H13110

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13110

LOCALITY

State(s):	Alaska
General Locality:	Kodiak Island, Alaska
Sub-locality:	Ugak Bay

2019

CHIEF OF PARTY
Benjamin K. Evans, CAPT/NOAA

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Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H13110

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:	**Kodiak Island, Alaska**
Sub-Locality:	**Ugak Bay**
Scale:	**40000**
Dates of Survey:	**05/11/2019 to 06/21/2019**
Instructions Dated:	**04/01/2019**
Project Number:	**OPR-P136-RA-19**
Field Unit:	**NOAA Ship Rainier (S221)**
Chief of Party:	**Benjamin K. Evans, CAPT/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:

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in NAD83 UTM 5N, MLLW . All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13110

Project: OPR-P136-RA-19

Locality: Kodiak Island, Alaska

Sublocality: Ugak Bay

Scale: 1:40000

May 2019 - June 2019

NOAA Ship Rainier (S221)

Chief of Party: Benjamin K. Evans, CAPT/NOAA

A. Area Surveyed

The survey area is referred to as H13110, "Ugak Bay" (Sheet 7) in the Project Instructions. The acquired survey area is approximately 22.22 square nautical miles, and encompasses the area assigned in the project instructions as well as a portion of H13109, "Pasagshak Pt" (Sheet 8). The project instructions provided an estimate of 32 square nautical miles. The hydrographer determined that the assigned sheet limits cover an area of 20.66 square nautical miles, and it was determined that the project instructions were incorrect.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
57° 30' 5.47" N 152° 48' 12.19" W	57° 22' 45.61" N 152° 31' 48.57" W

Table 1: Survey Limits

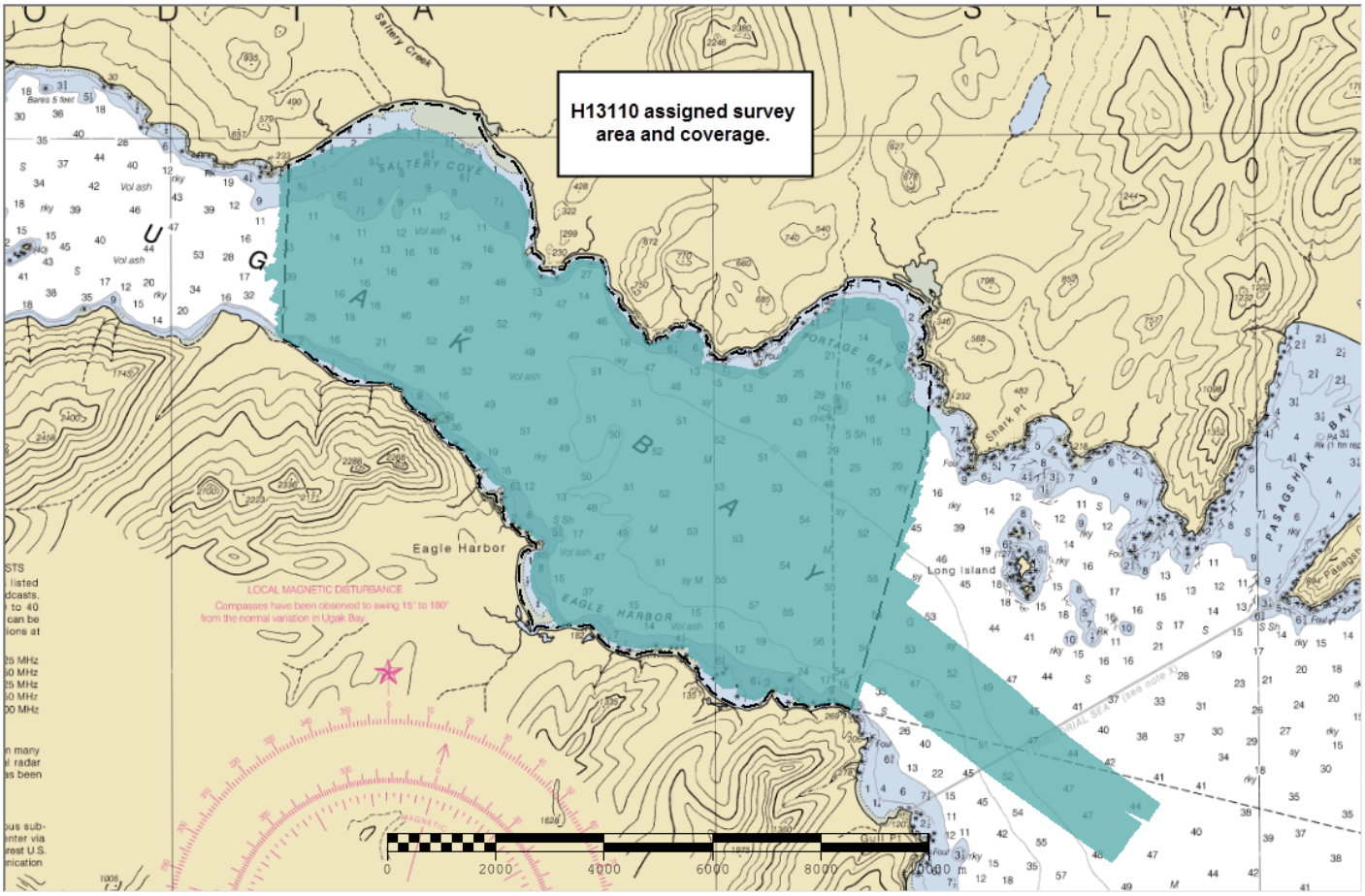


Figure 1: H13110 assigned survey area and coverage (Chart 16593)

Data were acquired within the assigned survey limits as required in the Project Instructions and HSSD. As noted above, additional data were acquired opportunistically extending southeast from the sheet limits during ship survey operations.

A.2 Survey Purpose

According to the Fisheries of the United States report, Kodiak, Alaska supports the third busiest and fourth richest fisheries port in the United States. In 2017 the port was responsible for 530 million pounds of fish and 152 million dollars of product. Ugak Bay is a well fished area and is adjacent to a coastal route frequently transited by commercial vessels to and from Kodiak. Much of the existing depth data of this area dates back to the 1930s, and is not surveyed to modern standards. This poses a serious risk to life, property and the delicate ecosystem around Kodiak Island. This survey will provide contemporary data to update National Ocean Service (NOS) nautical charting products and generate backscatter data, which will be used in habitat mapping and substrate analysis.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools Grid QA was used to analyze H13110 multibeam echo sounder (MBES) data density. The submitted H13110 variable-resolution (VR) surface met HSSD density requirements as shown in the histogram below.

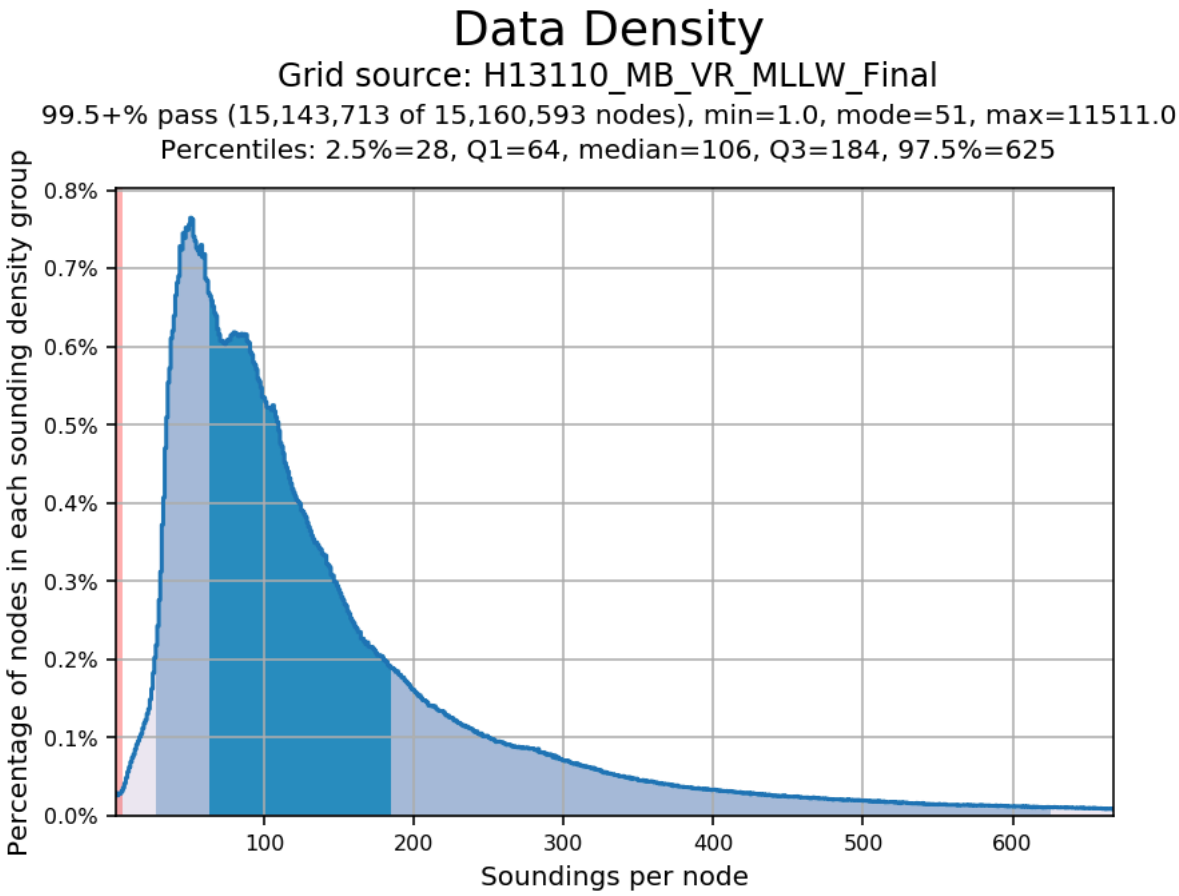


Figure 2: Pydro derived histogram plot showing HSSD density compliance of H13110 finalized variable-resolution MBES data.

A.4 Survey Coverage

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

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)
All waters in survey area	Acquire backscatter data during all multibeam data acquisition (Refer to HSSD Section 6.2)

Table 2: Survey Coverage

Complete multi beam echo sounder (MBES) coverage was acquired to the inshore limit of hydrography, the Navigable Area Limit Line (NALL). Areas where survey coverage did not reach the 3.5-meter depth contour, nor the assigned sheet limits, were due to the survey vessel reaching the extent of safe navigation as shown in the figures below. These areas are characterized as being near shore, subject to dangerous wave action or other hazards such as rocks or thick kelp.

A total of 10 holidays are present in survey coverage. Four correspond to features that were investigated during shoreline. Two were created during the final day of acquisition. Due to operational time constraints it was not possible to acquire them once discovered. The remaining four are a cluster located between two investigated features that wave action and hazardous operating conditions made unsafe to acquire.

