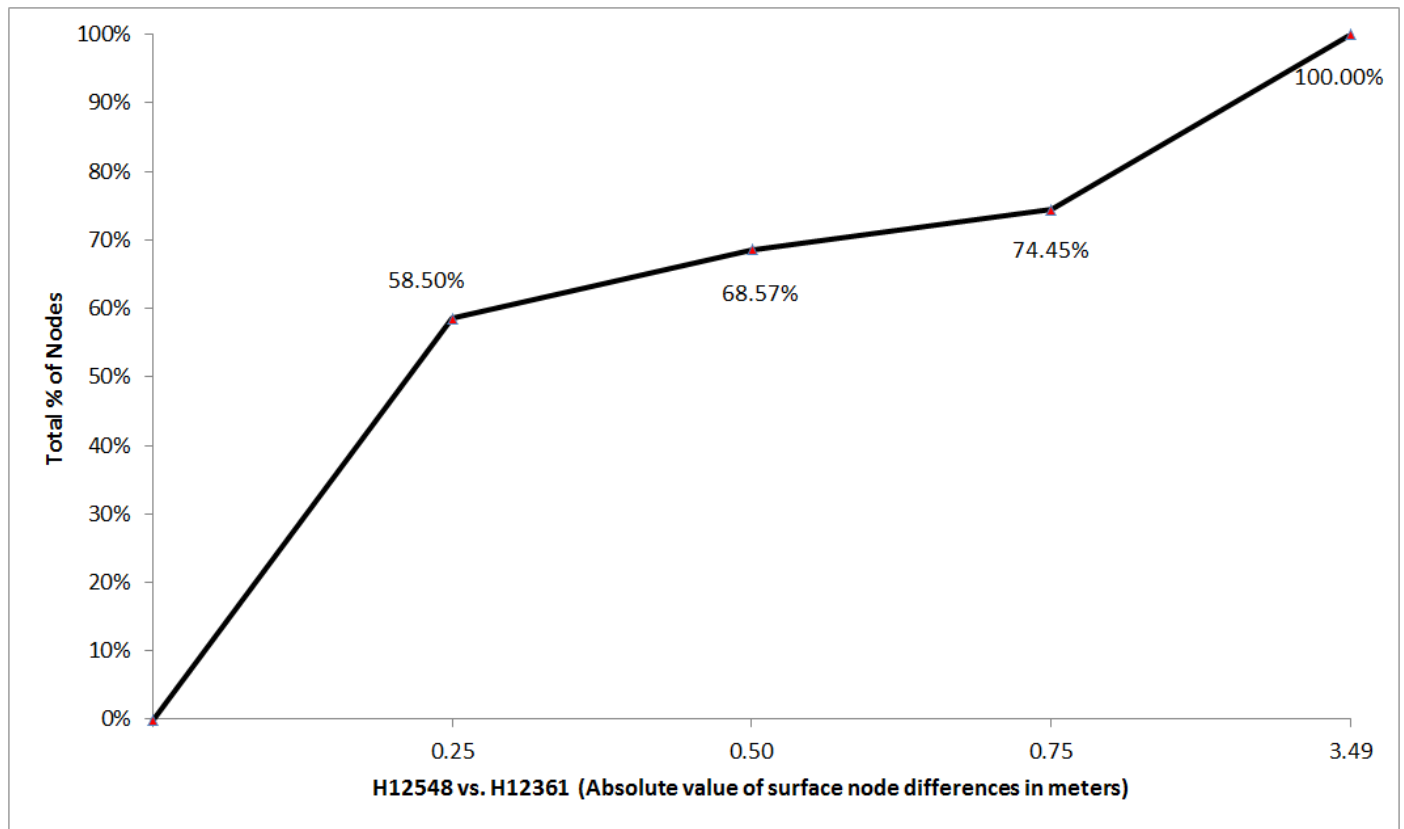


Figure 6: Difference Surface H12548 vs. H12361



*Figure 7: Difference Surface Statistics H12548 vs. H12361*

#### W00225

A difference surface was created at a 4-meter resolution between H12548 and the junction with survey area W00225 (2011), confirming that approximately 99.11% of the nodes agree to within +/-0.50m. The other 0.89% were on the outer edges of the swath at the coverage boundaries. The data were well within the IHO Order 1a allowable error.

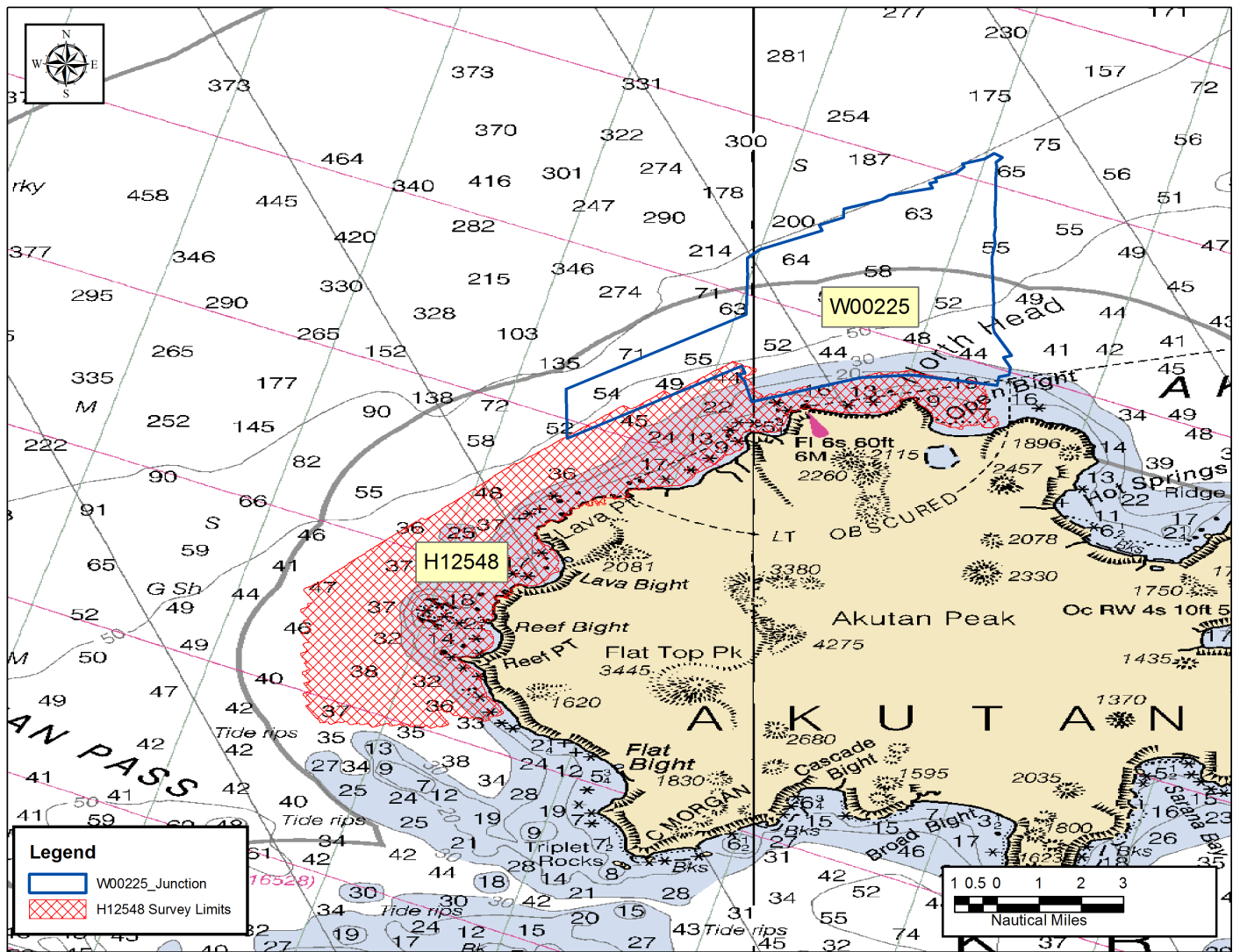


Figure 8: H12548 Junctions with W00225

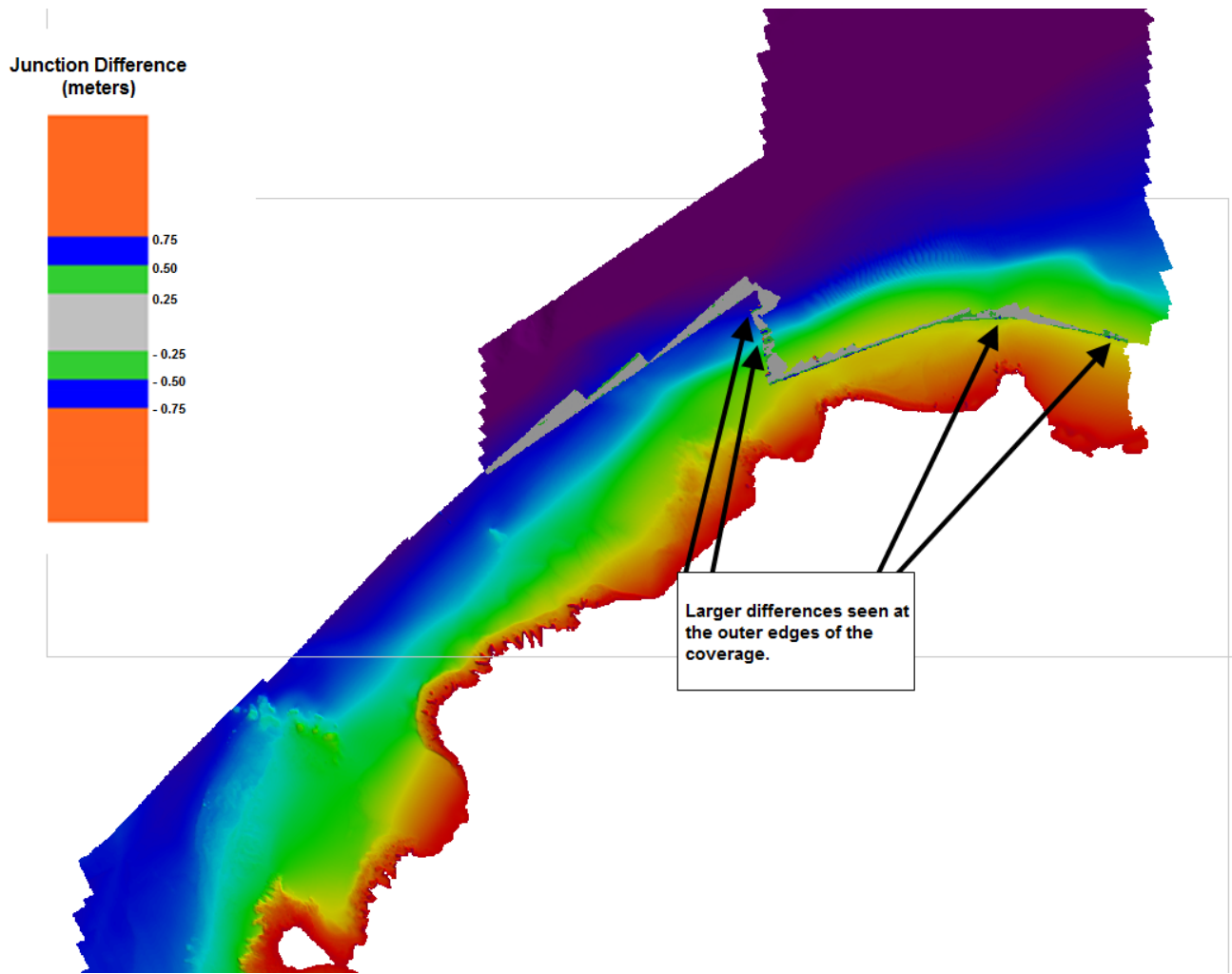


Figure 9: Difference Surface H12548 vs. W00225

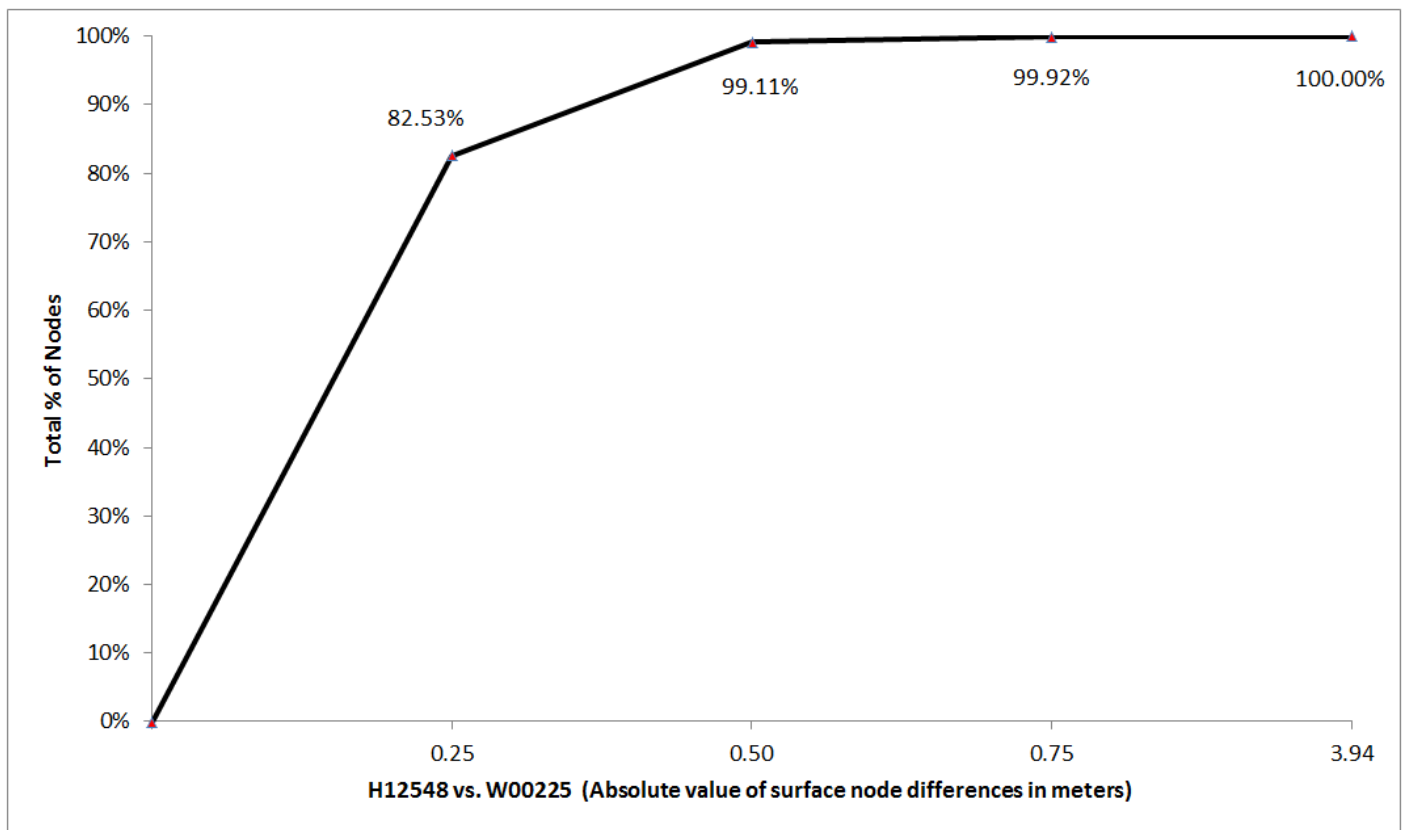


Figure 10: Difference Surface Statistics H12548 vs. W00225

### H11713

A difference surface was created to compare the 4-meter surface from H12548 and the junction with the 5-meter surface from H11713 (2007), confirming that approximately 96.57% of the nodes agree to within  $\pm 0.50\text{m}$ . The other 3.43% were on the outer edges of the swath at the coverage boundaries or were located in areas with rocky topography. The data were well within the IHO Order 1a allowable error.

