H13771

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13771

LOCALITY

State(s):	Virginia
General Locality:	Southwest Chesapeake Bay
Sub-locality:	Stingray Point Light to The Punchbowl

2023

CHIEF OF PARTY
David Neff, C.H.

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13771**

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):	**Virginia**
General Locality:	**Southwest Chesapeake Bay**
Sub-Locality:	**Stingray Point Light to The Punchbowl**
Scale:	**20000**
Dates of Survey:	**03/31/2023 to 12/12/2023**
Instructions Dated:	**03/08/2023**
Project Number:	**OPR-E351-KR-22**
Field Unit:	**eTrac**
Chief of Party:	**David Neff, C.H.**
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:

All times are UTC. The purpose of this survey is to update existing NOS nautical charts. H13771 covers approximately 48 square nautical miles of the Rappahannock River from Stingray Point Light to The Punchbowl, Virginia.

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 18N, 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 H13771

Project: OPR-E351-KR-22

Locality: Southwest Chesapeake Bay

Sublocality: Stingray Point Light to The Punchbowl

Scale: 1:20000

March 2023 - December 2023

eTrac

Chief of Party: David Neff, C.H.

A. Area Surveyed

eTrac conducted hydrographic survey operations in the Rappahannock River, Virginia. H13771 covers approximately 48 square nautical miles of survey area. 1699.49 linear nautical miles were acquired during the survey.

Survey was conducted within these limits between March 31, 2023 (DN090) and December 12, 2023 (DN346).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 46' 27.49" N 37° 32' 55.23" E	76° 38' 5.86" N 76° 15' 53.57" W

Table 1: Survey Limits

All data were acquired in accordance with the requirements in the Hydrographic Survey Project Instructions and specifications set forth in the Hydrographic Survey Specifications and Deliverables 2022 Edition (HSSD 2022).

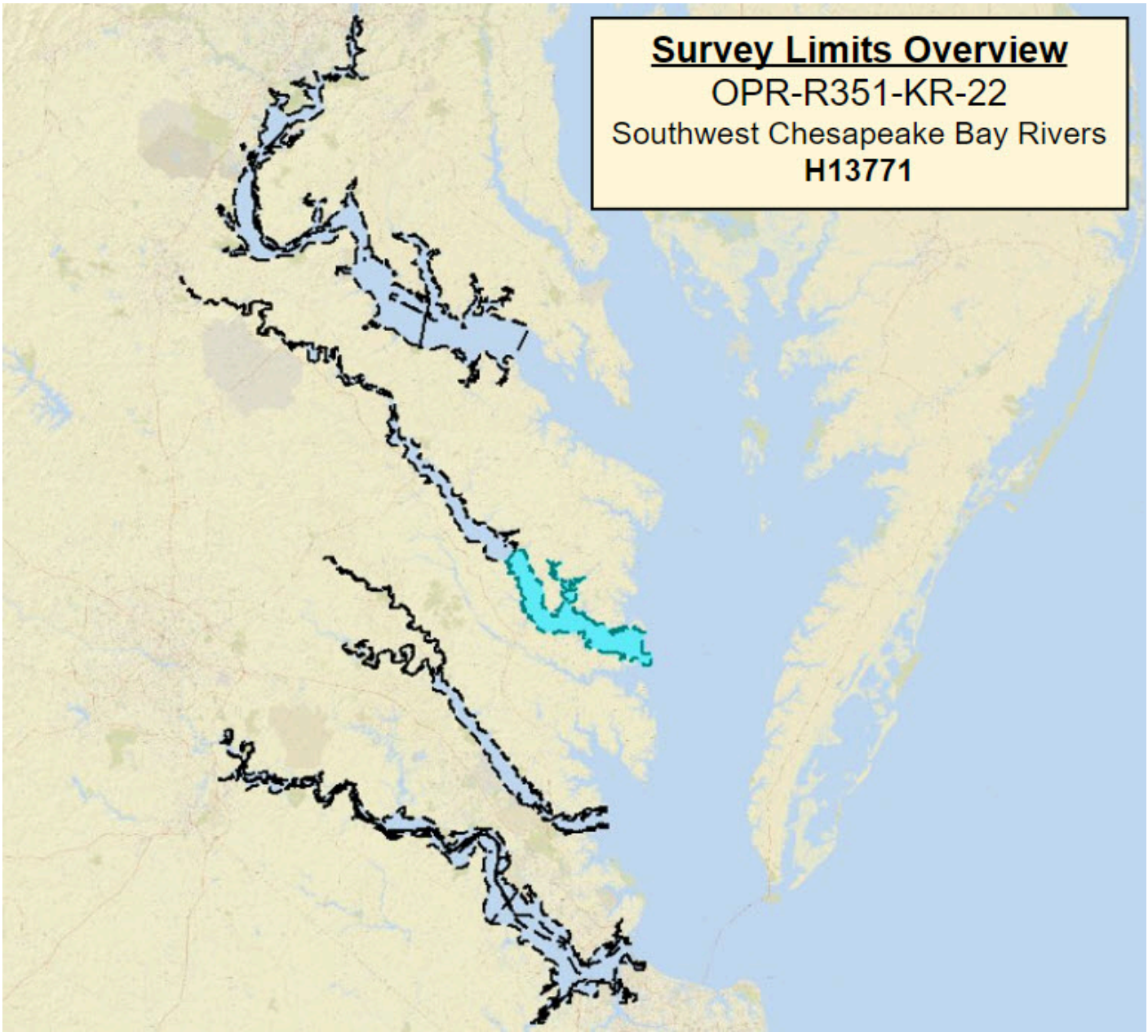


Figure 1: Survey Limits Overview (light blue area)

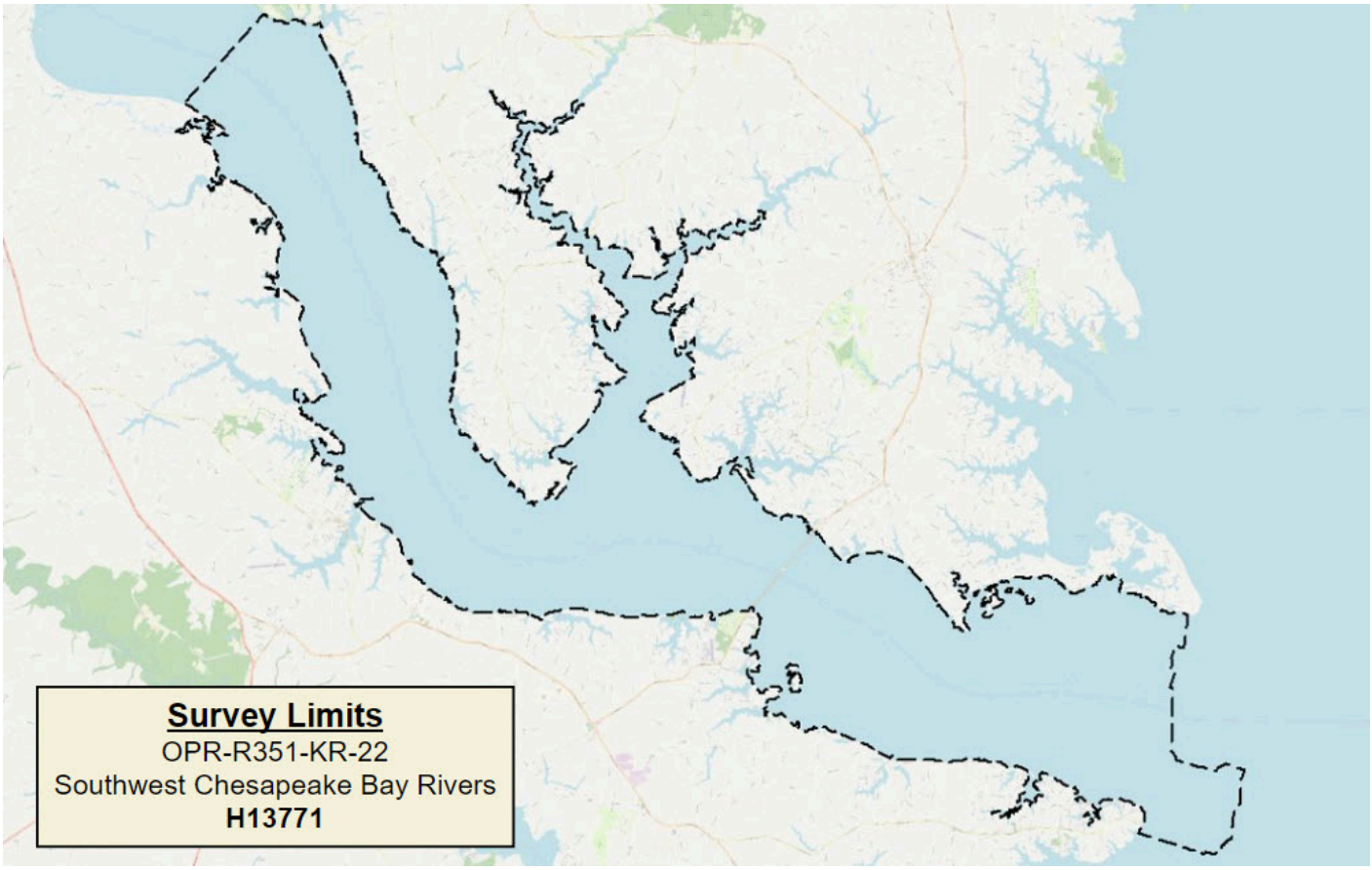


Figure 2: Survey Limits (black line)

A.2 Survey Purpose

The principal objective of the Southwest Chesapeake Bay Rivers project is manifold. This survey will supply forecasters and decision makers at the NOAA National Water Center with bathymetry data for critical hydrodynamic modeling. This data is necessary to understand the timing of rapid river stage increases and decreases, the duration of high water, inundation, or drought. The temperature and salinity distributions provided in flow models will support the Rappahannock oyster industry. This survey will emphasize features that effect safe navigation and update the Office of Coast Survey Nautical charts and services.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey H13771 is accurate to International Hydrographic Organization (IHO) Order 1a as required per the HSSD 2022.

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 Option B
All waters in survey area 2 to 8 m water depth	Sidescan Sonar Data may be aquired at an altitude of 6-20% of the range-scale
All waters in survey area in which a side scan sonar contact indicates a natural feature, i.e. mounds, with height greater than 1 meter.	1. Inside the traffic corridor and in areas of low under keel clearance, investigate all contacts to complete coverage standards in accordance with HSSD requirements. 2. Outside the traffic corridor, if discrete features are located within 8 mm at the largest scale chart, then the most significant feature within the 8 mm radius should be investigated (with 2 investigation lines perpendicular to each other).

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements listed above and in the HSSD 2022.

Note: Survey coverage did not extend to the entire survey boundary as the Navigable Area Limit Line (NALL) was reached. There are occasionally small gaps in the side scan mosaic along the NALL due to the inability to safely tow the side scan up to the NALL which would require operating the vessel beyond the NALL.
Gaps in complete survey coverage exist due to the presence of mariculture. An example of a coverage gap due to mariculture is presented below.
Gaps in complete survey coverage exist due to the presence of piles. An example of a coverage gap due to a ring of warning piles is presented below.
Gaps in complete survey coverage exist due to shoreline construction. An example of a coverage gap due to shoreline construction is presented below.