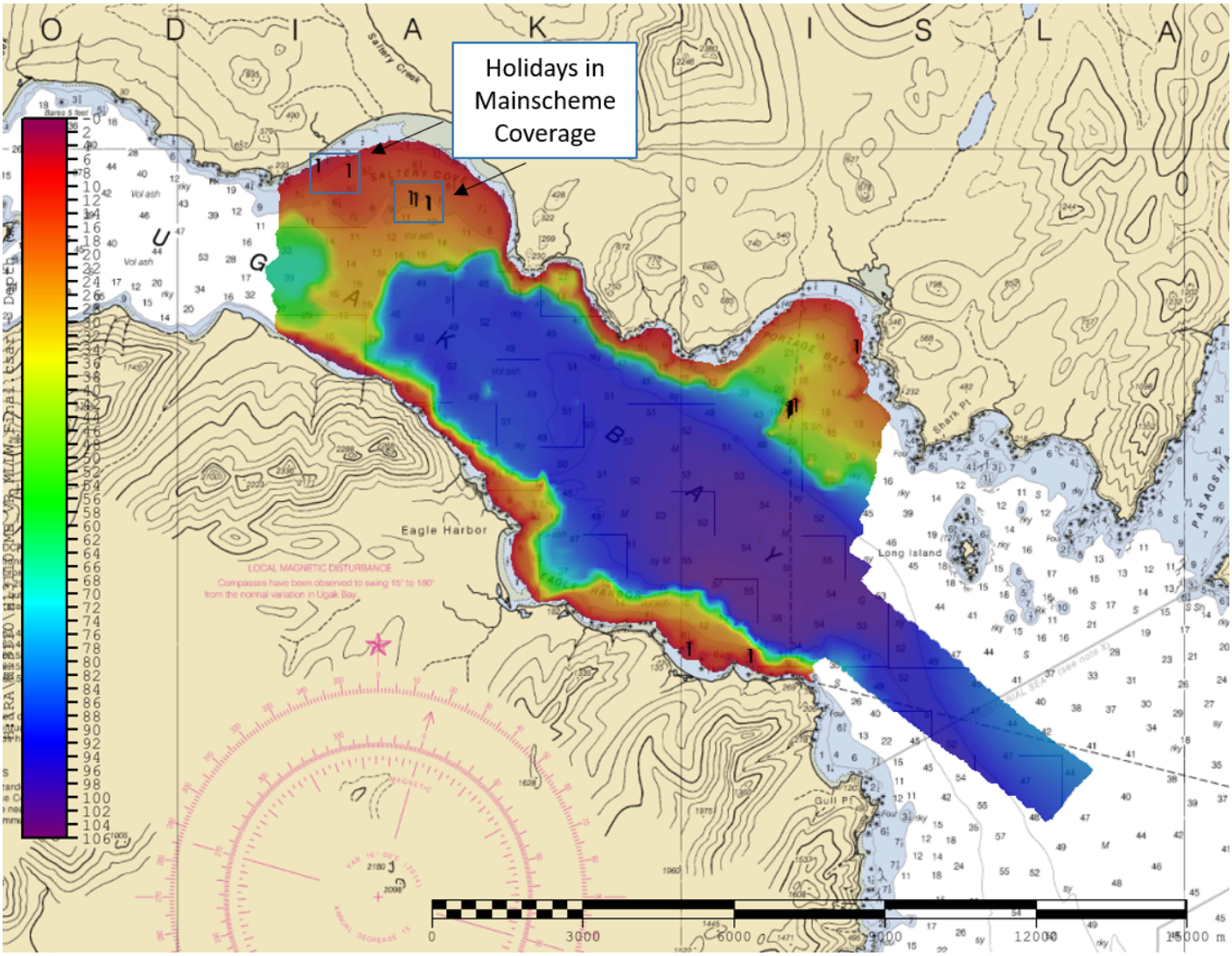


Figure 3: VR surface showing locations of holidays derived from Pydro. The two holidays in Mainscheme coverage identified in the most NW corner were created during the final day of acquisition; other holidays in the NW corner are the result of insufficient overlap during challenging weather conditions. All locations not directly explained in the image correspond to features.

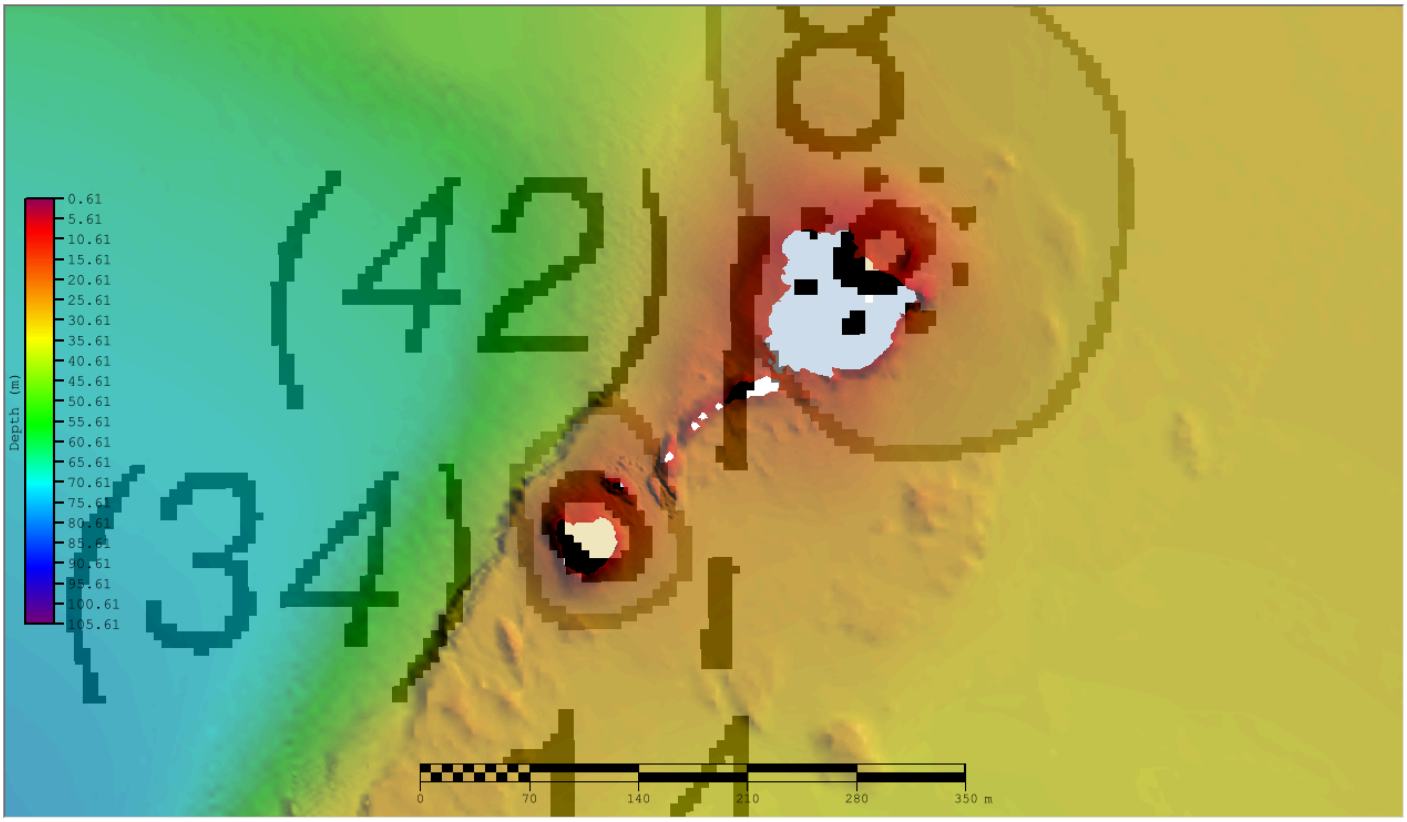


Figure 4: Holiday between two islets located in NE section of sheet. On the day of acquisition wave action and hazardous operating conditions made acquiring complete coverage unsafe. Due to time constraints it was not possible to acquire additional coverage.

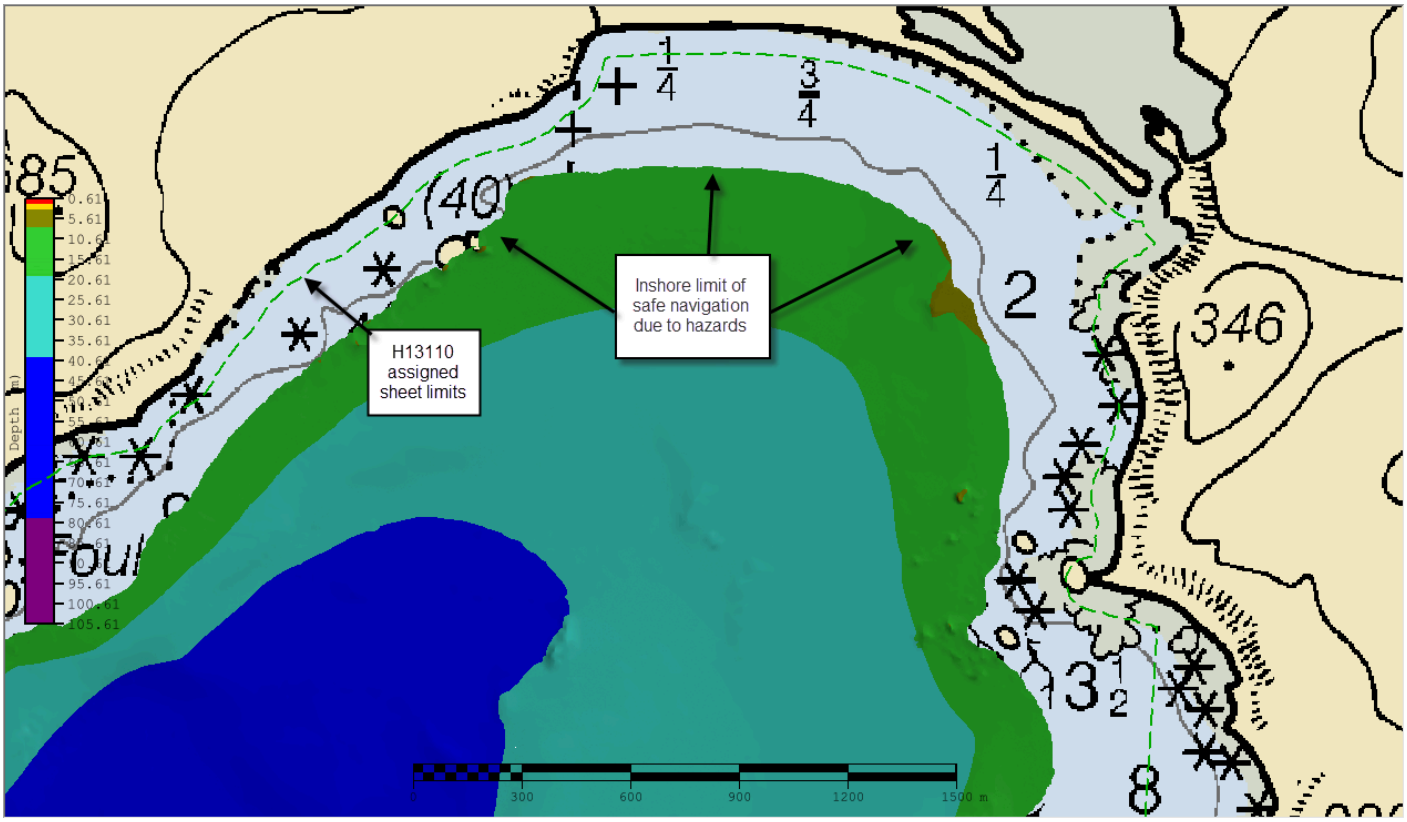


Figure 5: Examples of H13110 NALL determination; the green dashed line indicates assigned sheet limits. This area exhibited large quantities of bull kelp.