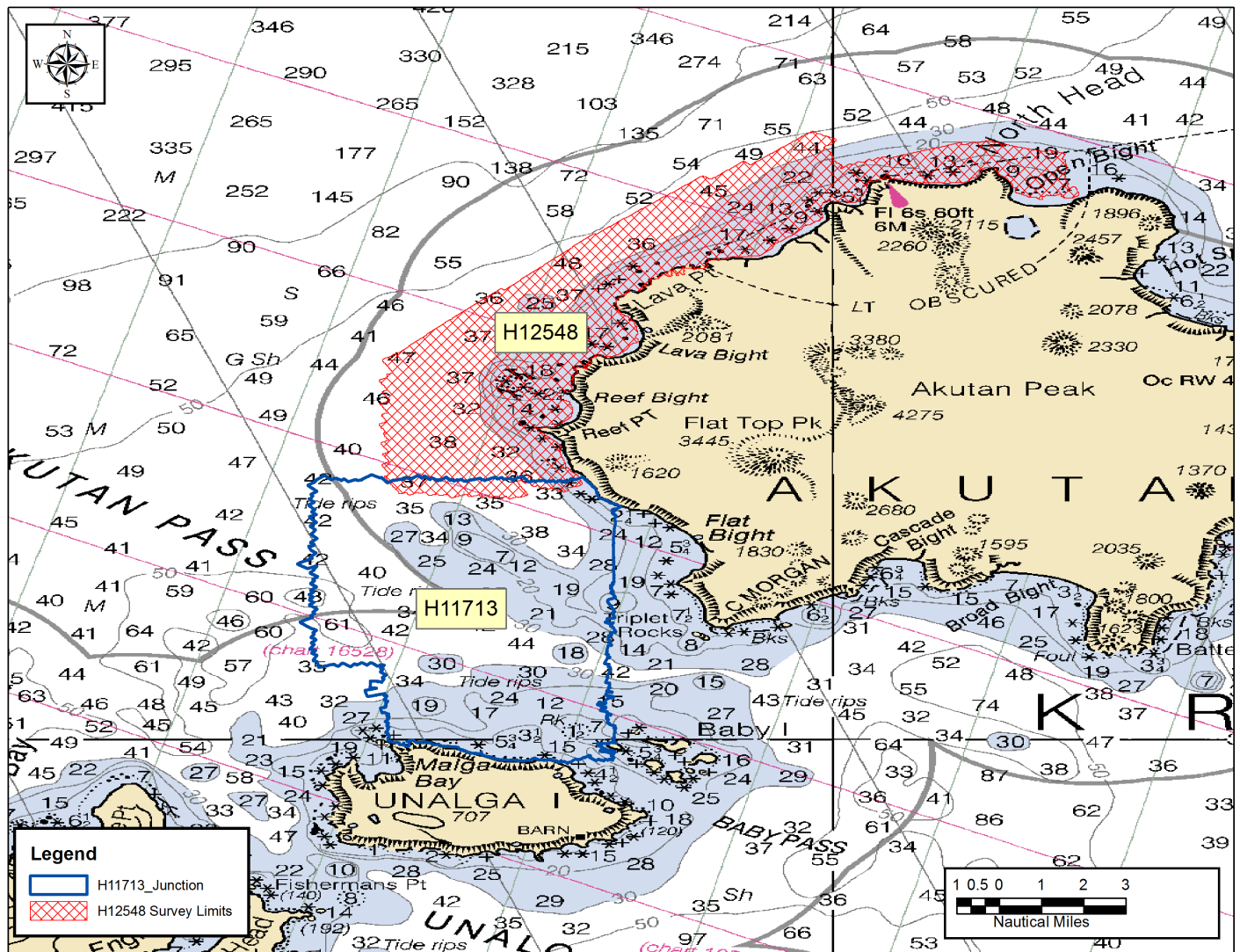


Figure 11: H12548 Junctions with H11713

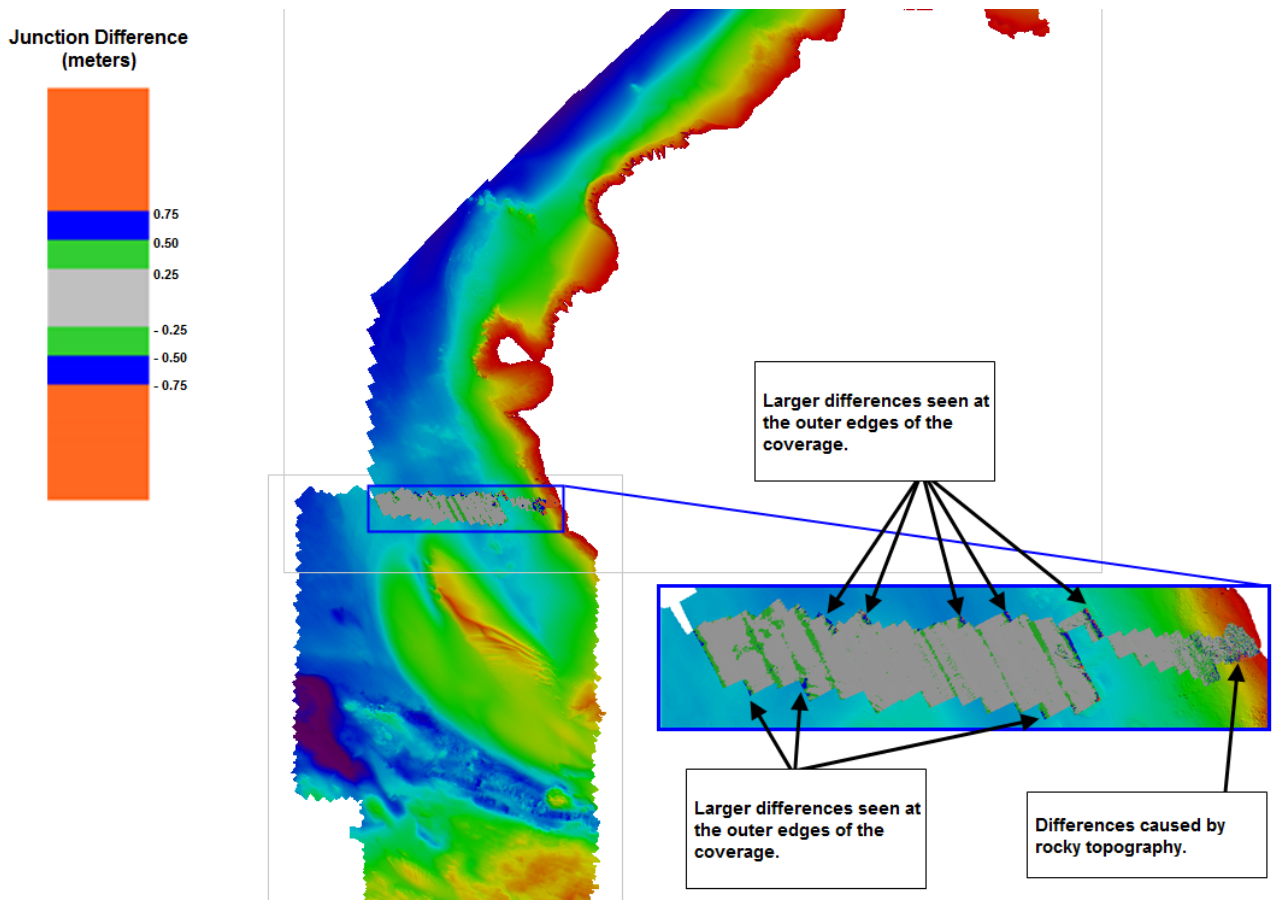


Figure 12: Difference Surface H12548 vs. H11713

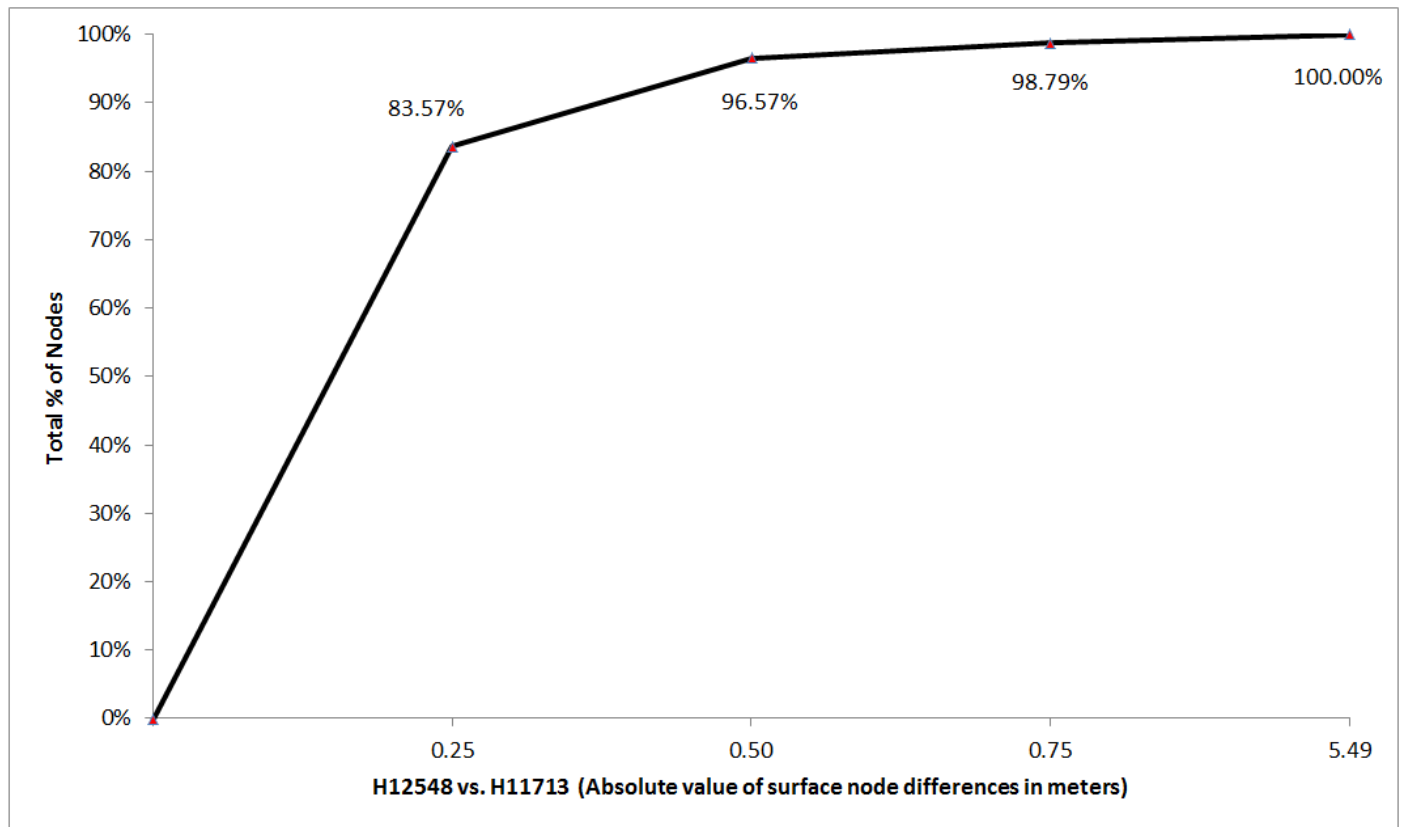


Figure 13: Difference Surface Statistics H12548 vs. H11713

*A concurrent junction is also made with H12549 to the north, OPR-Q191-KR-13, 1:40,000. The junction with survey H12549 was completed during the SAR. A difference surface was generated between the 8 meter combined surfaces from both surveys and the difference are generally within 1 meter in depths greater than 85 meters, which is well within IHO specifications. The areas that show greater differences are deep areas, the outer edge of swath coverage and areas of dramatic topography, which is to be expected.*

#### 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

### Kelp

Along coastal regions of the survey, an abundance of kelp was observed during data acquisition. Due to data quality and safety issues, there may be some areas where survey operations were halted, thus not achieving the 4 fathom survey limit. In addition to this, during data processing every effort was made to flag the kelp as rejected data wherever the CUBE BASE surface included the kelp as part of the seafloor.

### Sound Speed Refraction Errors

Sound speed refraction errors were seen in the outer beams of the swaths of survey lines that were run in deeper water. However, line overlap was sufficient, and the affected soundings were rejected in CARIS HIPS' Subset Editor routine to ensure the CUBE surface met IHO Order 1a specifications.

## B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed measurements were conducted and applied as discussed in the Corrections to Echo Soundings section of the DAPR.

## B.2.8 Coverage Equipment and Methods

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

## B.2.9 Data Density

The NOS Hydrographic Surveys Specifications and Deliverables, April 2012, requires 95% of all nodes to be populated with at least five soundings. Survey H12548 met these project specifications.

Density requirements for H12548 were achieved with at least 99.72% of finalized surface nodes containing five or more soundings. Nodes that failed to meet the allowable specifications were located in rough or rapidly changing topography or areas where the outer beams of the coverage boundaries were the single contributor to the surface.

### CUBE Surface Density Report

Surface Depth Range (m) % of nodes within HSSD 2012

H12548-1m_Final	0 - 20	99.73%
H12548-2m_Final	18 - 40	99.96%
H12548-4m_Final	36 - 80	99.94%
H12548-8m_Final	72 - 160	99.85%

Detection requirements were met by minimizing vessel speed when necessary, using sonar range scales appropriate to the water depth to maximize ping rates, and maximizing swath overlap. These variables were adjusted in real-time by the online acquisition crew based on the WinFrog QC and coverage displays. The shipboard processing crew provided feedback after preliminary processing and coverage creation in CARIS. HIPS and In-fills were run as necessary.

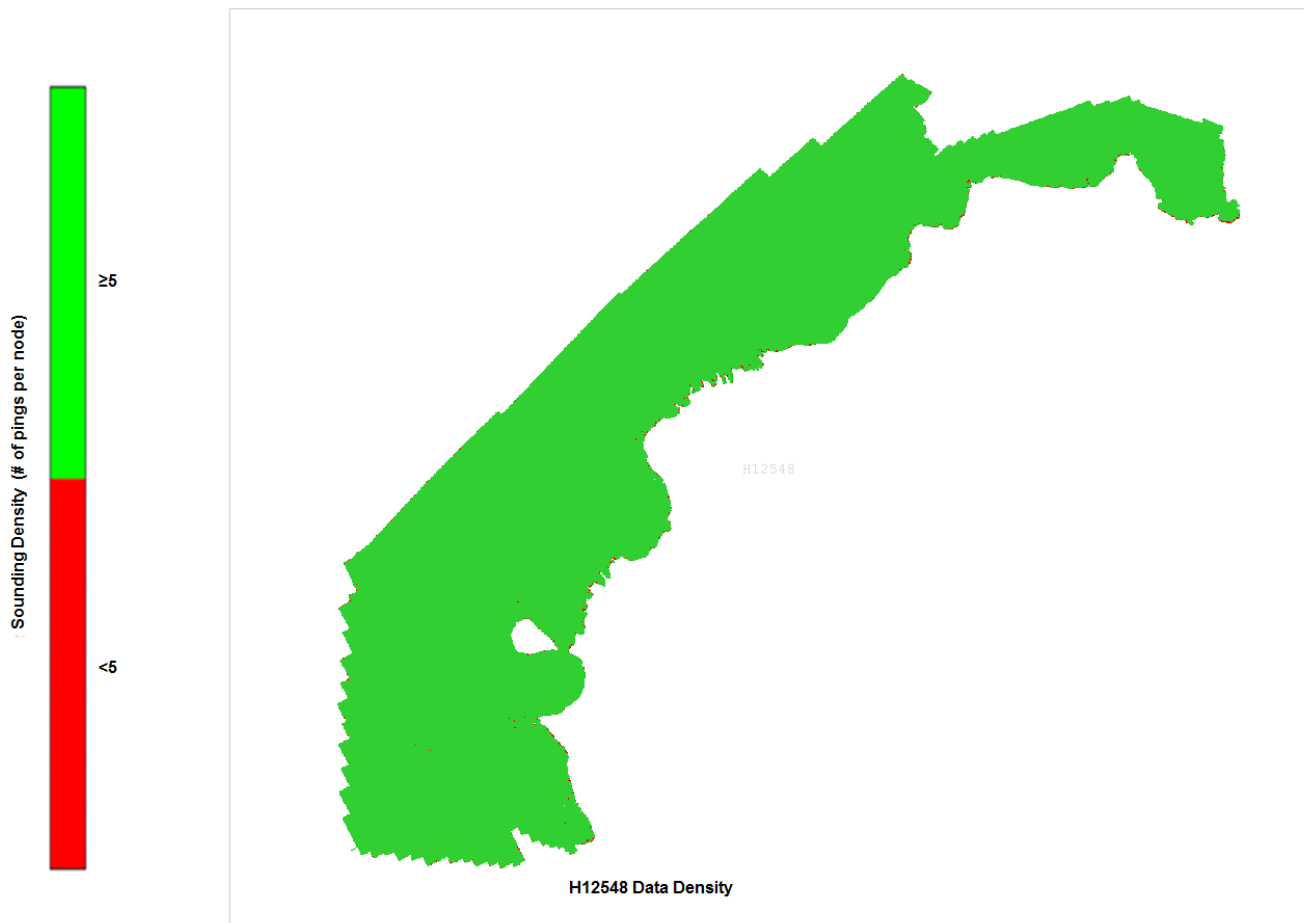


Figure 14: H12548 Data Density

## 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

Towed Side Scan Sonar (SSS) operations were not required by this contract, but the backscatter and beam imagery snippet data from all multibeam systems were logged and are stored in the s7k files. All beam imagery snippet data was logged in the 7028 record of the s7k file for the project.

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: Version 5.3.2

### 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
H12548_1m	CUBE	1 meters	0 meters - 99 meters	NOAA_1m	Complete MBES
H12548_1m_Final	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H12548_2m	CUBE	2 meters	0 meters - 99 meters	NOAA_2m	Complete MBES
H12548_2m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12548_4m	CUBE	4 meters	0 meters - 99 meters	NOAA_4m	Complete MBES
H12548_4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12548_8m	CUBE	8 meters	0 meters - 99 meters	NOAA_8m	Complete MBES
H12548_8m_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES

Table 9: Submitted Surfaces

The surfaces have been reviewed where noisy data, or 'fliers' are incorporated into the gridded solution causing the surface to be shoaler than the true seafloor. Where these spurious soundings cause the gridded surface to be shoaler than the reliably measured seabed by greater than the maximum allowable TVU at that depth, the noisy data have been rejected and the surface recomputed.

The NOAA CUBE parameters mandated in HSSD were used for the creation of all CUBE BASE surfaces in Survey H12548.

## C. Vertical and Horizontal Control

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

### C.1 Vertical Control

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

#### Standard Vertical Control Methods Used:

Discrete Zoning

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

<b>Station Name</b>	<b>Station ID</b>
Unalaska, Dutch Harbor	9462620
King Cove	9459881

*Table 10: NWLON Tide Stations*

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Broad Bight	9462676
SE Tigalda Island	9462705
Green Bight	9462786

Table 11: Subordinate Tide Stations

File Name	Status
9462676.tid	Verified Observed
9462705.tid	Verified Observed
9462786.tid	Verified Observed

Table 12: Water Level Files (.tid)

File Name	Status
OPR-Q191-KR-13_Zoning_20131008.zdf	Preliminary

Table 13: Tide Correctors (.zdf or .tc)

On October 08, 2013, John Oswald and Associates (JOA) issued verified tidal data and zoning for OPR-Q191-KR-13. All sounding data was then re-merged using CARIS HIPS and SIPS tide routine. JOA verified tidal data were used for all final Navigation BASE surfaces and S-57 Feature files. It should be noted that the tidal data applied to OPR-Q191-KR-13 is JOA verified and not CO-OPs verified. JOA are currently in the WALI verification process, which is pending, awaiting CO-OPs approval. Since the timeframe for CO-OPs verification is unknown, FPI were given approval, by our COTR, to submit the data with the JOA verified tides and zoning applied.

***JOA zoning model was approved as final by CO-OPs and zoning validation received January 30, 2014.***

## C.2 Horizontal Control

The horizontal datum for this project is NAD83.

The projection used for this project is 3N.

The following PPK methods were used for horizontal control:

Single Base

For real-time DGPS corrections, a CSI MBX-3 unit was tuned to the Cold Bay, Alaska USCG DGPS site. The unit output differentially corrected positions at 1 Hz to the (POS MV) 320 V4 where it was integrated with inertial data, and a position for the top-center of the IMU generated. This position was logged concurrently with the bathymetry from WinFrog and the POS file using Fugro Pelagos PosMvLogger. It was later corrected for offsets to the multibeam echosounder (MBES) by CARIS HIPS in post-processing.

