H13487

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13487

LOCALITY

State(s):	Mississippi
General Locality:	Approaches to Pascagoula, Louisiana, Mississippi, and Alabama
Sub-locality:	Approach to Pascagoula

2021

CHIEF OF PARTY
Jonathan L. Dasler, PE, PLS, CH

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13487**

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):	**Mississippi**
General Locality:	**Approaches to Pascagoula, Louisiana, Mississippi, and Alabama**
Sub-Locality:	**Approach to Pascagoula**
Scale:	**10000**
Dates of Survey:	**07/19/2021 to 12/13/2021**
Instructions Dated:	**04/27/2021**
Project Number:	**OPR-J315-KR-21**
Field Unit:	**David Evans and Associates, Inc.**
Chief of Party:	**Jonathan L. Dasler, PE, PLS, CH**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter Side Scan Sonar**
Verification by:	**Atlantic 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 16N, 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 H13487

Project: OPR-J315-KR-21

Locality: Approaches to Pascagoula, Louisiana, Mississippi, and Alabama

Sublocality: Approach to Pascagoula

Scale: 1:10000

July 2021 - December 2021

David Evans and Associates, Inc.

Chief of Party: Jonathan L. Dasler, PE, PLS, CH

A. Area Surveyed

David Evans and Associates, Inc. (DEA) conducted a hydrographic survey of the assigned area in the vicinity of Pascagoula, Mississippi. Survey H13487 was conducted in accordance with the Statement of Work and Hydrographic Survey Project Instructions dated April 27, 2021.

The Hydrographic Survey Project Instructions reference the National Ocean Service (NOS) Hydrographic Surveys Specifications and Deliverables Manual (HSSD) (April 2021) as the technical requirements for this project.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
30° 22' 42.64" N 88° 35' 0.84" W	30° 10' 1.8" N 88° 26' 57.98" W

Table 1: Survey Limits

Survey limits were surveyed in accordance with the requirements in the Project Instructions and the HSSD. The assigned survey areas are outlined in Figure 1.

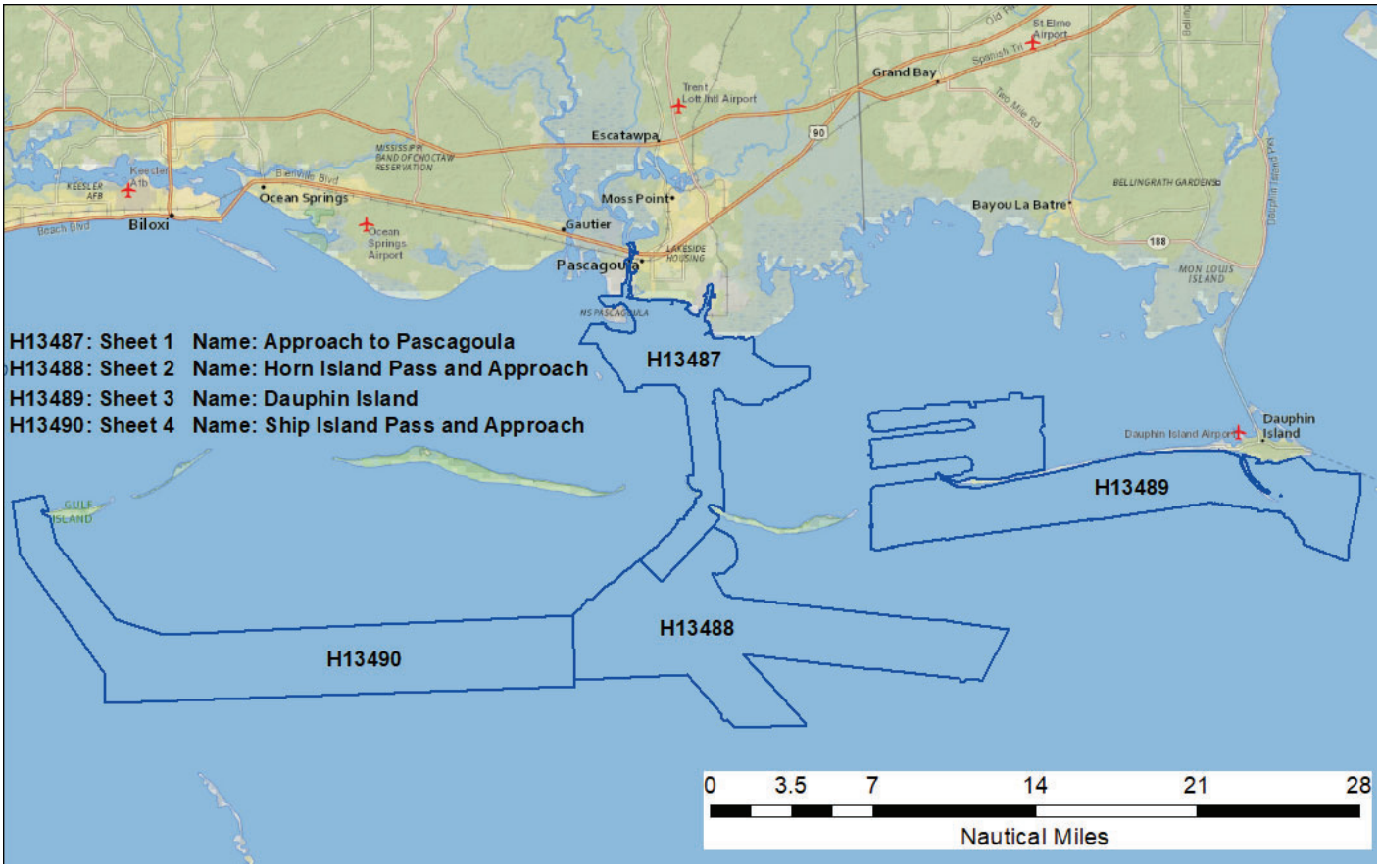


Figure 1: OPR-J315-KR-21 Assigned Survey Areas

A.2 Survey Purpose

The purpose of this survey, defined in the Project Instructions, is as follows: "The Port of Pascagoula, Mississippi is ranked as the 25th busiest by total tons of commerce in the US (1). This proposed survey area covers approximately 189 square nautical miles of the approaches to Pascagoula and Gulfport as well as sections of the Intercoastal Waterway (ICW) between Louisiana and Alabama. The region has been affected by several recent hurricanes so it is expected that modern hydrographic techniques will find significant changes to the seabed since the most recent surveys. Survey data from this project are intended to supersede all prior survey data in the common area."

(1) The U.S. Coastal and Inland Navigation System 2019 Transportation Facts & Information, Navigation and Civil Works Decision Support Center, USACE

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

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

Water Depth	Coverage Required
All waters in survey area	Acquire backscatter data during all multibeam data acquisition (Refer to HSSD Section 6.2).
All waters in survey area	Object Detection Coverage for channel areas represented as ACHARE (refer to HSSD Section 5.2.2.2), and Complete Coverage for non-ACHARE areas (refer to HSSD Section 5.2.2.3).

Table 2: Survey Coverage

Object Detection using 100% multibeam echosounder (MBES) coverage was obtained over channel areas represented as ACHARE polygons in the OPR-J315-KR-21 Project Reference File (PRF). Complete Coverage using 100% side scan sonar coverage with concurrent multibeam bathymetry was obtained over non-ACHARE areas. Backscatter was logged during all multibeam acquisition. These coverage types follow Option A of the Object Detection Coverage requirement specified in Section 5.2.2.2 of the 2021 HSSD, and Option B of the Complete Coverage requirement specified in Section 5.2.2.3. In all cases, the inshore limit of hydrography was the Navigable Area Limit Line (NALL) as defined in Section 1.3.2 of the HSSD. In some areas, the survey's Complete Coverage requirement was met by filling holidays in the side scan sonar coverage with multibeam, meeting the Complete Coverage Option A specification. In one instance, 200% side scan coverage was acquired in an assigned shallow water disproval radius rather than 100% multibeam.

Survey coverage for feature disprovals followed disproval radii as depicted in the PRF. After completing disprovals and reviewing coverage, it was discovered that some of the disproval radii included in the PRF were smaller than the chart scale specification included the HSSD. Operations Branch and Atlantic Hydrographic Branch (AHB) staff were notified about this discrepancy and DEA was informed that no additional coverage would be required for the disproval of the features. Correspondence related to this matter is included in Appendix II.

Several holidays exist in the multibeam coverage in the Port of Pascagoula where vessels, barges, or rigs were at berth for the duration of survey operations. Polygons depicting the locations of the holidays are included in the H13487_Notes_for_Reviewer.hob file as breakline area features. This file, which is included with Appendix II of this report, includes other notes that may aid in the review and interpretation of the survey data.

Figure 2 shows the H13487 survey outline in relation to the assigned survey area. The survey outline depicts coverage to the survey's Navigable Area Limit Line (NALL).

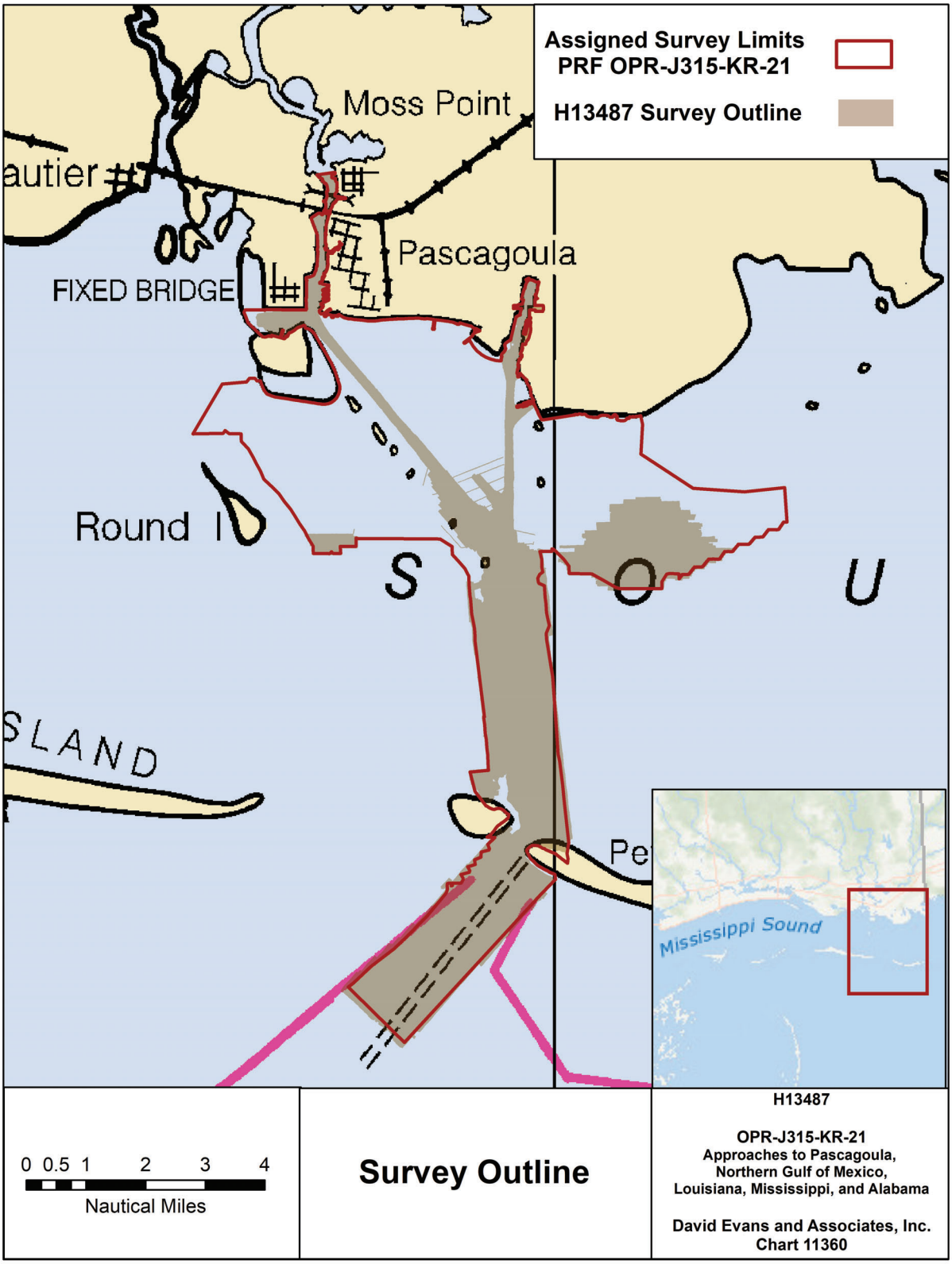


Figure 2: H13487 Survey Outline

A.6 Survey Statistics

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

	HULL ID	*S/V Blake*	*R/V Broughton*	*Total*
LNM	**SBES Mainscheme**	0	0	0
	MBES Mainscheme	274.56	190.29	464.85
	Lidar Mainscheme	0	0	0
	SSS Mainscheme	0	0.30	0.30
	SBES/SSS Mainscheme	0	0	0
	MBES/SSS Mainscheme	255.08	152.04	407.12
	SBES/MBES Crosslines	20.17	19.97	40.14
	Lidar Crosslines	0	0	0
Number of Bottom Samples				15
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				13.3

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/19/2021	200
07/20/2021	201
07/21/2021	202
07/22/2021	203
07/23/2021	204
07/24/2021	205
07/25/2021	206
08/02/2021	214
08/03/2021	215
08/04/2021	216
08/05/2021	217
08/06/2021	218
08/07/2021	219
08/08/2021	220
08/09/2021	221
08/10/2021	222
08/13/2021	225
08/14/2021	226
08/17/2021	229
08/18/2021	230
08/21/2021	233
08/23/2021	235
08/24/2021	236
08/25/2021	237
08/26/2021	238
10/03/2021	276
10/05/2021	278
10/06/2021	279
10/12/2021	285
10/13/2021	286
10/14/2021	287
10/15/2021	288

Survey Dates	Day of the Year
11/04/2021	308
11/17/2021	321
12/13/2021	347

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

The OPR-J315-KR-21 Data Acquisition and Processing Report (DAPR), submitted with prior survey H13488, details equipment and vessel information as well as data acquisition and processing procedures. There were no vessel or equipment configurations used during data acquisition that deviated from those described in the DAPR.

The S/V Blake is an 82-foot aluminum catamaran with a 27-foot beam and a draft of 4.5 feet (Figure 3). The R/V Broughton is a 24-foot custom Duckworth offshore with an 8.5-foot beam and a draft of 2.75 feet (Figure 4).