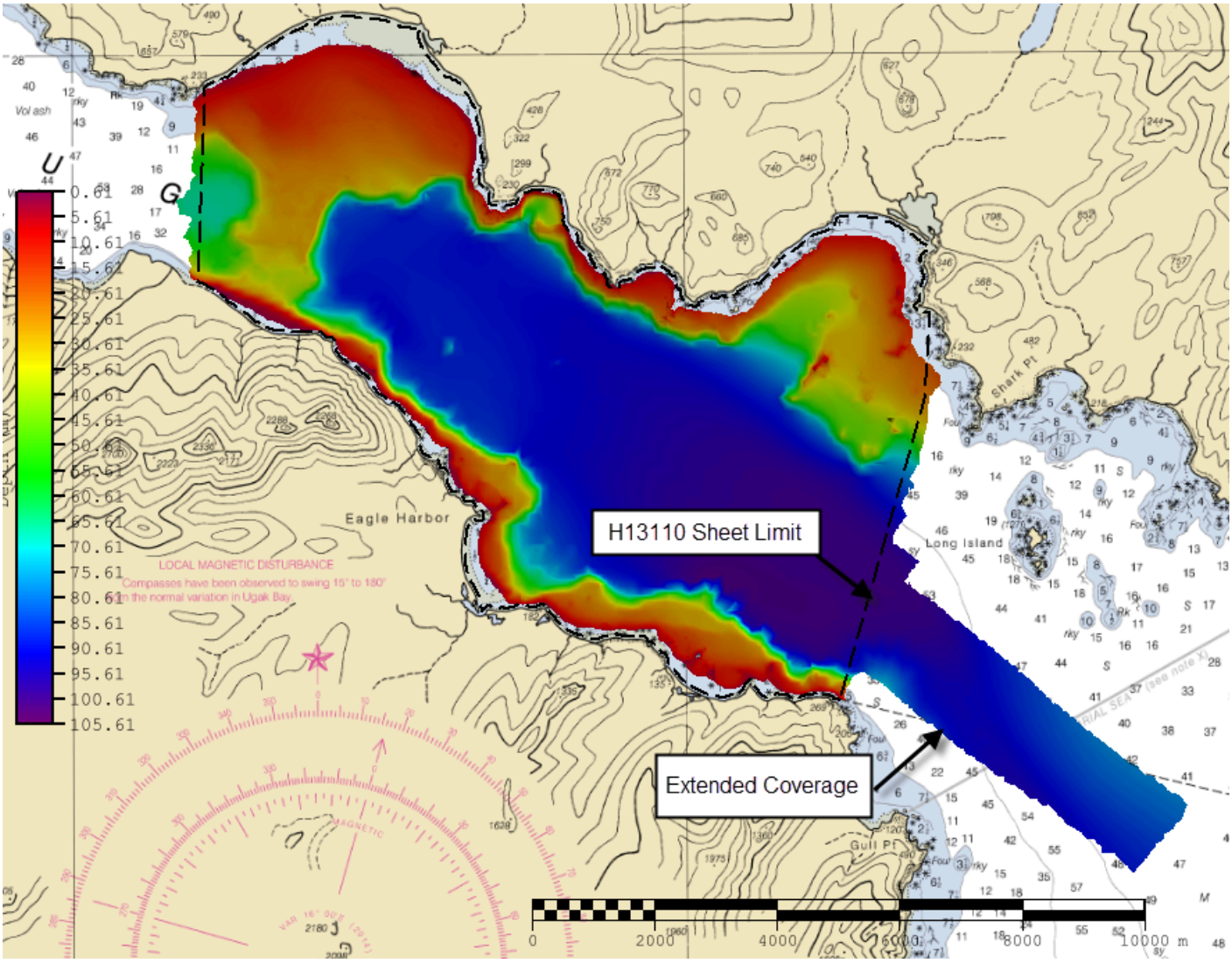


Figure 6: H13110 MBES coverage and assigned survey limits.
Note area where coverage was extended beyond sheet limits.

A.6 Survey Statistics

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

	HULL ID	*S221*	*2801*	*2802*	*2803*	*2804*	*Total*
LNM	**SBES Mainscheme**	0	0	0	0	0	0
	MBES Mainscheme	55.43	108.74	18.82	154.31	67.48	404.79
	Lidar Mainscheme	0	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0	0	0
	SBES/MBES Crosslines	0	13.97	0	0	0	13.97
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							4
Number Maritime Boundary Points Investigated							0
Number of DPs							99
Number of Items Investigated by Dive Ops							0
Total SNM							22.22

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
05/11/2019	131
05/12/2019	132

Survey Dates	Day of the Year
05/13/2019	133
05/14/2019	134
06/11/2019	162
06/12/2019	163
06/18/2019	169
06/19/2019	170
06/21/2019	172

Table 4: 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	*2804*	*2803*	*2802*	*2801*	*S221*	*2701*
LOA	8.8 meters	8.8 meters	8.8 meters	8.8 meters	70.4 meters	7.62 meters
Draft	1.1 meters	1.1 meters	1.1 meters	1.1 meters	4.7 meters	0.47 meters

Table 5: Vessels Used

Figure 7: RA-6 (2804) and RAINIER(S221) in Ugak Bay, AK

Figure 8: RA-2 (2701)

B.1.2 Equipment

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

Manufacturer	Model	Type
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 2040	MBES
Sea-Bird Scientific	SBE 19plus	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Kongsberg Maritime	EM 710	MBES
ODIM Brooke Ocean	MVP200	Sound Speed System
Velodyne LiDAR	VLP-16	Lidar System
ODIM Brooke Ocean	Echotrac CV200	SBES

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 3.45% of mainscheme acquisition.

RAINIER launch 2801 acquired 13.97 nautical miles of multi beam crosslines across most depth ranges and multiple boat days. Due to operational time constraints, the percentage of crosslines acquired was slightly less than the requirement specified in the HSSD, however the hydrographer deems them adequate for verifying and evaluating the internal consistency of H13110 survey data. Analysis was performed using the Compare Grids function in Pydro Explorer on finalized VR surfaces of H13110 mainscheme only and crossline only data. 99.5% of nodes met allowable uncertainties.

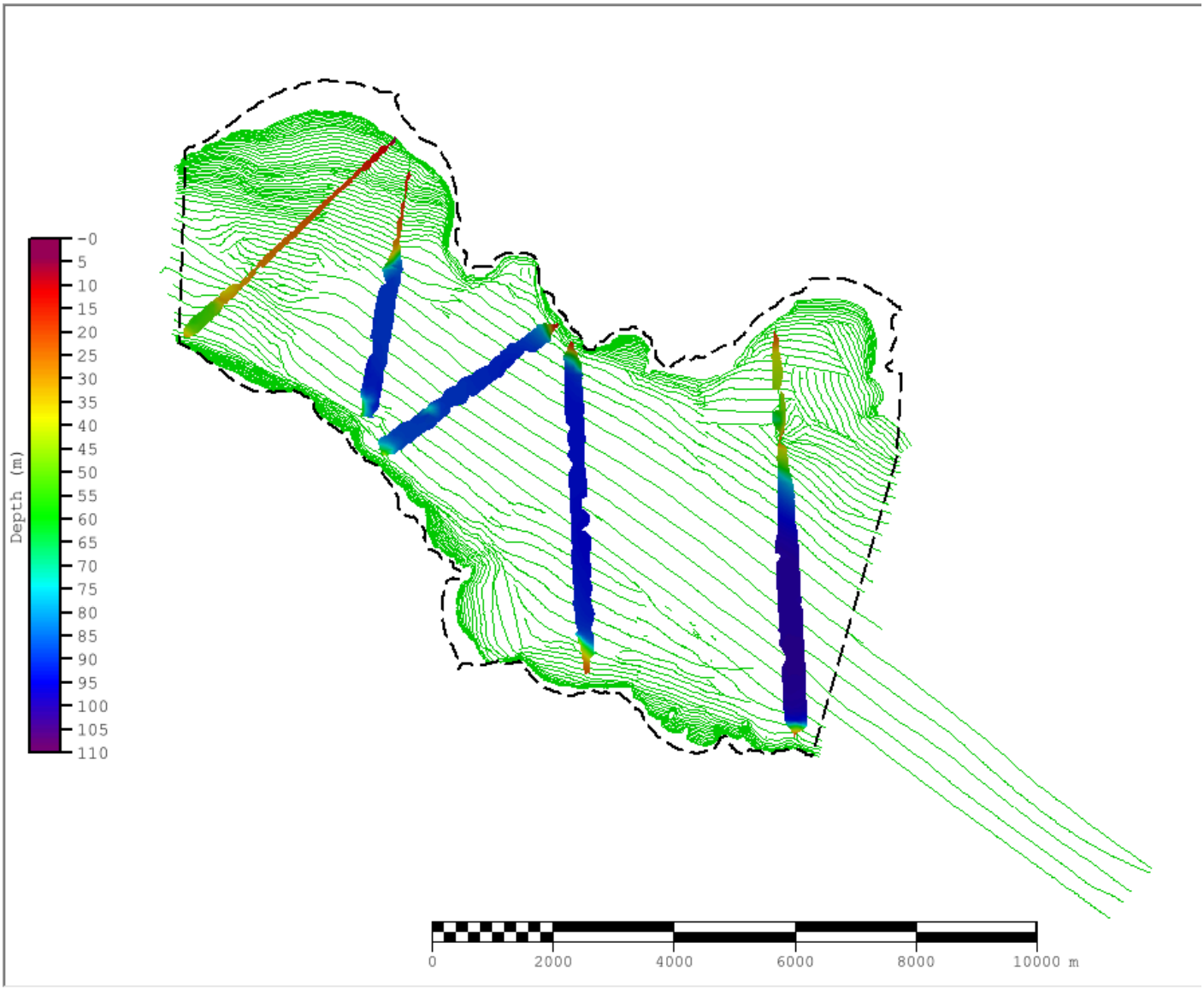


Figure 9: H13110 crossline surface overlaid on mainscheme tracklines.