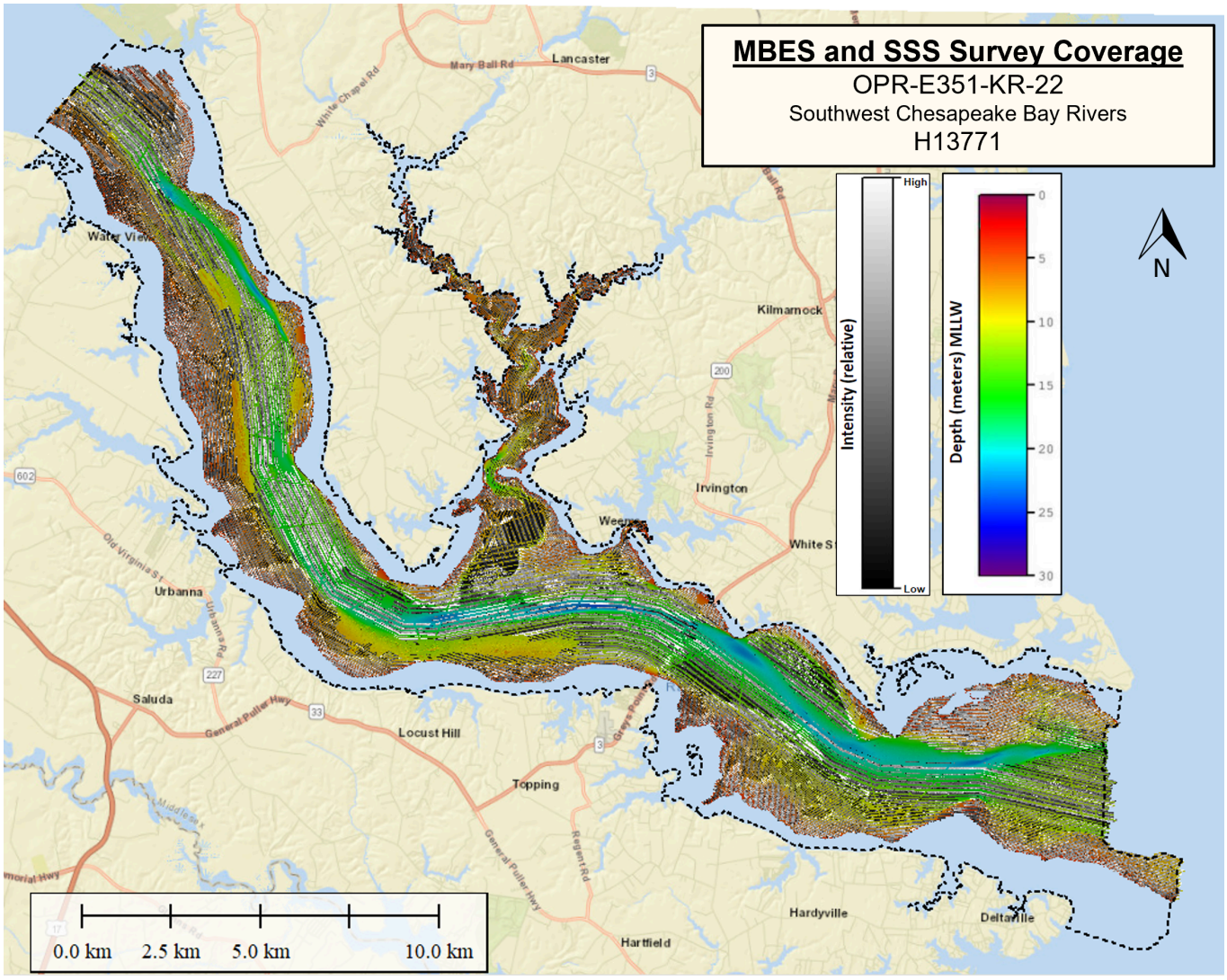


Figure 3: Survey Coverage with combined MBES and SSS

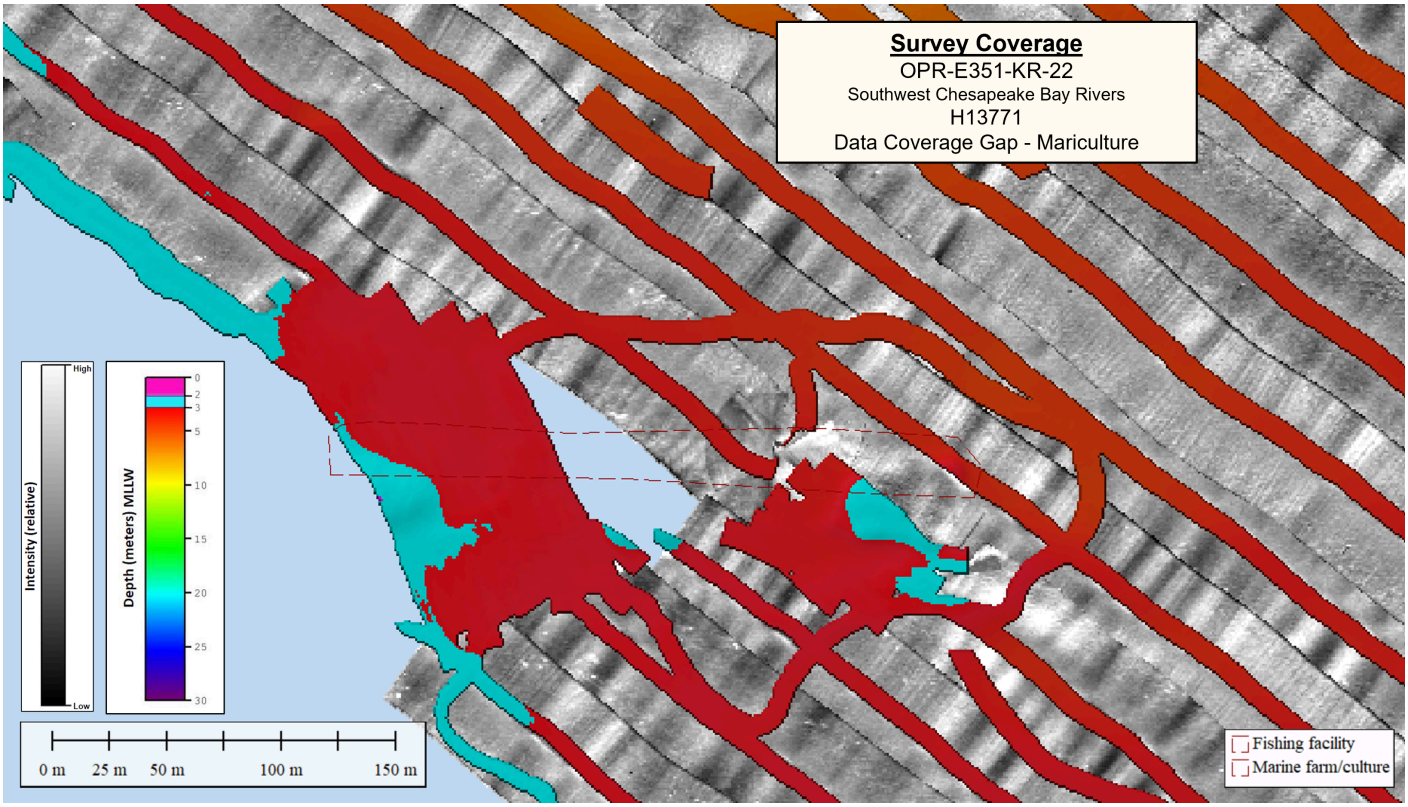


Figure 4: Data coverage gap caused by mariculture

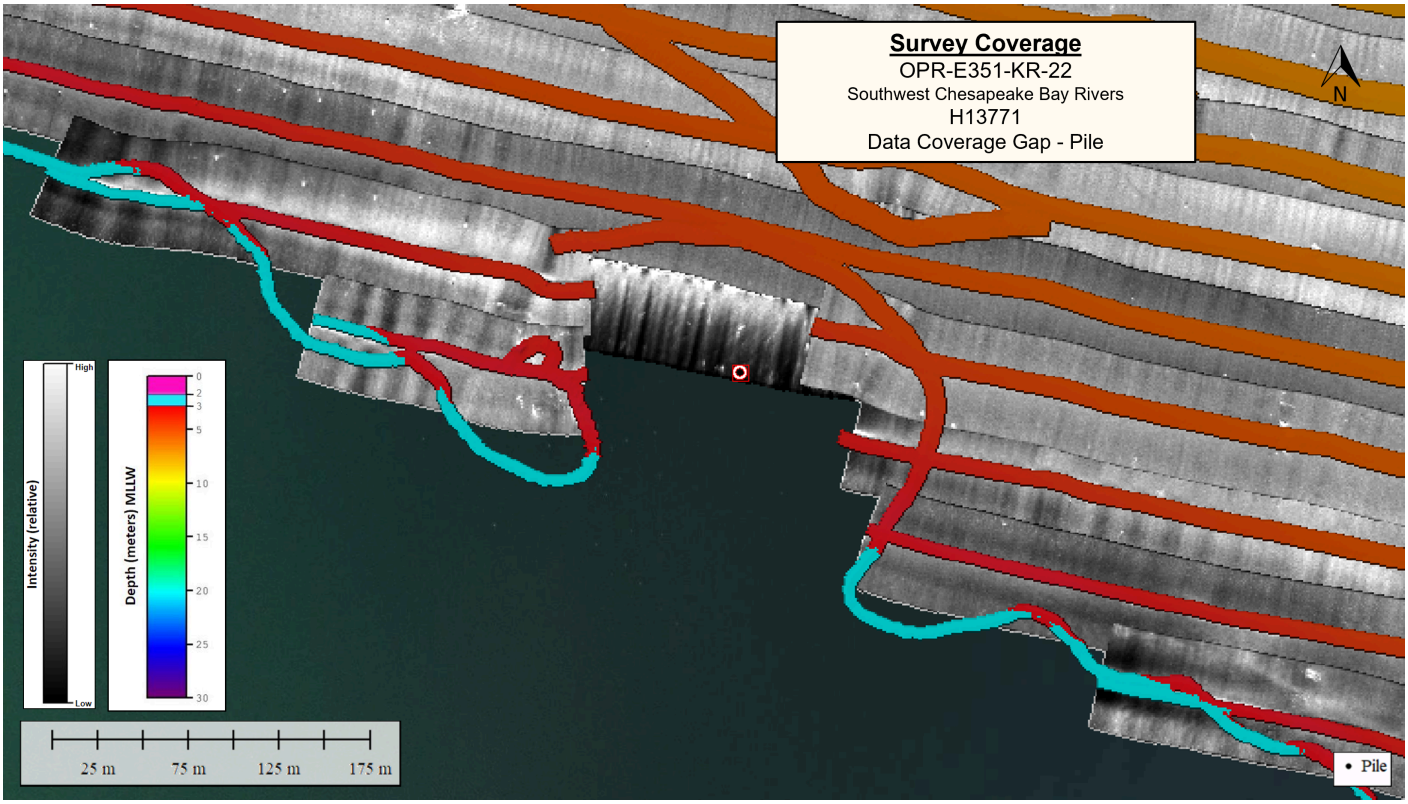


Figure 5: Data coverage gap caused by piles

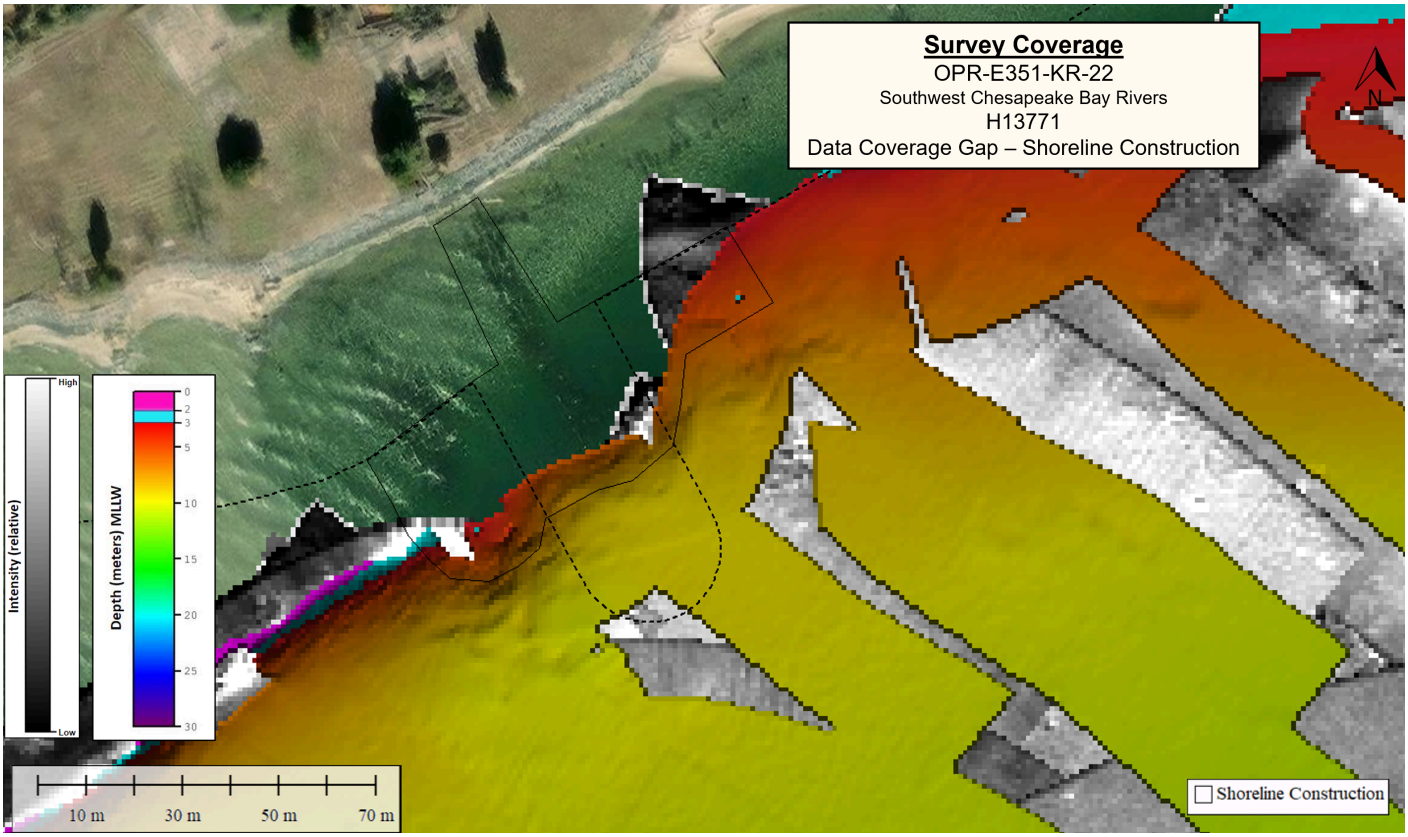


Figure 6: Data coverage gap caused by shoreline construction

A.6 Survey Statistics

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

	HULL ID	*R/V Endeavor*	*R/V Pulse*	*R/V Spectrum*	*R/V Taku*	*R/V Voxel*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0	0.0	0.0
	MBES Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	Lidar Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	170.1	806.28	98.16	248.17	297.12	1619.92
	SBES/MBES Crosslines	0.0	16.63	15.08	47.86	0.0	79.57
	Lidar Crosslines	0.0	0.0	0.0	0.0	0.0	0.0
Number of Bottom Samples							5
Number Maritime Boundary Points Investigated							0
Number of DPs							0
Number of Items Investigated by Dive Ops							0
Total SNM							48.13

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
03/31/2023	90

Survey Dates	Day of the Year
04/01/2023	91
04/02/2023	92
04/03/2023	93
04/04/2023	94
04/05/2023	95
04/06/2023	96
04/07/2023	97
04/08/2023	98
04/09/2023	99
04/10/2023	100
04/11/2023	101
04/12/2023	102
04/13/2023	103
04/14/2023	104
04/15/2023	105
04/16/2023	106
04/17/2023	107
04/18/2023	108
04/19/2023	109
04/20/2023	110
04/21/2023	111
04/22/2023	112
04/23/2023	113
04/24/2023	114
04/25/2023	115
04/26/2023	116
04/27/2023	117
04/29/2023	119
04/30/2023	120
05/03/2023	123
05/04/2023	124
05/05/2023	125

Survey Dates	Day of the Year
05/06/2023	126
05/16/2023	136
05/16/2023	136
05/17/2023	137
05/19/2023	139
05/20/2023	140
05/21/2023	141
05/22/2023	142
05/23/2023	143
09/21/2023	264
09/22/2023	265
09/24/2023	267
09/25/2023	268
09/26/2023	269
09/27/2023	270
09/28/2023	271
09/29/2023	272
09/30/2023	273
10/08/2023	281
10/11/2023	284
10/12/2023	285
10/13/2023	286
10/14/2023	287
10/24/2023	297
12/12/2023	346

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 are discussed in the following sections.

B.1.1 Vessels

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

Hull ID	***R/V Endeavor***	***R/V Pulse***	***R/V Spectrum***	***R/V Taku***	***R/V Voxel***
LOA	13.4 meters	7.3 meters	6.7 meters	9.4 meters	14.0 meters
Draft	0.8 meters	0.6 meters	0.6 meters	0.8 meters	0.6 meters

Table 5: Vessels Used

The R/V Endeavor is a 13.4 meter aluminum catamaran built by Armstrong Marine equipped with an over-the-side Pitman Arm Sonar Mount with a secondary tie point, a hydraulic A-frame and davit.

The R/V Pulse is a 7.3 aluminum monohull equipped with a Universal Sonar Mount (USM) starboard multibeam pole mount and davit.

The R/V Spectrum is a 6.7 meter aluminum monohull equipped with a Universal Sonar Mount (USM) starboard multibeam pole mount and davit.

The R/V Taku is a 9.4 aluminum catamaran built by Armstrong Marine equipped with a Universal Sonar Mount (USM) stern multibeam pole mount, hydraulic A-frame and davit.