B.1.1 Vessels

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

Hull ID	*S/V Blake*	*R/V Broughton*
LOA	82 feet	24 feet
Draft	4.5 feet	2.75 feet

Table 5: Vessels Used

Figure 3: S/V Blake

Figure 4: R/V Broughton

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne RESON	SeaBat T50-R	MBES
EdgeTech	4200	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	MicroX SV	Sound Speed System
AML Oceanographic	MVP30-350	Sound Speed System
AML Oceanographic	SmartX	Sound Speed System

Table 6: Major Systems Used

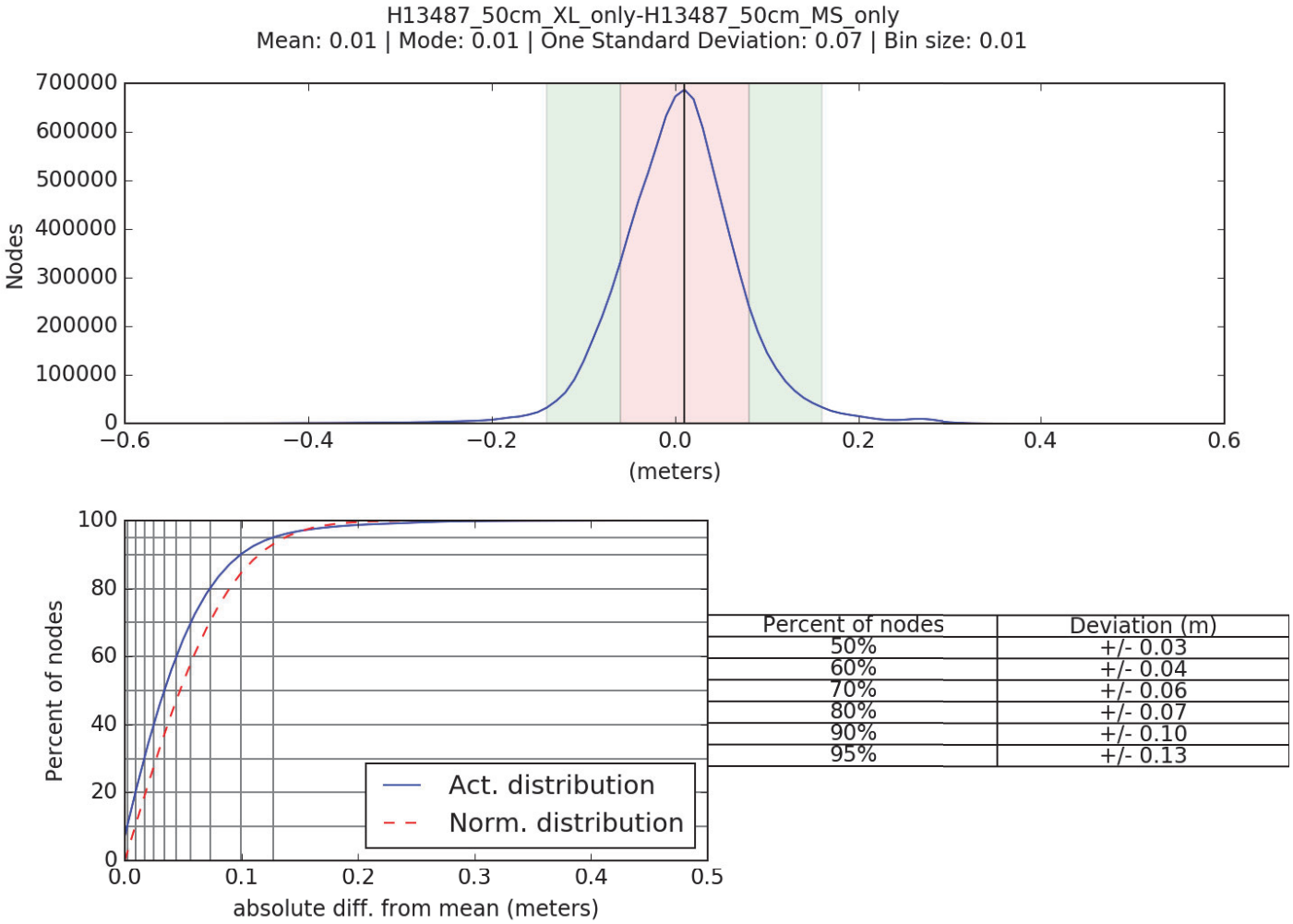
B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines were run across 4.60% of the entire survey area to provide a varied spatial and temporal distribution for analysis of internal consistency within the survey data.

Crossline analysis was performed using the CARIS Hydrographic Information Processing System (HIPS) Quality Control (QC) Report tool, which compares crossline data to a gridded surface and reports results by beam number. Crosslines were compared to a 1-meter Combined Uncertainty and Bathymetry Estimator (CUBE) surface encompassing mainscheme, fill, and investigation data for the entire survey area.

DEA performed an additional crossline analysis using the NOAA Pydro Compare Grids tool to analyze the differences between gridded mainscheme depths and gridded crossline depths. Input grids were 1-meter resolution CUBE surfaces of mainscheme and crossline depths. Results from the crossline to mainscheme difference analysis are depicted in Figure 5, with units represented in meters.



Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.10
95%	+/- 0.13

Figure 5: H13487 Crossline Difference

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.05 meters	0.152 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S/V Blake	n/a meters/second	1.0 meters/second	n/a meters/second	0.5 meters/second
R/V Broughton	1.0 meters/second	n/a meters/second	n/a meters/second	0.5 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Additional discussion of these parameters is included in the DAPR. The S/V Blake used an AML MVP30-350 with integrated Micro SVP&T to acquire sound speed measurements. The R/V Broughton used an AML Smart X to acquire sound speed measurements. The measurement uncertainty for these sensors is listed in the Moving Vessel Profiler (MVP) and Conductivity Temperature and Depth (CTD) columns in Table 8.

During surface finalization in HIPS, the "Greater of the two values" option was selected, where the calculated uncertainty from Total Propagated Uncertainty (TPU) is compared to the standard deviation of the soundings influencing the node, and where the greater value is assigned as the final uncertainty of the node. The uncertainty of the finalized surface increased for nodes that had a standard deviation greater than TPU.

To determine if the surface grid nodes met the International Hydrographic Organization (IHO) Order 1a specification, a ratio of the final node uncertainty to the allowable uncertainty at that depth was determined. As a percentage, this value represents the amount of error budget utilized by the Total Vertical Uncertainty (TVU) at each node. Values greater than 100% indicate nodes exceeding the allowable IHO uncertainty. The resulting calculated TVU values of all nodes in the submitted finalized surfaces is shown in Figures 6 through 8.

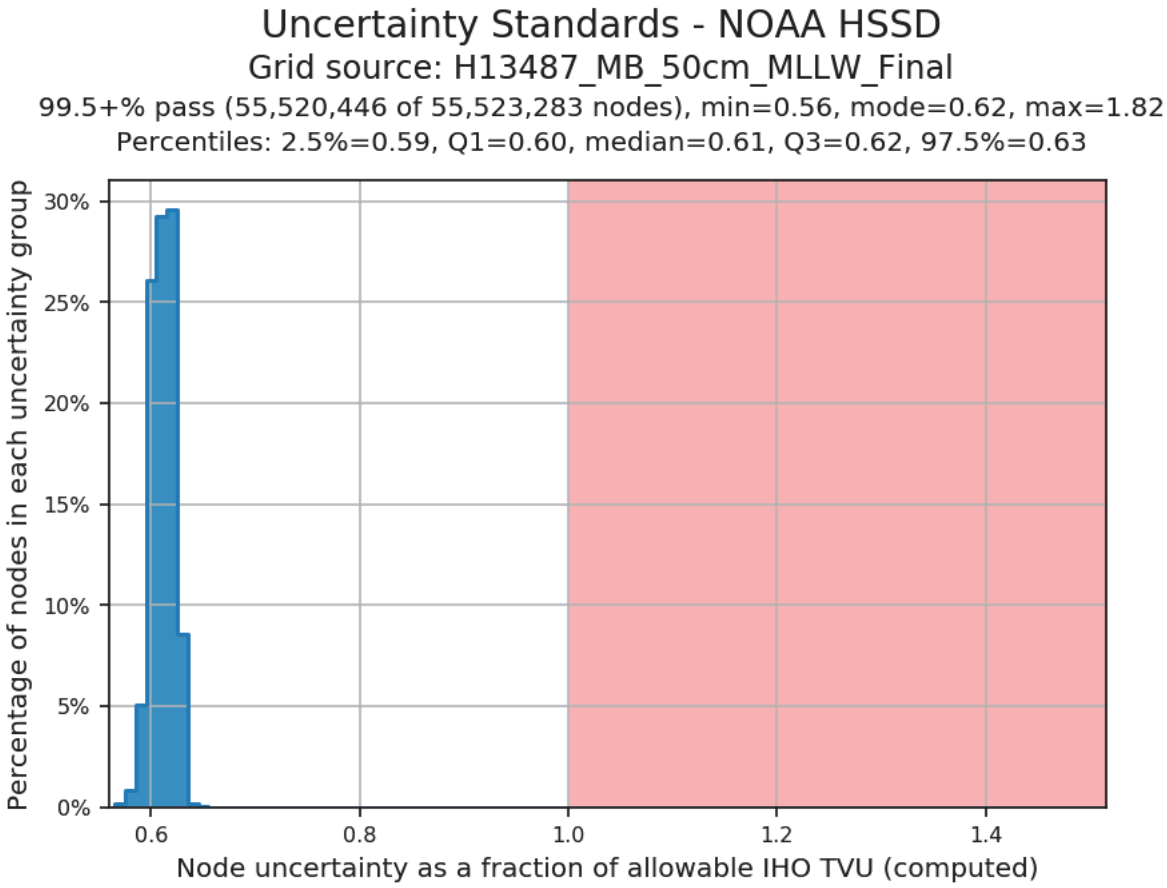


Figure 6: Node TVU Statistics - 50 centimeters, Finalized

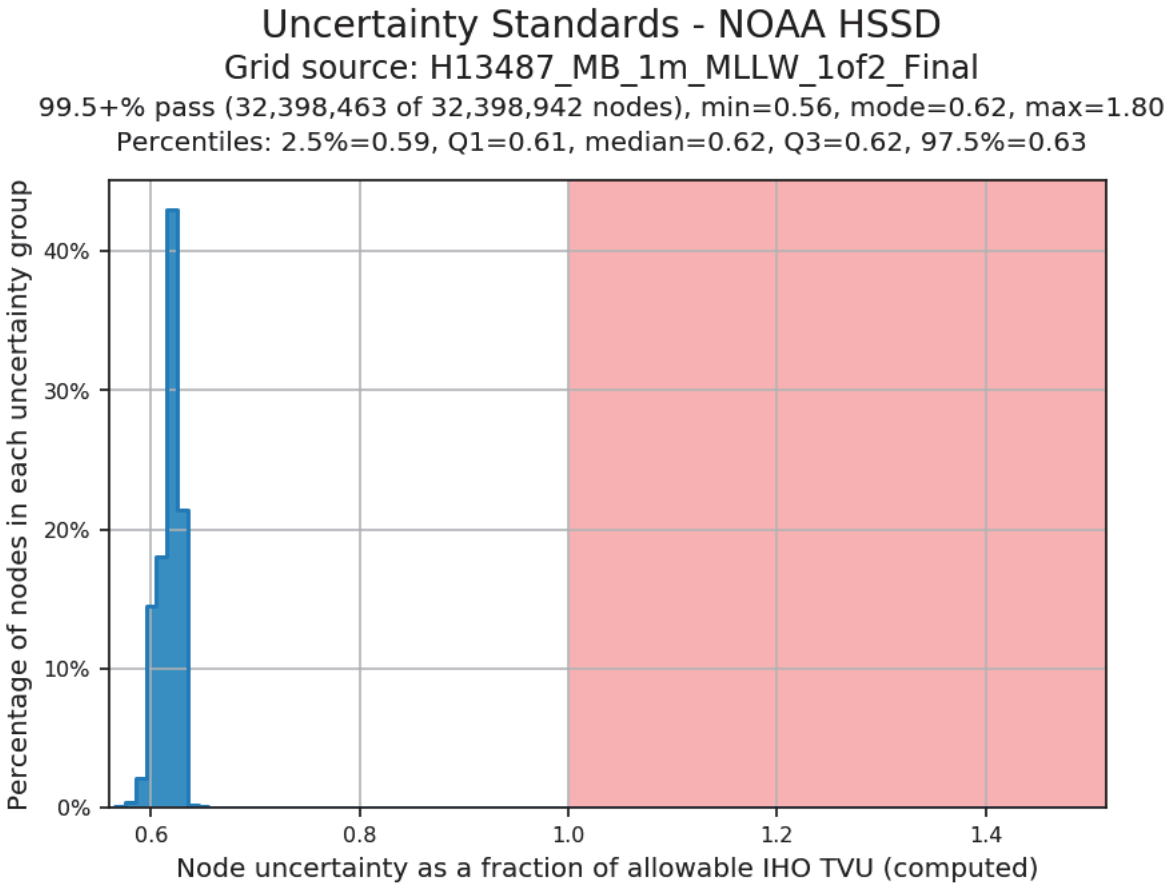


Figure 7: Node TVU Statistics - 1 meter, Finalized

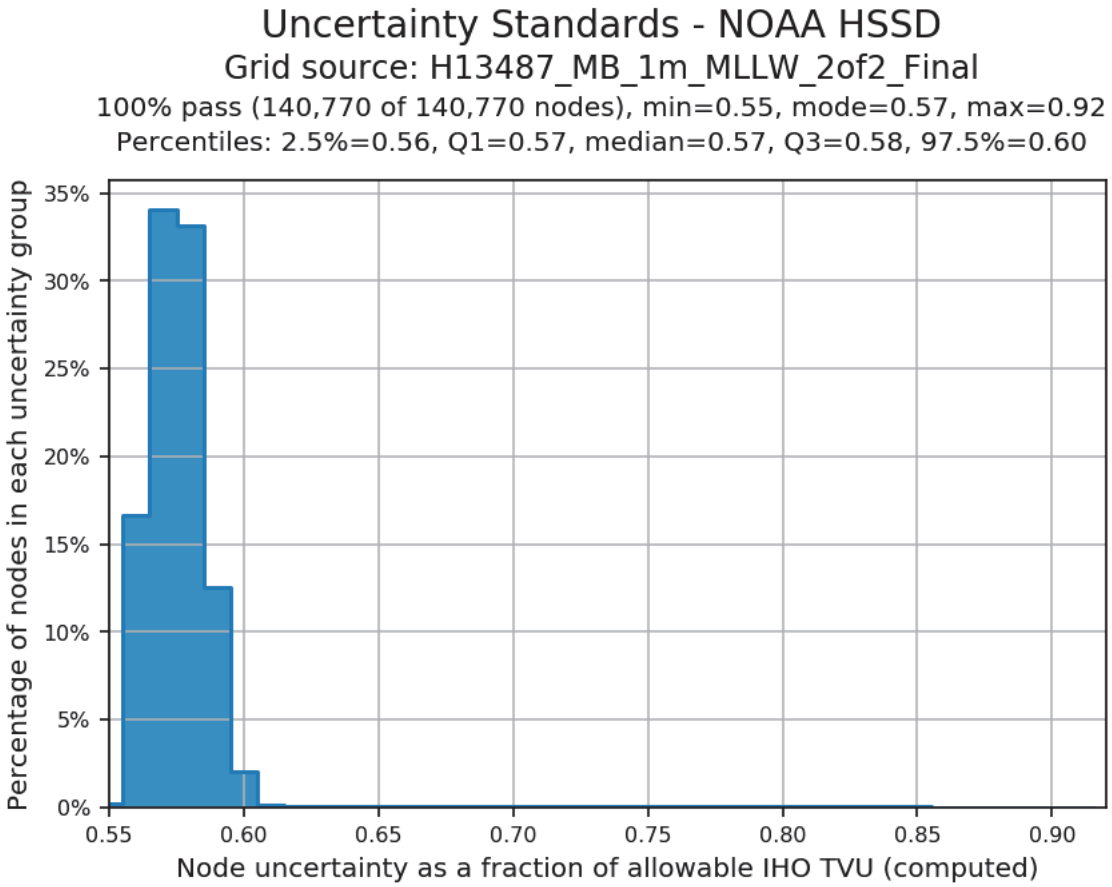


Figure 8: Node TVU Statistics - 1 meter, Finalized

B.2.3 Junctions

Survey H13487 junctions with current survey H13488, and prior contemporary surveys H12356, H13059, H13061, H13062, and H13065. Figure 9 depicts H13487 and the junctioning surveys.