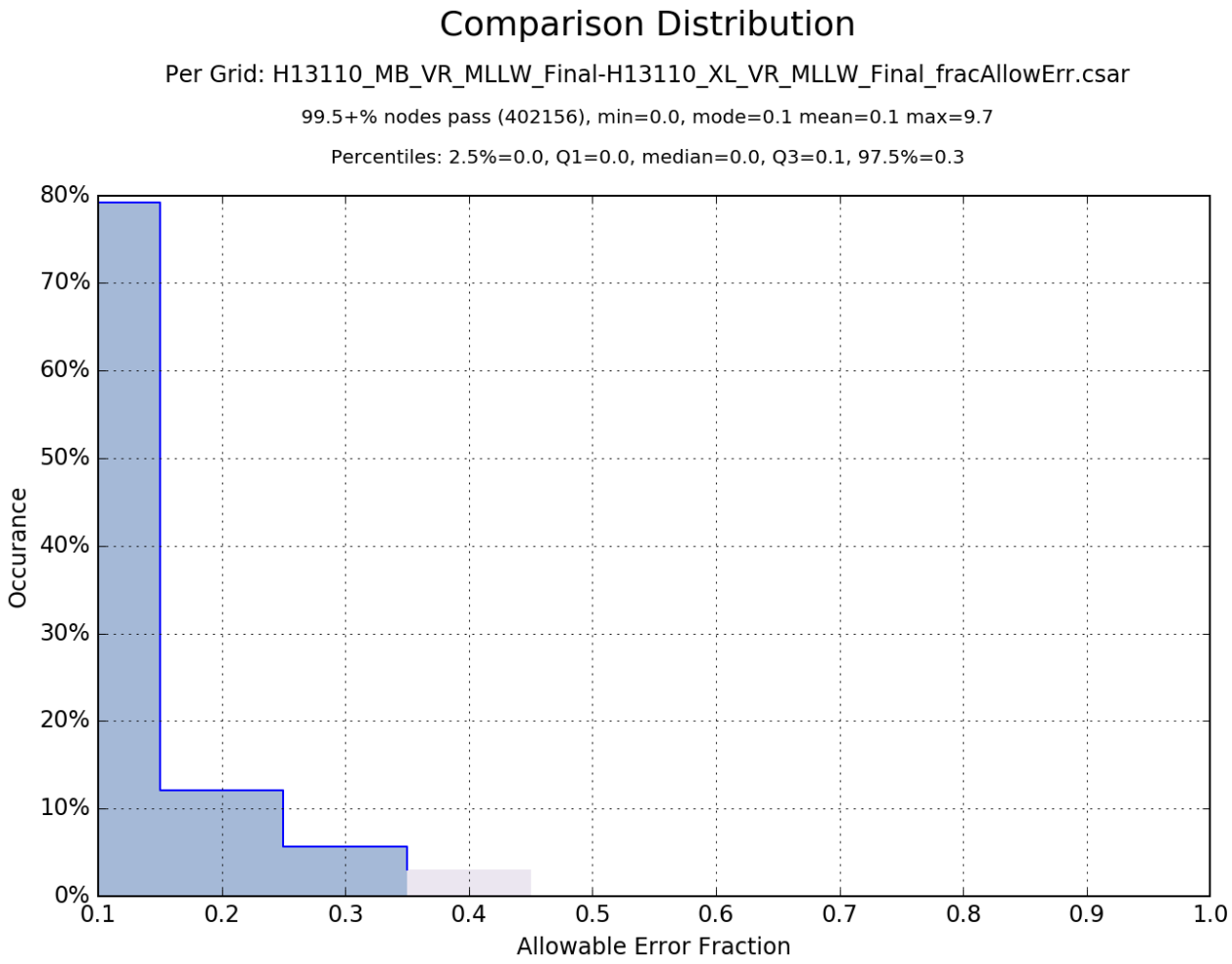
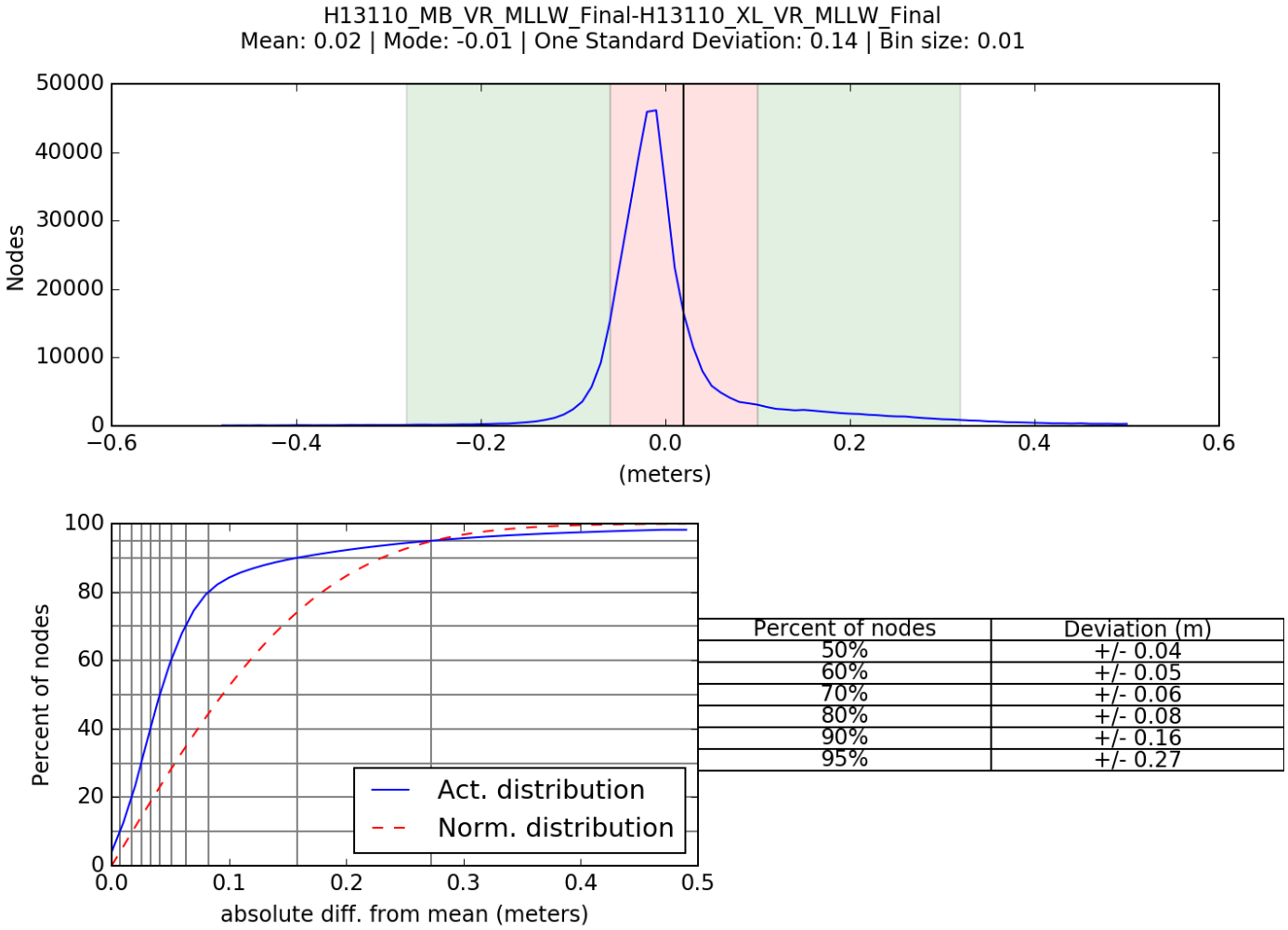


Figure 10: Pydro derived plot showing node percentage-pass value of H13110 mainscheme to crossline data.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.08
90%	+/- 0.16
95%	+/- 0.27

Figure 11: Pydro derived plot showing absolute difference statistics of H13110 mainscheme to crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0 meters	0.15 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
S221	N/A	1.0 meters/second	0.05 meters/second
2801, 2802, 2803, 2804	3.0 meters/second	N/A	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13110 were derived from a combination of fixed values for equipment and vessel characteristics, as well as from assigned values for sound speed uncertainties. The uncertainty for the Ellipsoidally Referenced Tidal Datum Model (ERTDM) used to reduce data to the ellipse was determined to be 0.15 meters based on a conservative modeling of uncertainty for the separation model. Please see Appendix A Supplemental Correspondence for more details. ERTDM is synonym to what was formerly know as poor man's VDatum (PMVD).

In addition to the usual a priori estimates of uncertainty, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from Kongsberg MBES sonars were recorded and applied in post-processing. Applanix TrueHeave (POS) files, which record estimates of heave uncertainty, were also applied during post-processing. Finally, the post processed uncertainties associated with vessel position and attitude were applied in Caris HIPS using SBET and RMS files generated using POSPac MMS software.

Uncertainty values of the submitted finalized grid were calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA within Pydro QC Tools was used to analyze H13110 Total Vertical Uncertainty (TVU) compliance, a histogram plot of the results is shown below.

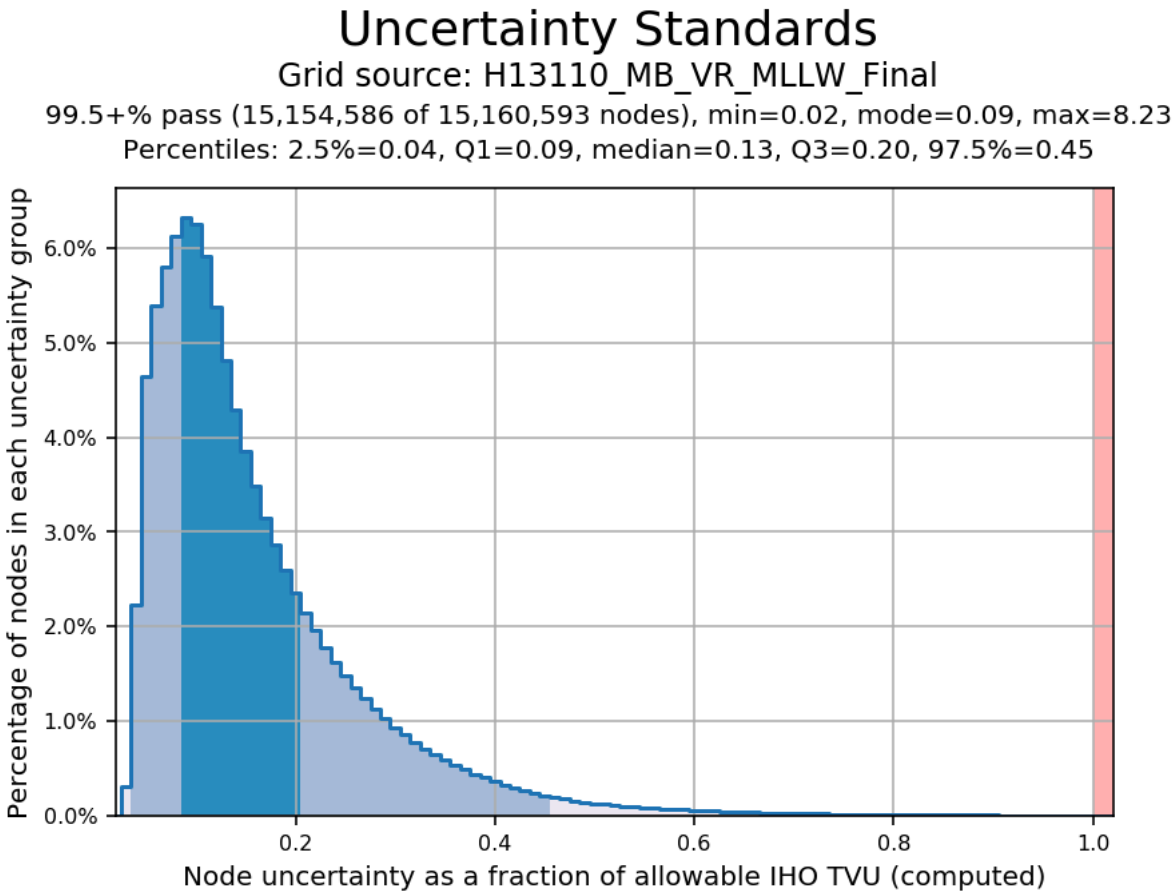


Figure 12: Pydro derived plot showing TVU compliance of H13110 finalized multi-resolution MBES data.

The hydrographer has correctly documented the separation model's uncertainty of 0.15m, but has not applied this uncertainty in the data.

The hydrographer states, in Table 8 above, that the Sound Speed Uncertainty applied for vessel S221 Measured-MVP values was 1.0m/s, but the processing logs show the applied Measured sound speed uncertainty used for S221 was actually 3.0m/s.

B.2.3 Junctions

There are no junctions associated with this survey.

There are no contemporary surveys that junction with this survey.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

S221 Logging of Delayed Heave

On day number 132 (May 12, 2019) the POSMV file for vessel S221 was incorrectly set up, resulting in no delayed heave being logged. Therefore real-time heave was applied. As the data in question was acquired via S221 (less subject to the effects of heave) on a relatively calm day, and delayed heave is a post processed element, it was determined that no additional error was induced.

SBET - Lack of solution status near a steep elevation

On day number 162 (June 11, 2019) launch 2801 experienced a poor GPS solution from inadequate satellite constellation due to terrain blockage (mountains) in a SW portion of the survey area. As a result the processed SBET was approximately 4 meters offset from adjacent lines. The Pydro AutoQC tool was used to interpolate over the affected area, and a new SBET was created and applied, resolving the issue. The affected line was 0004_20190611_171953_2801_300A_162.