The R/V Voxel is a 14.0 meter aluminum catamaran built by Armstrong Marine equipped with an electro hydraulic actuated moonpool accessed adjustable aluminum and stainless steel custom mount and hydraulic A-frame.

B.1.2 Equipment

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

Manufacturer	Model	Type
R2Sonic	2024	MBES
R2Sonic	2022	MBES
AML Oceanographic	3-RT Velocity Probe	Sound Speed System
AML Oceanographic	MicroX SV	Sound Speed System
AML Oceanographic	AML-3 LGR	Sound Speed System
AML Oceanographic	BaseX2	Sound Speed System
Applanix	POS MV WaveMaster	Positioning and Attitude System
Applanix	POS MV OceanMaster	Positioning and Attitude System
R2Sonic	I2NS	Positioning System
EdgeTech	4125	SSS
EdgeTech	4200	SSS

Table 6: Major Systems Used

Note: R/V Endeavor utilized a single head R2Sonic 2024 multibeam echosounder system (MBES) with the exception of October 2023 when R/V Endeavor utilized a dual head R2Sonic 2022 MBES. R/V Endeavor also utilized an AML 3-RT for the surface sound speed system, an AML-3 LGR for the sound speed system, an R2Sonic I2NS for the positioning and attitude system, and an EdgeTech 4200 MP side scan sonar (SSS).

R/V Pulse utilized a single head R2Sonic 2022 multibeam echosounder system (MBES) until May 10th 2023 when the MBES was exchanged for a single head R2Sonic 2024 MBES. R/V Pulse also utilized an AML 3-RT for the surface sound speed system, an AML-3 LGR for the sound speed system, an Applanix POSMV WaveMaster (POS MV 320 v4) for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS).

R/V Spectrum utilized a single head R2Sonic 2024 multibeam echosounder system (MBES), an AML Micro.X for the surface sound speed system, an AML Base.X2 for the sound speed system, an Applanix POSMV WaveMaster (POS MV 320 v4) for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS).

R/V Taku utilized a single head R2Sonic 2024 multibeam echosounder system (MBES), an AML 3-RT for the surface sound speed system, an AML Base.X2 for the sound speed system, an Applanix POSMV OceanMaster (POS MV 320 v5) for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS).

R/V Voxel utilized a single head R2Sonic 2024 multibeam echosounder system (MBES), an AML 3-RT for the surface sound speed system, an AML-3 LGR for the sound speed system, an Applanix POSMV

OceanMaster (POS MV 320 v5) for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS).

B.2 Quality Control

B.2.1 Crosslines

A beam-to-beam statistical analysis was performed using the Cross Check tool in Qimera. A 1 meter Combined Uncertainty and Bathymetric Estimator (CUBE) weighted dynamic surface was created incorporating only the mainscheme lines and excluded crosslines. The Cross Check tool was used to perform the beam-by-beam comparison of the crossline data to the mainscheme surface. Comparisons showed excellent agreement, well above 95% of the allowable TVU.

The percentage of crossline miles as compared to main scheme miles was 4.91%

Note: This surface was created for QC only and is not submitted as a surface deliverable.

Below is a histogram of the crossline comparison statistics showing IHO Order 1a compliance per beam.