Final positioning was done using post-processed kinematic (PPK) methods. Applanix POSPac MMS v5.4 software was used in conjunction with the POS files and local 1Hz base station data to generate a higher accuracy position, which was applied in processing to replace the real-time position records.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Broad Bight	BB_E
SE Tigalda Island	TI_N

Table 14: User Installed Base Stations

***SBET is not applied to lines 2P6B07-SH110, 2P6B06-INF03, 2P6B06-INF01, 2P6B06-INF04, 2P6B06-INF02, 1P6B10-1220, 2P6B06-TIE02, 2P6B06-TIE01, 2P6B06-TIE03 SBET RMS is not applied to lines 2P6B07-SH110, 2P6B06-INF03, 2P6B06-INF01, 2P6B06-INF04, 2P6B06-TIE02, 2P6B06-TIE01, 1P6B11-0080, 1P6B11-1140, 1P6B11-0565, 1P6B11-1300, 1P6B11-1460, 1P6B11-1560, 1P6B11-1680, 1P6B11-1990A, 1P6B11-1380, 1P6B11-0325, 1P6B11-0770, 1P6B11-0965, 1P6B11-1990, 1P6B11-1800, 1P6B11-1910, 2P6B07-SH099, 2P6B07-SH103, 2P6B07-SH100, 2P6B07-SH104, 2P6B07-SH106, 2P6B07-SH101, 2P6B07-SH105, 2P6B07-SH102, 2P6B07-SH107, 2P6B07-SH109, 2P6B07-SH108, 2P6B07-SH110***

The following DGPS Stations were used for horizontal control:

DGPS Stations
Cold Bay DGPS Station

Table 15: USCG DGPS Stations

## D. Results and Recommendations

### D.1 Chart Comparison

#### D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNМ Date	NM Date
16531	1:80000	7	02/2002	10/01/2013	09/28/2013

*Table 16: Largest Scale Raster Charts*

#### 16531

The Raster chart was downloaded from NOAA's Office of Coast Survey website on October 9, 2013.

Given that the survey area was ensonified with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on Raster chart 16531 varied between 1 and 3 fathoms. Generally, the surveyed data in the vicinity of the charted spot soundings from Raster chart 16531 agree to within 1 to 2 fathoms.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.

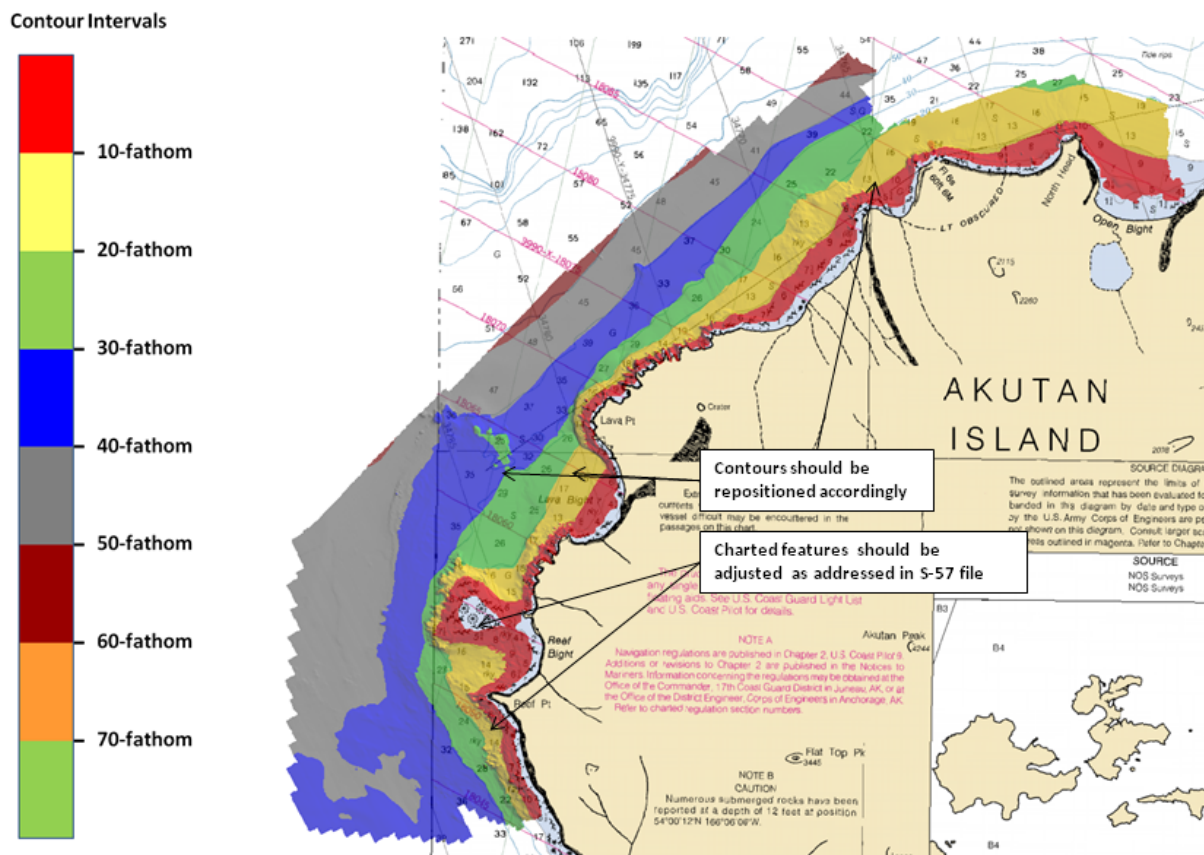


Figure 15: Chart Comparison H12548 vs. 16531

*In addition, chart 16520, 1:300,000, ED 23, which coincides with ENC US4AK6FM, covers the western quarter of the survey. Chart 16520 was not listed in the PI for comparison, so the field wasn't required to address it.*

### D.1.2 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3AK61M	1:300000	16	01/12/2011	06/24/2013	NO
US4AK6FM	1:80000	8	04/28/2011	05/02/2013	NO

*Table 17: Largest Scale ENC's*

#### US3AK61M

The ENC's were downloaded from NOAA's Office of Coast Survey website on October 9, 2013. Thus, the issue dates displayed in the table above are more recent than the dates in the Project Instructions.

Given that the survey area was ensounded with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on ENC US3AK61M varied between 1 meter and 8 meters. Generally, the surveyed data in the vicinity of the charted spot soundings from the ENC agreed to within 1 to 5 meters.

Although the ENC displays the spot soundings in meters, the contours are displayed in fathoms. The surveyed data for sheet H12548 shows contours that generally agree with the contour trends from ENC US3AK61M.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.

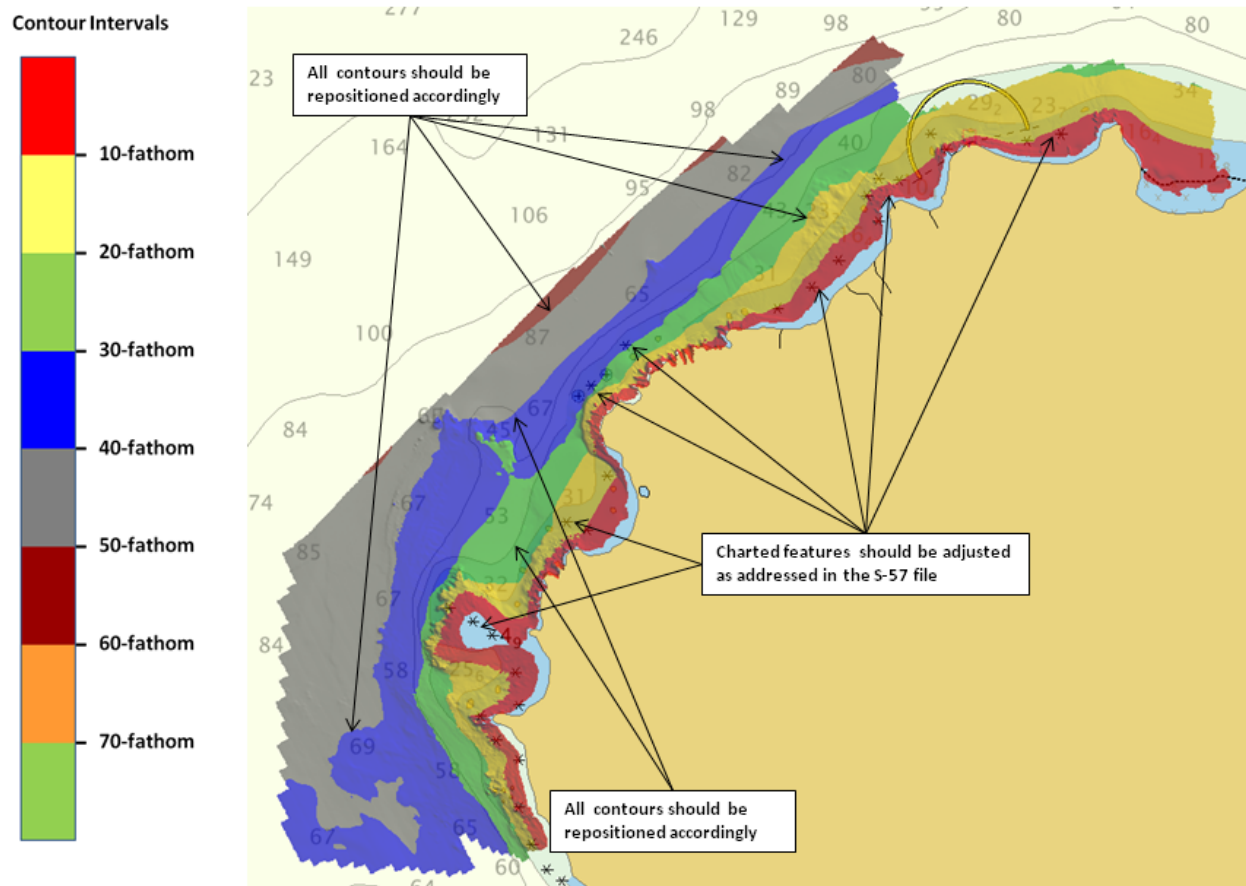


Figure 16: Chart Comparison H12548 vs. US3AK61M

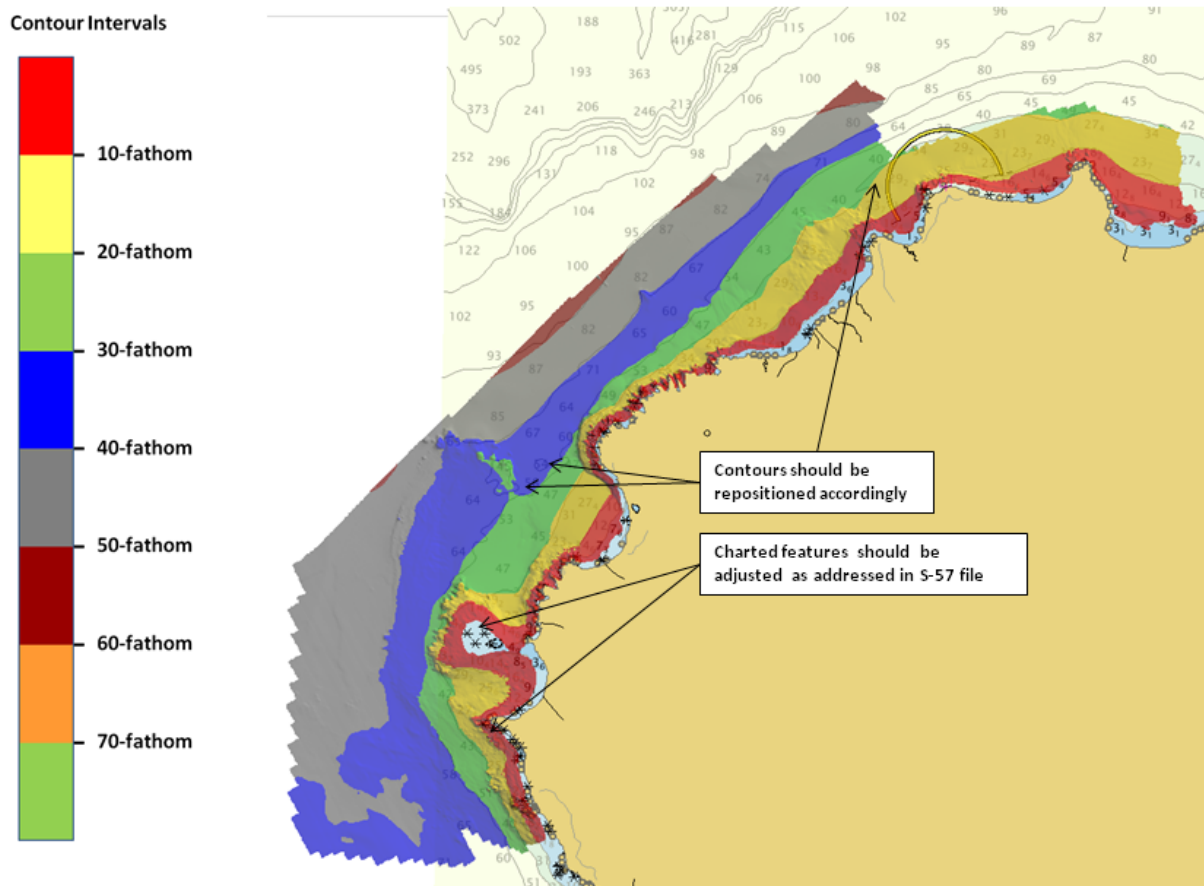
#### US4AK6FM

Given that the survey area was ensounded with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on ENC US4AK6FM varied between 1 meter and 5 meters.

Although the ENC displays the spot soundings in meters, the contours are displayed in fathoms. The surveyed data for sheet H12548 shows contours that generally agree with the contour trends from ENC US4AK6FM.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.



*Figure 17: Chart Comparison H12548 vs. US4AK6FM*

#### **D.1.3 AWOIS Items**

No AWOIS items exist for this survey.

#### **D.1.4 Maritime Boundary Points**

No Maritime Boundary Points were assigned for this survey.

**D.1.5 Charted Features**

No charted features exist for this survey.

*Charted features exist, but no charted features that contain the chart label PA, ED, PD or Rep exist for this survey.*

**D.1.6 Uncharted Features**

No uncharted features exist for this survey.

*No uncharted wrecks or obstructions, or other features from miscellaneous sources, exist for this survey.*

**D.1.7 Dangers to Navigation**

The following DTON reports were submitted to the processing branch:

<b>DTON Report Name</b>	<b>Date Submitted</b>
H12548_DTON__Fugro_(07-21-13)	2013-07-21

*Table 18: DTON Reports*

Danger to Navigation Reports are included in Appendix I of this report.

During field operations for survey OPR-Q191-KLR-13, four DTONs were submitted on H12548, but only two met NOAA criteria.

**D.1.8 Shoal and Hazardous Features**

No shoals or potentially hazardous features exist for this survey.

**D.1.9 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.1.10 Bottom Samples**

Bottom samples were acquired per the Project Instructions.

## **D.2 Additional Results**

### **D.2.1 Shoreline**

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

*Limited shoreline verification was assigned in the Project Instructions, including the instruction to verify all features with asgmt attributed 'Assigned' regardless if it is located inshore of the Navigable Area Limit Line. In email with the COTR for a concurrent survey, this requirement was eased to allow the hydrographer discretion in selecting safe, navigationally significant features for field verification.*

### **D.2.2 Prior Surveys**

No prior survey comparisons exist for this survey.

### **D.2.3 Aids to Navigation**

One aid to navigation exists on the charts for H12548.

The charted aid to navigation was found to be serving its intended purpose:

1. FI 6s 60ft 6M at N54-13-16, W165-58-50

No uncharted aids to navigation were found in the survey area.

### **D.2.4 Overhead Features**

Overhead features do not exist for this survey.

### **D.2.5 Submarine Features**

Submarine features do not 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**

There is no present or planned construction or dredging within the survey limits.

### **D.2.10 New Survey Recommendation**

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

### **D.2.11 Final Feature File**

Charted features that fell inshore of the 4-fathom contour (NALL) were not investigated and have been noted with a “Not Addressed” comment in the “descrp” attribute of the final features file. Features that fell within the survey limits were addressed and attributed appropriately. This file contains the object and metadata with extended attributes as required in the Specifications and Deliverables (April 2012).

All features, including ones from the NOAA assigned feature file, that were within the geographical bounds of H12548 are included in the “H12548\_Field\_Features.000” file.

Note: Since CARIS Notebook and Bathy DataBase were unable to export to S-57 with the parameters outlined in section 8.2 of the HSSD 2012, an additional text file with the required meta information was sent to accompany the S-57 file.

*There were numerous rocks and islets that were covered by multibeam, but not addressed.*

### **D.2.12 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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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.

<b>Report Name</b>	<b>Report Date Sent</b>
Data Acquisition and Processing Report	2013-11-04
Horizontal and Vertical Control Report	2013-11-04
MAR-P-001-R2 MBES Acquisition Procedures	2013-11-04
DAC-P-010-R3 MBES Processing Procedures	2013-11-04
Tides and Water Levels Package	2013-11-04

<b>Approver Name</b>	<b>Approver Title</b>	<b>Approval Date</b>	<b>Signature</b>
Dean Moyles	Senior Hydrographer (ACSM Cert. No. 226)	11/04/2013	

## F. Table of Acronyms

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

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

<b>Acronym</b>	<b>Definition</b>
<b>PRF</b>	Project Reference File
<b>PS</b>	Physical Scientist
<b>PST</b>	Physical Science Technician
<b>RNC</b>	Raster Navigational Chart
<b>RTK</b>	Real Time Kinematic
<b>SBES</b>	Singlebeam Echosounder
<b>SBET</b>	Smooth Best Estimate and Trajectory
<b>SNM</b>	Square Nautical Miles
<b>SSS</b>	Side Scan Sonar
<b>ST</b>	Survey Technician
<b>SVP</b>	Sound Velocity Profiler
<b>TCARI</b>	Tidal Constituent And Residual Interpolation
<b>TPE</b>	Total Propagated Error
<b>TPU</b>	Topside Processing Unit
<b>USACE</b>	United States Army Corps of Engineers
<b>USCG</b>	United States Coast Guard
<b>UTM</b>	Universal Transverse Mercator
<b>XO</b>	Executive Officer
<b>ZDA</b>	Global Positioning System timing message
<b>ZDF</b>	Zone Definition File

**HYDROGRAPHIC TITLE SHEET**

**H12548**

**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: **Krenitzin Islands**

Sub-Locality: **Reef Point to North Head**

Scale: **40000**

Dates of Survey: **06/28/2013 to 07/20/2013**

Instructions Dated: **05/15/2013**

Project Number: **OPR-Q191-KR-13**

Field Unit: **Fugro Pelagos, Inc.**

Chief of Party: **Dean Moyles**

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. Revisions and notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via <http://www.ngdc.noaa.gov/>.*

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## Descriptive Report to Accompany Survey H12548

Project: OPR-Q191-KR-13

Locality: Krenitzin Islands

Sublocality: Reef Point to North Head

Scale: 1:40000

June 2013 - July 2013

**Fugro Pelagos, Inc.**

Chief of Party: Dean Moyles

### A. Area Surveyed

H12548 is located in the area from Reef Point to North Head.