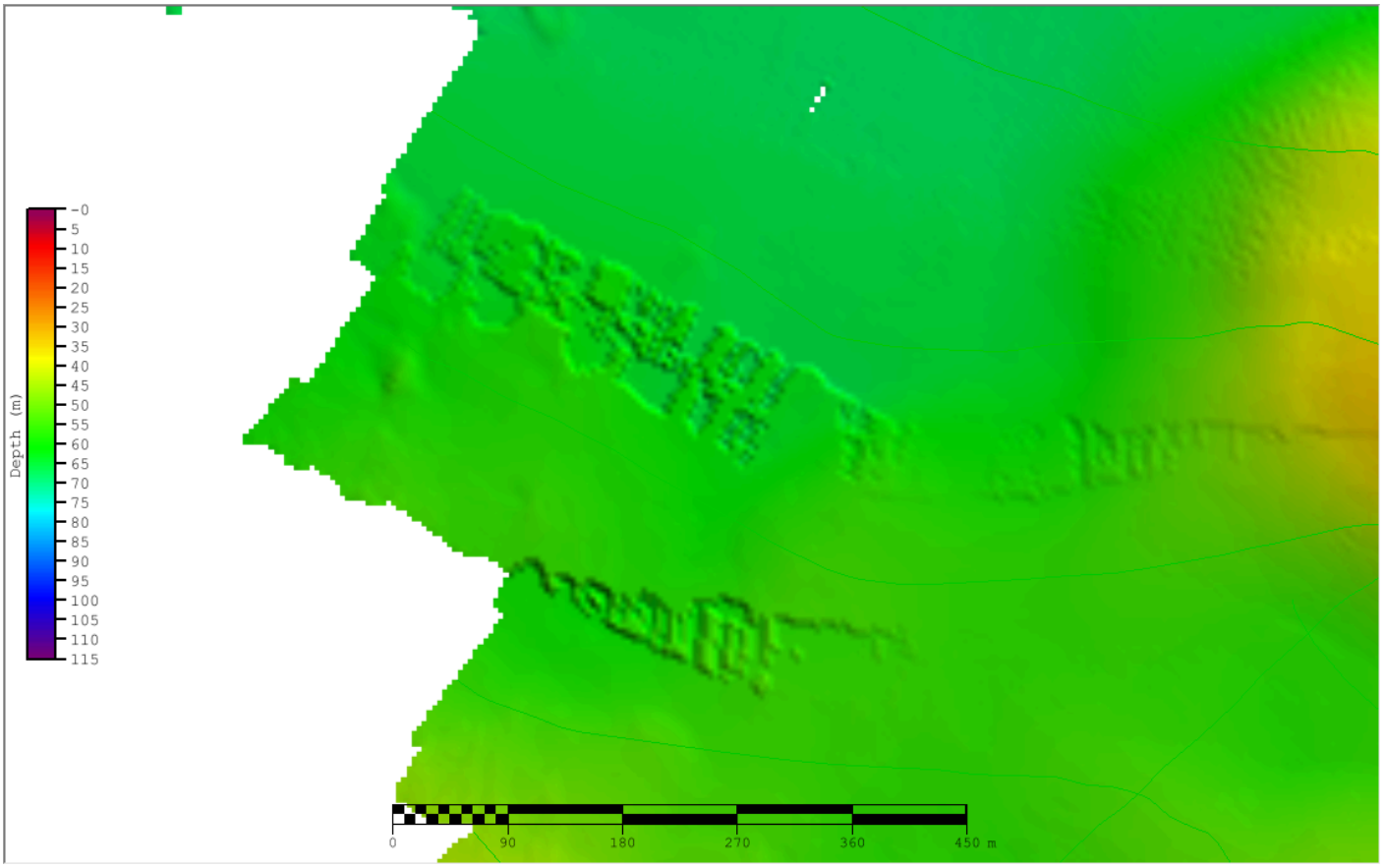


Figure 13: Approximate 4m offset in portion of data acquired by 2801 on DN 162.

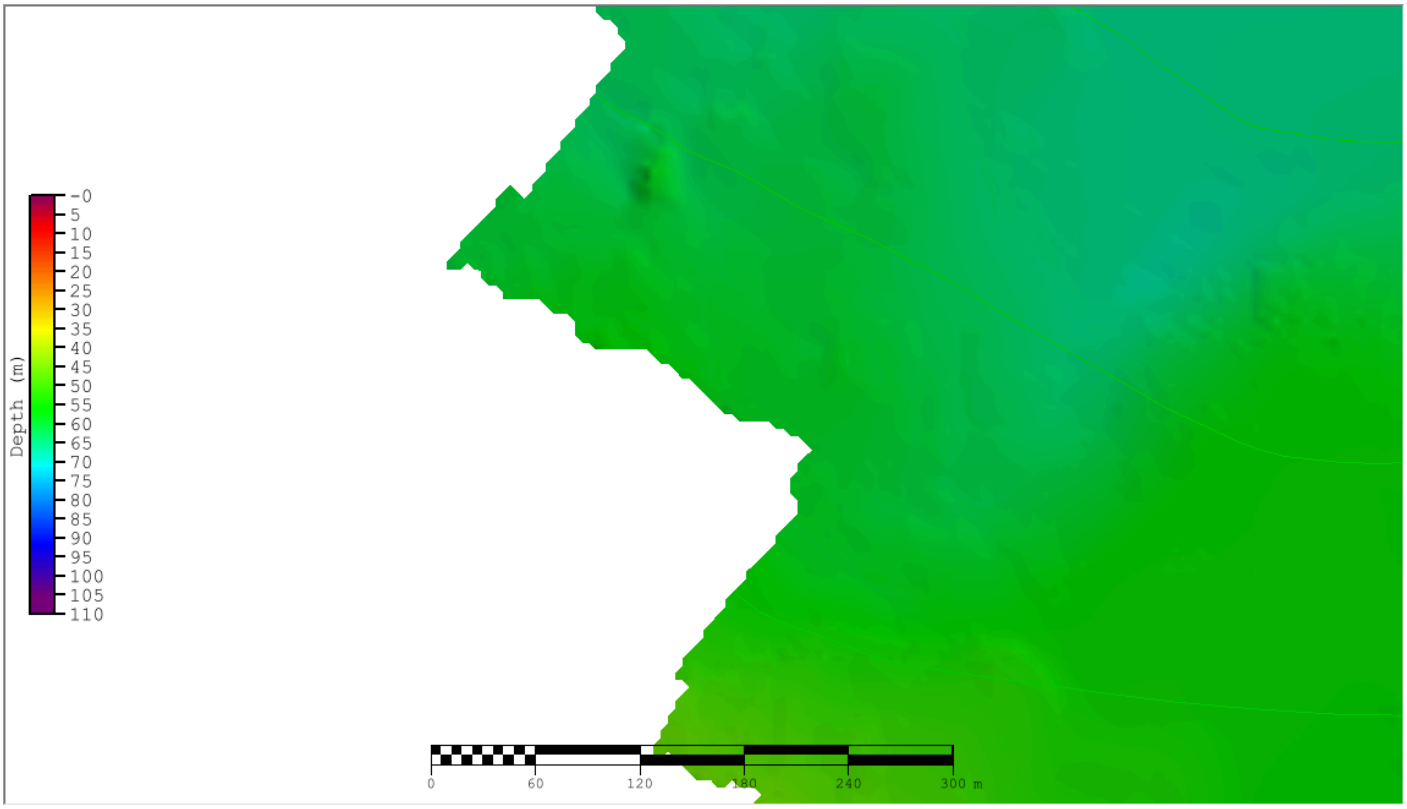


Figure 14: Affected SBET area after SBET interpolation.

B.2.6 Factors Affecting Soundings

Environmental Influence - Outer beam noise

Due to poor environmental conditions during the time of the survey, areas in the NW part of the survey. Despite the hydrographer's best efforts to monitor data quality in real time, bubble masses at and below the surface proved to be problematic and caused spreading of the outer beams. To address this issue, the hydrographer rejected the most egregious outer beam soundings obviously in error in an attempt to produce a surface that best represented the sea floor. In some cases, where there was not sufficient overlap between adjacent survey lines, small holidays are now left from cleaning. All examined offsets between survey lines were observed to be within NOAA HSSD standards.

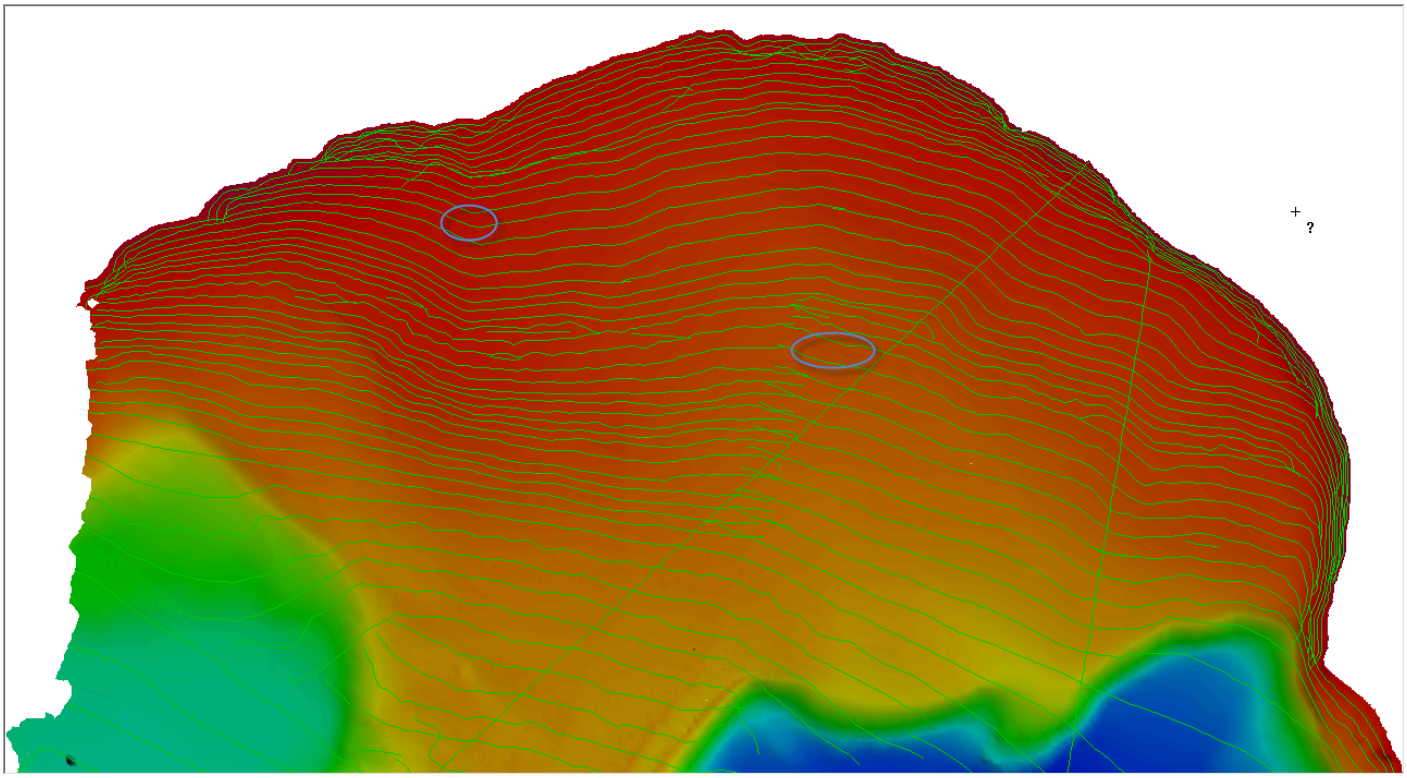


Figure 15: Imagine showing the main holiday areas in the NW part of H13110.

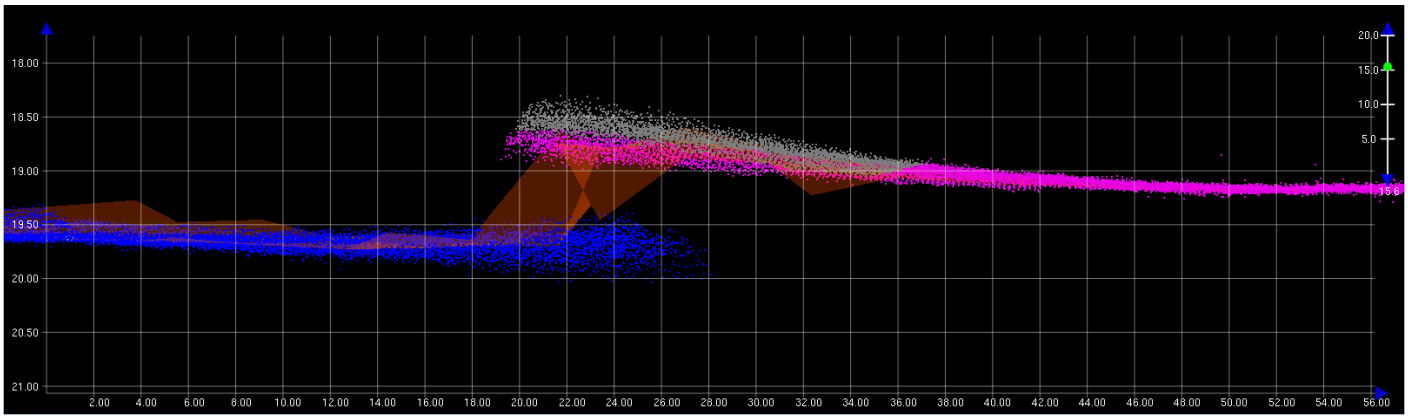


Figure 16: Image displaying environmental errors existing in NW portion of Survey.