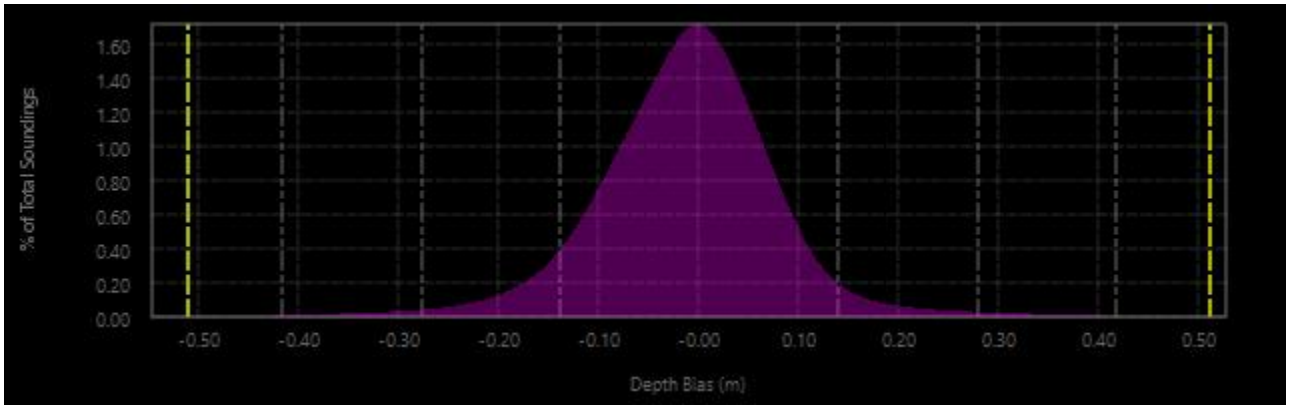


Figure 7: H13771 Crossline Comparison

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0.06 meters	N/A

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
R/V Endeavor	0.05 meters/second	N/A	N/A	0.2 meters/second
R/V Pulse	0.05 meters/second	N/A	N/A	0.2 meters/second
R/V Spectrum	0.05 meters/second	N/A	N/A	0.2 meters/second
R/V Taku	0.05 meters/second	N/A	N/A	0.2 meters/second
R/V Voxel	0.05 meters/second	N/A	N/A	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The standard deviation uncertainty and the total vertical uncertainty (TVU) layers of the Dynamic Surface were utilized during data processing to search for features, water column noise, and systematic errors.

IHO Order 1a uncertainty specification was met by 100% of the nodes.

In Qimera versions beginning in 2.5.1 and beyond, the user has the ability to export the Dynamic Surface to a Bathymetric Attributed Grid (BAG) with TVU represented in the uncertainty layer.

Using this BAG, the percentage of nodes that fell within the TVU specification for each Dynamic Surface was calculated using the NOAA QC tools program. These results are shown in an image below.

Complete Coverage Option B MBES (Finalized 1m CUBE weighted Dynamic Surface in NOAA QC Tools) = 95.5% of nodes are within the allowable TVU.

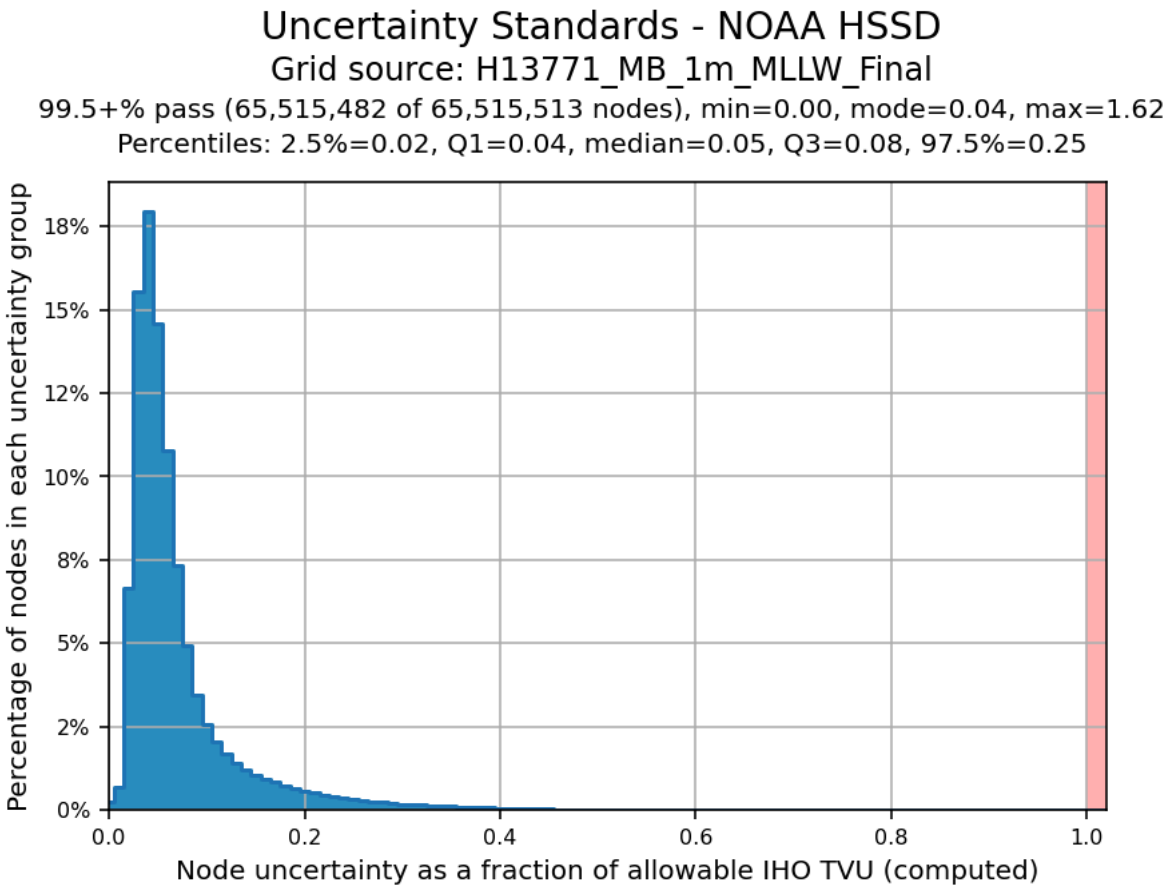


Figure 8: H13771 Finalized 1m MBES TVU Statistics

B.2.3 Junctions

Depth differences between junctioning surveys were evaluated using the JunctionTrac program, developed in-house by eTrac. For each junction, each CUBE weighted dynamic surface's nodes were exported to an ASCII CSV file where the fields were (Easting, Northing, Depth) for each node. A 1 meter difference surface between the junctioning datasets was also created and exported to an ASCII CSV file where the fields were (Easting, Northing, Diff) for each node. The three ASCII CSV files were then loaded into the JunctionTrac program and junction statistics were computed. A file was also created in this process to locate any nodes from the difference surface that exceed the allowable TVU, which was imported into Qimera and any identified points from JunctionTrac were analyzed. Note: the difference surfaces were created for comparison efforts only and are not submitted as surface deliverables.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13770	1:10000	2023	eTrac	NW
H11653	1:10000	2007	DE	SE
H11654	1:10000	2007	DE	SE

Table 9: Junctioning Surveys

H13770

The junction comparison was performed using all overlapping data between H13771 and H13770. Below is a histogram of junction comparison statistics showing the difference between the junctioning surfaces and allowable TVU as well as difference statistics. 100% of nodes were within allowable TVU.

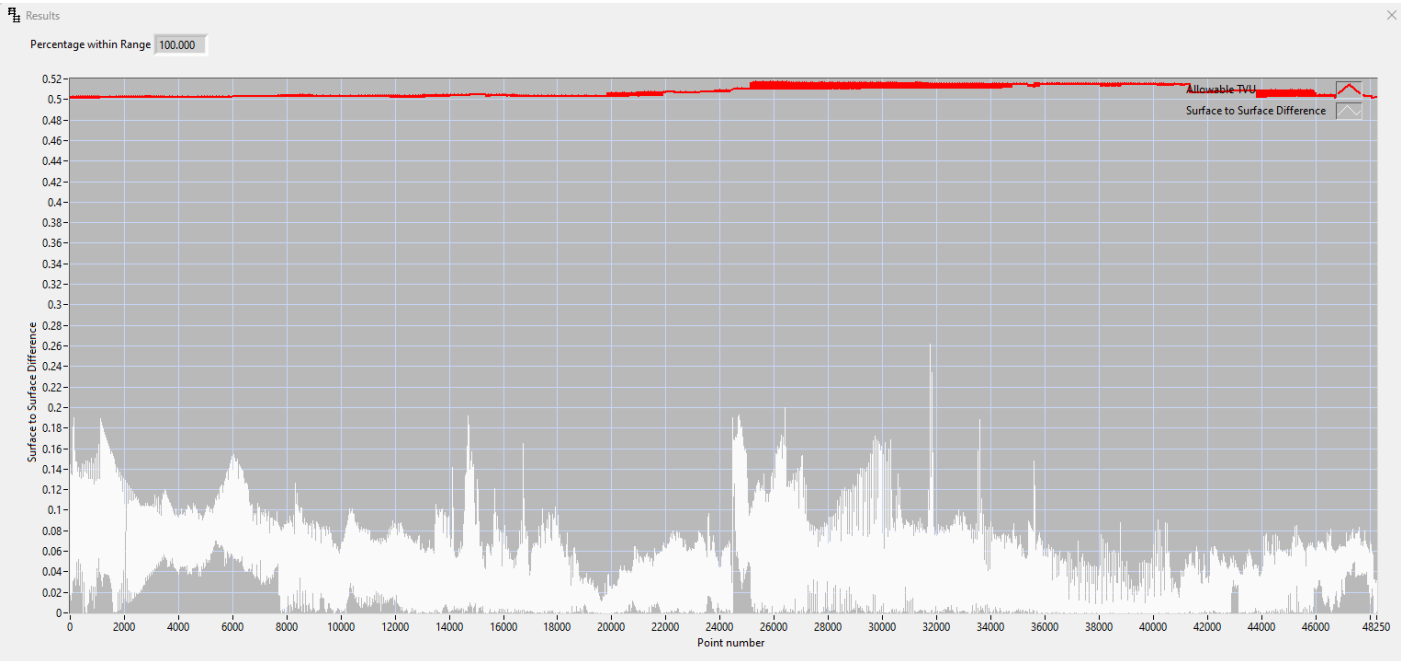
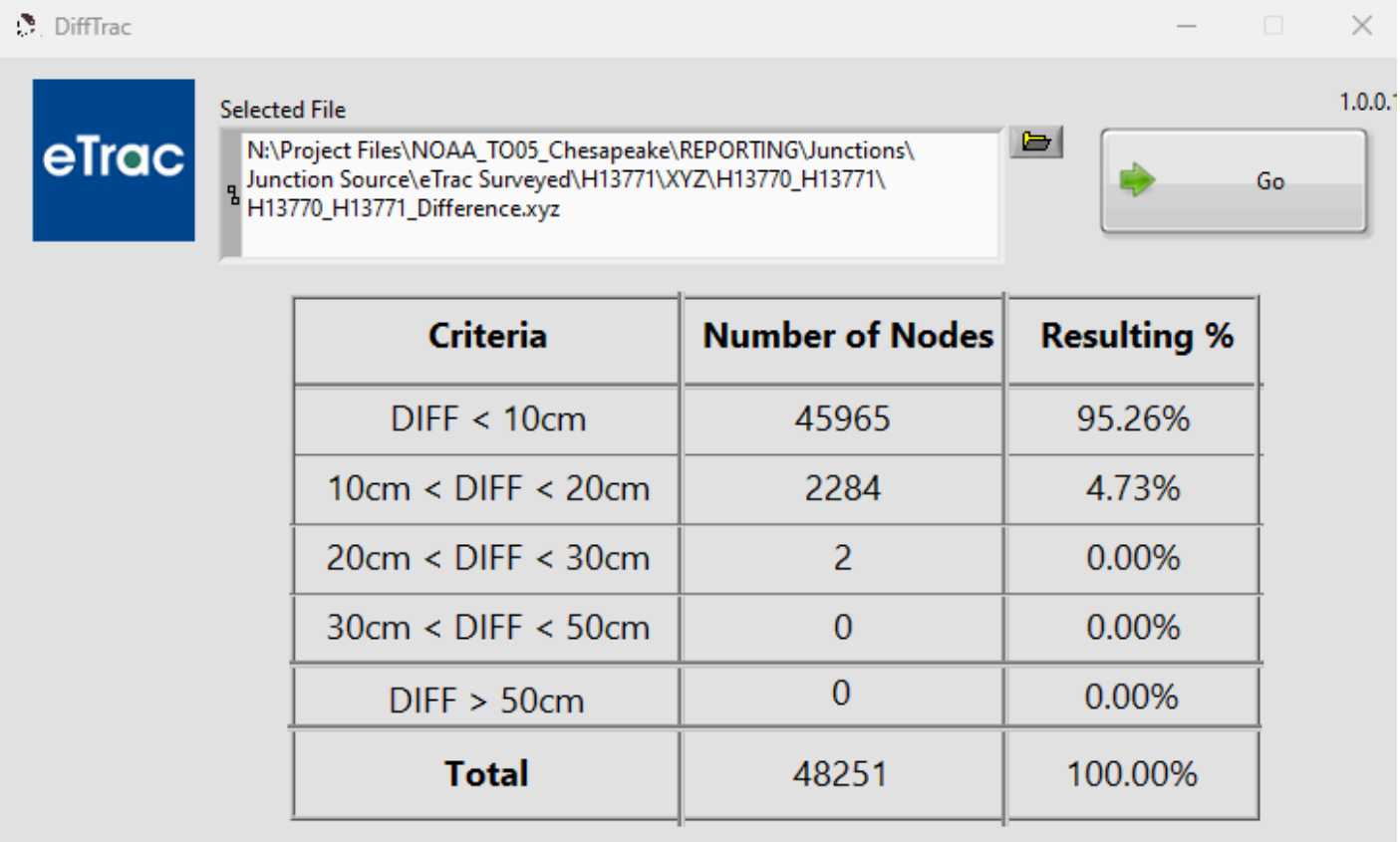