#### A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
54° 16' 32.02" N 165° 53' 21.01" E	54° 4' 53" N 166° 12' 58" E

*Table 1: Survey Limits*

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

#### A.2 Survey Purpose

The purpose of this work is to provide NOAA with modern and accurate hydrographic survey data for the area from Reef Point to North Head. The survey covered 22.24 square nautical miles of critical survey area as designated in the NOAA Hydrographic Survey Priorities, 2012 edition.

#### A.3 Survey Quality

The entire survey is adequate to supersede previous data.

### A.4 Survey Coverage

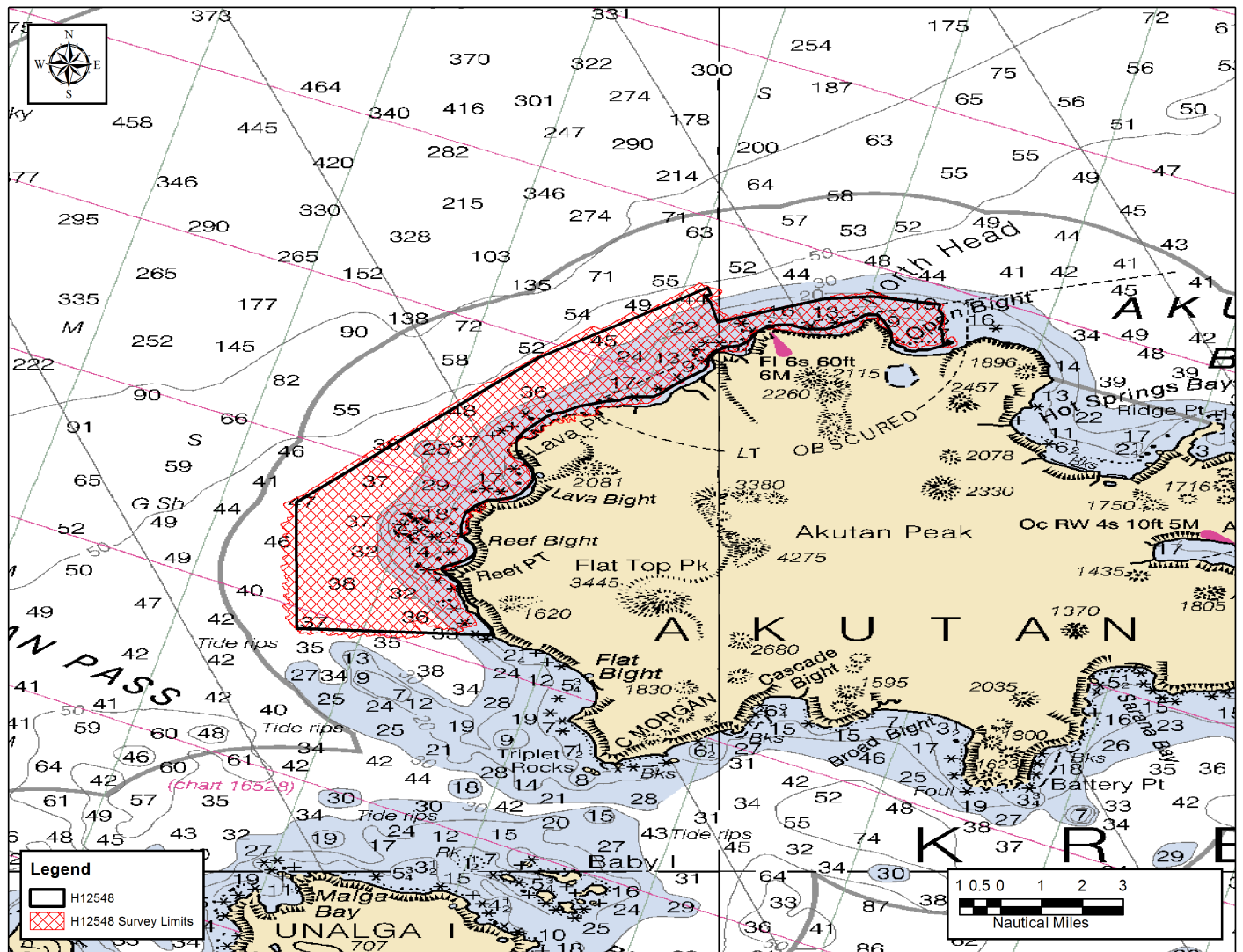


Figure 1: H12548 Survey Limits

Survey Coverage was in accordance with the requirements in the Project Instructions and the HSSD.

### A.5 Survey Statistics

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

	<b>HULL ID</b>	<i>Ocean Pioneer</i>	<i>R2</i>	<i>D2</i>	<i>Total</i>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	0	0
	<b>MBES Mainscheme</b>	208.8	35.96	312.3	557.06
	<b>Lidar Mainscheme</b>	0	0	0	0
	<b>SSS Mainscheme</b>	0	0	0	0
	<b>SBES/SSS Mainscheme</b>	0	0	0	0
	<b>MBES/SSS Mainscheme</b>	0	0	0	0
	<b>SBES/MBES Crosslines</b>	8.98	0	17.05	26.03
	<b>Lidar Crosslines</b>	0	0	0	0
<b>Number of Bottom Samples</b>					5
<b>Number of AWOIS Items Investigated</b>					0
<b>Number Maritime Boundary Points Investigated</b>					0
<b>Number of DPs</b>					0
<b>Number of Items Investigated by Dive Ops</b>					0
<b>Total SNM</b>					22.24

Table 2: Hydrographic Survey Statistics

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

<b>Survey Dates</b>	<b>Day of the Year</b>
06/28/2013	179
06/29/2013	180
06/30/2013	181
07/01/2013	182
07/06/2013	187
07/11/2013	192
07/12/2013	193
07/14/2013	195
07/15/2013	196
07/17/2013	198
07/18/2013	199
07/19/2013	200
07/20/2013	201

*Table 3: Dates of Hydrography*

*There were 3 bottom samples and 40 DPs collected for the survey.*

## **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	<i>Ocean Pioneer</i>	<i>R2</i>	<i>D2</i>
LOA	205 feet	29 feet	29 feet
Draft	14 feet	3 feet	3 feet

*Table 4: Vessels Used*

Due to an inoperable davit, production for vessel R2 was limited for the OPR-Q191-KLR-13 survey. The last day of survey for vessel R2 was JD 181.

***JD 181 2013 equates to June 30, 2013.***

### B.1.2 Equipment

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

Manufacturer	Model	Type
--------------	-------	------

*Table 5: Major Systems Used*

WaterLOG H3611 (Radar Water Level Sensors) were installed on the port and starboard gunwales of M/V Ocean Pioneer to obtain a more precise static draft measurement. Samples were taken over a 10 minute period and averaged to determine the vessel's draft. Traditional static draft measurement techniques were also employed as a substitute for the WaterLOG H3611 measurements when required.

***Refer to DAPR for major systems used.***

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines acquired for this survey totaled 5% of mainscheme acquisition.

Crosslines were planned and well distributed throughout the survey to ensure adequate quality control. Total crossline length surveyed was 26.03 nautical miles or 4.67 percent of the total mainscheme line length. Each crossline was compared to the entire mainscheme line plan through a 2m CUBE surface using the CARIS HIPS QC report routine. If the crossline covered an area with significantly rocky topography, the crossline was compared to a 1m CUBE surface of the entire mainscheme line plan.

The majority of the QC Reports fall well within the required accuracy specifications. However, several crosslines run by survey vessel D2 in the area from Reef Point to North Head contain beams in the QC report that fall below the 95% confidence level due to significantly rocky topography as illustrated in the crossline profile from H12548. Good conformity was still seen between the mainscheme lines and the crosslines.

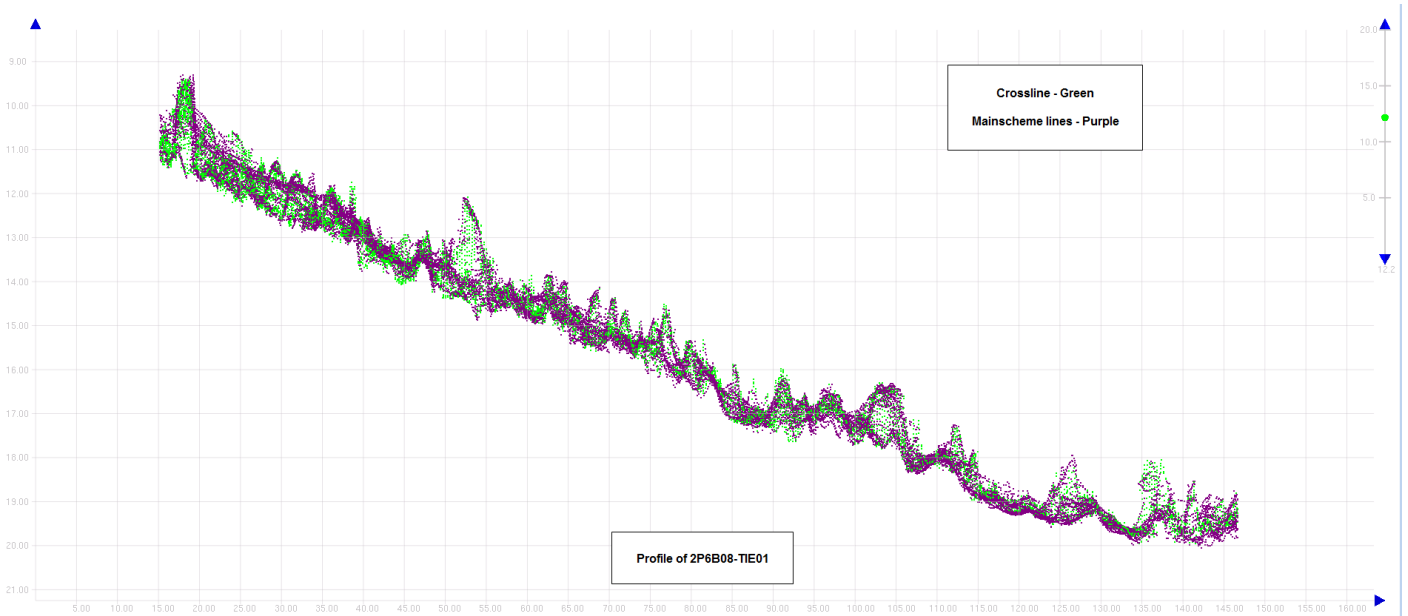


Figure 2: H12548 Crossline Profile

**B.2.2 Uncertainty**

The following survey specific parameters were used for this survey:

Measured	Zoning
0.1 meters	0.2 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
Ocean Pioneer	1.797 meters/second	0 meters/second	0.250 meters/second
R2	0 meters/second	0.439 meters/second	0.250 meters/second
D2	0 meters/second	1.101 meters/second	0.250 meters/second

Table 7: Survey Specific Sound Speed TPU Values

The majority of the data fell within IHO Order 1a accuracy specifications. Nodes that exceeded the allowable specifications were located in rough or rapidly changing topography or areas where the outer beams of the coverage boundaries were the single contributor to the surface. Despite the higher uncertainty values in these areas, agreement between adjacent lines and co-linearity between soundings was good.

Note: The percentage of nodes within IHO Order 1a, were computed by CARIS using the Surface QC Report utility and are as follows:

#### CUBE Surface Uncertainty Report

Surface Depth Range (m) % of nodes within IHO Order 1a

H12548-1m_Final	0 - 20	95.37%
H12548-2m_Final	18 - 40	99.62%
H12548-4m_Final	36 - 80	99.99%
H12548-8m_Final	72 - 160	100.00%

As illustrated in the uncertainty errors graphic, the uncertainty is generally lowest near the sonar nadir beams and increases toward the outside of each swath. This is expected and primarily a result of the sonar's device model used within CARIS HIPS for TPU calculations. In general, total propagated uncertainty varies proportionally to water depth. Outer beams also have higher uncertainty values as a function of the bottom-detection algorithms within the sonar. Data met project specifications.