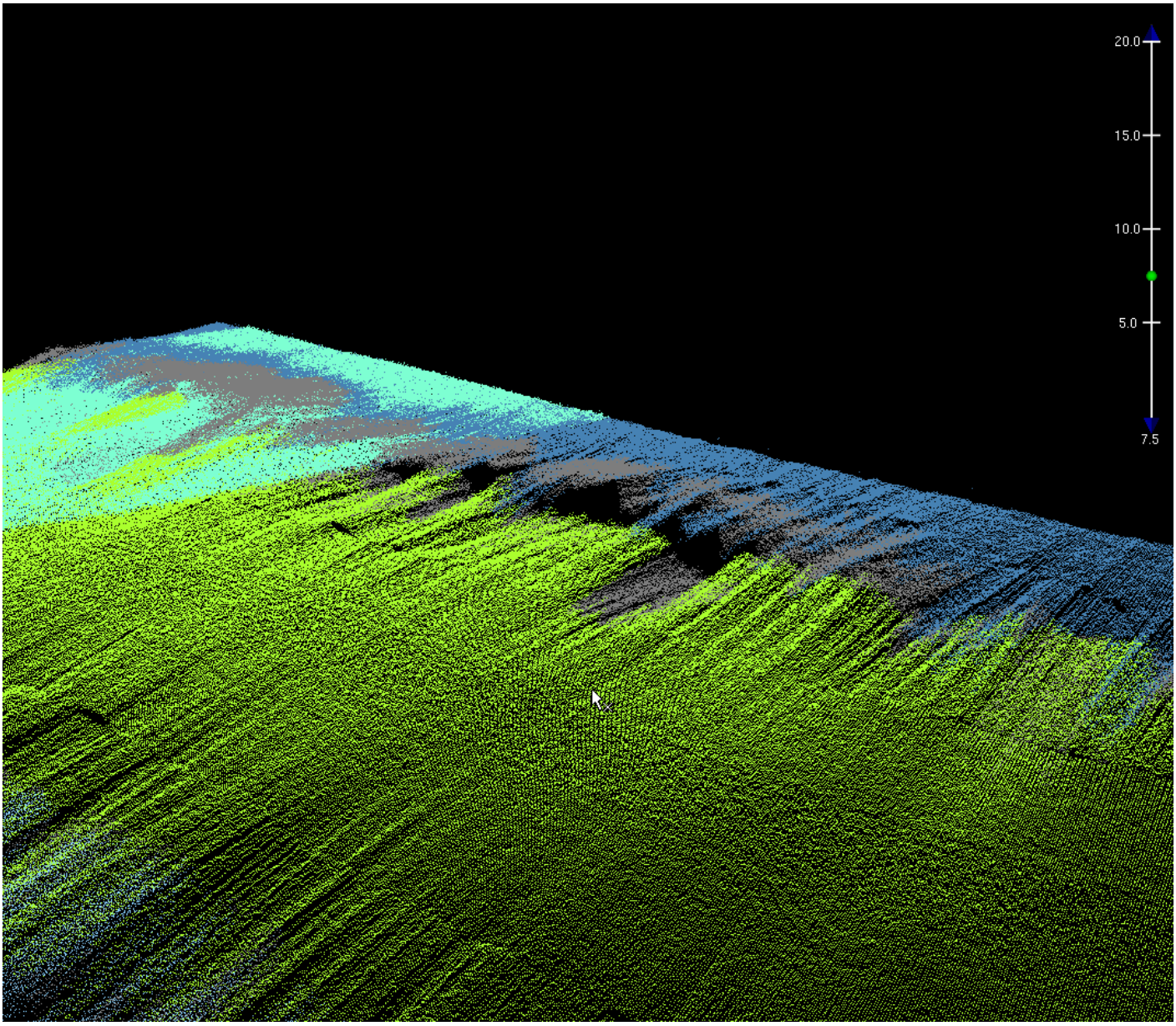


Figure 17: Image showing areas where soundings were removed, leaving holidays.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Once every four hours.

Fifty five sound speed profiles were acquired for this survey at discrete locations within the survey area at least once every four hours, when significant changes in surface sound speed were observed, or when operating in a new area. Sound speed profiles were acquired using Sea-Bird Scientific SBE 19plus Profiler

and Odim Brooke Ocean MVP200. All casts were concatenated into a master file and applied using the "Nearest distance within Time" (4 hours) profile selection method.

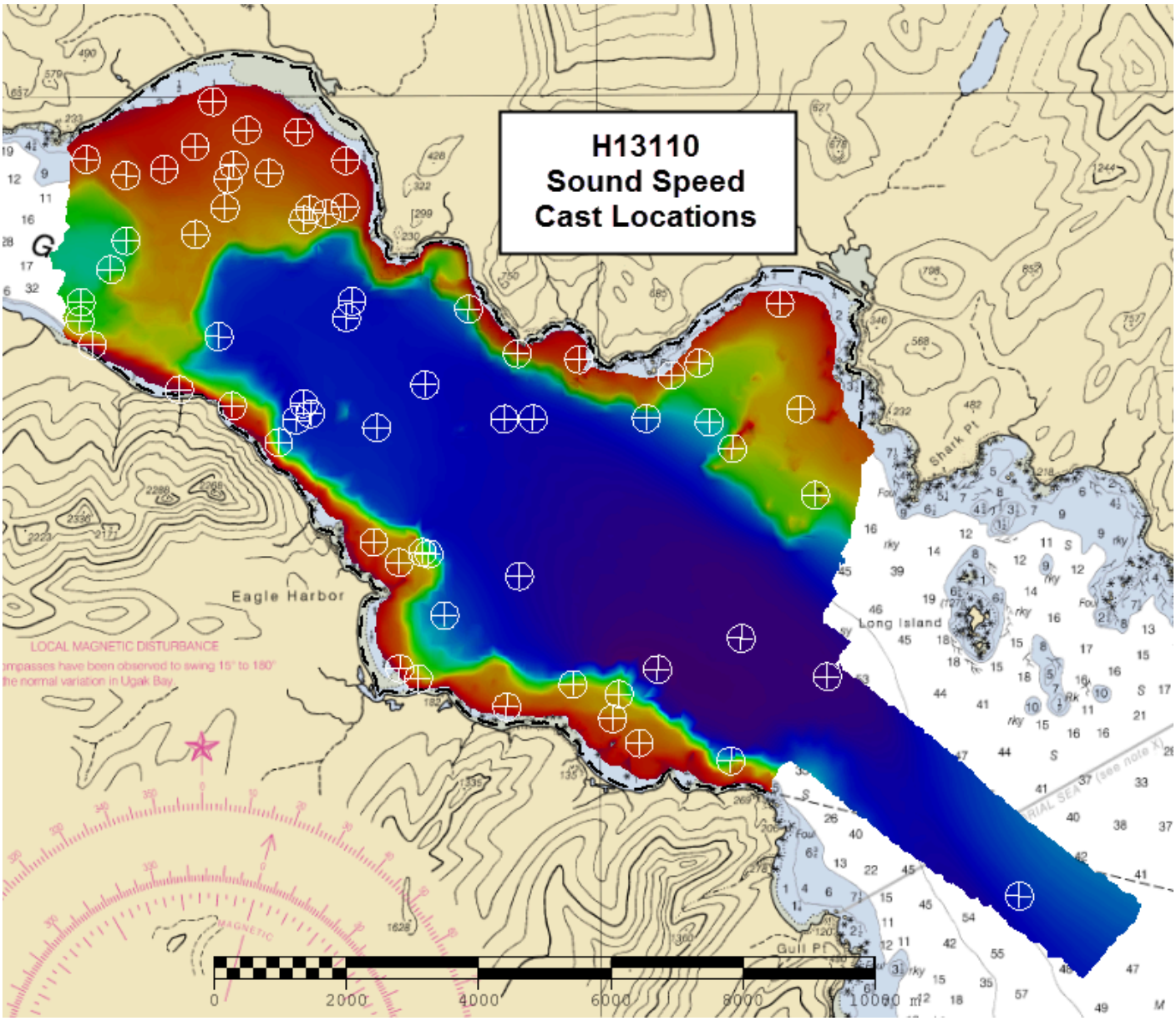


Figure 18: H13110 sound speed cast locations

B.2.8 Coverage Equipment and Methods

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

B.2.9 Detect Fliers

Pydro QC Tools v. 3.1.1 Detect Fliers was used to find fliers in the finalized variable resolution surface. Detect Fliers parameters included Gaussian Curvature, Adjacent Cells, Edge Slivers, and Isolated Nodes. Flier height was not restricted.

Obvious noise was rejected by the hydrographer in Caris subset editor. After data cleaning, Detect Fliers identified 1 fliers. This was investigated and found to be a false positive.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

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

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Raw backscatter data was acquired as .all files logged during MBES operations and subsequently processed by personnel aboard RAINIER. The .GSF files created during processing and one backscatter mosaic per vessel per frequency has been delivered with this report. Backscatter processing procedures are described in the DAPR.

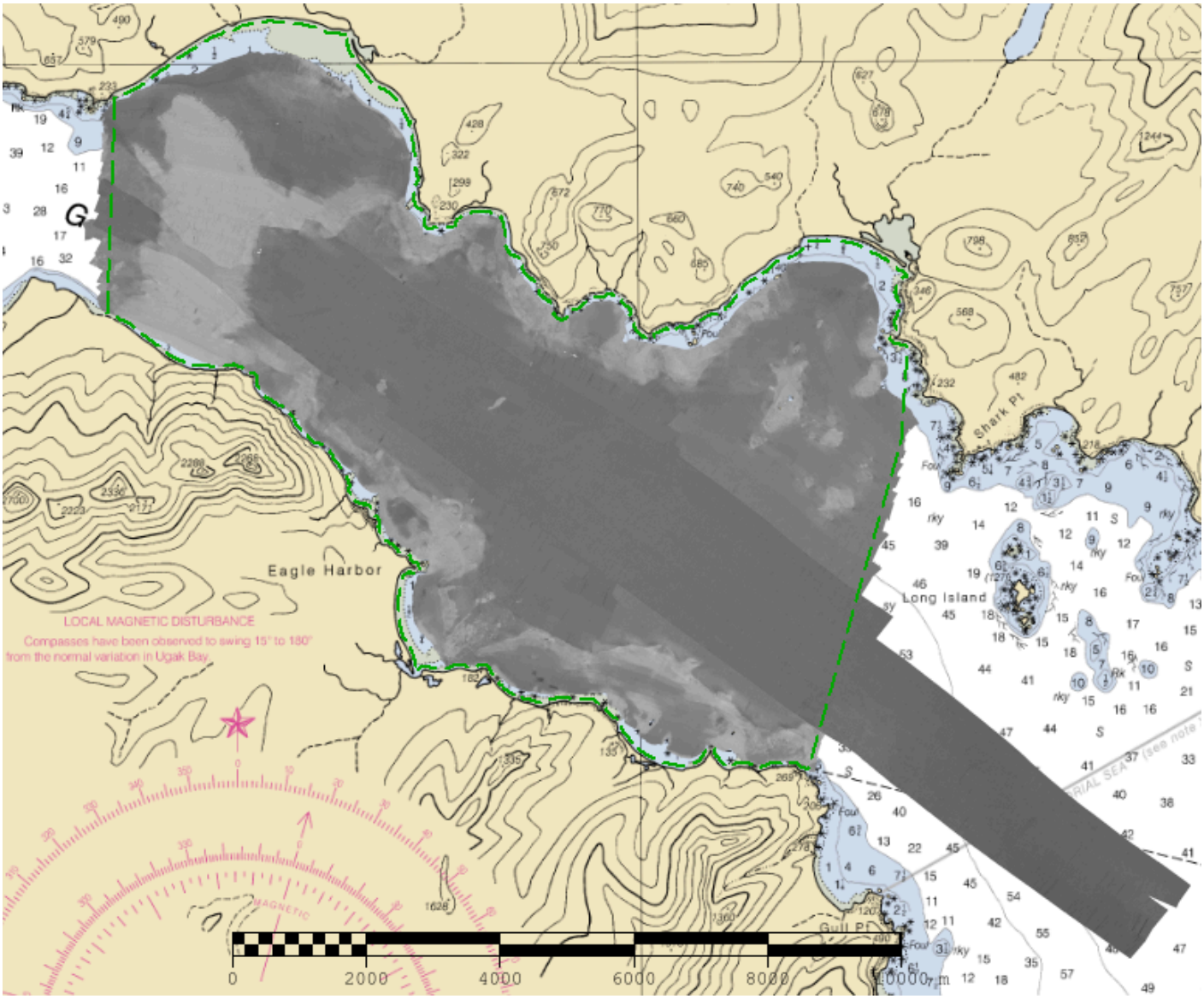


Figure 19: Overview of H13110 backscatter mosaics (Chart 16593)

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

Manufacturer	Name	Version
CARIS	HIPS/SIPS	11.1

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 Geocoder Tool Box (FMGT)	7.8.1

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Extended Attribute Files Version 5_7.