Figure 9: H13771 - H13770 Junction Comparison



Criteria	Number of Nodes	Resulting %
DIFF < 10cm	45965	95.26%
10cm < DIFF < 20cm	2284	4.73%
20cm < DIFF < 30cm	2	0.00%
30cm < DIFF < 50cm	0	0.00%
DIFF > 50cm	0	0.00%
Total	48251	100.00%

Figure 10: H13771 - H13770 Difference Statistics

H11653

The junction comparison was performed using all overlapping data between H13771 and H11653. Below is a histogram of junction comparison statistics showing the difference between the junctioning surfaces and allowable TVU as well as difference statistics. 100% of nodes were within allowable TVU.

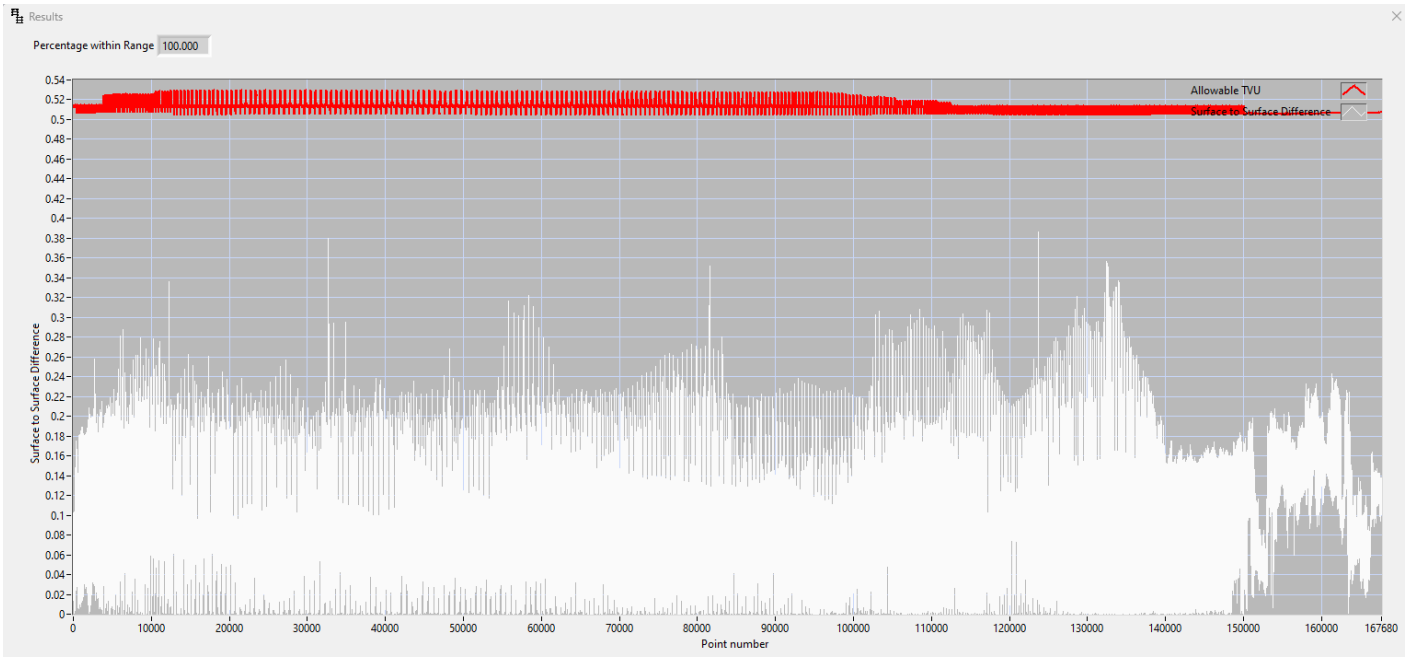


Figure 11: H13771 - H11653 Junction Comparison

DiffTrac

1.0.0.1

Selected File

D:\CHESAPEAKE\REPORTING\Junctions\H13771_H11653\
H13771_H11653_Difference_1m.xyz

Go

Criteria	Number of Nodes	Resulting %
DIFF < 10cm	108156	64.50%
10cm < DIFF < 20cm	55668	33.20%
20cm < DIFF < 30cm	3811	2.27%
30cm < DIFF < 50cm	46	0.03%
DIFF > 50cm	0	0.00%
Total	167681	100.00%

Figure 12: H13771 - H11653 Difference Statistics

H11654

The junction comparison was performed using all overlapping data between H13771 and H11654. Below is a histogram of junction comparison statistics showing the difference between the junctioning surfaces and allowable TVU as well as difference statistics. 90.89% of nodes were within allowable TVU.
Note: Spikes above the allowable TVU were caused by migrating bedforms.

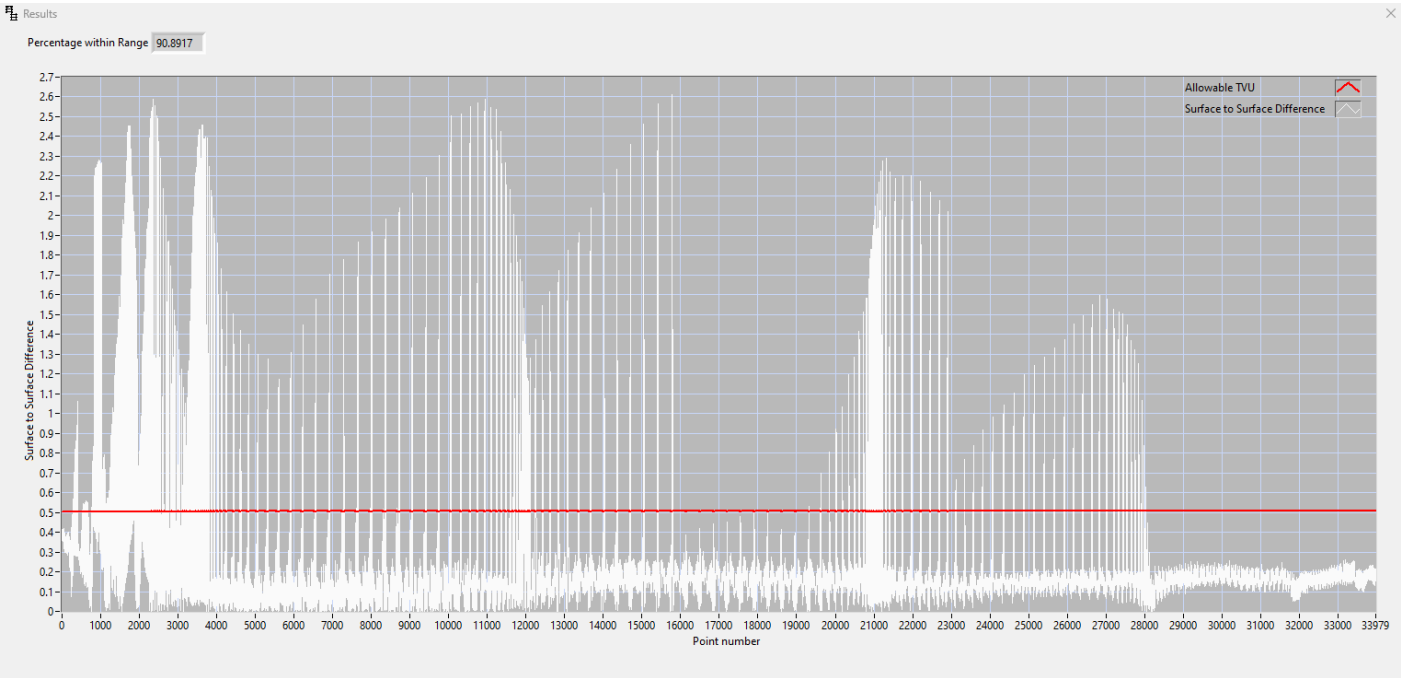
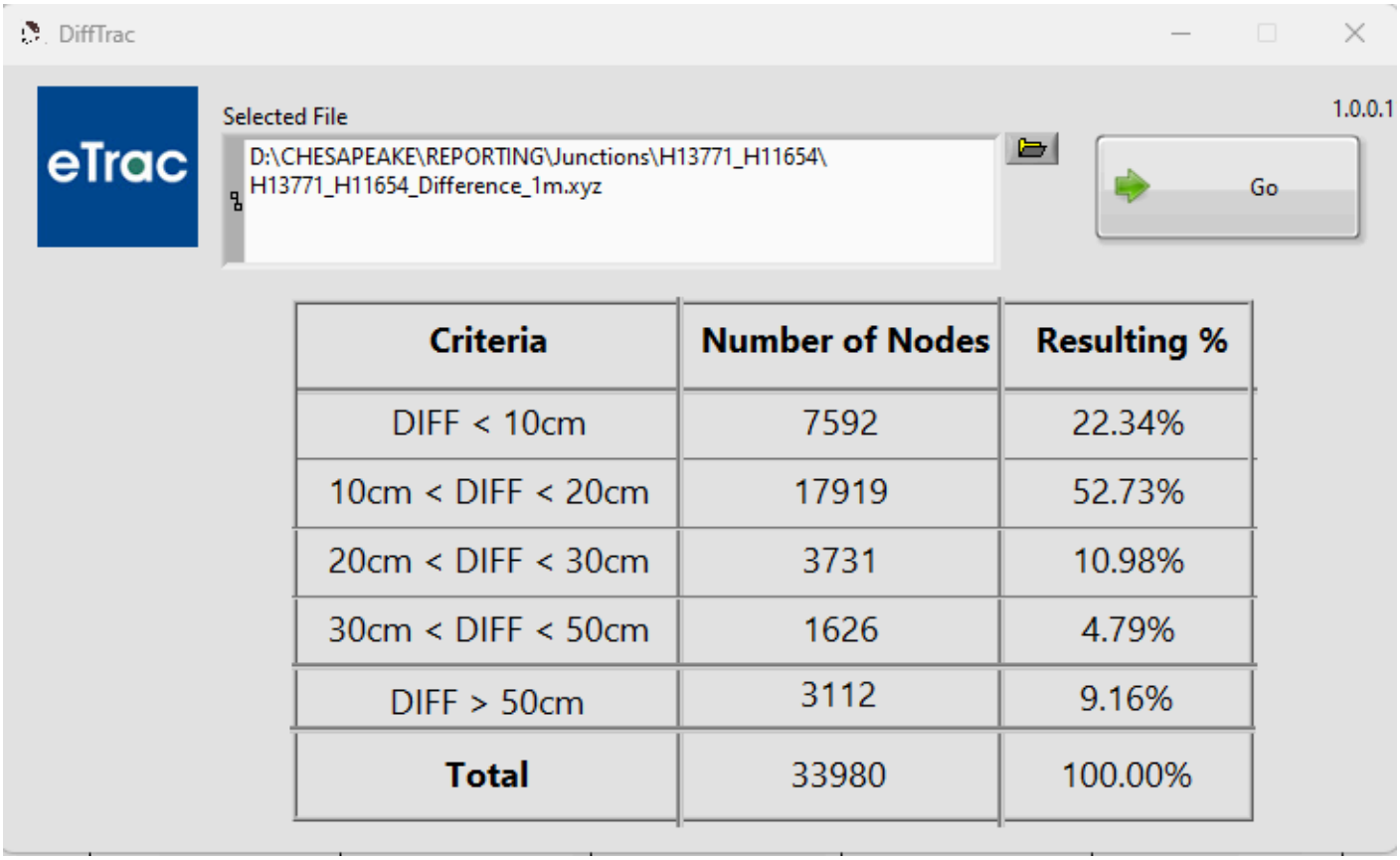