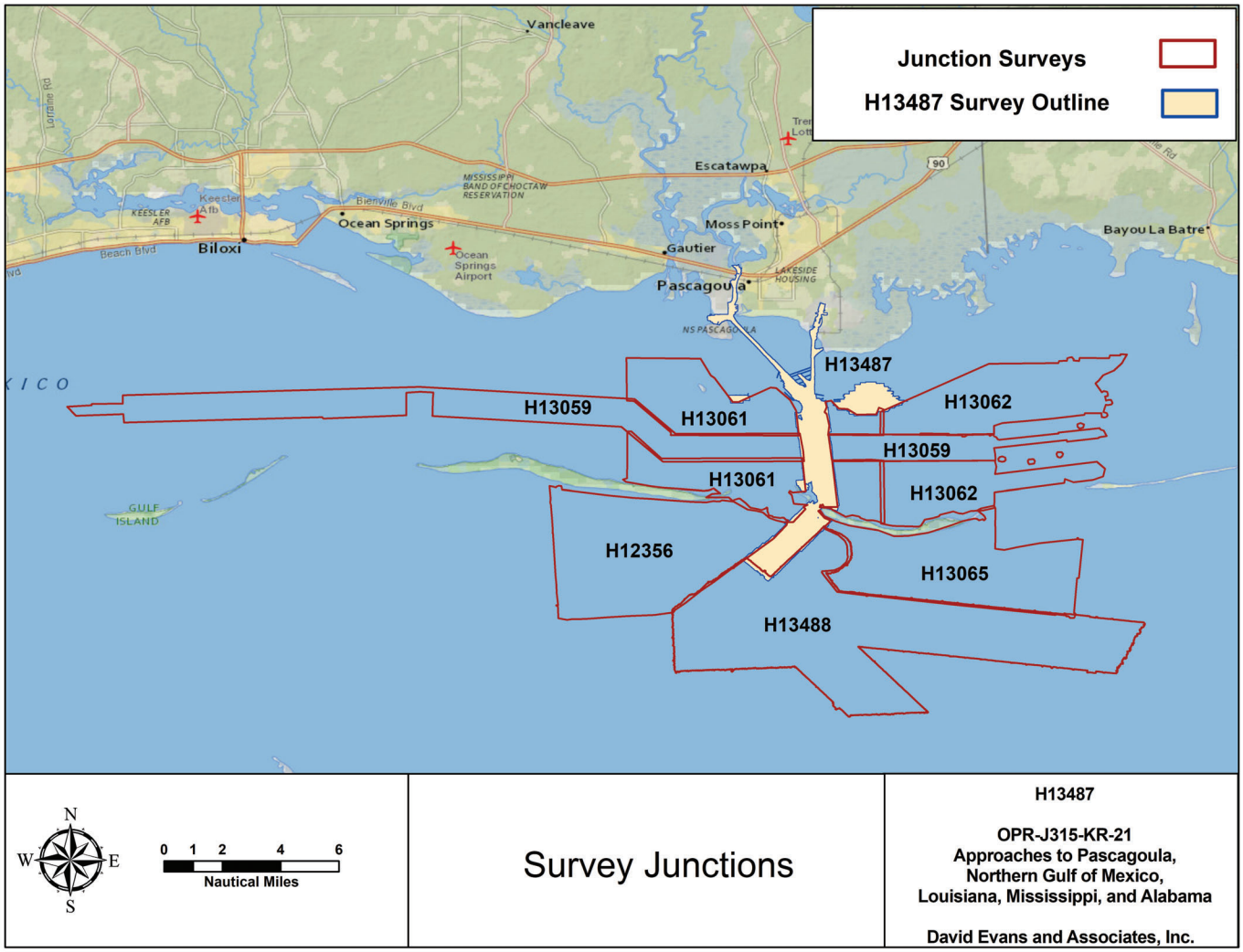


Figure 9: Survey Junctions with Registry Number H13487

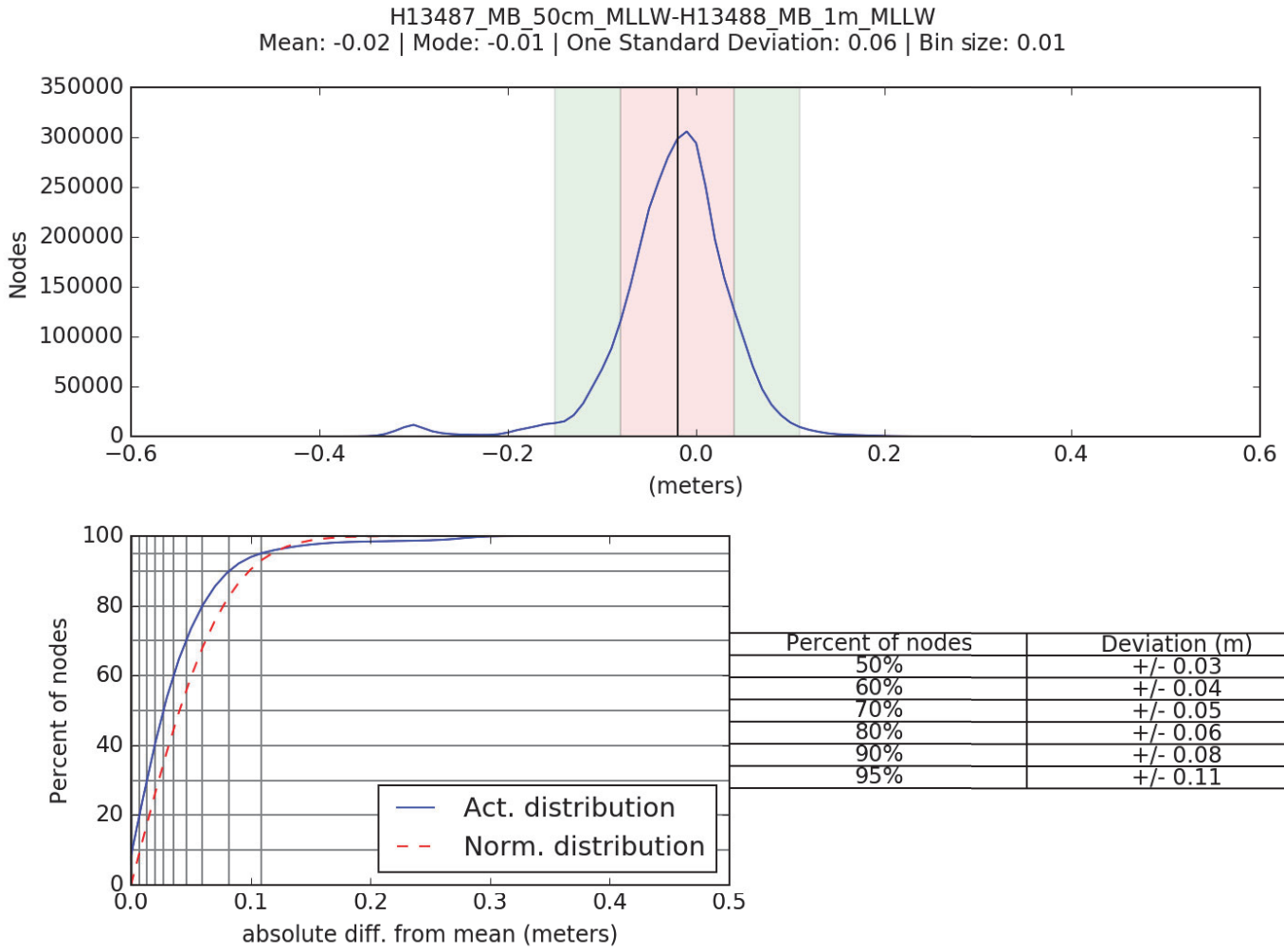
The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13488	1:10000	2021	David Evans and Associates, Inc.	S
H12356	1:20000	2011	David Evans and Associates, Inc.	SW
H13059	1:10000	2017	David Evans and Associates, Inc.	W
H13061	1:10000	2017	David Evans and Associates, Inc.	W
H13062	1:20000	2017	David Evans and Associates, Inc.	E
H13065	1:20000	2017	David Evans and Associates, Inc.	SE

Table 9: Junctioning Surveys

H13488

The mean difference between H13487 and H13488 is 2 centimeters (H13487 deeper than H13488), shown in Figure 10.



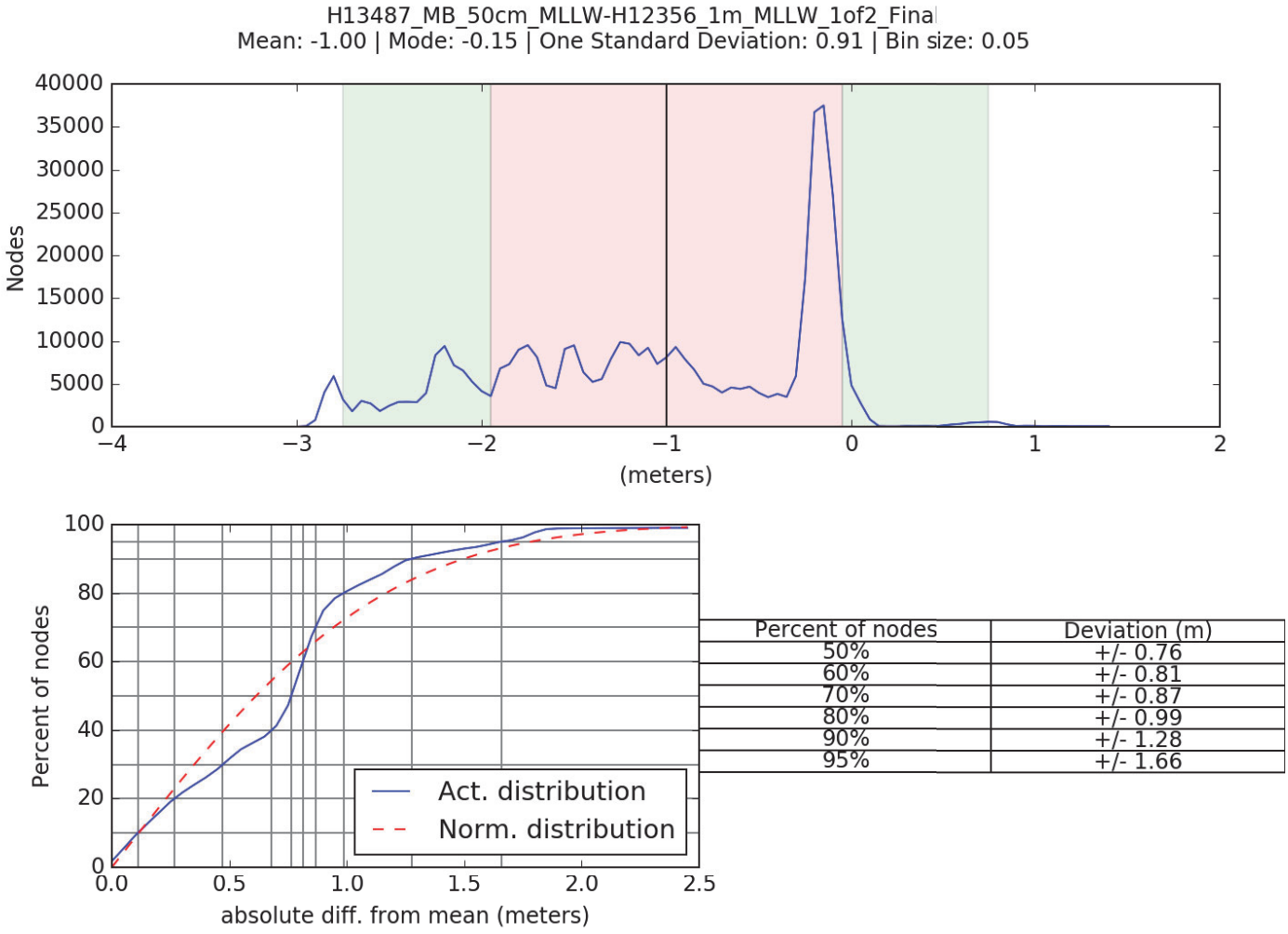
Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.06
90%	+/- 0.08
95%	+/- 0.11

Figure 10: Distribution Summary Plot of Survey H13487 50-centimeter vs H13488 1-meter

H12356

The mean difference between H13487 and H12356 survey depths is 1 meter (H13487 deeper than H12356), shown in Figure 11. The junction appears to be in an area of frequent bottom change, which likely accounts for the poor agreement between the two surveys, with H12356 having been surveyed 10 years prior to H13487. The area has been significantly impacted by recent hurricanes, as noted in the project instructions, which may account for some of the differences observed in the junction analysis. In addition, Global

Positioning System (GPS) Tides computed for prior survey H12356 used a VDatum-based Mean Lower Low Water (MLLW) separation model that has a mean difference of 9 centimeters when compared to the model used for survey H13487 over the area of junction overlap. Removing the model differences from the analysis would improve the junction comparison between surveys H12356 and H13487 to 91 centimeters. Farther south, the mean difference between survey H12356 and current survey H13490 improves to 25 centimeters.