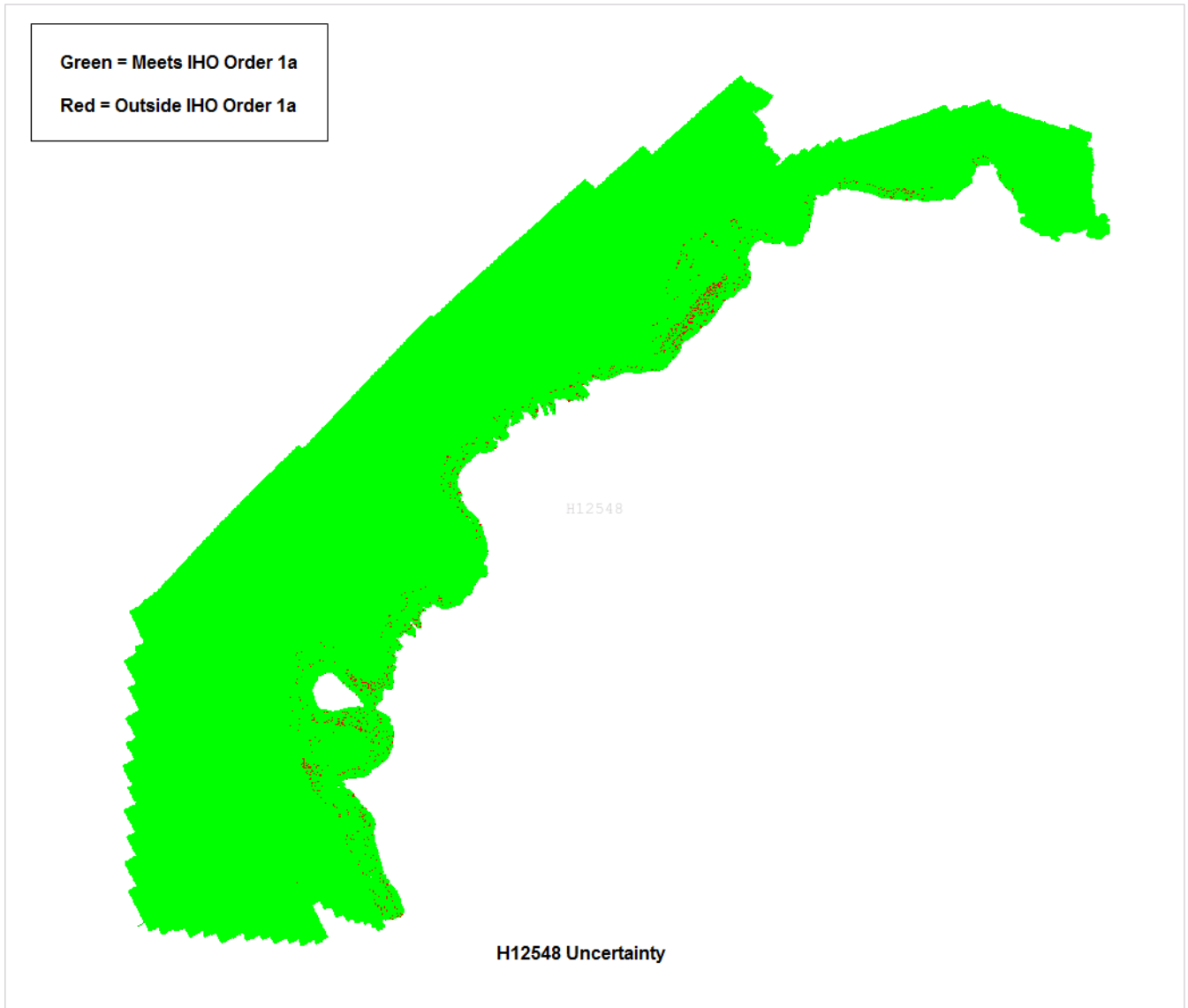


Figure 3: H12548 Uncertainty

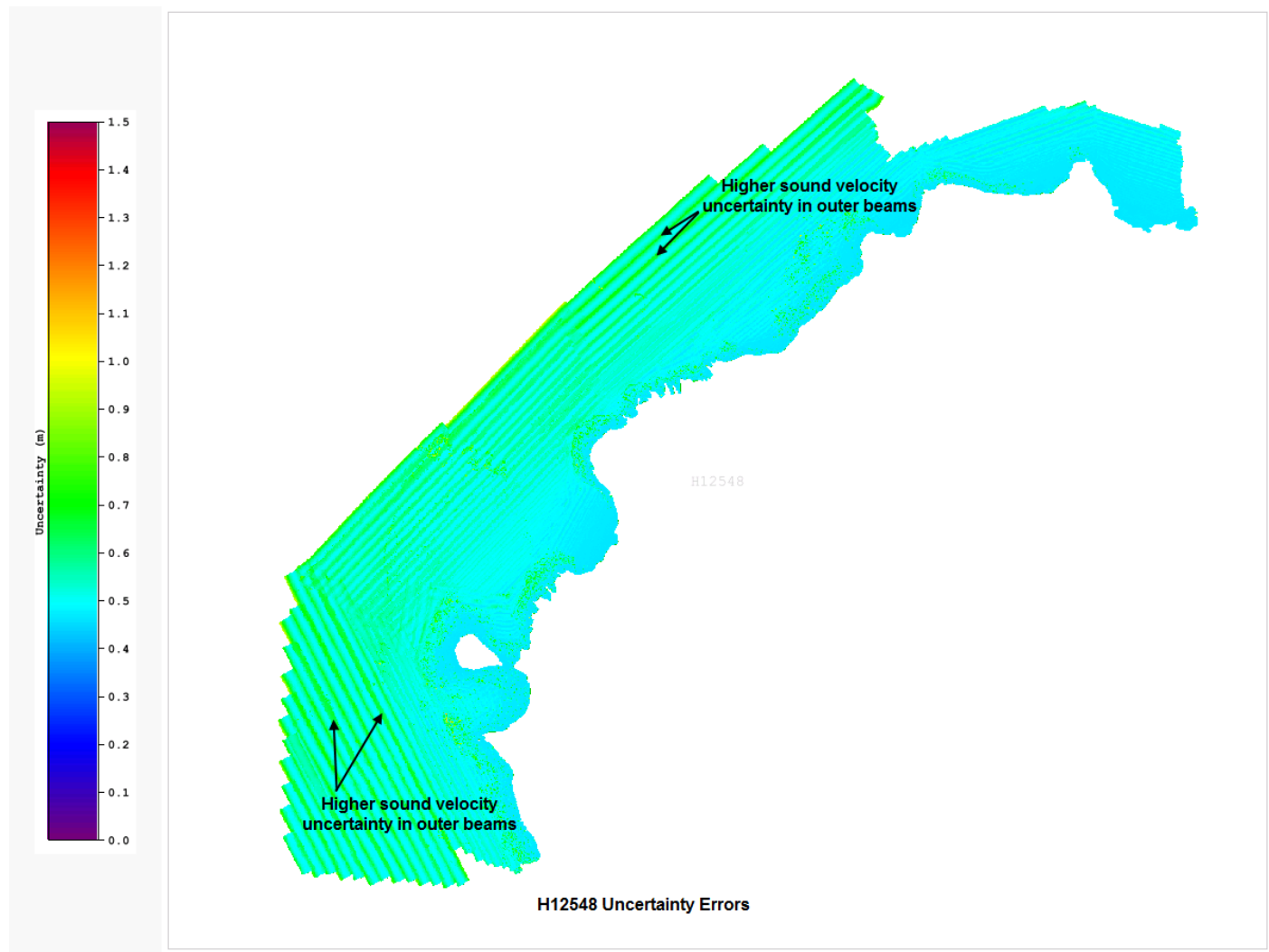


Figure 4: H12548 Uncertainty Errors

*TVU values exceed IHO budgets in nearshore areas with higher frequency than usual. In the DAPR, section B, the surveyor indicates that the following values were entered into the CARIS 'Compute TPU box: Measured Tidal Uncertainty: 0.1m and Tidal Zoning Uncertainty: 0.2m. It is also indicated that these values were based on the HSSD 2012 which itself states that "An estimate for a typical processing error is 0.10 m at the 95% confidence level...." and ... "Estimates for typical errors associated with tidal zoning are 0.20 m at the 95% confidence level." Since CARIS expects these values to be input at the 68% CI level, the surveyor has effectively doubled the TVU associated with tides. This doubling of the tidal constituent of TVU is consistent with frequency with which the TVU budget was exceeded in nearshore areas. In review - and without any re-evaluation of TVU values based on the above findings - the number of nodes in the 1m surface meeting IHO order 1a TVU budget was found to be 95.25%. This acceptable percentage disagrees with the documented uncertainty report.*

### B.2.3 Junctions

The surveys are in agreement along their common borders. The conformity between H12548 and the bordering survey area (H12549) was inspected during processing, using CARIS HIPS' Subset Editor routine and finalized BASE Surfaces. Difference surfaces were also created at a 4-meter resolution between H12548 and the junction with survey area H12361 (2011), the junction with survey area W00225 (2011), and the junction with the 5-meter surface from H11713 (2007). The data were well within the IHO Order 1a allowable error.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12361	1:10000	2011	Fugro Pelagos, Inc.	E
W00225	1:40000	2011	Fugro Pelagos, Inc.	NE
H11713	1:10000	2007	Fugro Pelagos, Inc.	S

*Table 8: Junctioning Surveys*

#### H12361

A difference surfaces was created at a 4-meter resolution between H12548 and the junction with survey area H12361 (2011), confirming that approximately 68.57% of the nodes agree to within +/-0.50m. The other 31.43% were on the outer edges of the swath at the coverage boundaries or were in areas with dynamic topography. The data were well within the IHO Order 1a allowable error.

The southern portion of the junction area between H12548 and H12361 exhibited characteristics of a dynamic bottom. From the 2011 survey of H12361 to the 2013 survey of H12548, sediment appears to have eroded and deposited in specific sub-localities, as shown in the image provided. The hydrographer attempted to locate rocks or other fixed features in the junction area exhibiting this dynamic bottom; however, no rocks or fixed features were available to provide support for the claim that the differences between the two surveys are indeed due to a dynamic bottom. However, the hydrographer believes the differences are caused by dynamic bottom due to a) the sandy bottom type, b) the tide rips in the area, as indicated on NOAA's raster chart 16531, and c) the strong agreement between the survey data in the northern portion of the survey junction area.

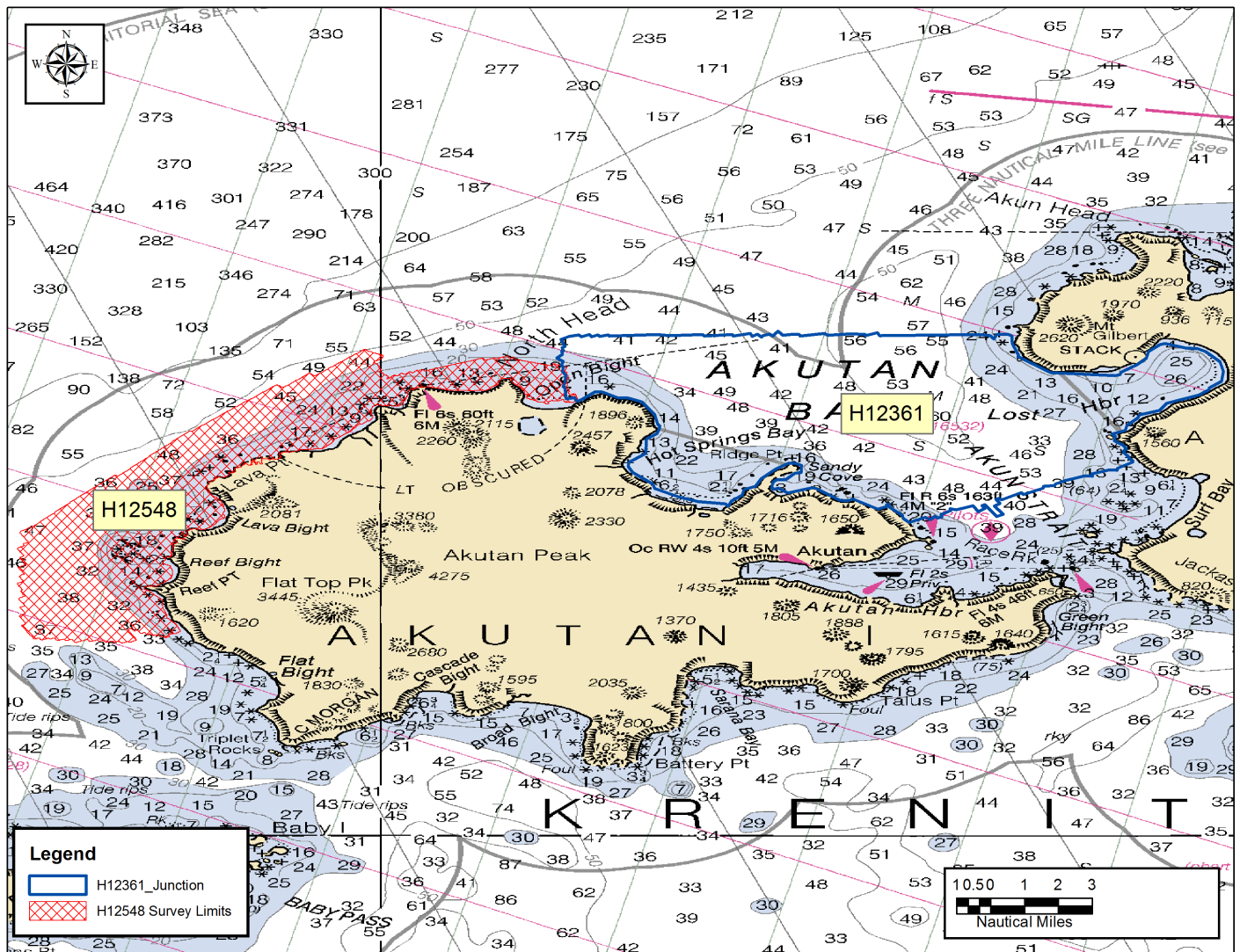


Figure 5: H12548 Junctions with H12361

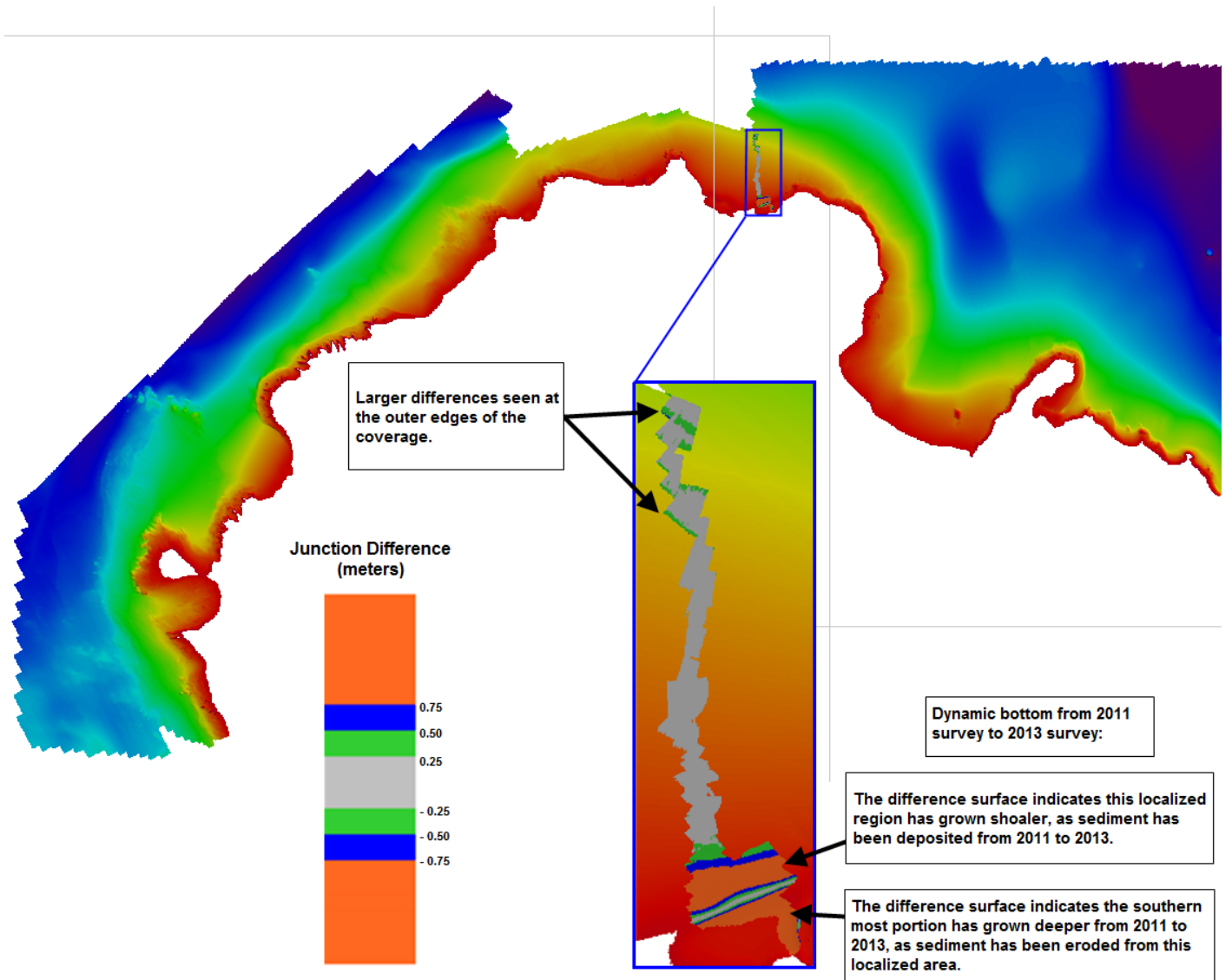


Figure 6: Difference Surface H12548 vs. H12361

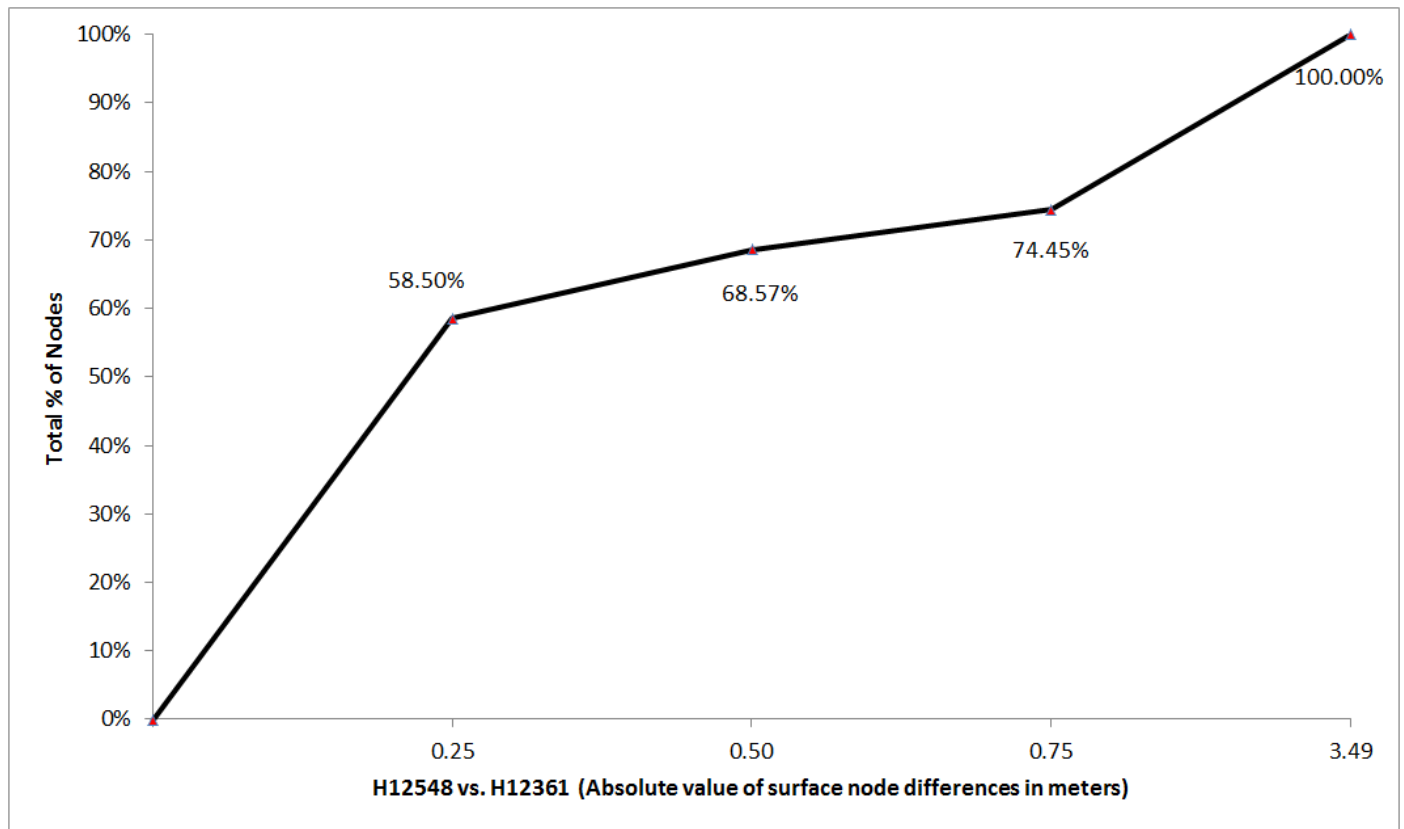


Figure 7: Difference Surface Statistics H12548 vs. H12361

#### W00225

A difference surface was created at a 4-meter resolution between H12548 and the junction with survey area W00225 (2011), confirming that approximately 99.11% of the nodes agree to within  $\pm 0.50\text{m}$ . The other 0.89% were on the outer edges of the swath at the coverage boundaries. The data were well within the IHO Order 1a allowable error.