Figure 13: H13771 - H11654 Junction Comparison



Criteria	Number of Nodes	Resulting %
DIFF < 10cm	7592	22.34%
10cm < DIFF < 20cm	17919	52.73%
20cm < DIFF < 30cm	3731	10.98%
30cm < DIFF < 50cm	1626	4.79%
DIFF > 50cm	3112	9.16%
Total	33980	100.00%

Figure 14: H13771 - H11654 Difference Statistics

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

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: SVP casts were generally taken every 2 hours. Occasionally casts would exceed a 2 hour frequency, however would never exceed a 4 hour frequency.

On R/V Endeavor, R/V Pulse, R/V Spectrum, R/V Taku, and R/V Voxel casts were applied in QPS Qinsy acquisition software at the time of the cast. Surface SVP measured at 1Hz was compared to surface speed from the current profile in real-time. If the surface velocity comparison was in excess of 2m/s at any time during survey operations, a new cast was taken.

Surface sound speeds were compared in real-time and profile to profile for each cast on the vessel. Additionally, the processor reviewed profiles in Qimera to remove spurious readings within a cast, compare day-to-day casts, and to check distribution over the surveyed area, in order to better understand trends for efficient acquisition planning.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Data Density Evaluation

In order to determine if the density of the data met the specified 5 soundings per node, data density was evaluated using DensityTrac in the AmiTrac program, developed in-house by eTrac. Each finalized CUBE weighted dynamic surface's nodes were exported to a BBH file. The BBH file was then loaded into the DensityTrac program and density statistics were computed.

For H13771 the following percentages represent the results of the density query:

Complete Coverage MBES (Finalized 1m CUBE weighted Dynamic Surface) = 99.01% of nodes are composed from at least 5 soundings.

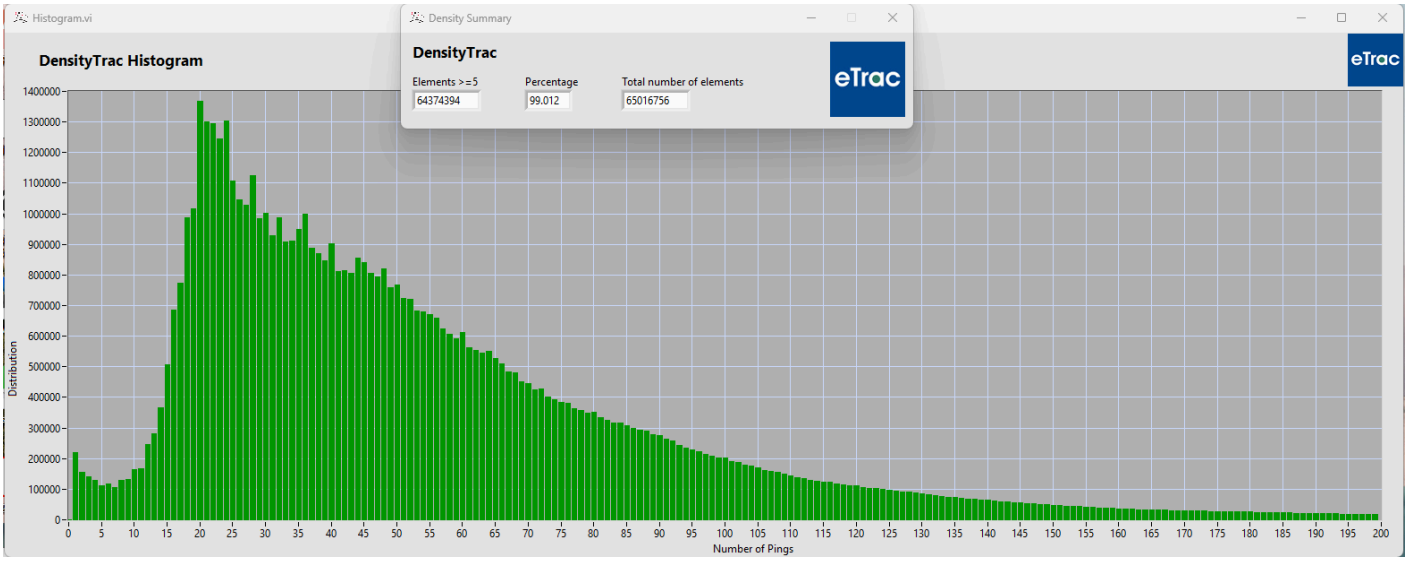


Figure 15: H13771 Finalized 1m Set Line Spacing MBES Density Distribution

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

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

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter data were collected throughout the survey and are retained in the raw DB files. Every effort was made in the field to collect quality backscatter data while maintaining the primary mandate of high quality bathymetric data. eTrac verified coverage and general quality of the backscatter data collected daily. A beam intensity window was monitored in Qinsy during acquisition to ensure backscatter data collection. Raw backscatter data were viewed in QPS FMGeocoder (FMGT) to further confirm collection criteria had been met. After MBES data was fully processed and cleaned in Qimera, GSF files were exported and brought into FMGT and processed into backscatter mosaics grouped by acoustic frequency and survey system.

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

Feature Object Catalog, NOAA Profile Version 2022 was used only in CARIS. Qimera was used as the primary processing software.

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
H13771_MB_1m_MLLW_Final	BAG	1 meters	0.55 meters - 25.05 meters	NOAA_1m	Complete MBES
H13771_MBAB_2m_EN_400kHz_1of5	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13771_MBAB_2m_PU_400kHz_2of5	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13771_MBAB_2m_SP_400kHz_3of5	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13771_MBAB_2m_TA_400kHz_4of5	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13771_MBAB_2m_VO_400kHz_5of5	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13771_SSSAB_1m_400kHz_1of2	SSS Mosaic	1 meters	-	N/A	100% SSS
H13771_SSSAB_1m_400kHz_2of2	SSS Mosaic	1 meters	-	N/A	200% SSS

Table 10: Submitted Surfaces

A 1m surface is provided meeting complete coverage MBES with backscatter specifications for H13771.

Note: The 1m MBES surface's depth ranges were extended past 20m to include the remaining deeper values beyond 20m to avoid creating superfluous surfaces at a lower resolution.

A 1m mosaic is provided meeting complete coverage with 100% SSS specifications for H13771.

A separate 1m mosaic is also provided meeting specifications for the 200% disproval radii.