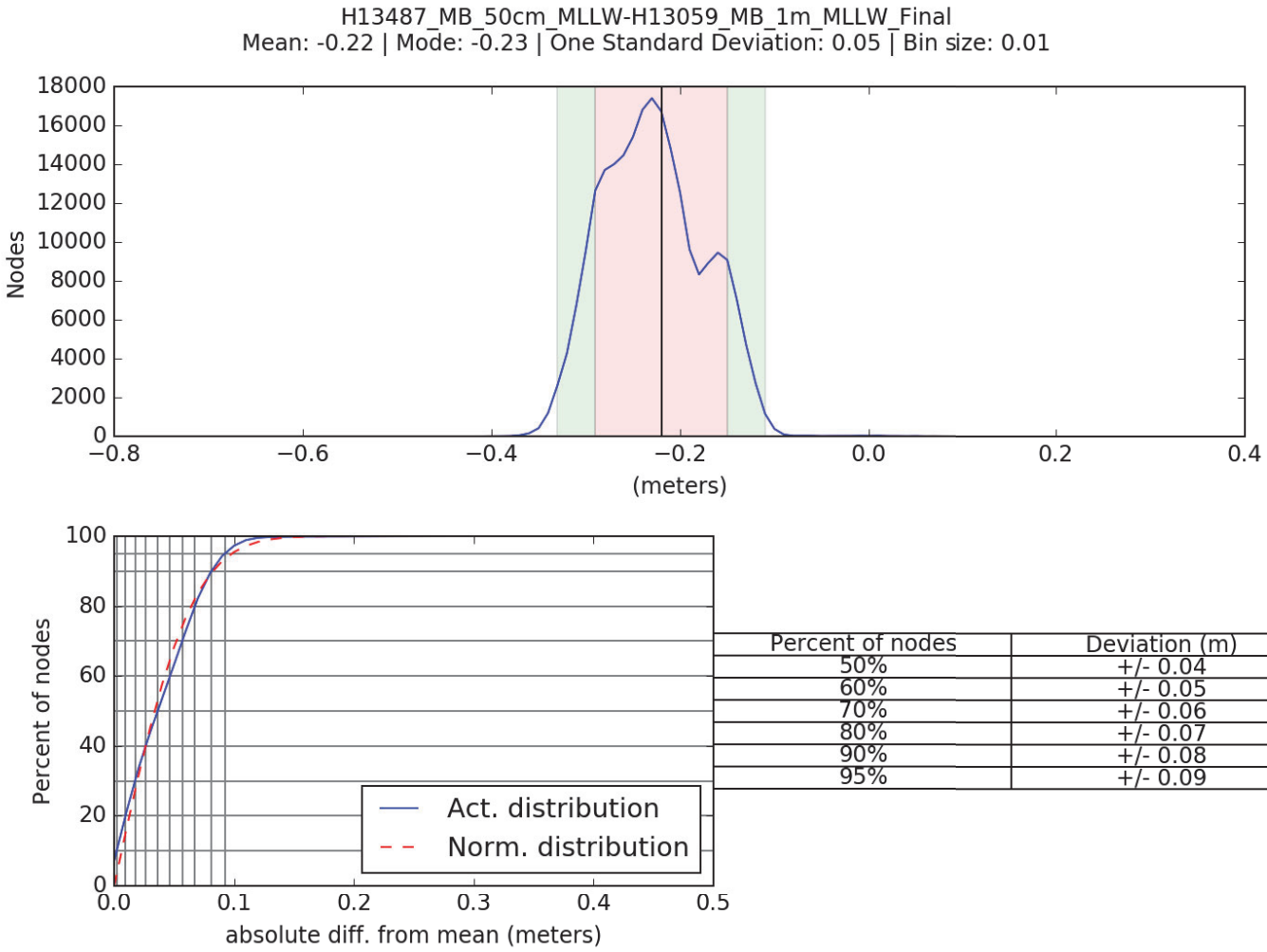
Percent of nodes	Deviation (m)
50%	+/- 0.76
60%	+/- 0.81
70%	+/- 0.87
80%	+/- 0.99
90%	+/- 1.28
95%	+/- 1.66

Figure 11: Distribution Summary Plot of Survey H13487 50-centimeter vs H12356 1-meter

H13059

The mean difference between H13487 and H13059 survey depths is 22 centimeters (H13487 deeper than H13059), shown in Figure 12. Survey H13059 was reduced to MLLW using Tidal Constituent and Residual Interpolation (TCARI), incorporating water levels from National Water Level Observation Network (NWLON) stations at Dauphin Island, Alabama (8735180), Pascagoula NOAA Lab, Mississippi (8741533), and Bay Waveland (8747437) where survey H13487 used GPS Tides computed from single-base post-

processing methods. The project area has also been impacted by recent hurricanes, which can result in changes to the seabed.

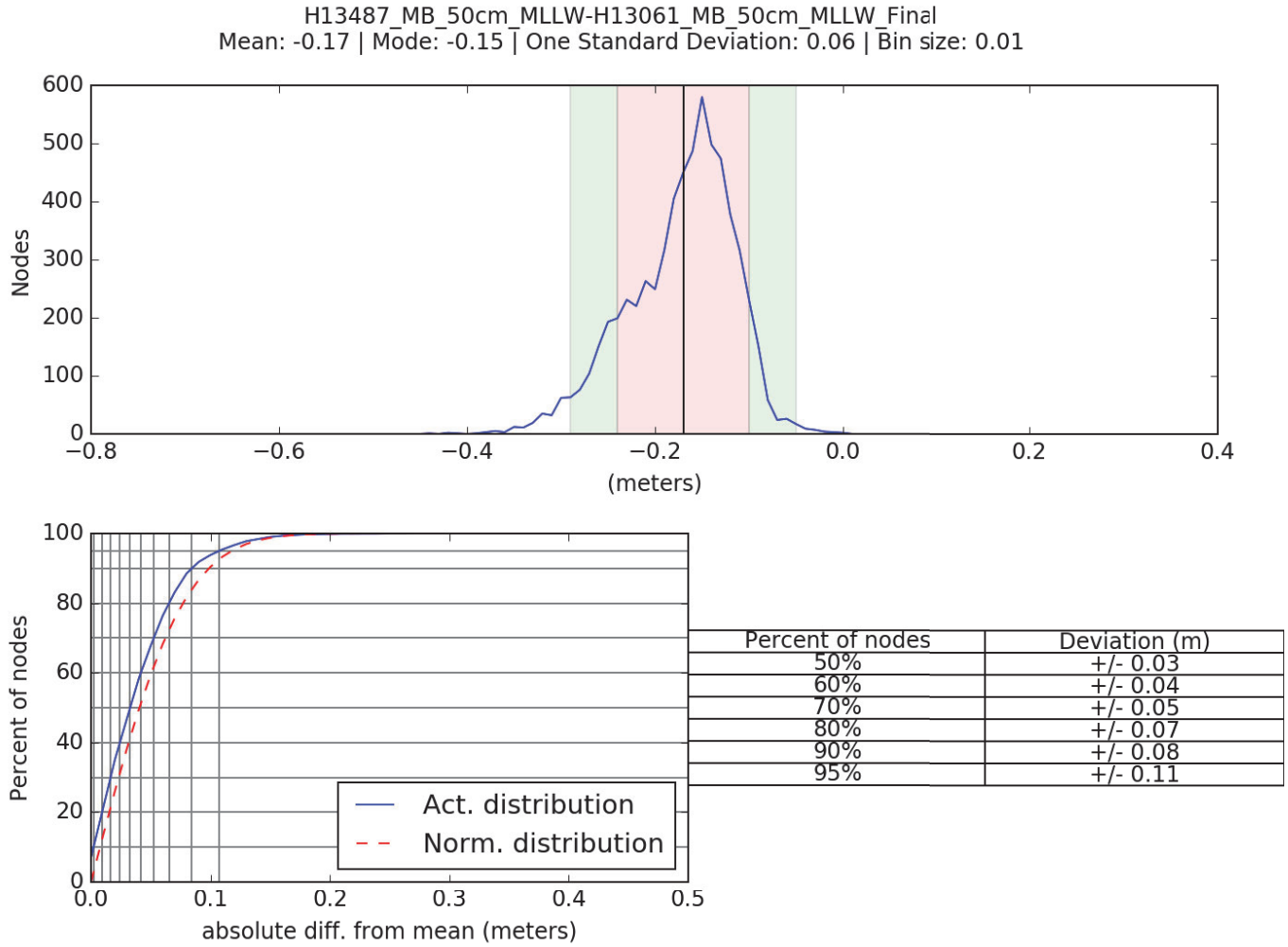


Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.05
70%	+/- 0.06
80%	+/- 0.07
90%	+/- 0.08
95%	+/- 0.09

Figure 12: Distribution Summary Plot of Survey H13487 50-centimeter vs H13059 1-meter

H13061

The mean difference between H13487 and H13061 is 17 centimeters (H13487 deeper than H13061), shown in Figure 13. Like the junction with H13059, survey H13061 was reduced to MLLW using TCARI, while survey H13487 used Ellipsoidally Referenced Survey (ERS) methods. The project area has also been impacted by recent hurricanes, which can result in changes to the seabed.

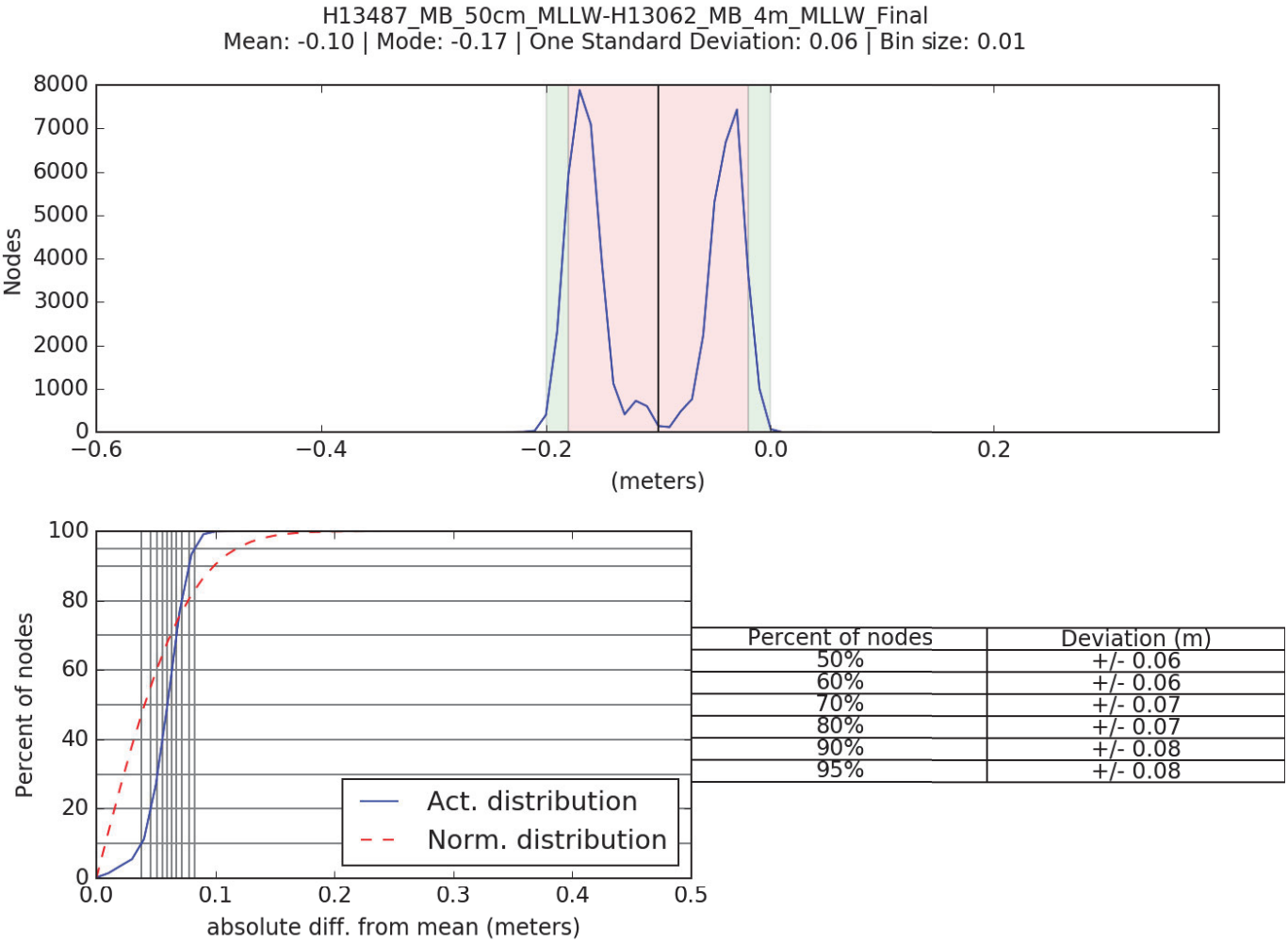


Percent of nodes	Deviation (m)
50%	+/- 0.03
60%	+/- 0.04
70%	+/- 0.05
80%	+/- 0.07
90%	+/- 0.08
95%	+/- 0.11

Figure 13: Distribution Summary Plot of Survey H13487 50-centimeter vs H13061 50-centimeter

H13062

The mean difference between H13487 and H13062 survey depths is 10 centimeters (H13487 deeper than H13062), shown in Figure 14. Like the junction with H13059, survey H13062 was reduced to MLLW using TCARI, while survey H13487 used ERS methods. The project area has also been impacted by recent hurricanes, which can result in changes to the seabed.