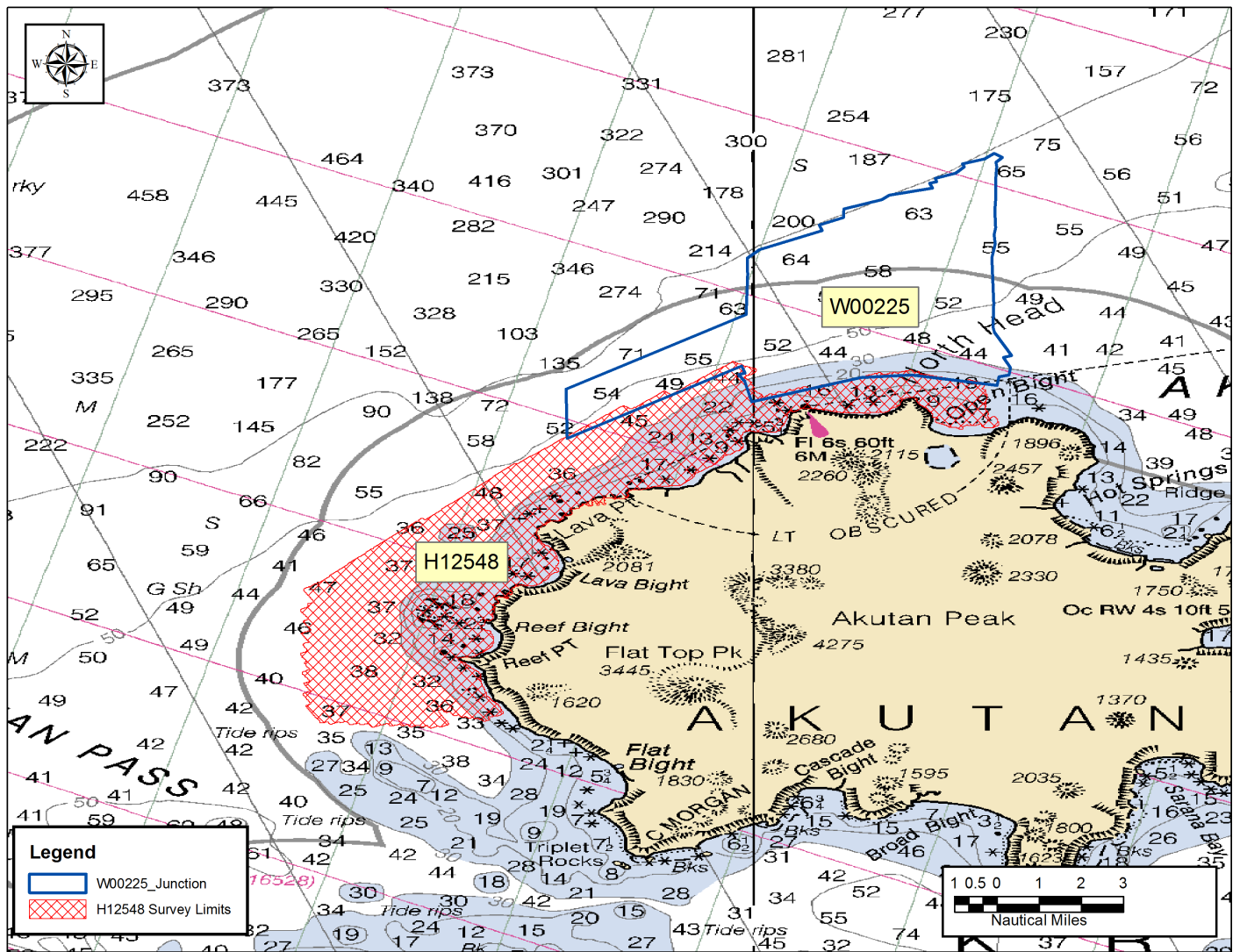


Figure 8: H12548 Junctions with W00225

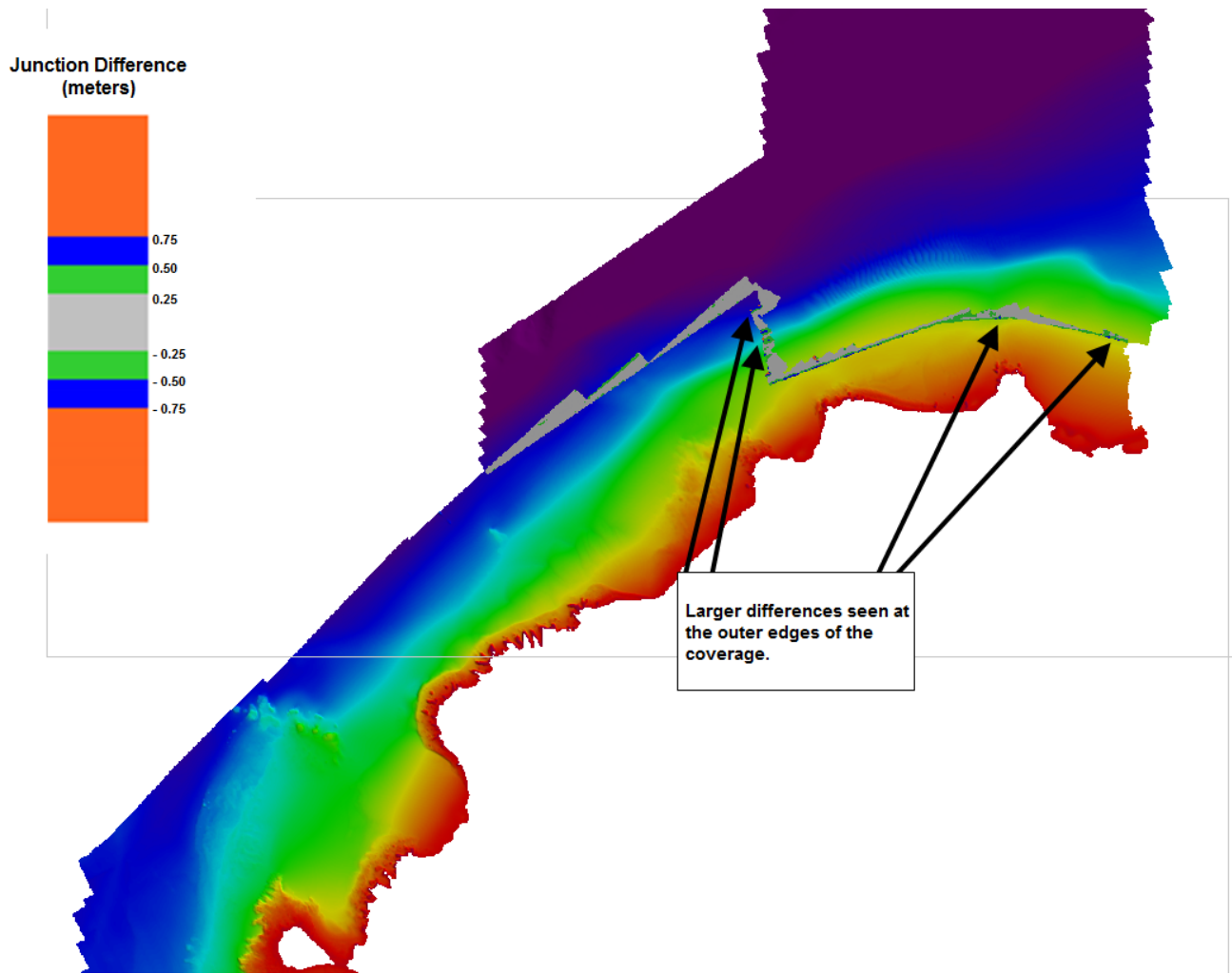


Figure 9: Difference Surface H12548 vs. W00225

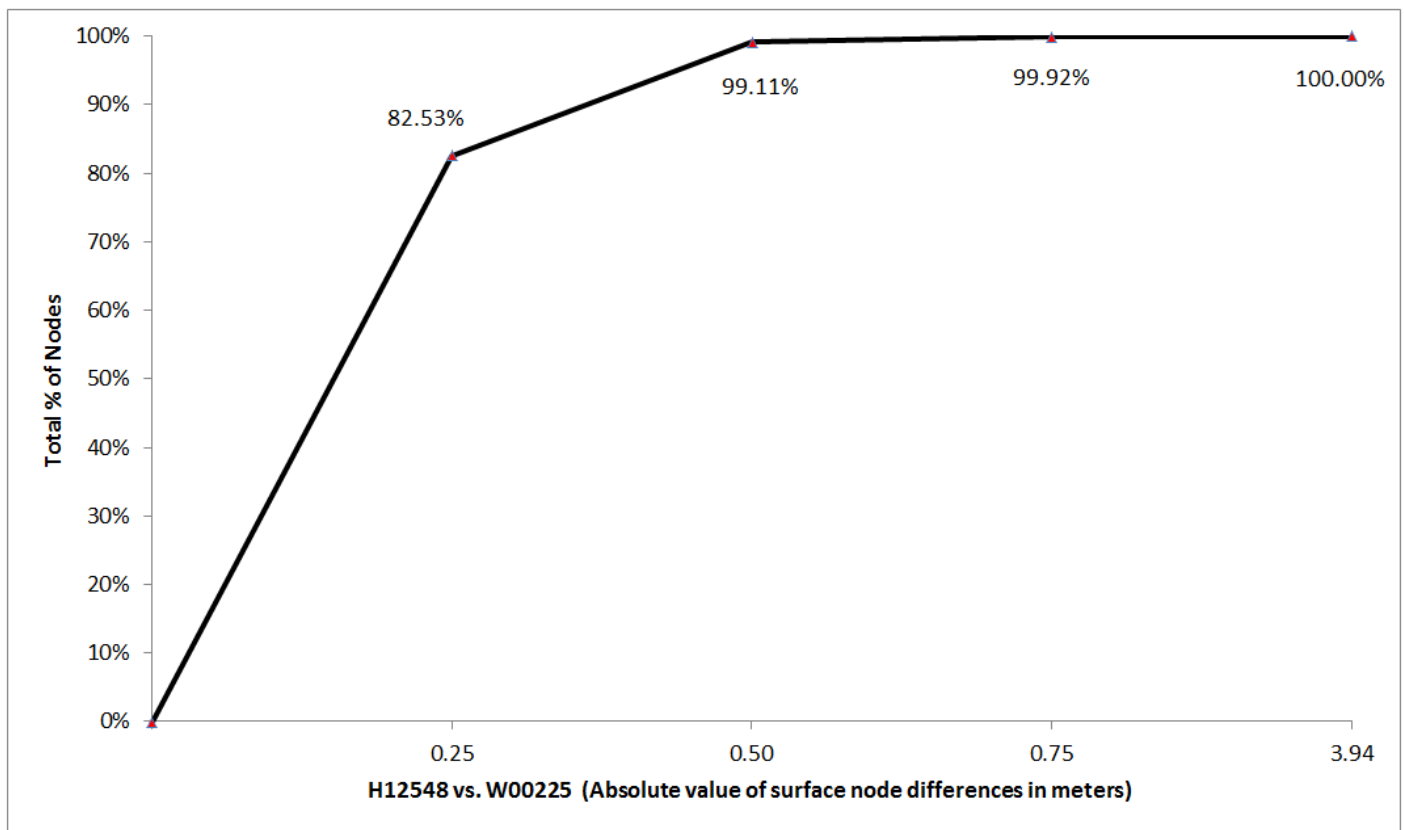


Figure 10: Difference Surface Statistics H12548 vs. W00225

### H11713

A difference surface was created to compare the 4-meter surface from H12548 and the junction with the 5-meter surface from H11713 (2007), confirming that approximately 96.57% of the nodes agree to within  $\pm 0.50\text{m}$ . The other 3.43% were on the outer edges of the swath at the coverage boundaries or were located in areas with rocky topography. The data were well within the IHO Order 1a allowable error.