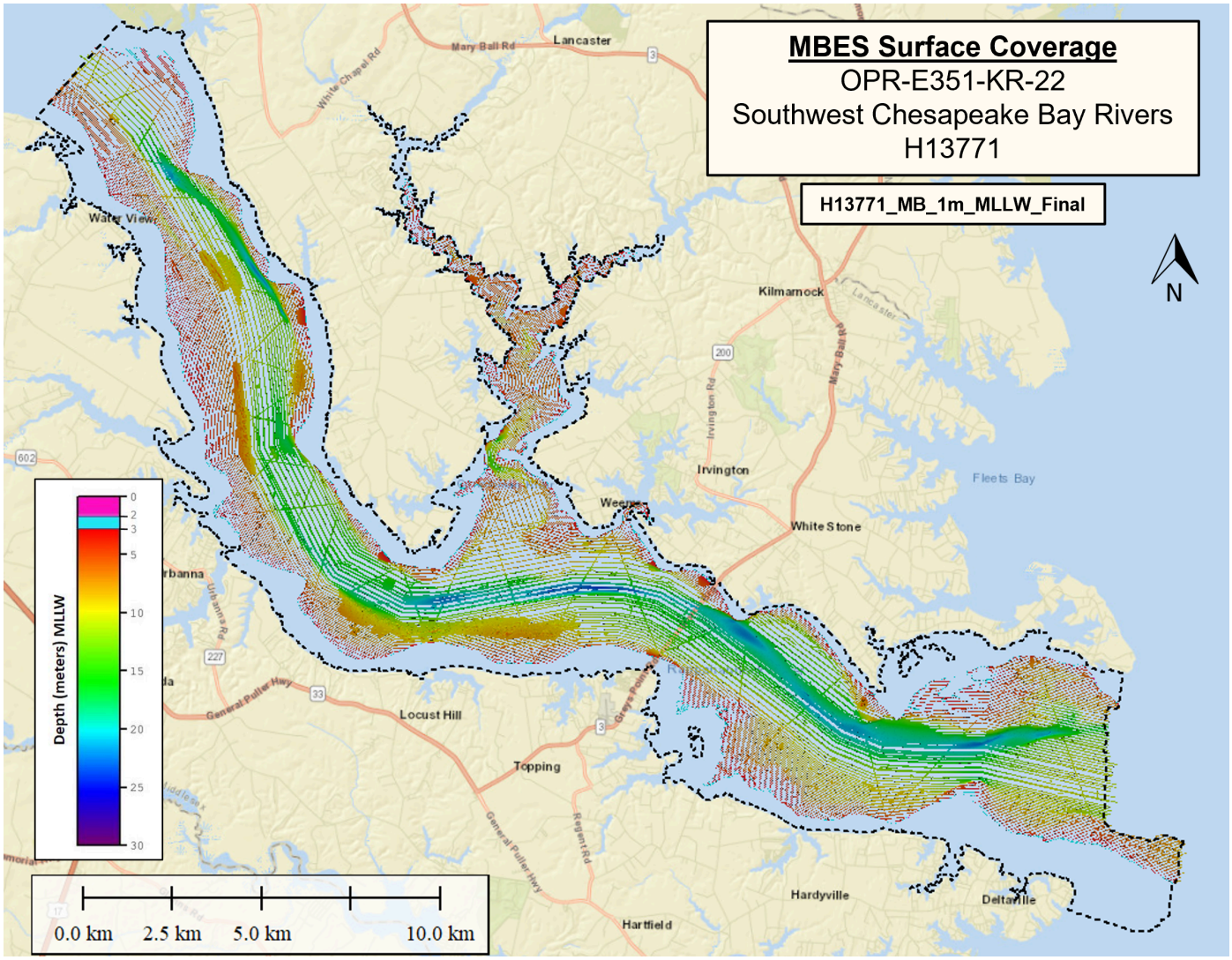


Figure 16: H13771 Finalized 1m CUBE Weighted Dynamic Surface Coverage

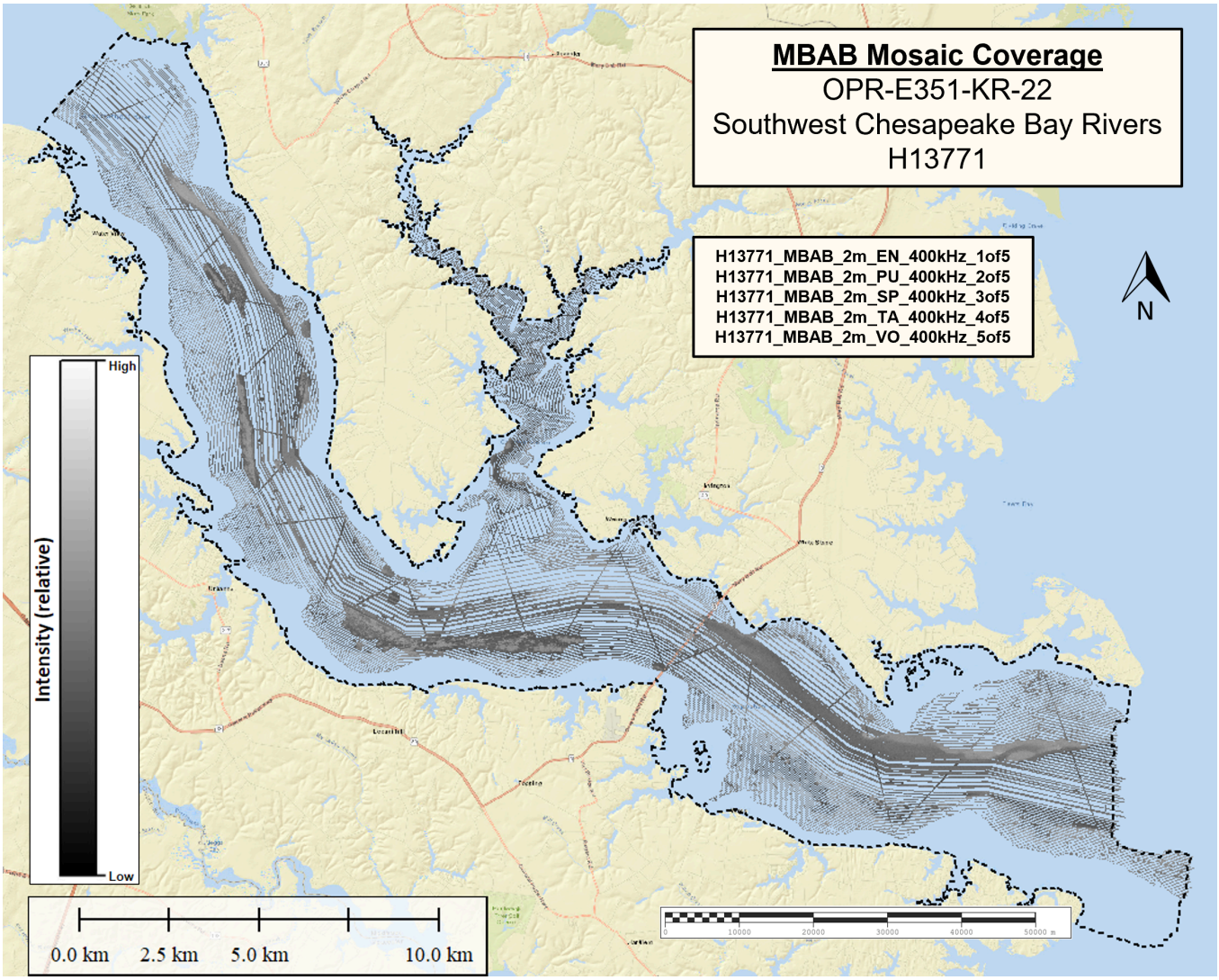


Figure 17: H13771 Finalized 2m MBAB mosaics

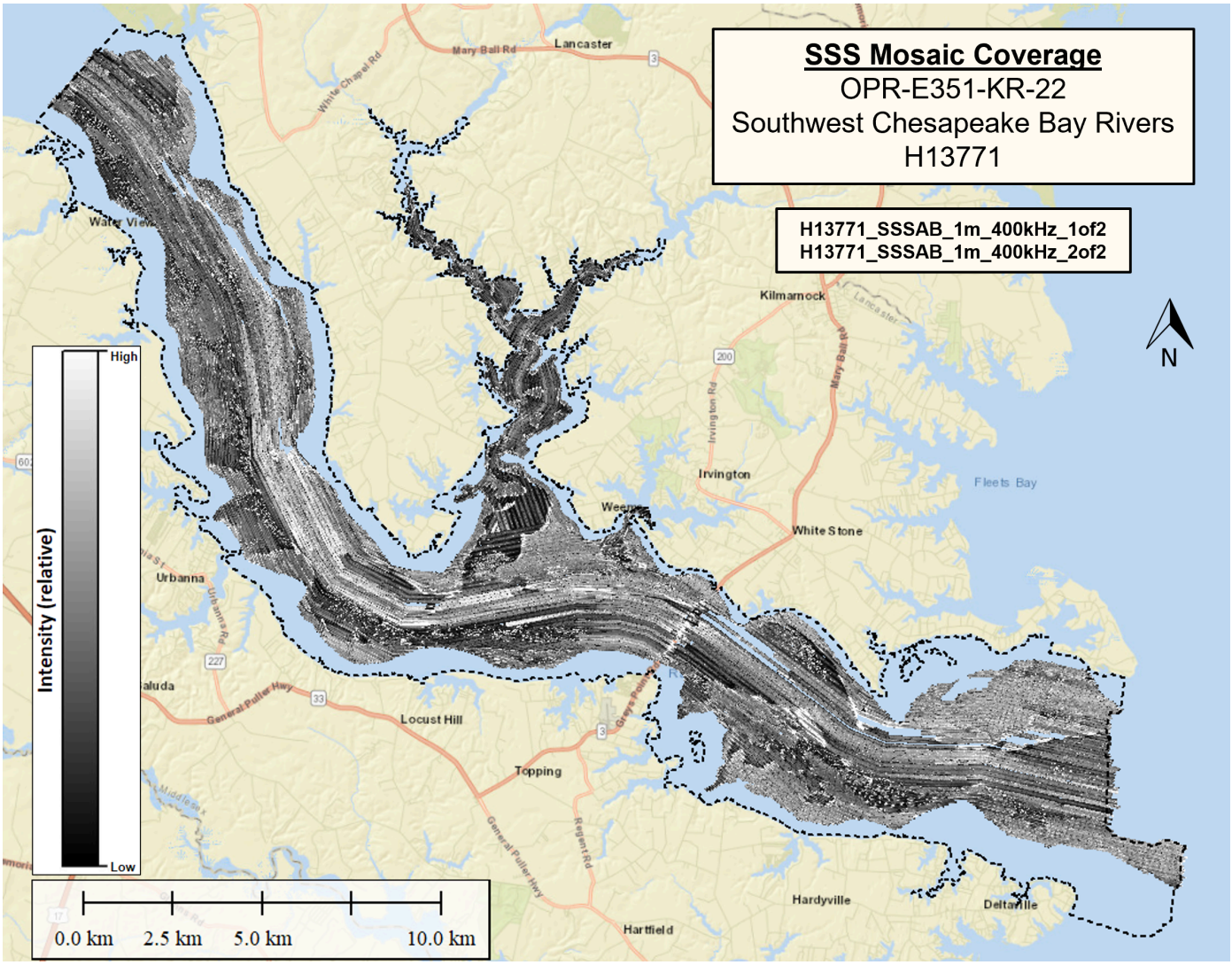


Figure 18: H13771 Finalized 1m SSS mosaic

B.5.3 Additional Task: Final Data Submission - Grids

An additional assigned task for this sheet was to include interpolated grids in Mean Lower Low Water (MLLW) and North American Vertical Datum of 1988 (NAVD88) datum.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR and 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	OPR-E351-KR-22_NAD83-MLLW.qgfvom

Table 11: ERS method and SEP file

In order to reference soundings to Mean Lower Low Water Datum, a separation model was provided by NOAA and was applied to the Qinsy DB files via a .qgfvom separation file in the acquisition software.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983 (2011).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 18.

The following PPK methods were used for horizontal control:

- RTX

Applanix PosPac MMS was utilized to post process real time positioning data utilizing Trimble's PP-RTX implementation of Trimble CenterPoint RTX to create a Smoothed Best Estimate of Trajectory (SBET).