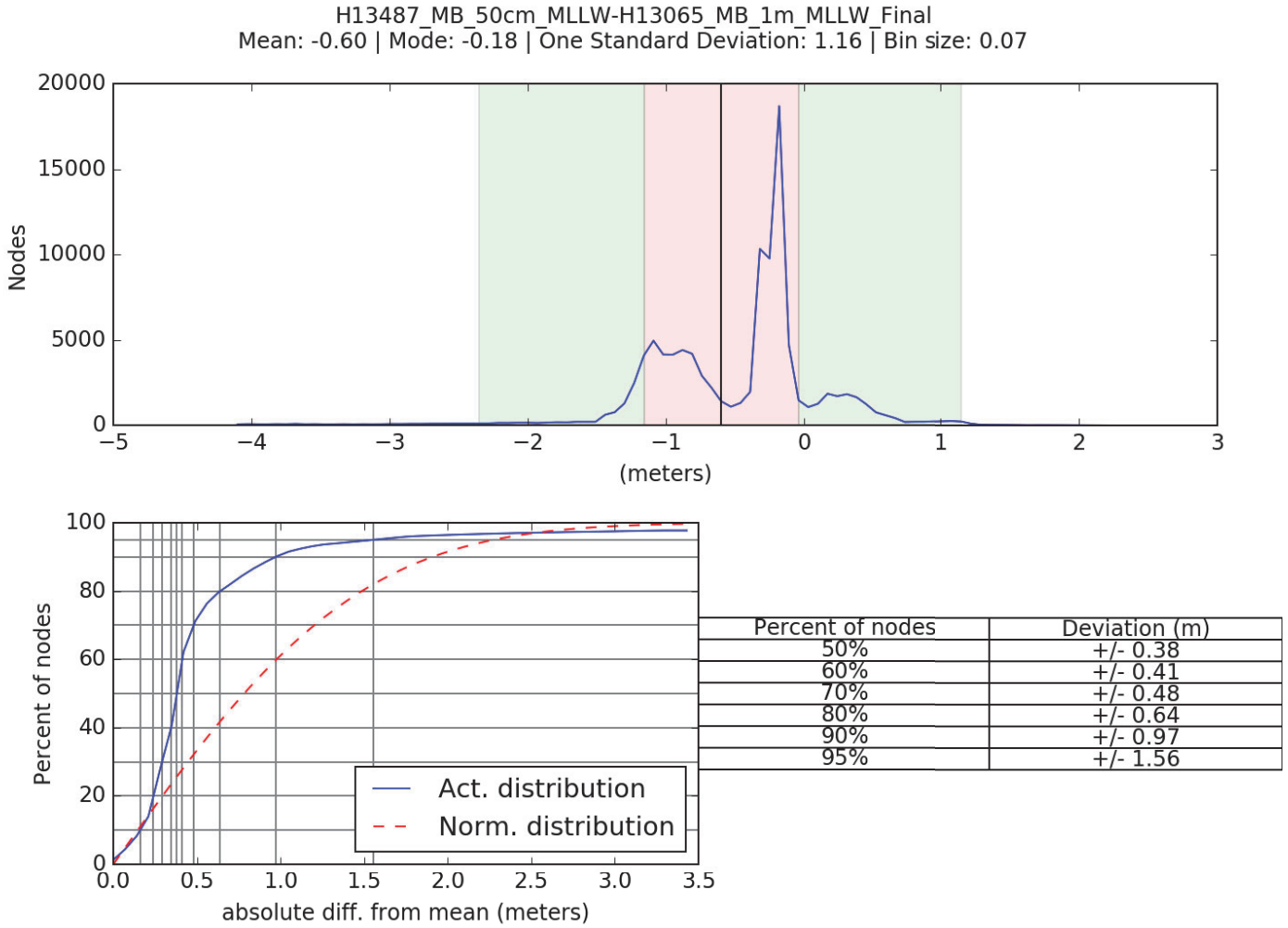


Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.06
70%	+/- 0.07
80%	+/- 0.07
90%	+/- 0.08
95%	+/- 0.08

Figure 14: Distribution Summary Plot of Survey H13487 50-centimeter vs H13062 4-meter

H13065

The mean difference between H13487 and H13065 survey depths is 60 centimeters (H13487 deeper than H13065), shown in Figure 15. Like the junction with H13059, survey H13065 was reduced to MLLW using TCARI, while survey H13487 used ERS methods. The project area has also been impacted by recent hurricanes, which can result in changes to the seabed.



Percent of nodes	Deviation (m)
50%	+/- 0.38
60%	+/- 0.41
70%	+/- 0.48
80%	+/- 0.64
90%	+/- 0.97
95%	+/- 1.56

Figure 15: Distribution Summary Plot of Survey H13487 50-centimeter vs H13065 1-meter

B.2.4 Sonar QC Checks

Quality control is discussed in detail in Section B of the DAPR.

Multibeam data were reviewed at multiple levels of data processing, including CARIS HIPS conversion, subset editing, and analysis of anomalies revealed in CUBE surfaces.

Side scan data were reviewed at multiple levels of data processing, including during the initial SonarWiz import and preliminary stages of bottom-tracking, navigation review, and contact identification, as well as during the final stages of mosaic generation, data coverage and quality assessment, and contact correlation and attribution.

B.2.5 Equipment Effectiveness

Side Scan Sonar Timing Offset

Side scan files collected by the R/V Broughton on August 17, 2021, (DN229) in H13487 show a timing offset between the HYPACK navigation records and the side scan records in the HSX files. This occurred when timing from the Discover software was used in the HYPACK hardware configuration rather than the acquisition computer time, which was synced with the Position and Orientation System for Marine Vessels (POS MV).

This timing offset carried through to the processed SonarWiz data; however, SonarWiz software reads the time and ping information from the first side scan record in the HSX file upon import and positions it using the following position record in the file. Because of this, the positioning of side scan data is accurate and meets coverage and contact detection requirements, and it is only the ping times that are offset from the true time of acquisition.

The reviewer should be aware of potential issues that may arise if this data is processed using other side scan processing software (e.g., SIPS), as those software may read the time/position records in the HSX files differently than SonarWiz software and have issues properly displaying the data.

B.2.6 Factors Affecting Soundings

Surface Sound Speed

A highly variable surface sound speed was observed in multibeam data collected in the enclosed harbors of the Port of Pascagoula on August 8, 2021 (DN220), and August 9, 2021 (DN221). This variability, which was attributed to surface warming, resulted in occasional 15- to 20-centimeter refraction artifacts in the multibeam data and less pronounced artifacts in the survey's bathymetric grids. In all cases, the magnitude of the artifact is less than the allowable total vertical uncertainty for the survey.

Edited SBET

Several multibeam survey lines collected by the R/V Broughton on August 8, 2021, (DN220) were processed using an edited Smooth Best Estimate of Trajectory (SBET) where GPS height anomalies were removed using the Pydro POSPac Auto QC Tool. This impacted the following survey lines: 2021BR1737, 2021BR1741, 2021BR1745, 2021BR1749, 2021BR1753, 2021BR1756, and 2021BR1758. The edited SBET was submitted with the original SBET in an "Edited" subfolder.

Bottom Changes During Survey Operations

Hurricane Ida, which made landfall near Port Fourchon, LA, on August 29, 2021, impacted the survey area. Occasional misalignments exist between multibeam data acquired before and after the Category 4 hurricane. Areas where bottom change is visible in the multibeam data have been noted in the H13487_Notes_for_Reviewer.hob file with SNDWAV area features. This file is included with Appendix II of this report.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Approximately 20-minute intervals

For H13487 survey operations, casts were distributed both temporally and spatially based on observed changes in sound speed profiles. Sound speed readings were applied in CARIS HIPS using the nearest in distance within a two-hour interval.

All sound speed profiles were acquired within 500 meters of the survey limits.

During H13487 survey operations, the S/V Blake occasionally acquired the first cast of the day after starting multibeam data acquisition. In all cases, the first cast of the day was acquired within six minutes of the first sonar ping of the day. This issue occurred on the following days:

July 21, 2021 (DN202)
July 22, 2021 (DN203)
July 23, 2021 (DN204)
July 24, 2021 (DN205)
July 25, 2021 (DN206)
August 18, 2021 (DN230)
August 26, 2021 (DN238)
October 5, 2021 (DN278)

B.2.8 Coverage Equipment and Methods

Survey speeds were maintained to meet or exceed along-track sounding density requirements.

Multibeam data and side scan mosaics were thoroughly reviewed for holidays and areas of poor-quality coverage due to biomass, vessel wakes, or other factors. Feature and side scan sonar contact investigations were performed with multibeam sonar to obtain a least depth, meeting the survey's coverage requirements. Survey coverage for feature disprovals was acquired inside disproval radii to meet the coverage requirement for the area. Additional discussion of coverage methods can be found in the DAPR.

B.2.9 Density

The sounding density requirement of 95% of all nodes, populated with at least five soundings per node, was verified by analyzing the density layer of the finalized surfaces. Individual surface results are stated in Figures 16 through 18.