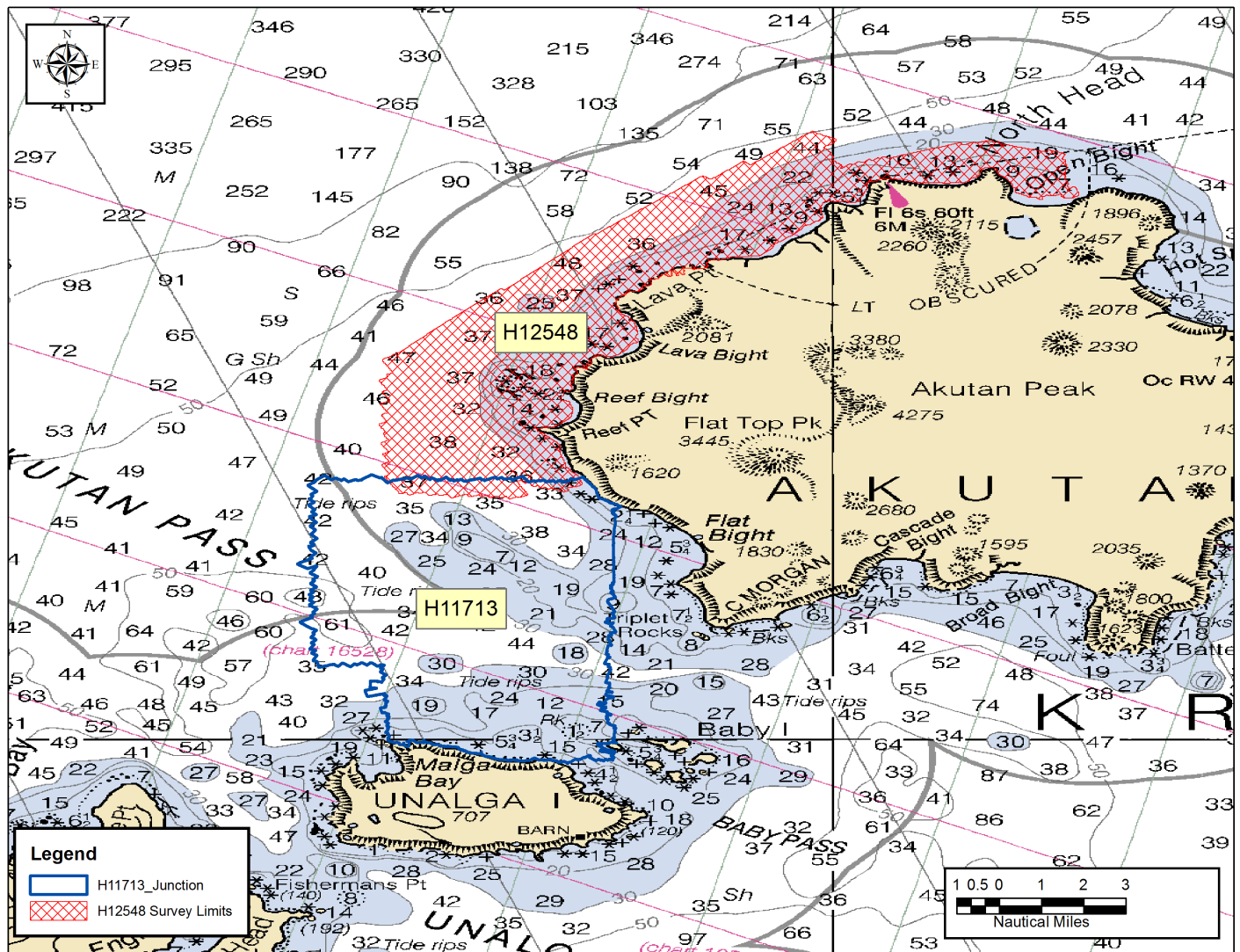


Figure 11: H12548 Junctions with H11713

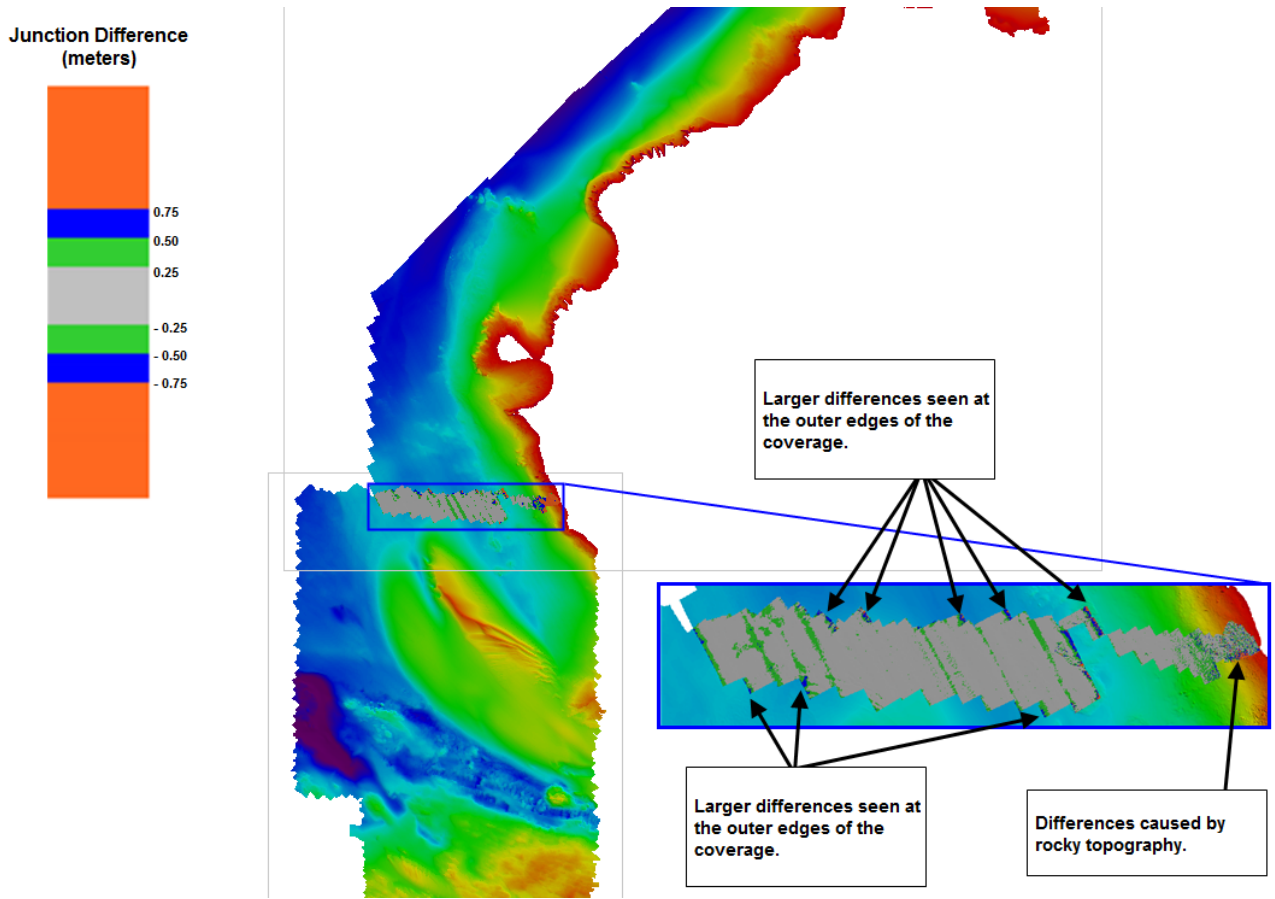


Figure 12: Difference Surface H12548 vs. H11713

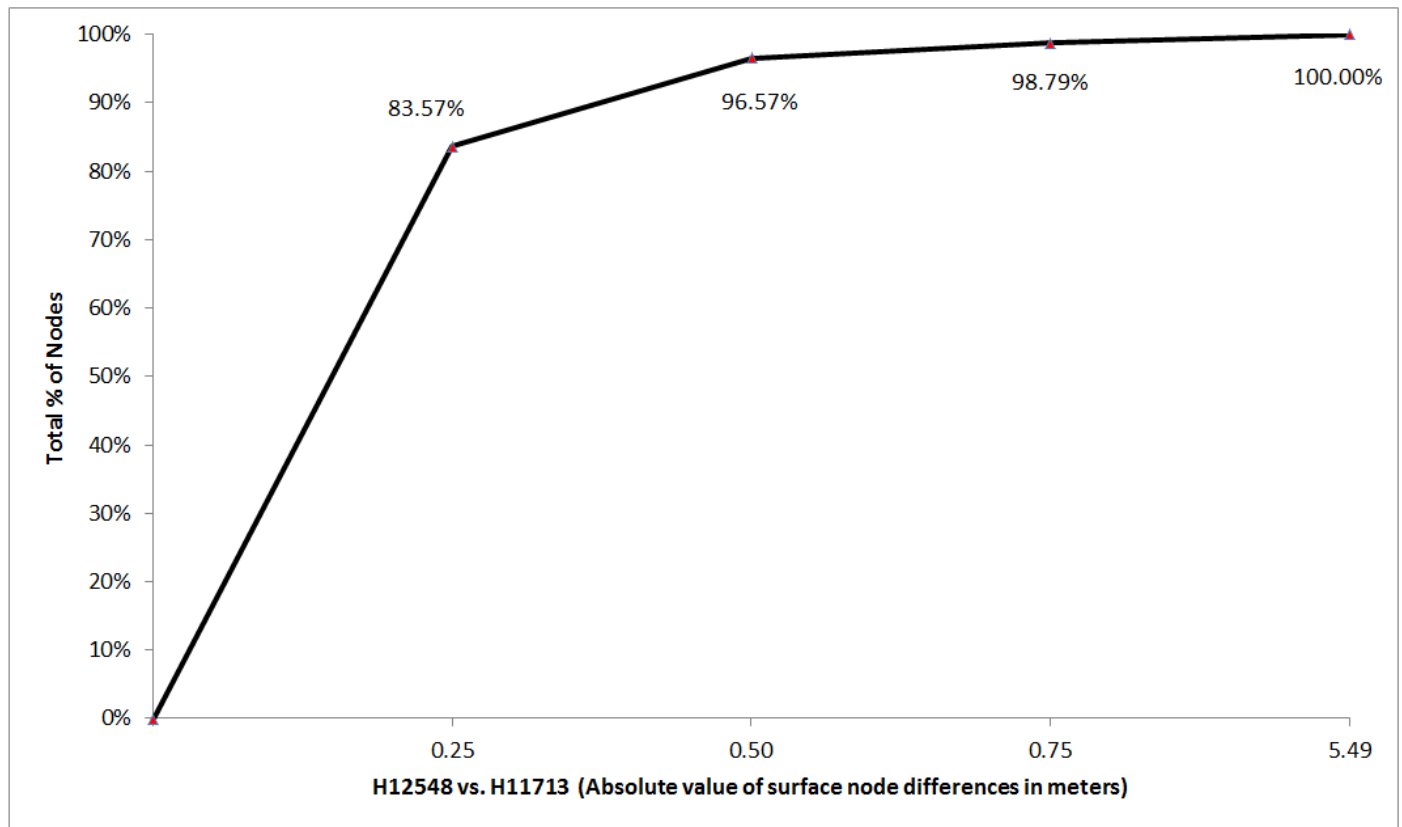


Figure 13: Difference Surface Statistics H12548 vs. H11713

*A concurrent junction is also made with H12549 to the north, OPR-Q191-KR-13, 1:40,000. The junction with survey H12549 was completed during the SAR. A difference surface was generated between the 8 meter combined surfaces from both surveys and the difference are generally within 1 meter in depths greater than 85 meters, which is well within IHO specifications. The areas that show greater differences are deep areas, the outer edge of swath coverage and areas of dramatic topography, which is to be expected.*

#### 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

### Kelp

Along coastal regions of the survey, an abundance of kelp was observed during data acquisition. Due to data quality and safety issues, there may be some areas where survey operations were halted, thus not achieving the 4 fathom survey limit. In addition to this, during data processing every effort was made to flag the kelp as rejected data wherever the CUBE BASE surface included the kelp as part of the seafloor.

### Sound Speed Refraction Errors

Sound speed refraction errors were seen in the outer beams of the swaths of survey lines that were run in deeper water. However, line overlap was sufficient, and the affected soundings were rejected in CARIS HIPS' Subset Editor routine to ensure the CUBE surface met IHO Order 1a specifications.

## B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed measurements were conducted and applied as discussed in the Corrections to Echo Soundings section of the DAPR.

## B.2.8 Coverage Equipment and Methods

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

## B.2.9 Data Density

The NOS Hydrographic Surveys Specifications and Deliverables, April 2012, requires 95% of all nodes to be populated with at least five soundings. Survey H12548 met these project specifications.

Density requirements for H12548 were achieved with at least 99.72% of finalized surface nodes containing five or more soundings. Nodes that failed to meet the allowable specifications were located in rough or rapidly changing topography or areas where the outer beams of the coverage boundaries were the single contributor to the surface.

### CUBE Surface Density Report

Surface Depth Range (m) % of nodes within HSSD 2012

H12548-1m_Final	0 - 20	99.73%
H12548-2m_Final	18 - 40	99.96%
H12548-4m_Final	36 - 80	99.94%
H12548-8m_Final	72 - 160	99.85%

Detection requirements were met by minimizing vessel speed when necessary, using sonar range scales appropriate to the water depth to maximize ping rates, and maximizing swath overlap. These variables were adjusted in real-time by the online acquisition crew based on the WinFrog QC and coverage displays. The shipboard processing crew provided feedback after preliminary processing and coverage creation in CARIS. HIPS and In-fills were run as necessary.

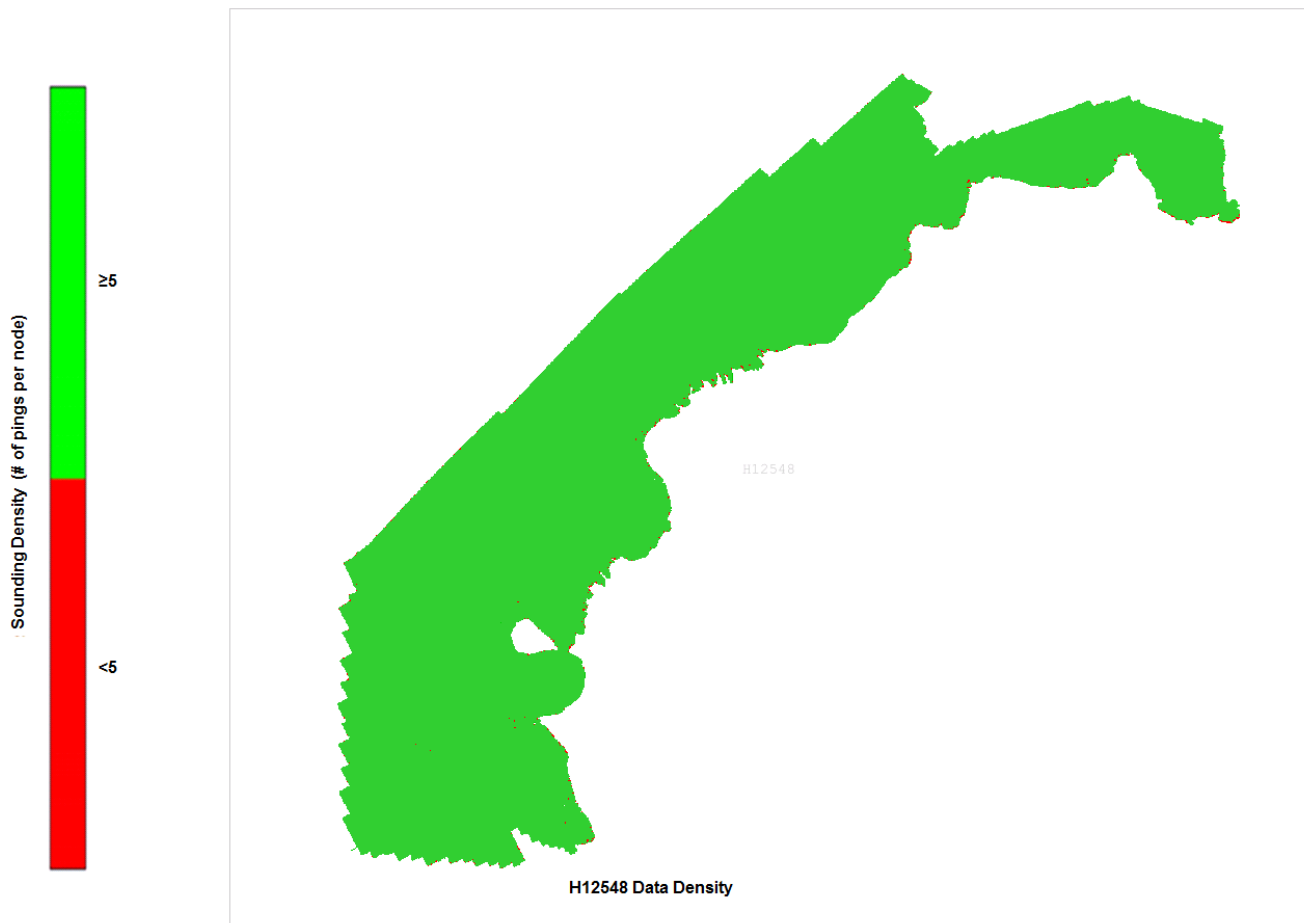


Figure 14: H12548 Data Density

## 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

Towed Side Scan Sonar (SSS) operations were not required by this contract, but the backscatter and beam imagery snippet data from all multibeam systems were logged and are stored in the s7k files. All beam imagery snippet data was logged in the 7028 record of the s7k file for the project.

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: Version 5.3.2

### 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
H12548_1m	CUBE	1 meters	0 meters - 99 meters	NOAA_1m	Complete MBES
H12548_1m_Final	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H12548_2m	CUBE	2 meters	0 meters - 99 meters	NOAA_2m	Complete MBES
H12548_2m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12548_4m	CUBE	4 meters	0 meters - 99 meters	NOAA_4m	Complete MBES
H12548_4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12548_8m	CUBE	8 meters	0 meters - 99 meters	NOAA_8m	Complete MBES
H12548_8m_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES

Table 9: Submitted Surfaces

The surfaces have been reviewed where noisy data, or 'fliers' are incorporated into the gridded solution causing the surface to be shoaler than the true seafloor. Where these spurious soundings cause the gridded surface to be shoaler than the reliably measured seabed by greater than the maximum allowable TVU at that depth, the noisy data have been rejected and the surface recomputed.

The NOAA CUBE parameters mandated in HSSD were used for the creation of all CUBE BASE surfaces in Survey H12548.

## C. Vertical and Horizontal Control

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

### C.1 Vertical Control

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

#### Standard Vertical Control Methods Used:

Discrete Zoning

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

<b>Station Name</b>	<b>Station ID</b>
Unalaska, Dutch Harbor	9462620
King Cove	9459881

*Table 10: NWLON Tide Stations*

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Broad Bight	9462676
SE Tigalda Island	9462705
Green Bight	9462786

Table 11: Subordinate Tide Stations

File Name	Status
9462676.tid	Verified Observed
9462705.tid	Verified Observed
9462786.tid	Verified Observed

Table 12: Water Level Files (.tid)

File Name	Status
OPR-Q191-KR-13_Zoning_20131008.zdf	Preliminary

Table 13: Tide Correctors (.zdf or .tc)

On October 08, 2013, John Oswald and Associates (JOA) issued verified tidal data and zoning for OPR-Q191-KR-13. All sounding data was then re-merged using CARIS HIPS and SIPS tide routine. JOA verified tidal data were used for all final Navigation BASE surfaces and S-57 Feature files. It should be noted that the tidal data applied to OPR-Q191-KR-13 is JOA verified and not CO-OPs verified. JOA are currently in the WALI verification process, which is pending, awaiting CO-OPs approval. Since the timeframe for CO-OPs verification is unknown, FPI were given approval, by our COTR, to submit the data with the JOA verified tides and zoning applied.

***JOA zoning model was approved as final by CO-OPs and zoning validation received January 30, 2014.***

## C.2 Horizontal Control

The horizontal datum for this project is NAD83.

The projection used for this project is 3N.

The following PPK methods were used for horizontal control:

Single Base

For real-time DGPS corrections, a CSI MBX-3 unit was tuned to the Cold Bay, Alaska USCG DGPS site. The unit output differentially corrected positions at 1 Hz to the (POS MV) 320 V4 where it was integrated with inertial data, and a position for the top-center of the IMU generated. This position was logged concurrently with the bathymetry from WinFrog and the POS file using Fugro Pelagos PosMvLogger. It was later corrected for offsets to the multibeam echosounder (MBES) by CARIS HIPS in post-processing.

Final positioning was done using post-processed kinematic (PPK) methods. Applanix POSPac MMS v5.4 software was used in conjunction with the POS files and local 1Hz base station data to generate a higher accuracy position, which was applied in processing to replace the real-time position records.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Broad Bight	BB_E
SE Tigalda Island	TI_N

Table 14: User Installed Base Stations

***SBET is not applied to lines 2P6B07-SH110, 2P6B06-INF03, 2P6B06-INF01, 2P6B06-INF04, 2P6B06-INF02, 1P6B10-1220, 2P6B06-TIE02, 2P6B06-TIE01, 2P6B06-TIE03 SBET RMS is not applied to lines 2P6B07-SH110, 2P6B06-INF03, 2P6B06-INF01, 2P6B06-INF04, 2P6B06-TIE02, 2P6B06-TIE01, 1P6B11-0080, 1P6B11-1140, 1P6B11-0565, 1P6B11-1300, 1P6B11-1460, 1P6B11-1560, 1P6B11-1680, 1P6B11-1990A, 1P6B11-1380, 1P6B11-0325, 1P6B11-0770, 1P6B11-0965, 1P6B11-1990, 1P6B11-1800, 1P6B11-1910, 2P6B07-SH099, 2P6B07-SH103, 2P6B07-SH100, 2P6B07-SH104, 2P6B07-SH106, 2P6B07-SH101, 2P6B07-SH105, 2P6B07-SH102, 2P6B07-SH107, 2P6B07-SH109, 2P6B07-SH108, 2P6B07-SH110***

The following DGPS Stations were used for horizontal control:

DGPS Stations
Cold Bay DGPS Station

Table 15: USCG DGPS Stations

## D. Results and Recommendations

### D.1 Chart Comparison

#### D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNМ Date	NM Date
16531	1:80000	7	02/2002	10/01/2013	09/28/2013

*Table 16: Largest Scale Raster Charts*

#### 16531

The Raster chart was downloaded from NOAA's Office of Coast Survey website on October 9, 2013.

Given that the survey area was ensonified with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on Raster chart 16531 varied between 1 and 3 fathoms. Generally, the surveyed data in the vicinity of the charted spot soundings from Raster chart 16531 agree to within 1 to 2 fathoms.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.

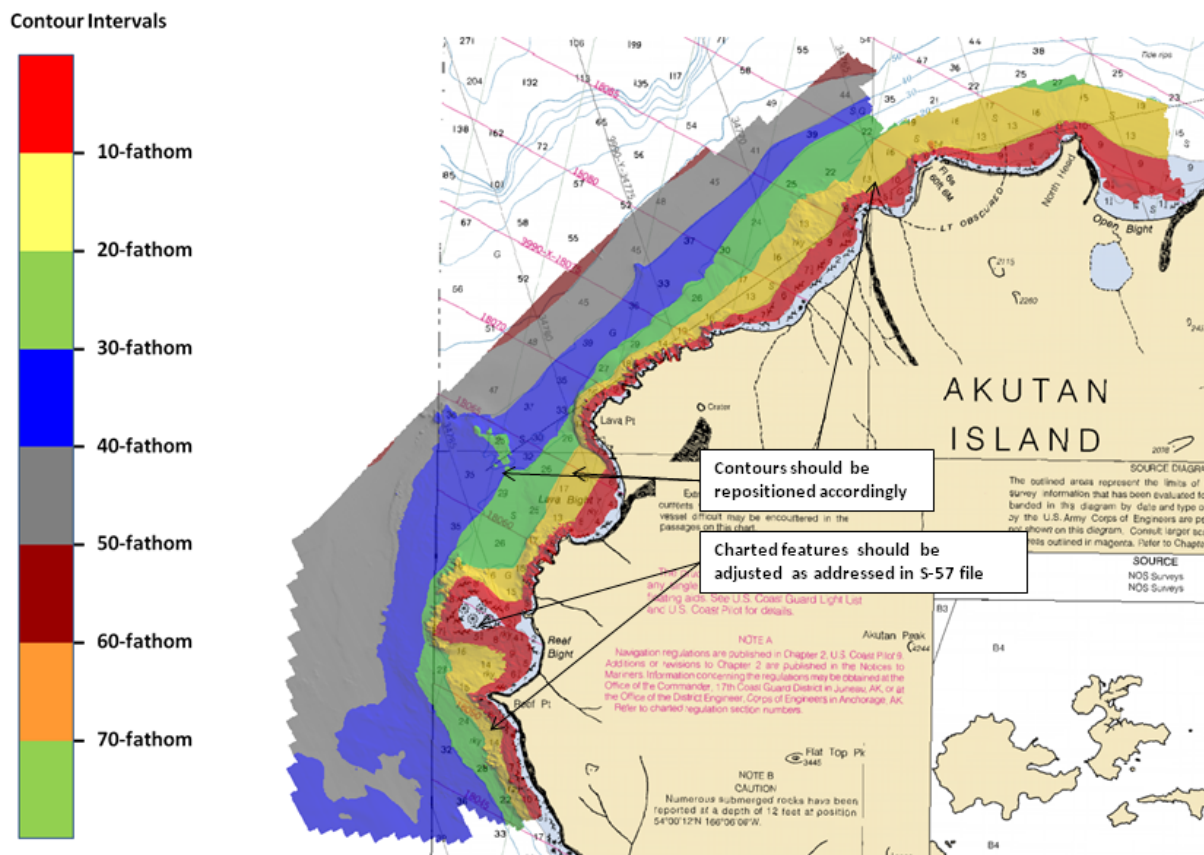


Figure 15: Chart Comparison H12548 vs. 16531

*In addition, chart 16520, 1:300,000, ED 23, which coincides with ENC US4AK6FM, covers the western quarter of the survey. Chart 16520 was not listed in the PI for comparison, so the field wasn't required to address it.*

### D.1.2 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3AK61M	1:300000	16	01/12/2011	06/24/2013	NO
US4AK6FM	1:80000	8	04/28/2011	05/02/2013	NO

*Table 17: Largest Scale ENC's*

#### US3AK61M

The ENC's were downloaded from NOAA's Office of Coast Survey website on October 9, 2013. Thus, the issue dates displayed in the table above are more recent than the dates in the Project Instructions.