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
H13110_MB_VR_MLLW_final	CARIS VR Surface (CUBE)	Variable Resolution	0.80 meters - 105.80 meters	NOAA_VR	Complete MBES
H13110_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	0.80 meters - 105.80 meters	NOAA_VR	Complete MBES

Table 11: Submitted Surfaces

Submitted surfaces were generated using the NOAA recommended parameters for depth-based (Ranges) Caris variable-resolution bathymetric grids as specified in the 2019 HSSD.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via ERTDM	P136RA2019_ERTDM_NAD83-MLLW.csar; P136RA2019_ERTDM_NAD83-MHW.csar

Table 12: ERS method and SEP file

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 5.

The following PPK methods were used for horizontal control:

- RTX

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition.

C.3 Additional Horizontal or Vertical Control Issues

C.3.1 SBET Processing Method

Precise Positioning-Real Time Extended (PP-RTX) processing methods were used in Applanix PosPac MMS 8.3 software to produce SBETs for post-processing horizontal correction.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was made between H13110 survey data and Electronic Navigational Chart (ENC) US4AK5OM using CUBE surfaces, selected soundings, and contours created in CARIS.

D.1.1 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4AK5OM	1:800000	8	08/17/2019	08/17/2019	NO

Table 13: Largest Scale ENCs

US4AK5OM

A comparison was made between H13110 derived contours and ENC US4AK5OM with the following results. H13110 3-fathom and 10-fathom contours were generally inshore of the charted ENC depth curves. As noted below, many ledges extend farther out on the ENCs than their actual positions.

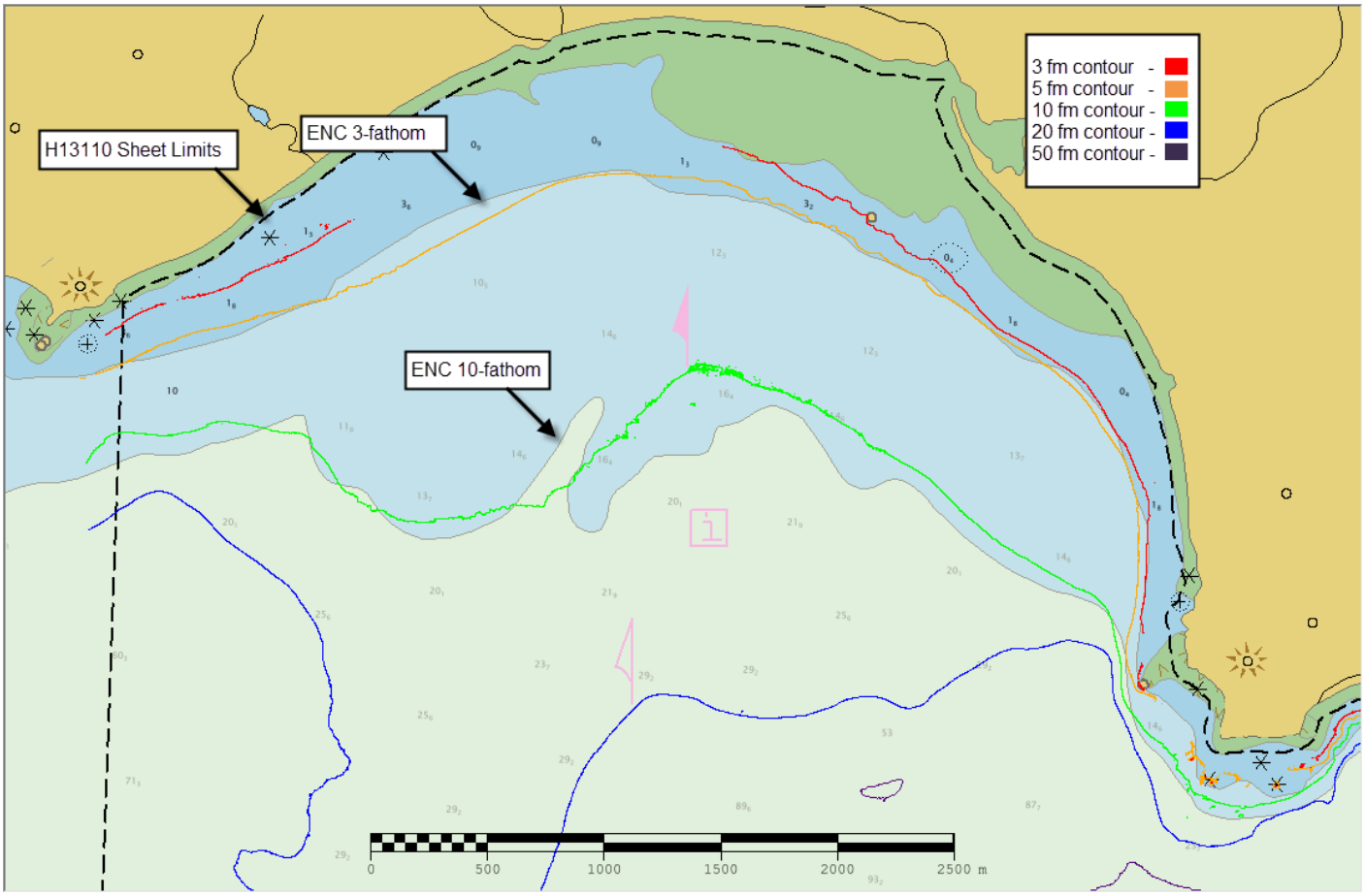


Figure 20: ENC US4AK5OM overlaid with H13110 contours.

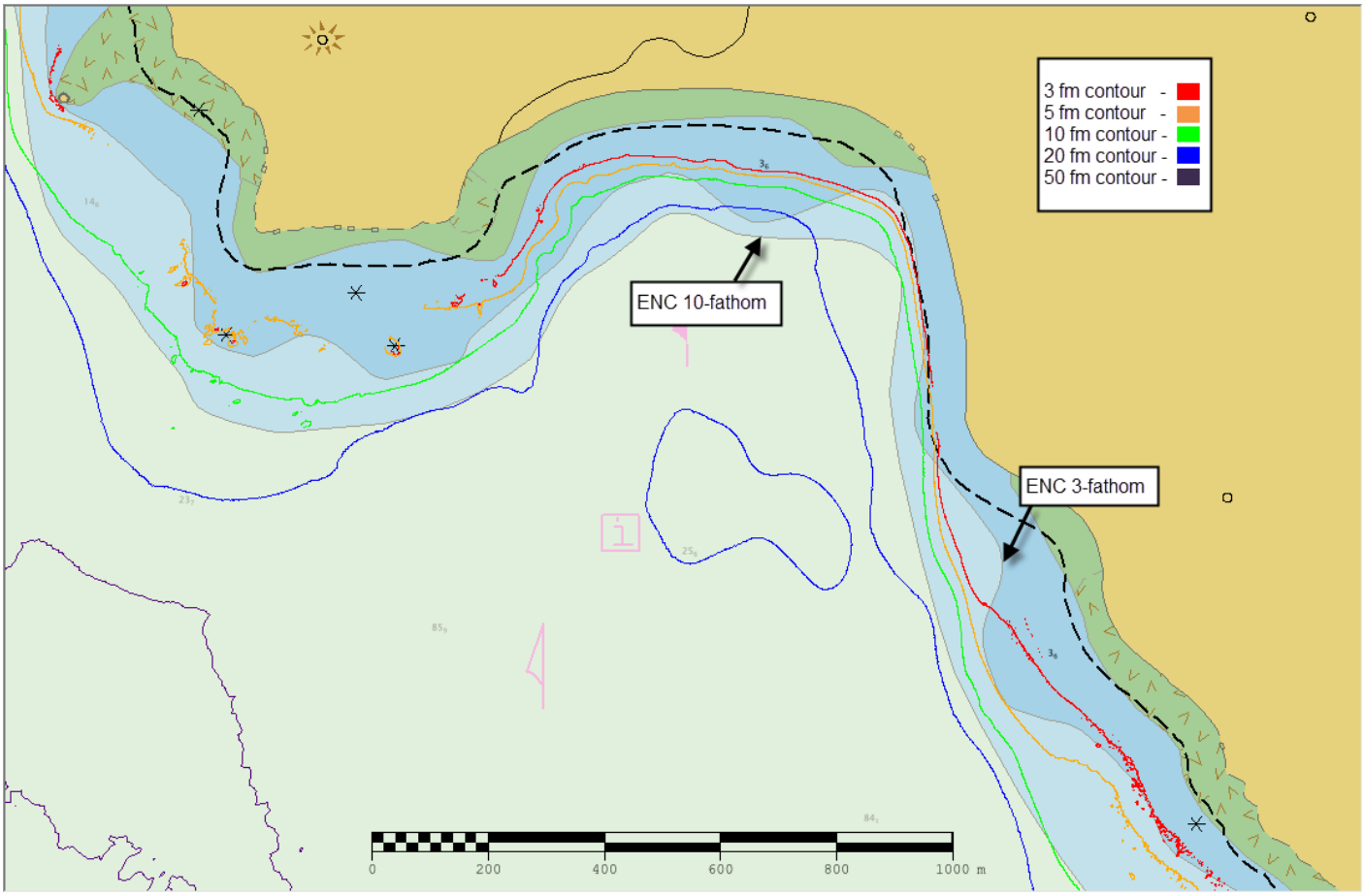


Figure 21: ENC US4AK5OM overlaid with H13110 contours showing discrepancies between charted depth curves and survey data.