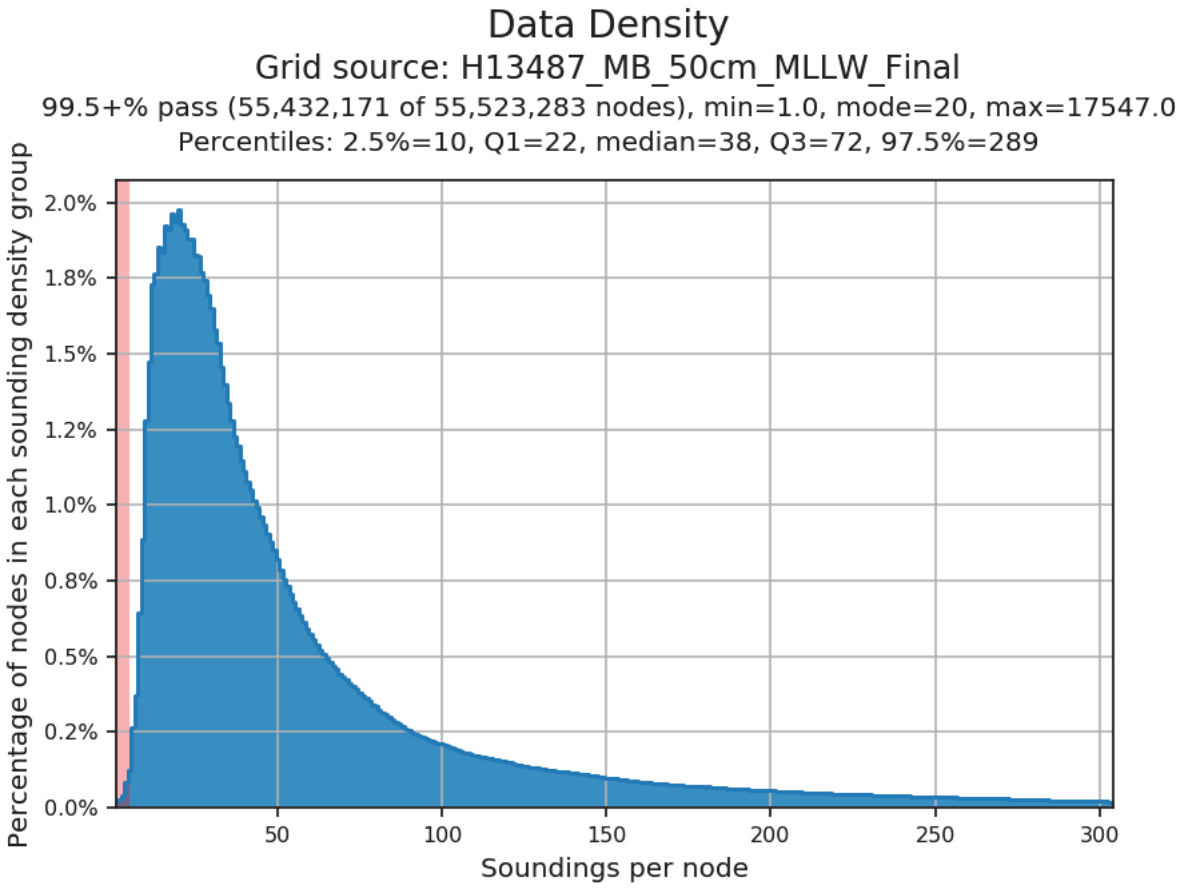


Figure 16: Node Density Statistics - 50 centimeter, Finalized

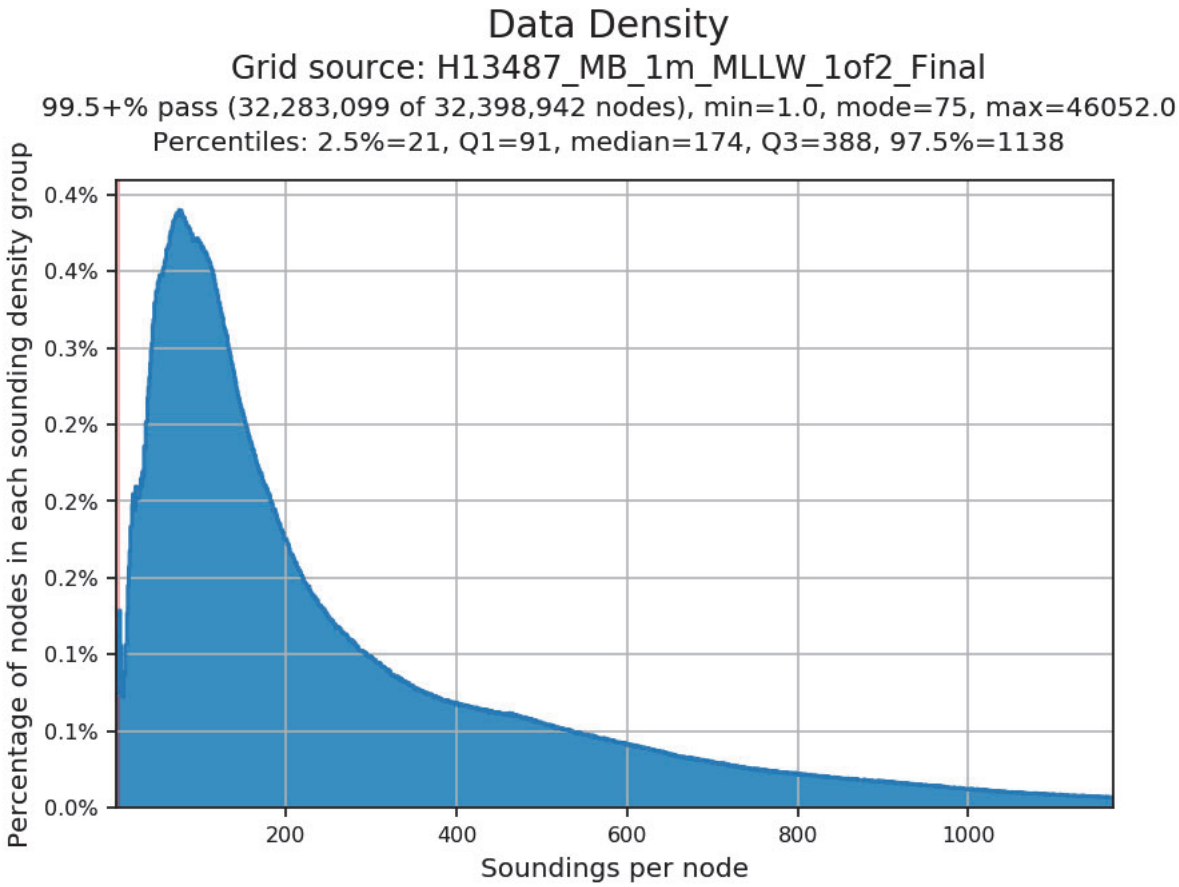


Figure 17: Node Density Statistics - 1 meter, Finalized

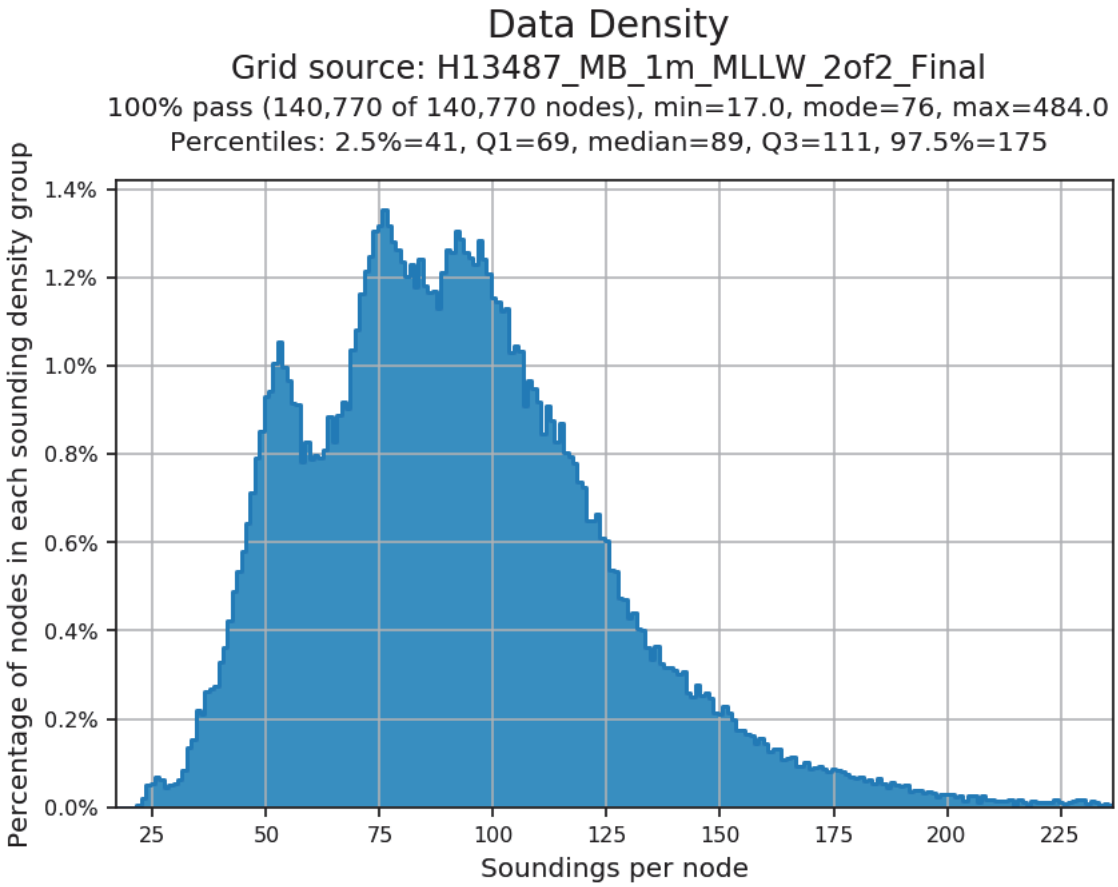


Figure 18: Node Density Statistics - 1 meter, Finalized

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

Data reduction procedures for survey H13487 are detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Multibeam backscatter was logged in HYPACK 7K format and included with the H13487 digital deliverables. Data were processed periodically in CARIS HIPS to evaluate backscatter quality, but the processed data is not included with the deliverables. For data management purposes, the names of multibeam crosslines have been appended with the suffix _XL. This change was made to HIPS files only. The original file names of raw data files (HYPACK HSX and 7K) have been retained.

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	11.3.8

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
Chesapeake Technology, Inc.	SonarWiz	7.06.06 (64-bit)

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2021.

A detailed listing of all data processing software is included in the OPR-J315-KR-21 DAPR.

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
H13487_MB_50cm_MLLW.csar	CARIS Raster Surface (CUBE)	0.5 meters	0.591 meters - 22.318 meters	NOAA_0.5m	Object Detection
H13487_MB_50cm_MLLW_Final.csar	Finalized CARIS Raster Surface (CUBE)	0.5 meters	0.591 meters - 20.000 meters	NOAA_0.5m	Object Detection
H13487_MB_1m_MLLW.csar	CARIS Raster Surface (CUBE)	1 meters	0.588 meters - 22.308 meters	NOAA_1m	Complete MBES
H13487_MB_1m_MLLW_1of2_Final.csar	Finalized CARIS Raster Surface (CUBE)	1 meters	0.588 meters - 20.000 meters	NOAA_1m	Complete MBES
H13487_MB_1m_MLLW_2of2_Final.csar	Finalized CARIS Raster Surface (CUBE)	1 meters	18.000 meters - 22.308 meters	NOAA_1m	Object Detection
H13487_SSSAB_1m_600kHz_1of2	SSS Mosaic	1 meters	0 N/A - 0 N/A	N/A	100% SSS
H13487_SSSAB_1m_600kHz_2of2	SSS Mosaic	1 meters	0 N/A - 0 N/A	N/A	200% SSS

Table 12: Submitted Surfaces

Bathymetric grids were created relative to MLLW in CUBE format using Object Detection and Complete Coverage resolution requirements as specified in the HSSD. Grids covering areas surrounding charted channels, which were assigned for Object Detection Coverage, have been extracted from a 50-centimeter grid covering the entire survey area to limit coverage to the ACHARE polygons depicted in the PRF. This practice, which was approved by Operations Branch and AHB, excluded areas surveyed to the Complete Coverage requirements from the Object Detection grids and the grid analysis reported in Sections B.2.2 and B.2.9. Correspondence related to this technique is included in Appendix II.

Two 1-meter-resolution finalized surfaces have been submitted for the survey: one to meet the Complete Coverage requirement in areas outside of the ACHARE polygons, and one to meet the Object Detection requirement for deeper areas inside the ACHARE polygons, which extend below the 0.5-meter depth band.

B.5.3 SSS Holiday

A holiday in the 200% side scan mosaic is present along the 3.5-meter inshore limit within an assigned disproval radius. The feature associated with the disproval radius is located outside of the assigned area, however, the disproval radius extends into the survey area. The side scan holiday was not present during initial processing of the data which relied on Real Time Extended (RTX) post-processing methods for GPS tides. After survey operations in the area were complete, navigation data were reprocessed using single base methods in order improve the vertical accuracy of the post-processed navigation solutions for the survey area. The change in post-processing methods resulted in slightly deeper depths within the disproval radius, shifting the 3.5-meter contour beyond the survey's 200% coverage. The holiday (30 17 42.0N, 88 31 48.0W) was reviewed by Operations Branch staff and deemed to be insignificant, requiring no additional data acquisition to fill. Correspondence related to this holiday is included in Appendix II.

B.5.4 Split Line for Disproval

Side scan line 2021BR2351452 was split into two segments in SonarWiz in order to achieve 200% SSS coverage within a disproval radius. One line segment was included in the 100% mosaic, and the other was used in the 200% mosaic.

C. Vertical and Horizontal Control

A summary of the horizontal and vertical control for survey H13487 follows.

C.1 Vertical Control

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

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-J315-KR-21_100m_NAD83_2011-MLLW.csar

Table 13: 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 16.

The following PPK methods were used for horizontal control:

- Single Base

The separation model listed in Table 13 was provided with the Project Instructions and used for sounding correction within the assigned survey area. Real-time navigation for all MBES survey lines were overwritten with post-processed navigation solutions in SBET format. Post-processed solutions were generated using Applanix POSPac MMS using the single-base processing option and by incorporating base station data from nearby base stations, as listed in Table 14, operated by the Gulf Coast Geospatial Center (GCGC). Additional discussion on post-processing methods and survey control is included in the DAPR.

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
Gautier, MS	MSGA
Grand Bay NERR	MSGB

Table 14: CORS Base Stations

D. Results and Recommendations

D.1 Chart Comparison

The chart comparison was performed by comparing H13487 survey depths to a digital surface generated from the Band 4 and Band 5 electronic navigational charts (ENCs) covering the survey area. A 5-meter and 50-meter product surface was generated from a triangular irregular network (TIN) created from the ENC's soundings, depth contours, and depth features. Additional 5-meter (extracted where Object Detection Coverage was available) and 50-meter (for the Complete Coverage area) HIPS product surfaces were generated from the 1-meter CUBE surface. The chart comparison was conducted by creating and reviewing a difference surface using the ENC surface and survey surface as inputs. The chart comparison also included a review of all assigned charted features within the survey area. The results of the comparison are detailed below.

The relevant charts used during the comparison were reviewed to check that all United States Coast Guard (USCG) Local Notice to Mariners issued during survey acquisition, and impacting the survey area, were applied and addressed by this survey.

The ENCs used in the chart comparison are listed in Table 15. Figures 19 through 26 show the magnitude of differences along the comparison area.