Given that the survey area was ensounded with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on ENC US3AK61M varied between 1 meter and 8 meters. Generally, the surveyed data in the vicinity of the charted spot soundings from the ENC agreed to within 1 to 5 meters.

Although the ENC displays the spot soundings in meters, the contours are displayed in fathoms. The surveyed data for sheet H12548 shows contours that generally agree with the contour trends from ENC US3AK61M.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.

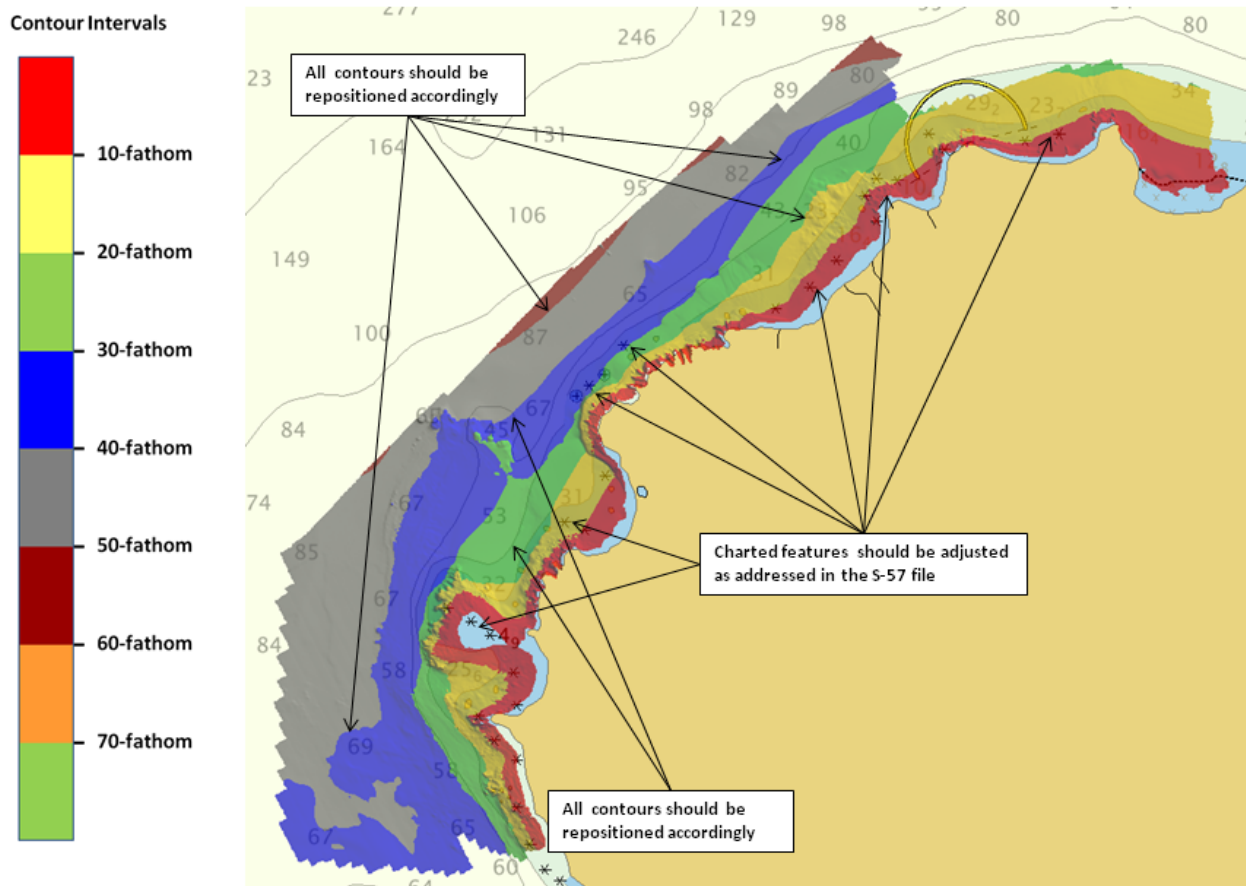


Figure 16: Chart Comparison H12548 vs. US3AK61M

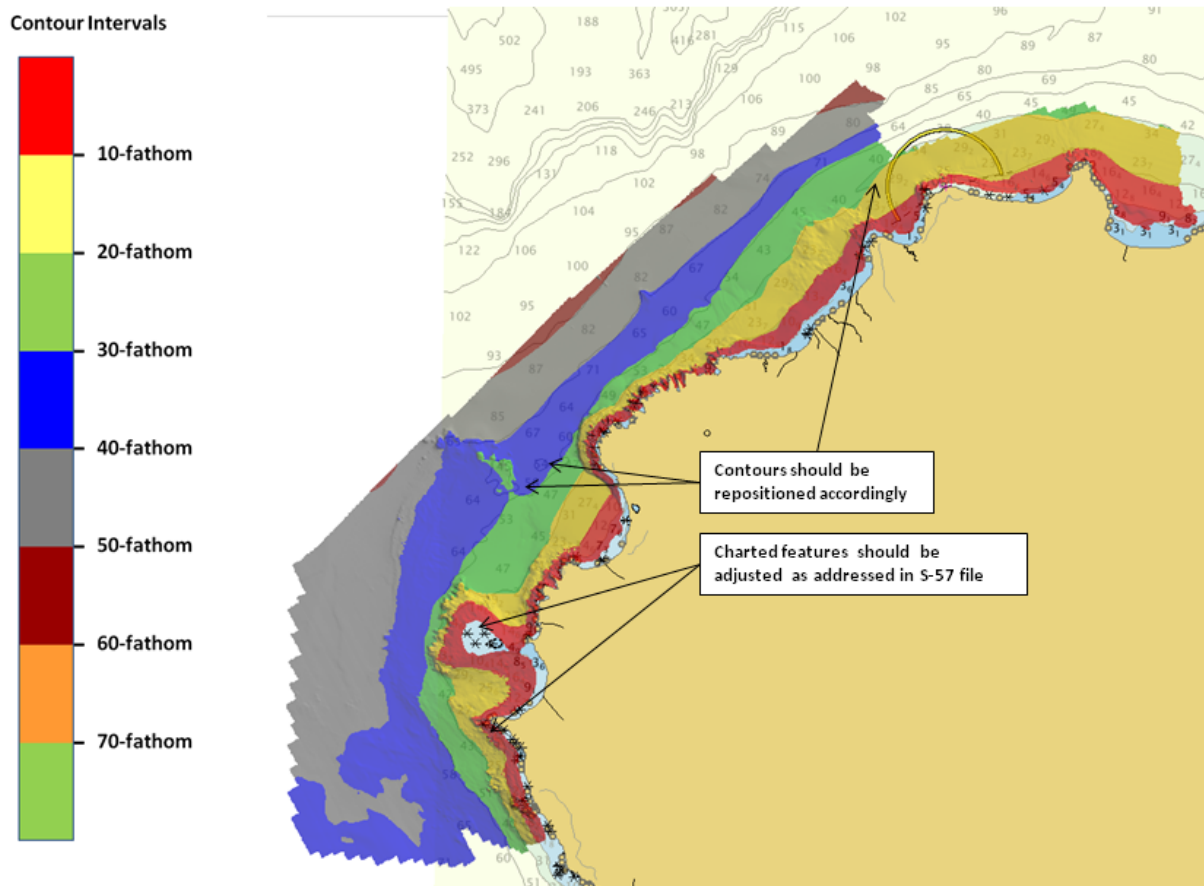
#### US4AK6FM

Given that the survey area was ensounded with 100% multibeam coverage, discrepancies were discovered between the charted and surveyed depths.

Sounding agreement between surveyed soundings on sheet H12548 and spot soundings displayed on ENC US4AK6FM varied between 1 meter and 5 meters.

Although the ENC displays the spot soundings in meters, the contours are displayed in fathoms. The surveyed data for sheet H12548 shows contours that generally agree with the contour trends from ENC US4AK6FM.

The Hydrographer recommends that soundings within the survey limits of H12548 supersede all prior survey and charted depths.



*Figure 17: Chart Comparison H12548 vs. US4AK6FM*

#### **D.1.3 AWOIS Items**

No AWOIS items exist for this survey.

#### **D.1.4 Maritime Boundary Points**

No Maritime Boundary Points were assigned for this survey.

**D.1.5 Charted Features**

No charted features exist for this survey.

*Charted features exist, but no charted features that contain the chart label PA, ED, PD or Rep exist for this survey.*

**D.1.6 Uncharted Features**

No uncharted features exist for this survey.

*No uncharted wrecks or obstructions, or other features from miscellaneous sources, exist for this survey.*

**D.1.7 Dangers to Navigation**

The following DTON reports were submitted to the processing branch:

<b>DTON Report Name</b>	<b>Date Submitted</b>
H12548_DTON__Fugro_(07-21-13)	2013-07-21

*Table 18: DTON Reports*

Danger to Navigation Reports are included in Appendix I of this report.

During field operations for survey OPR-Q191-KLR-13, four DTONs were submitted on H12548, but only two met NOAA criteria.

**D.1.8 Shoal and Hazardous Features**

No shoals or potentially hazardous features exist for this survey.

**D.1.9 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.1.10 Bottom Samples**

Bottom samples were acquired per the Project Instructions.

## **D.2 Additional Results**

### **D.2.1 Shoreline**

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

*Limited shoreline verification was assigned in the Project Instructions, including the instruction to verify all features with asgmt attributed 'Assigned' regardless if it is located inshore of the Navigable Area Limit Line. In email with the COTR for a concurrent survey, this requirement was eased to allow the hydrographer discretion in selecting safe, navigationally significant features for field verification.*

### **D.2.2 Prior Surveys**

No prior survey comparisons exist for this survey.

### **D.2.3 Aids to Navigation**

One aid to navigation exists on the charts for H12548.

The charted aid to navigation was found to be serving its intended purpose:

1. FI 6s 60ft 6M at N54-13-16, W165-58-50

No uncharted aids to navigation were found in the survey area.

### **D.2.4 Overhead Features**

Overhead features do not exist for this survey.

### **D.2.5 Submarine Features**

Submarine features do not 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**

There is no present or planned construction or dredging within the survey limits.

### **D.2.10 New Survey Recommendation**

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

### **D.2.11 Final Feature File**

Charted features that fell inshore of the 4-fathom contour (NALL) were not investigated and have been noted with a “Not Addressed” comment in the “descrp” attribute of the final features file. Features that fell within the survey limits were addressed and attributed appropriately. This file contains the object and metadata with extended attributes as required in the Specifications and Deliverables (April 2012).

All features, including ones from the NOAA assigned feature file, that were within the geographical bounds of H12548 are included in the “H12548\_Field\_Features.000” file.

Note: Since CARIS Notebook and Bathy DataBase were unable to export to S-57 with the parameters outlined in section 8.2 of the HSSD 2012, an additional text file with the required meta information was sent to accompany the S-57 file.

*There were numerous rocks and islets that were covered by multibeam, but not addressed.*

### **D.2.12 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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2013-11-04
Horizontal and Vertical Control Report	2013-11-04
MAR-P-001-R2 MBES Acquisition Procedures	2013-11-04
DAC-P-010-R3 MBES Processing Procedures	2013-11-04
Tides and Water Levels Package	2013-11-04

Approver Name	Approver Title	Approval Date	Signature
Dean Moyles	Senior Hydrographer (ACSM Cert. No. 226)	11/04/2013	Dean Moyles <small>Digitally signed by Dean Moyles            DN: cn=Dean Moyles, o=Fugro            Pelagos, Inc., ou,            email=dmoyles@fugro.com, c=US            Date: 2014.05.23 04:14:23 -07'00'</small>

## F. Table of Acronyms

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

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

<b>Acronym</b>	<b>Definition</b>
<b>PRF</b>	Project Reference File
<b>PS</b>	Physical Scientist
<b>PST</b>	Physical Science Technician
<b>RNC</b>	Raster Navigational Chart
<b>RTK</b>	Real Time Kinematic
<b>SBES</b>	Singlebeam Echosounder
<b>SBET</b>	Smooth Best Estimate and Trajectory
<b>SNM</b>	Square Nautical Miles
<b>SSS</b>	Side Scan Sonar
<b>ST</b>	Survey Technician
<b>SVP</b>	Sound Velocity Profiler
<b>TCARI</b>	Tidal Constituent And Residual Interpolation
<b>TPE</b>	Total Propagated Error
<b>TPU</b>	Topside Processing Unit
<b>USACE</b>	United States Army Corps of Engineers
<b>USCG</b>	United States Coast Guard
<b>UTM</b>	Universal Transverse Mercator
<b>XO</b>	Executive Officer
<b>ZDA</b>	Global Positioning System timing message
<b>ZDF</b>	Zone Definition File

# REPORT OF DANGERS TO NAVIGATION

**Hydrographic Survey Registry Number:** H12548

**Survey Title:**     **State:**         Alaska

**Locality:**     Krenitzin Islands

**Sub-locality:** Reef Point to North Head

**Project Number:**     OPR-Q191-KRL-13

**Survey Dates:**     June 28, 2013 – N/A

**Survey Danger Acquisition Date and Time:** See feature.

Features are reduced to Mean Lower Low Water with preliminary tidal data provided by John Oswald & Associates (JOA).

## Affected Raster Charts:

Chart Number	Scale	Edition	Edition Date
16531	80,000	7	02/2002

## Affected ENC's:

ENC Name	Scale	Edition	Issue Date
US4AK6FM	80,000	8	05/02/2013
US3AK61M	300,000	16	6/24/2013

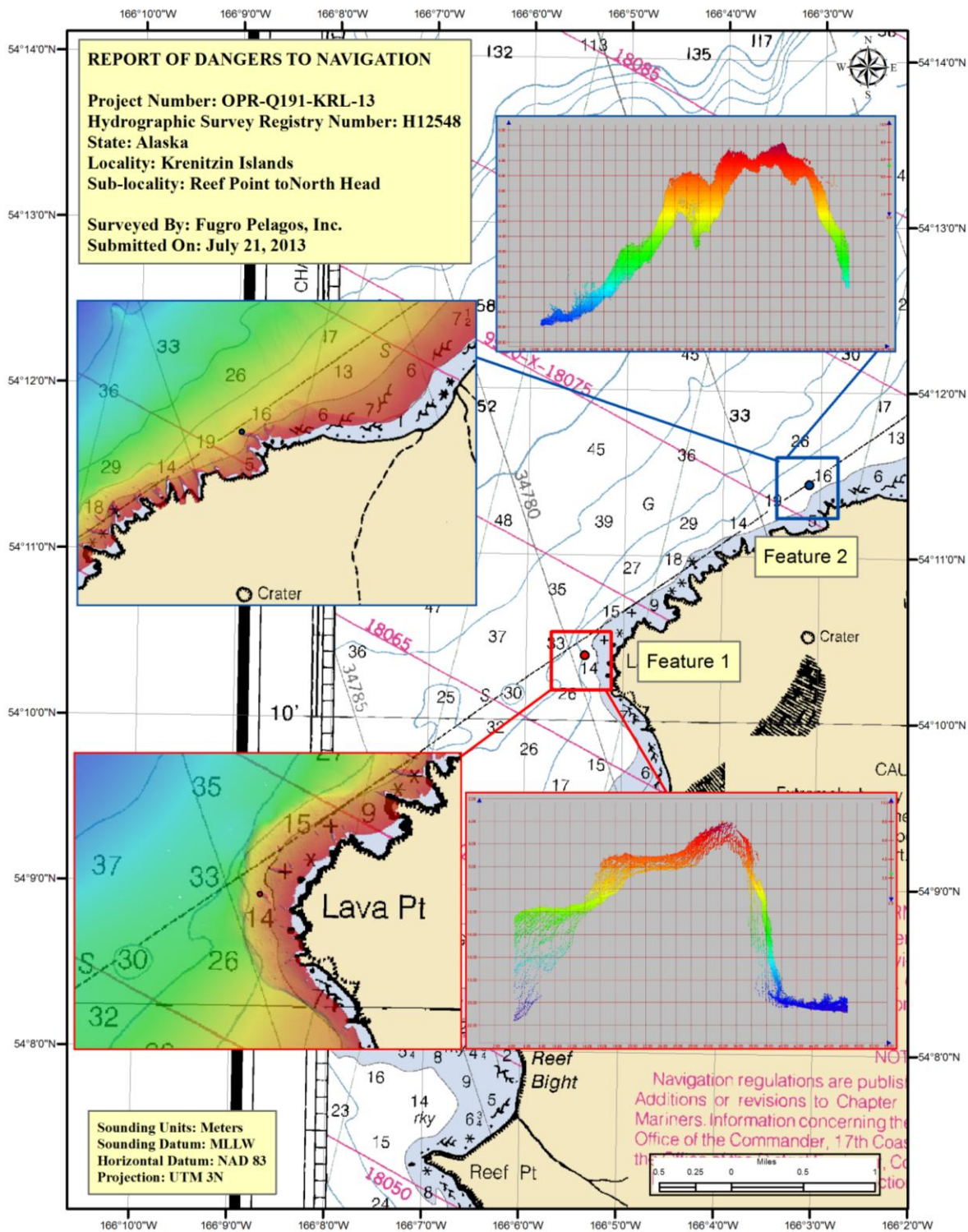
## DANGER:

Feature	Depth	Latitude	Longitude	Time (UTC)
* 1. Sounding	2.2 fathoms	54-04-15.73N	166-05-17.83W	2013-06-28 17:30:06.225
2. Sounding	0.8 fathoms	54-11-23.47N	166-03-03.47W	2013-07-18 23:03:24.100

\* DTON #1 geographic position is Lat. 54-10-23.724N, Long. 166-05-17.780W

## COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch (N/CS34), at (206) 526-6835.



APPROVAL PAGE

H12548

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

- H12548\_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12548\_GeoImage.pdf

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

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.

Approved: \_\_\_\_\_

**CDR Benjamin K. Evans, NOAA**

Chief, Pacific Hydrographic Branch