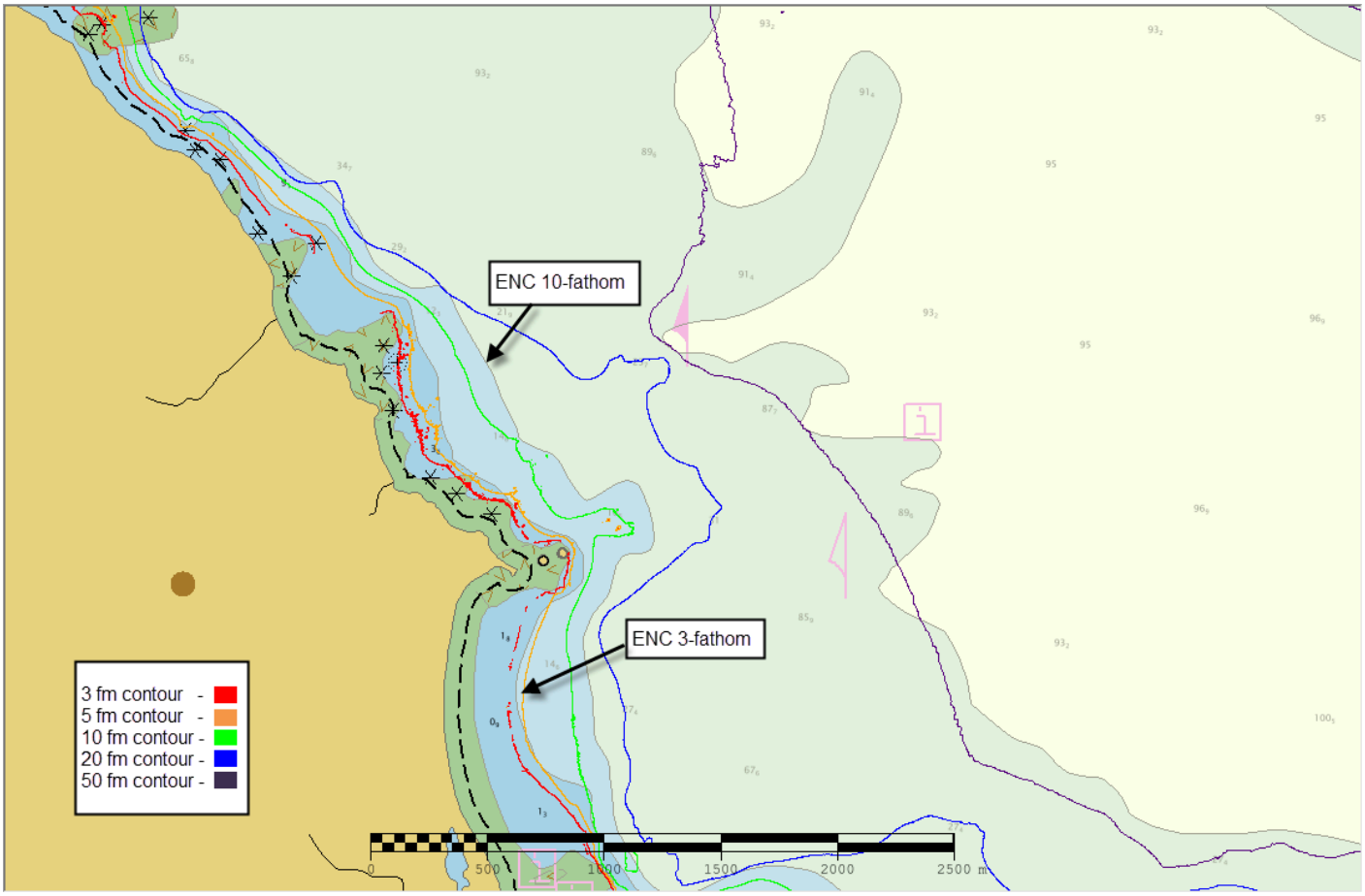


Figure 22: ENC US4AK5OM overlaid with H13110 contours showing discrepancies between charted depth curves and survey data.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features with the label PA,ED,PD,or REP exist for this survey.

D.1.4 Uncharted Features

No new navigationally significant features were detected that were not included in the H13110 Final Feature File or elsewhere in this report.

D.1.5 Shoal and Hazardous Features

In many instances charted ledges extend past their positions identified during shoreline acquisition.

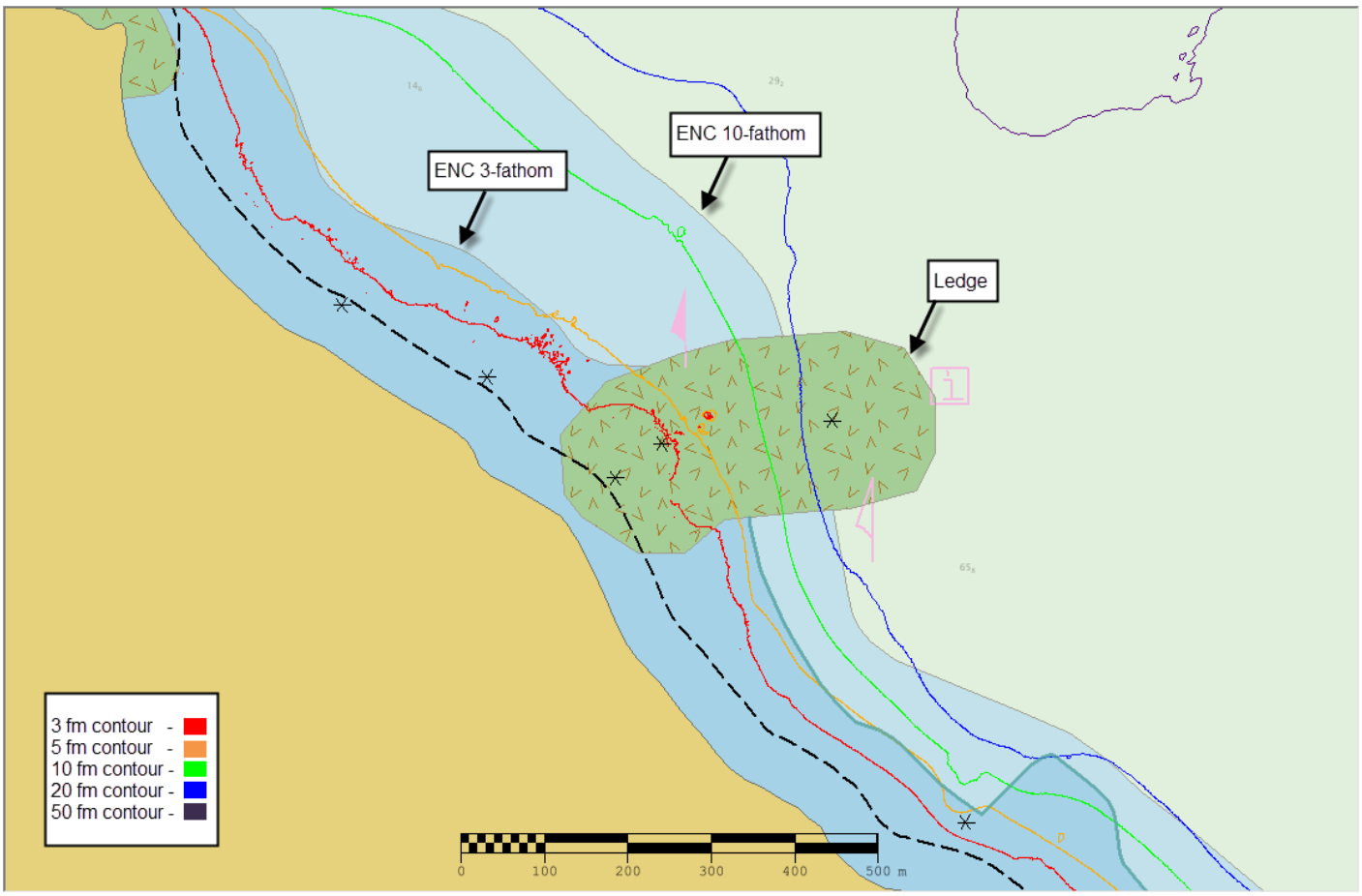


Figure 23: US4AK5OM overlaid with H13110 contours showing mischarted ledge.

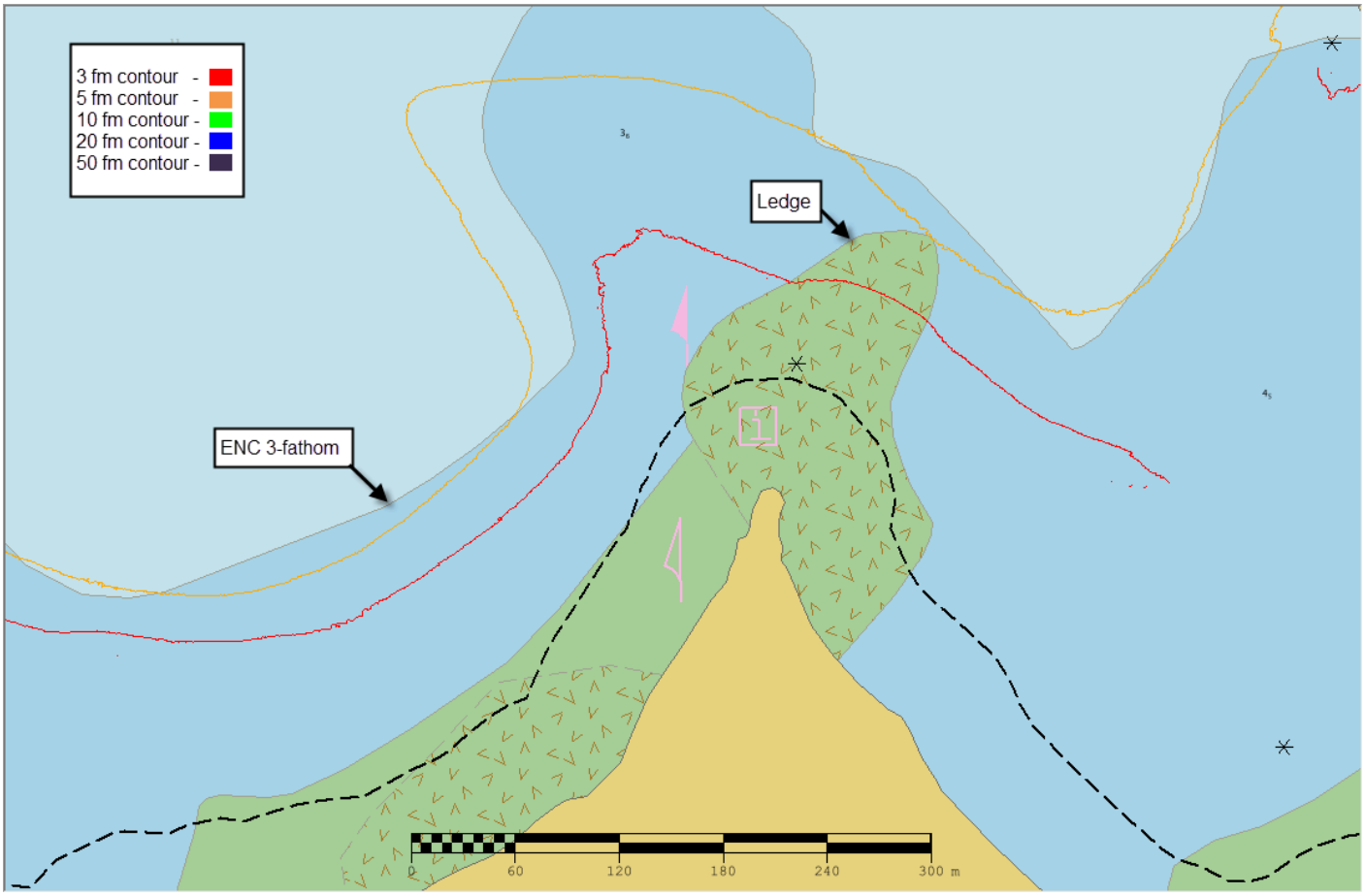


Figure 24: US4AK5OM overlaid with H13110 contours showing mischarted ledge.

D.1.6 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.1.7 Bottom Samples

Four bottom samples were investigated for this survey; the results are included in the H13110 Final Feature File submitted with this report.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was conducted in accordance with applicable sections of NOAA HSSD and FPM using the Project Reference File (PRF) and Composite Source File (CSF) provided with the Project

Instructions. In the field, all assigned features that were safe to approach, were addressed as required with S-57 attribution and recorded in the H13110_FFF to best represent the features at chart scale. This file also includes new features found in the field as well as recommendations to update, retain or delete assigned features.

Three assigned rocks were investigated with single beam echo sounder. During acquisition no sign of the rocks were detected, however equipment misconfiguration of the SBES at the time of the survey rendered the data unusable for determining a least depth on the rocks with sufficient confidence. Visual observations and recommendations on the rocks are included in the final feature file.

The height of one assigned feature was unable to be obtained via LiDAR. The rock was awash at the time of observation. The tidal adjustment of a feature approximately 59m to the SE observed at approximately the same time was used to obtain the raw height. Visual observations and recommendations on the rock are included in the final feature file.

D.2.2 Aids to Navigation

No Aids to navigation (ATONs) exist for this survey.

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

No submarine features exist for this survey.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

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

D.2.8 Construction and Dredging

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

D.2.9 New Survey Recommendation

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

D.2.10 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Samuel F. Greenaway CDR/NOAA	Chief of Party	03/03/2020	Digitally signed by GREENAWAY.SAMUEL.F.1275635347 Date: 2020.03.05 07:09:32 -08'00'
Hadley A. Owen, LT/NOAA	Field Operations Officer	03/03/2020	Digitally signed by OWEN.HADLEY.ANNE.1410967070 Date: 2020.03.03 12:52:32 -08'00'
James B. Jacobson	Chief Survey Technician	03/03/2020	JACOBSON.JAMES.BRYAN.1269664017 I have reviewed this document 2020.03.03 12:31:16 -08'00'
Amanda M. Finn	Senior Survey Technician	03/03/2020	FINN.AMANDA.MARIA.1540474253 Digitally signed by FINN.AMANDA.MARIA.1540474253 Date: 2020.03.04 07:47:54 -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	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

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

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File