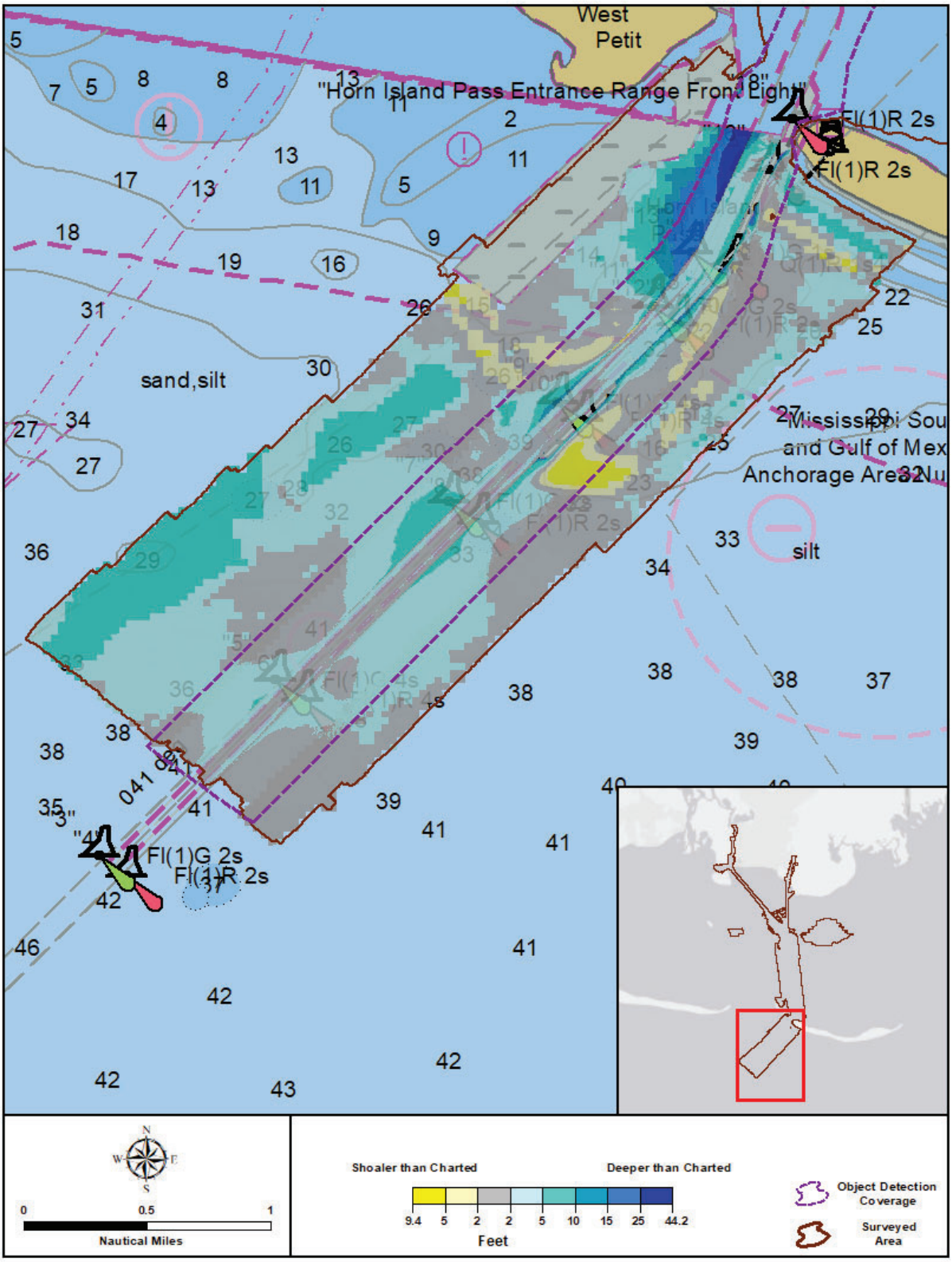


Figure 19: Depth Difference Between H13487 and US4MS12M

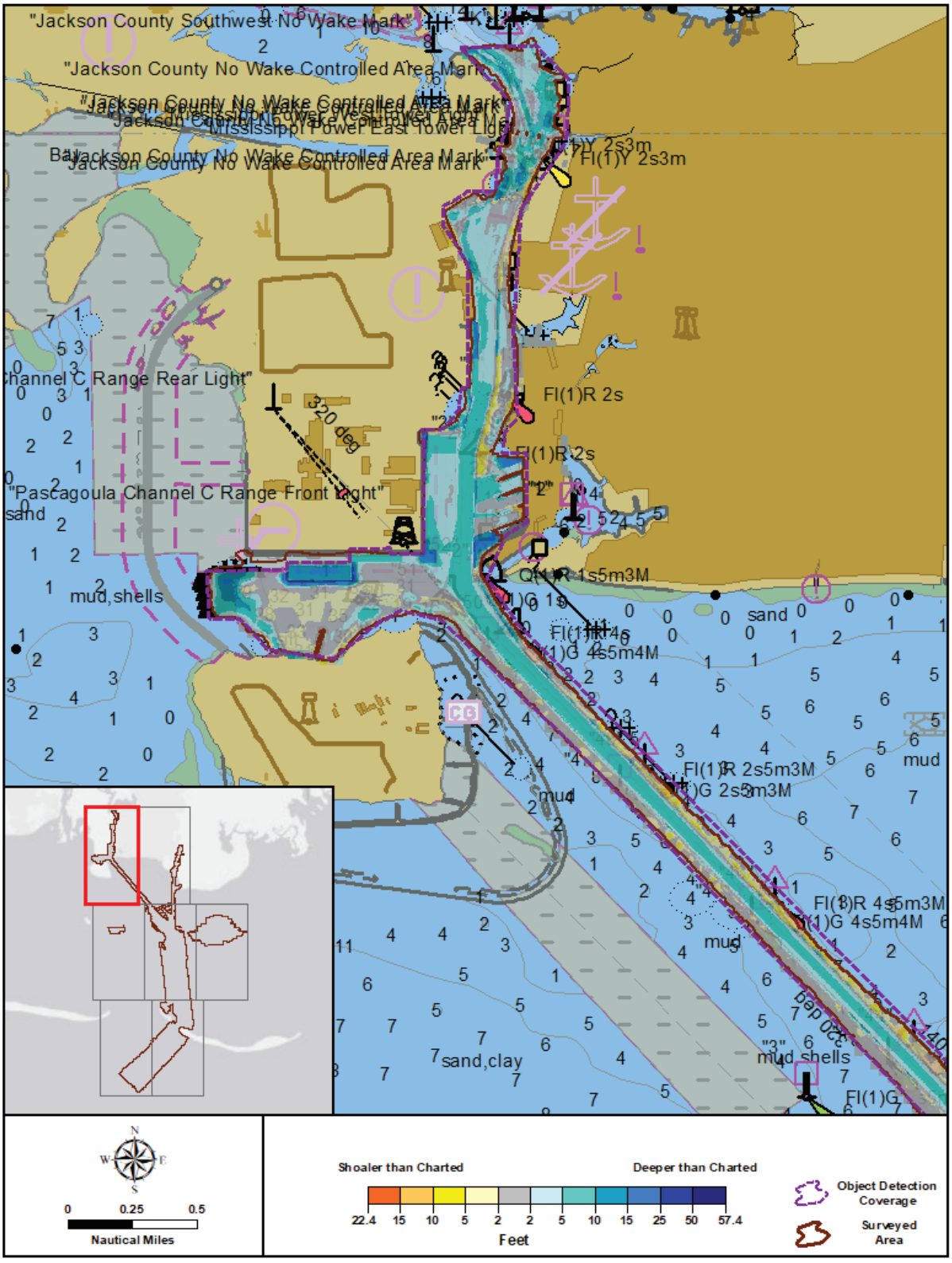


Figure 20: Depth Difference Between H13487 and US5MS22M, Area 1 of 7

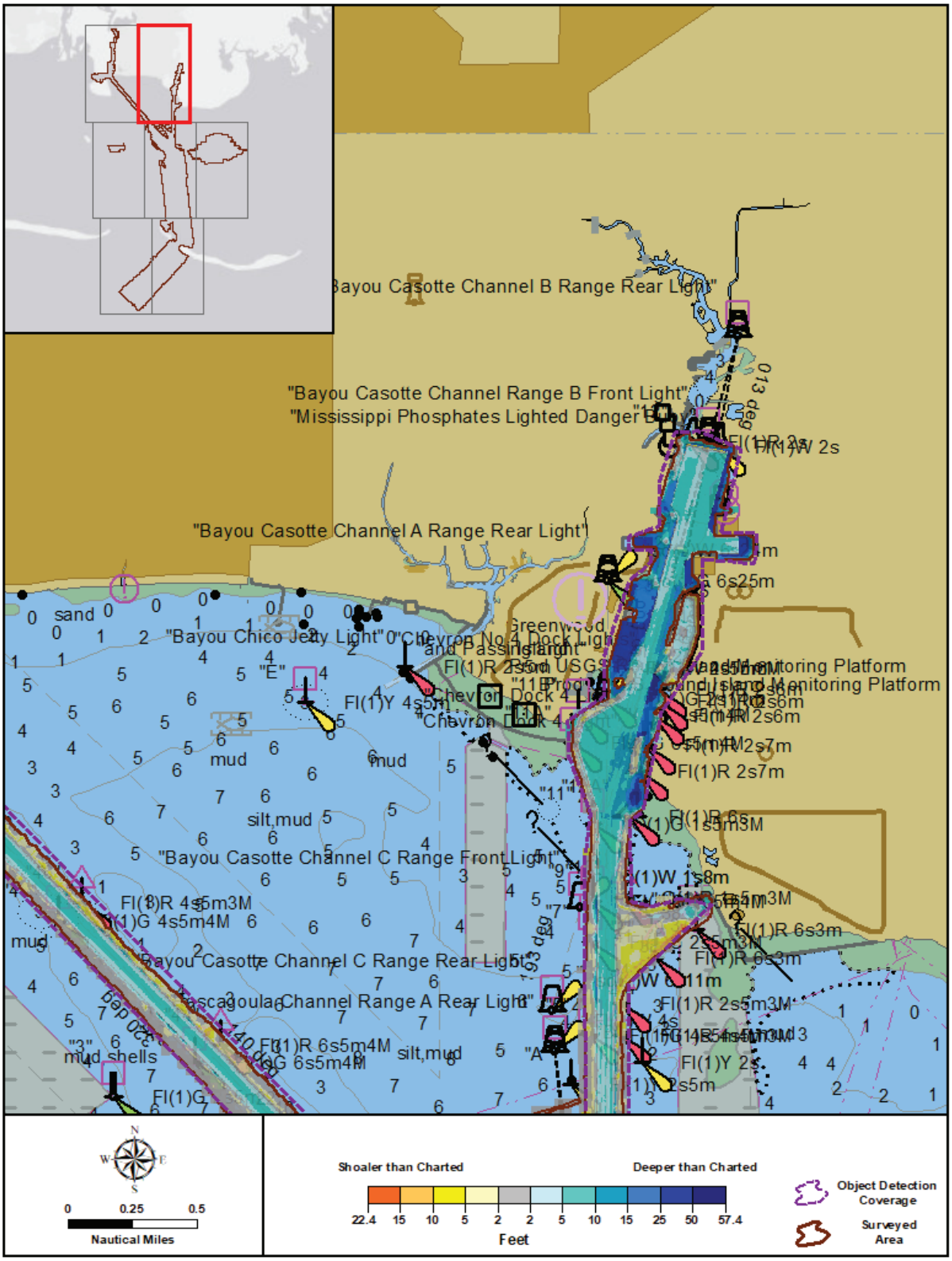


Figure 21: Depth Difference Between H13487 and US5MS22M, Area 2 of 7

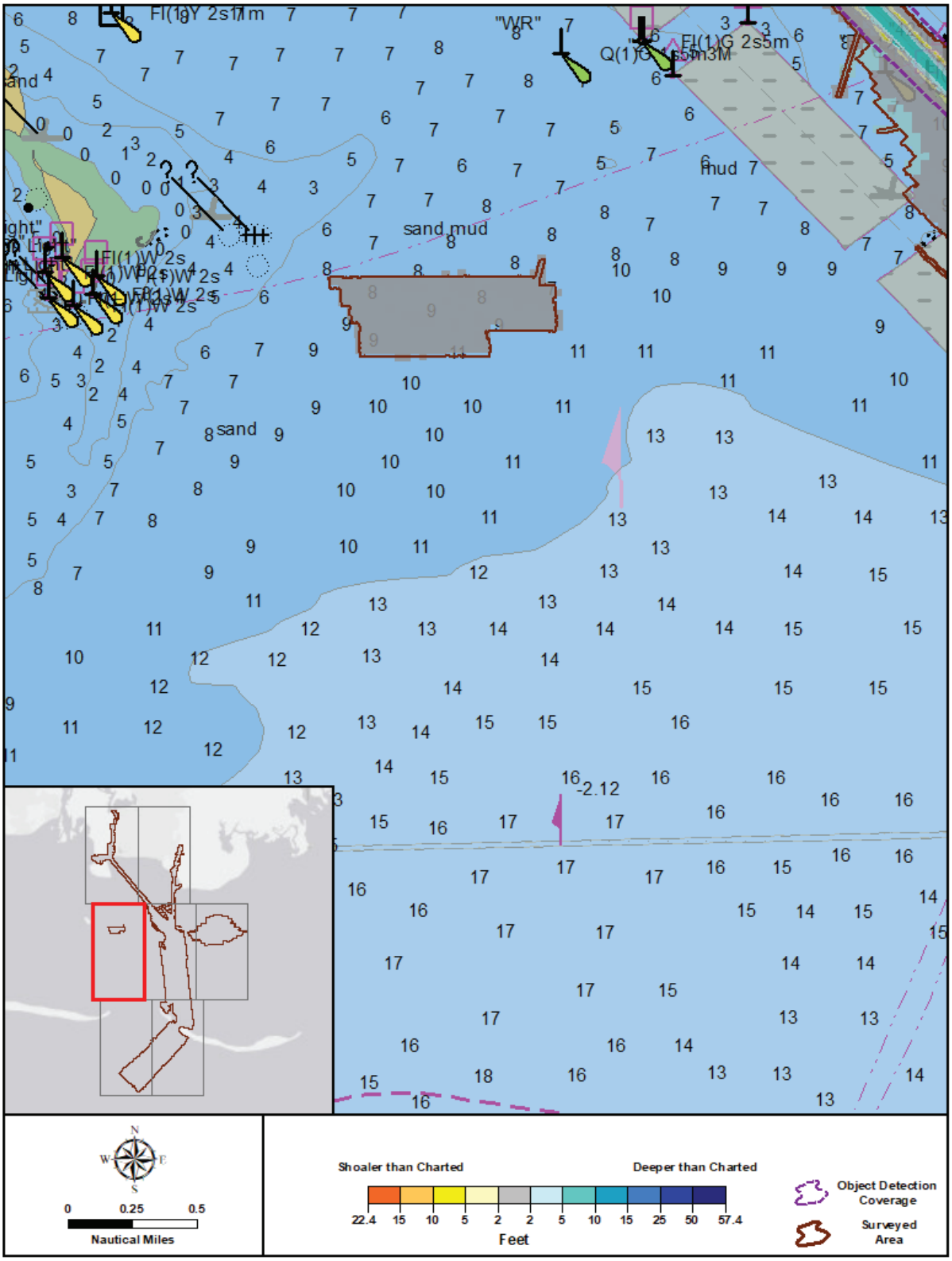


Figure 22: Depth Difference Between H13487 and US5MS22M, Area 3 of 7

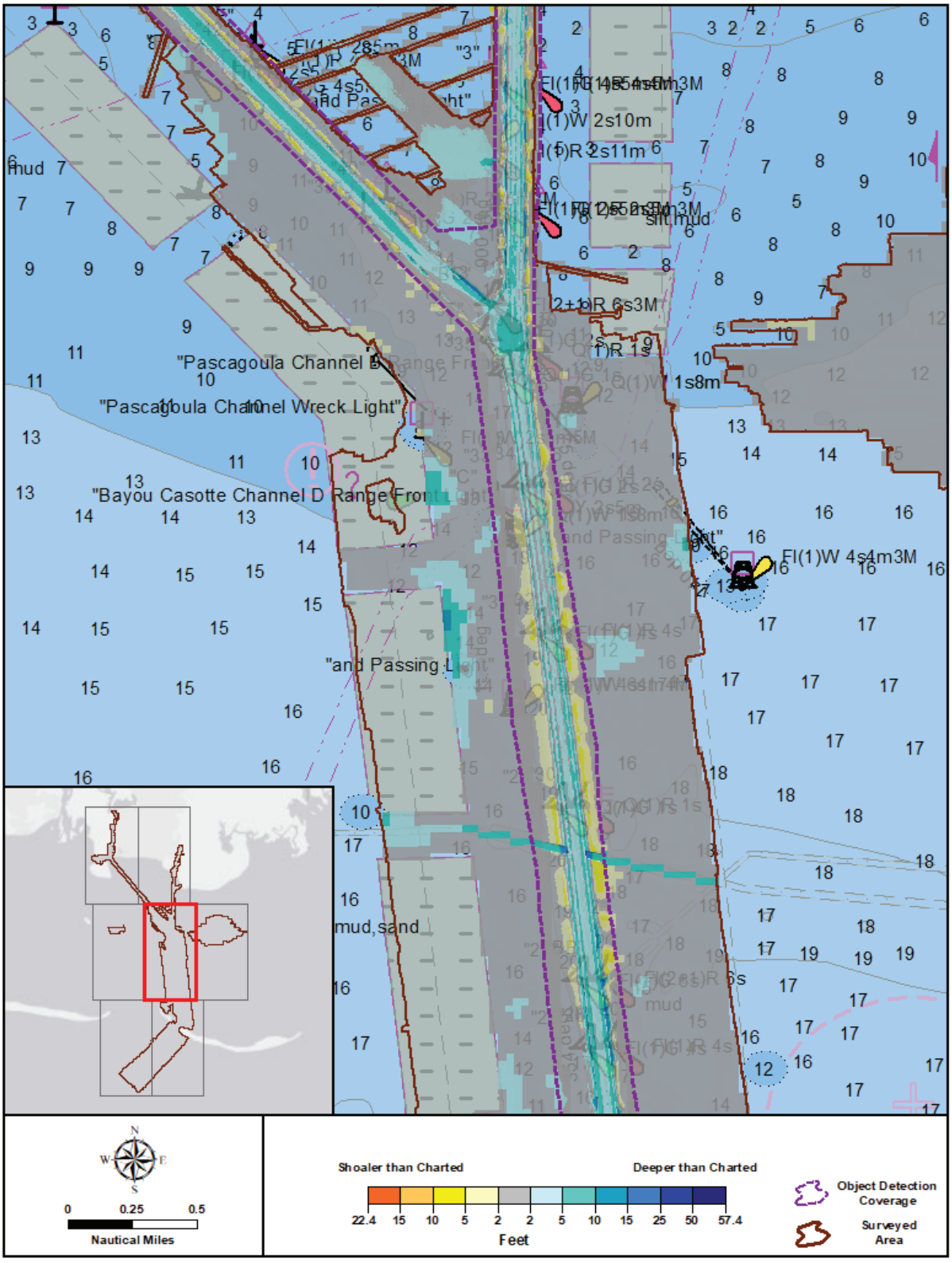


Figure 23: Depth Difference Between H13487 and US5MS22M, Area 4 of 7

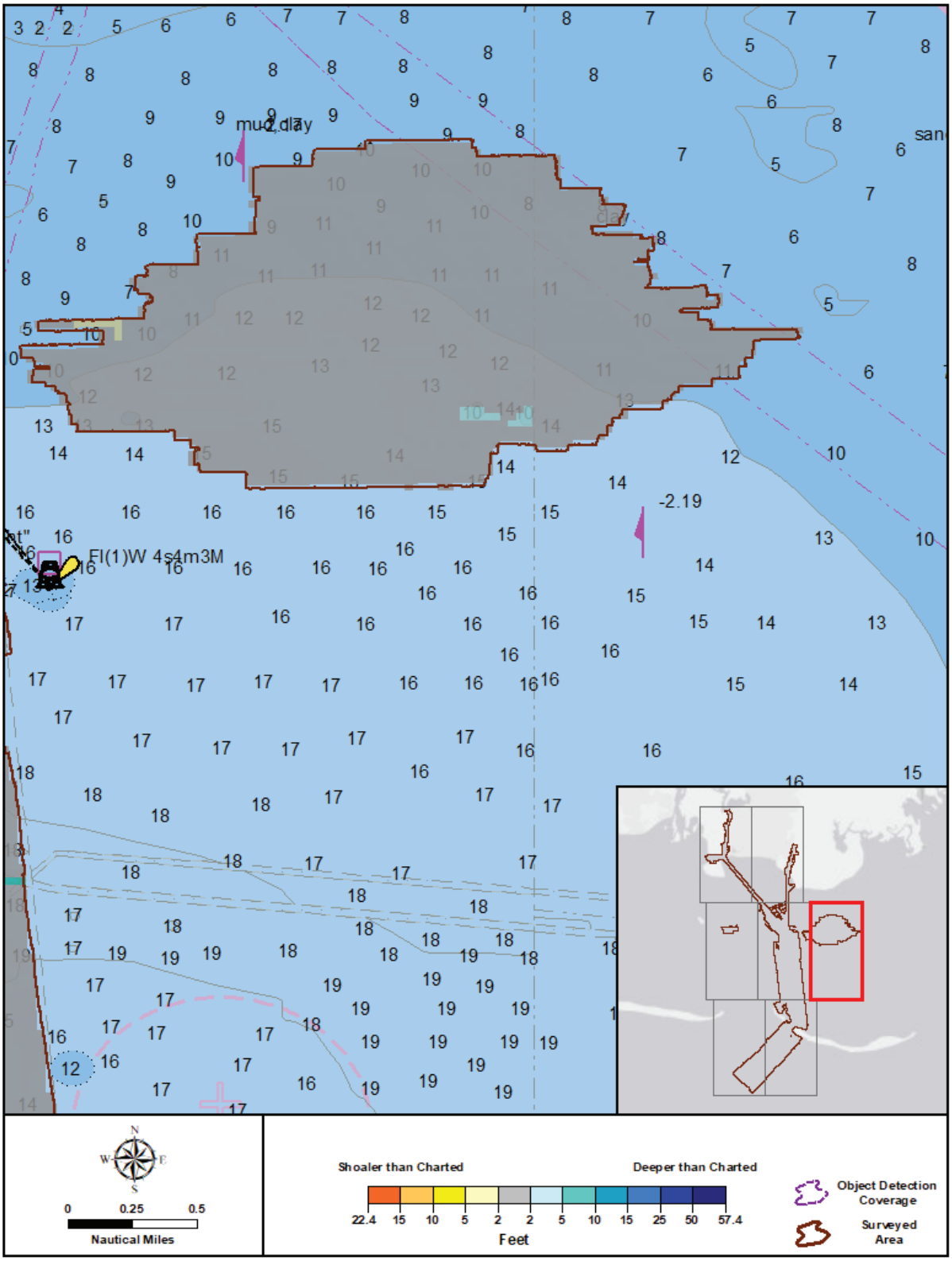


Figure 24: Depth Difference Between H13487 and US5MS22M, Area 5 of 7

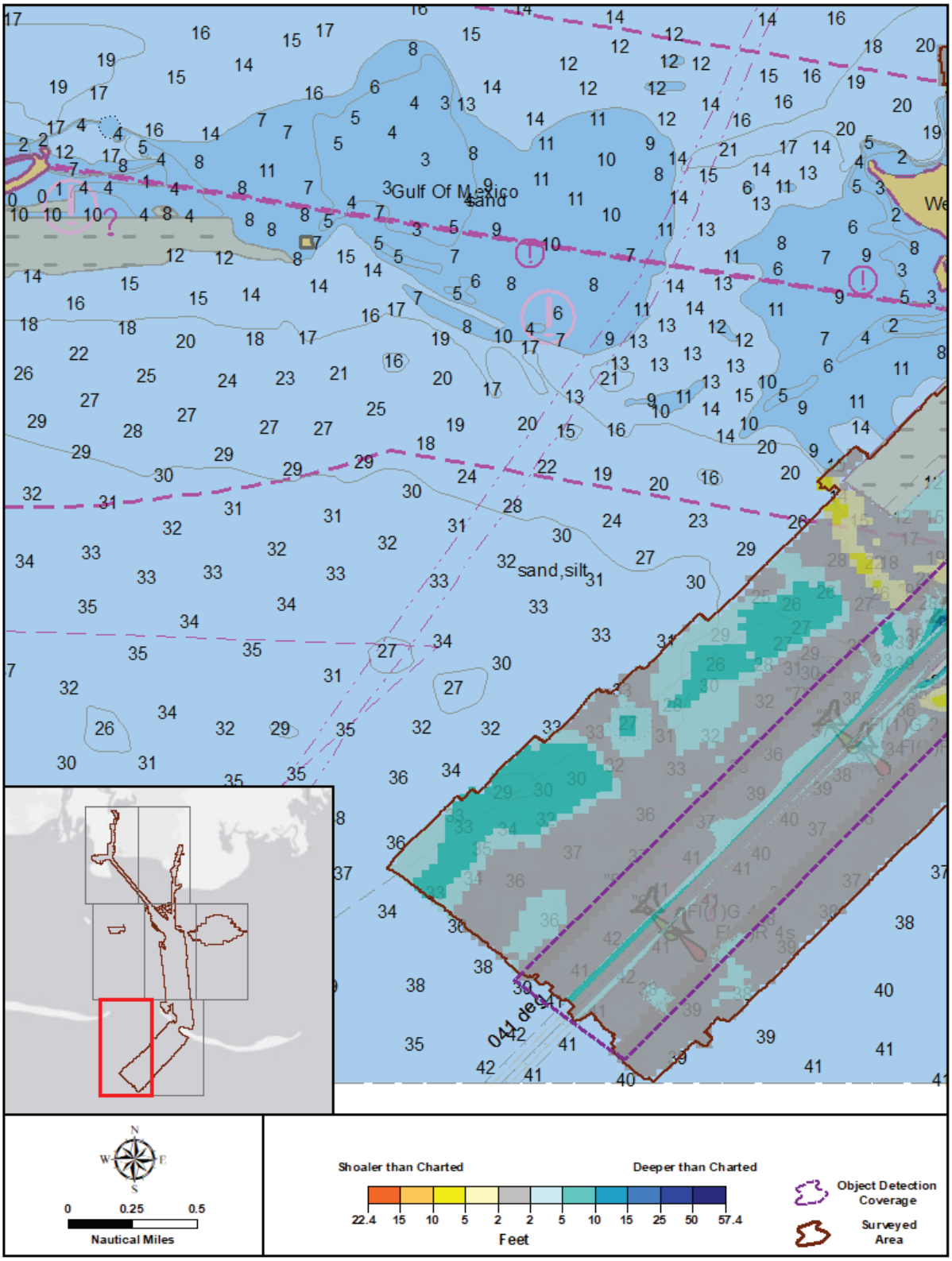


Figure 25: Depth Difference Between H13487 and US5MS22M, Area 6 of 7

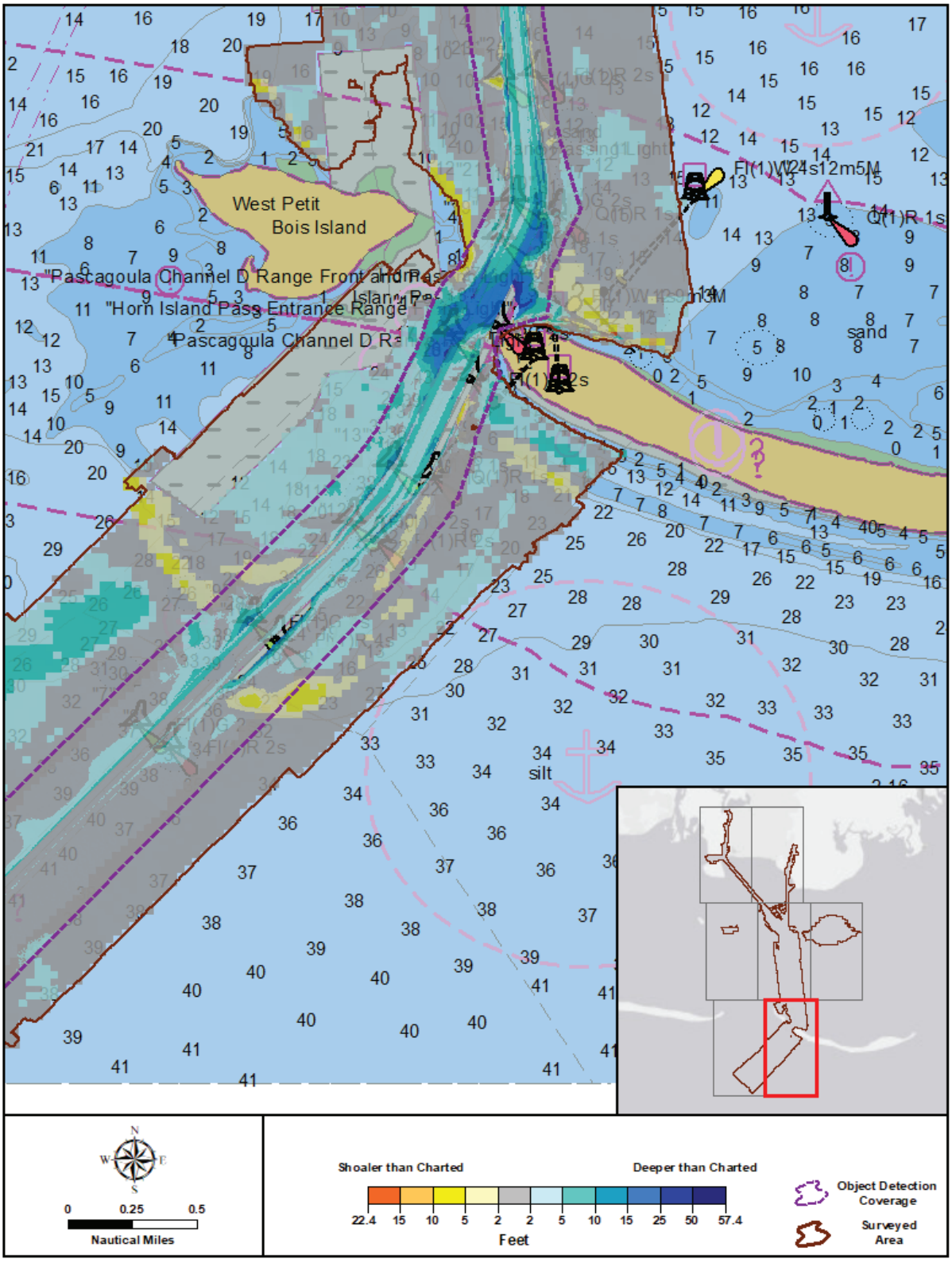


Figure 26: Depth Difference Between H13487 and US5MS22M, Area 7 of 7

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
US4MS12M	1:80000	45	10/14/2021	11/30/2021
US5MS22M	1:20000	51	12/20/2021	12/20/2021

Table 15: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

One Danger to Navigation (DtoN) report was submitted for this survey.

-H13487 DtoN 01, submitted August 5, 2021, reported an uncharted baring wreck located in a charted Spoil area.

The DtoN has been added to the ENCs using preliminary survey data. The hydrographer recommends updating the charts to depict the DtoN as portrayed in the Final Feature File (FFF).

D.1.3 Charted Features

All assigned features included in the project Composite Source File (CSF) found seaward of the NALL have been addressed by the survey and are included in the FFF.

All disproved features have been included in the FFF with a description of "Delete." All new features have been included in the FFF with the surveyed feature depicted and a description of "New." Assigned features located inshore of the NALL are included in the FFF with a description of "Not Addressed." Where an attribute or feature acronym was changed, but geometry was maintained, a description of "Update" was used.

Contact heights included in the side scan contact .000 file have been sourced from the shadow height measurement obtained from SonarWiz. Due to limitations in computing accurate heights from side scan shadow lengths, contact heights may not match heights from correlating contacts or feature heights measured from multibeam data included in the Final Feature File. The height field for contacts created on baring features observed in side scan data have been intentionally left blank.

D.1.4 Uncharted Features

All uncharted features are portrayed in the FFF as surveyed and attributed with the description of "New." Refer to the FFF for additional information.

D.1.5 Channels

Numerous channels, which are part of the United States National Channel Framework (NCF) maintained by the US Army Corps of Engineers (USACE), are charted within the survey area. These include Bayou Casotte Channel, Bayou La Batre Sound Channel, Horn Island Pass Channel, Krebs Lake Channel, Pascagoula 1 Channel, Pascagoula Bar Channel, Pascagoula Lower Sound Channel, Pascagoula River Channel, Pascagoula Upper River Channel, and Pascagoula Upper Sound Channel. Several areas of shoaling were observed in channels within the survey area and reported to USACE and NOAA during survey operations. Correspondence related to the shoaling is included in Appendix II.

There are no charted precautionary areas, traffic separation schemes, or pilot boarding areas within the survey limits. There are three range lines marked by Bayou Casotte Channel A, C, and D Range Lights within the survey area.

The survey area encompasses the Horn Island Pass to Mobile Ship Channel Safety Fairway and the Pascagoula Safety Fairway (33 CFR 166.200). The hydrographer recommends encoding the name of safety fairways in the ENCs. Safety fairways are included in the Code of Federal Regulations (CFR).

The survey area crosses the charted Restricted Area surrounding the Gulf Islands National Seashore (GUIS).

D.2 Additional Results

D.2.1 Aids to Navigation

Aids to Navigation (AtoNs) were investigated using bathymetric data and visual observations. Ten AtoN discrepancies were reported to USCG using the Navigation Center’s Online ATON Discrepancy Report Form on October 21, 2021, January 19, 2022, and January 21, 2022. Copies of the online submittals are included in Appendix II. AtoNs have been included in the FFF with appropriate comments and recommendations.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Fifteen bottom samples were acquired on October 12, 2021, (DN285) and October 13, 2021 (DN286). The bottom sampling plan followed suggested sample locations included in the provided PRF. Minor adjustments were made to the recommended sampling locations with approval from the Contracting Officer's Representative (COR). Correspondence is included in Appendix II of this report.

D.2.4 Overhead Features

One overhead cable and three bridges were assigned in the CSF for visual confirmation. These features are addressed in the FFF.

D.2.5 Submarine Features

There are six submerged pipelines and one submerged cable charted in the survey area. Two sections of potentially exposed pipeline were reported following HSSD 1.7.1 and 1.7.3. Correspondence related to this reporting is included in Appendix II.

D.2.6 Platforms

The CSF included one offshore platform point feature, which is addressed in the FFF.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

The Dredge COLUMBIA was observed working in the vicinity of the Horn Island Pass Channel and the Pascagoula Lower Sound Channel during survey operations. Dredge operations were completed either before or after survey acquisition. There are no known areas in the survey where multibeam data are misaligned due to bottom change caused by dredging during survey operations.

D.2.10 New Survey Recommendations

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

D.2.11 ENC Scale Recommendations

According to the National Charting Plan, the ENCs covering the survey area are slated to be reschemed to include new Band 2 through Band 5 cells based on a gridded production scheme. The hydrographer has no ENC scale recommendations for the 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, 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.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2021-12-09

Approver Name	Approver Title	Approval Date	Signature
Jonathan L. Dasler, PE, PLS, CH	NSPS-THSOA Certified Hydrographer, Chief of Party	01/27/2022	Digitally signed by Jonathan L. Dasler, PE, PLS, CH Date: 2022.01.27 12:34:10 -08'00'
Jason Creech, CH	NSPS-THSOA Certified Hydrographer, Charting Manager / Project Manager	01/27/2022	Digitally signed by Jason Creech Date: 2022.01.27 12:43:07 -08'00'
James Guilford	IHO Cat-A Hydrographer, Lead Hydrographer	01/27/2022	Digitally signed by James Guilford Date: 2022.01.27 12:52:39 -08'00'
Michael Redmayne	IHO Cat-A Hydrographer, Lead Hydrographer	01/27/2022	Digitally signed by Michael Redmayne Date: 2022.01.27 13:00:02 -08'00'
Jason Dorfman	Lead Hydrographer	01/27/2022	Digitally signed by Jason Dorfman Date: 2022.01.27 13:14:23 -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