RTK

GNSS satellite corrections were received on each vessel using either the G2+ or G4+ carrier signal from the Marinestar Global Correction System maintained by Fugro.

C.3 Additional Horizontal or Vertical Control Issues

C.3.1 Additional Task: Final Data Submission- Grids

An additional assigned task for this sheet was to include interpolated grids in North American Vertical Datum of 1988 (NAVD88) datum. In order to reference soundings to NAVD88 Datum, a separation model was provided by NOAA and was applied to the gridded MLLW data in QGIS.

D. Results and Recommendations

D.1 Chart Comparison

A chart comparison was conducted for H13771 using Pydro CA tools, Qimera, and Caris HIPS and SIPS. Survey data were compared against the largest scale ENC to accomplish the chart comparison. The largest scale ENC does not cover the entire survey boundary so two other charts were used to complete the chart comparison. Details of the ENCs used are listed below.

US5VA41M, scale: 40000, edition: 20, update application date: 12/10/2021, issue date: 12/10/2021

US5VA63M, scale: 40000, edition: 19, update application date: 01/06/2022, issue date: 03/18/2022

Throughout survey operations sounding comparisons between the charted depths and the surveyed depths were analyzed to identify depth discrepancies. Using 1 meter CUBE weighted Dynamic surfaces, soundings were generated in the "Sounding Selection" tab of Pydro CA tools. Soundings were displayed against the charted soundings and a visual comparison was made in Caris HIPS and SIPS. Additionally, potential DtoNs and discrepancies were generated using the "DTM vs Chart" tab of Pydro CA tools. The results were displayed through CA tools and investigated in CARIS HIPS and SIPS and Qimera.

An example image of the generated soundings on each chart is included below.

Results of the chart comparison are included in the following sections.

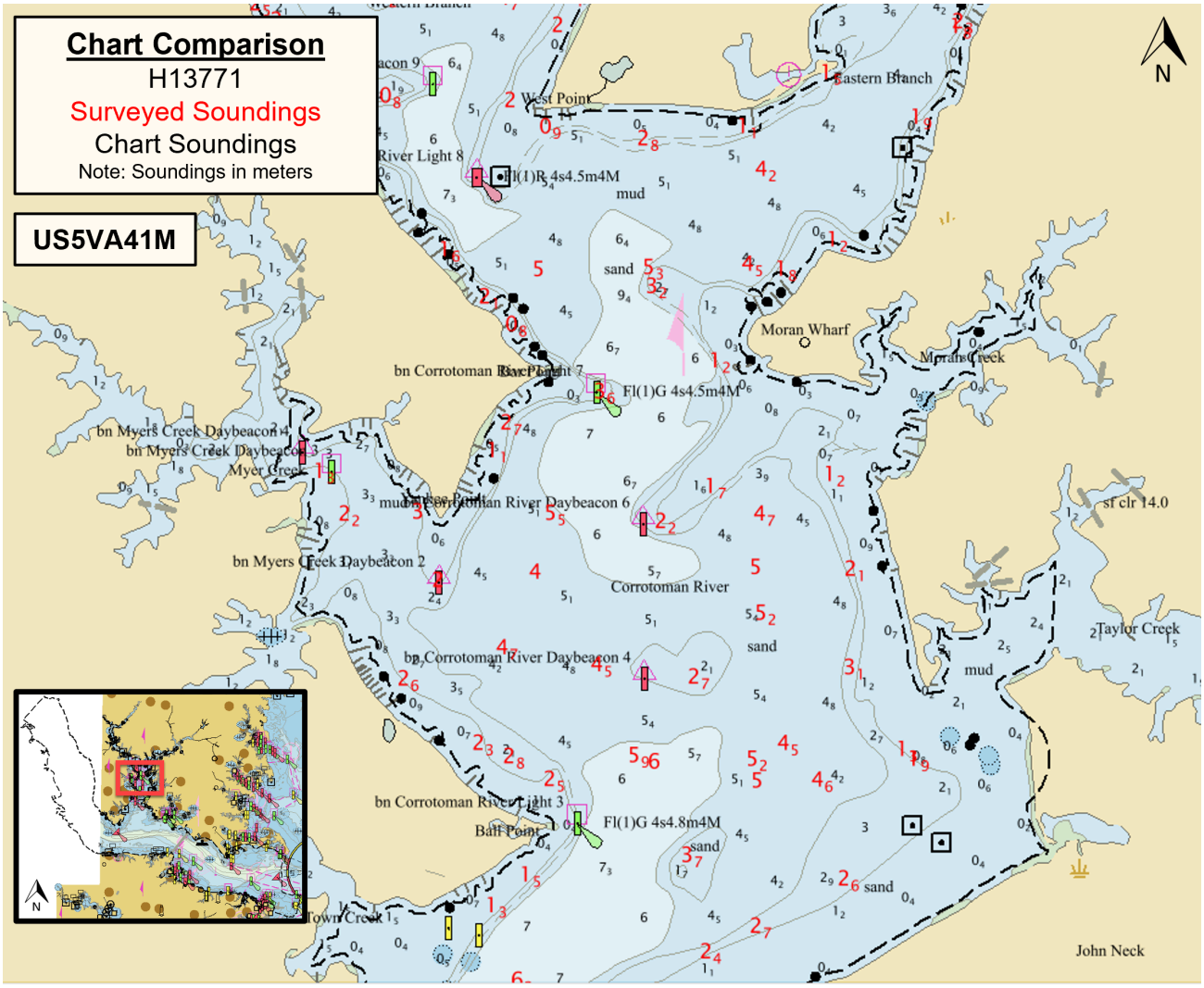


Figure 19: Generated Soundings used for Chart Comparison (US5VA41M)

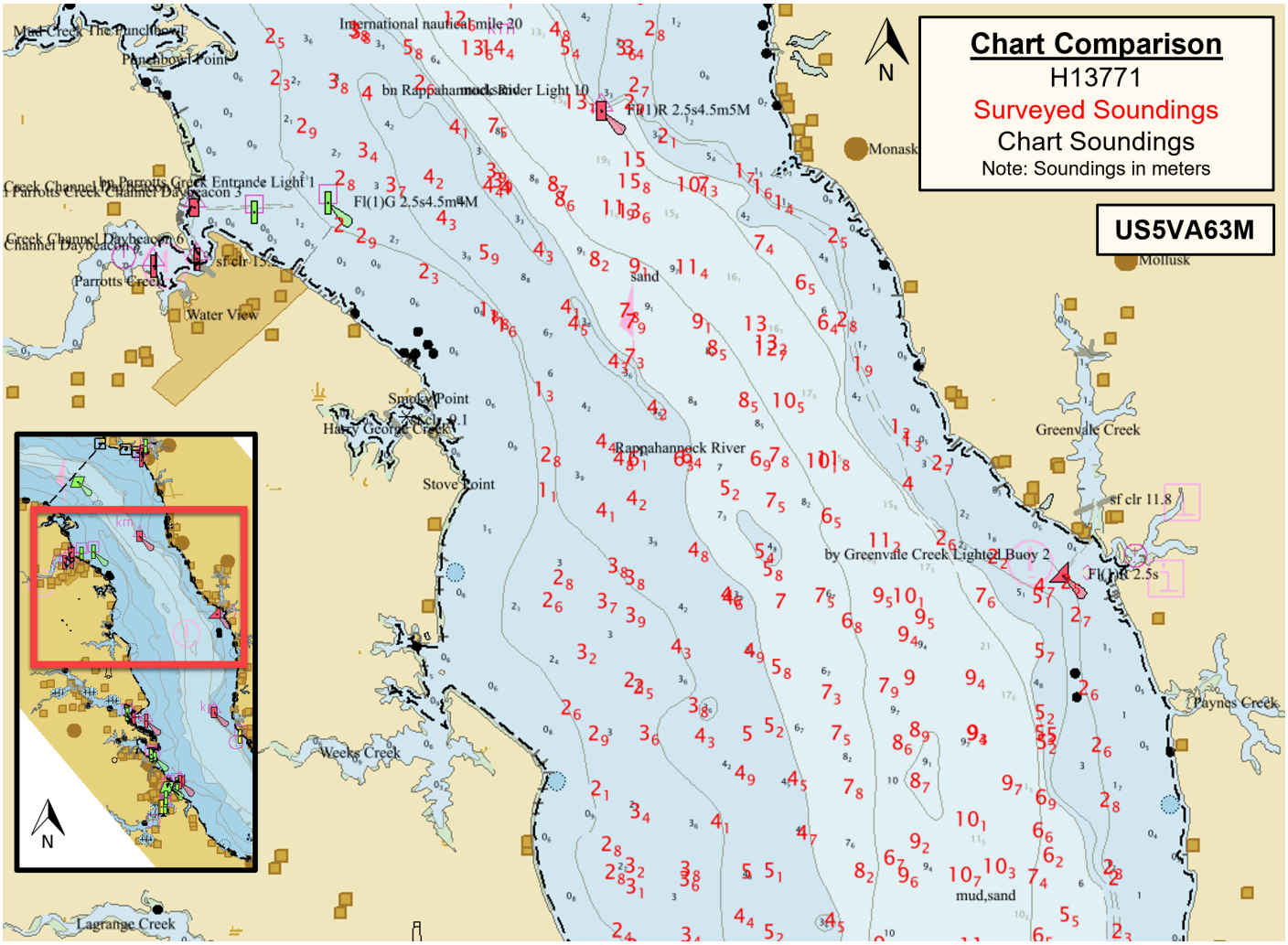


Figure 20: Generated Soundings used for Chart Comparison (US5VA63M)

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
US5VA41M	1:40000	20	12/10/2021	12/10/2021
US5VA63M	1:40000	19	01/06/2022	03/18/2022

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

There were 3 DtoNs found in H13771, and added to the Final Feature File (FFF). Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 7XXXXX). Refer to the FFF for determinations and recommendations of each feature. The DtoNs were submitted in the following Danger to navigation reports:

H13771_DtoN_01
H13771_DtoN_05-06

D.1.3 Charted Features

There were 380 charted feature assigned to H13771 that is included in the Final Feature File (FFF). Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 7XXXXX). Refer to the FFF for determinations and recommendations of each feature.

D.1.4 Uncharted Features

57 new features were found in H13771. Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 7XXXXX). Refer to the FFF for determinations and recommendations of each feature.

Note: DtoNs are not included in the number of new features in this section. DtoNs can be found separately in section D.1.2.

Note: Throughout H13771 there were temporary aids for fishing gear. These aids were not included in the FFF due to their temporary nature.

D.1.5 Channels

Broad Creek Channel and Hunton Creek Channel were assigned as a dredge areas. Neither channel was addressed as they were inshore of NALL. The dredge areas were not included in the FFF following investigation requirements.

D.2 Additional Results

D.2.1 Aids to Navigation

Throughout H13771 there were temporary aids for fishing gear. These aids were not included in the FFF due to their temporary nature. All charted AtoNs within the survey area were found to be on station. No AtoNs were reported to the U.S. Coast Guard.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

5 bottom samples were obtained in accordance with section 7.1 of the HSSD 2022 in areas designated by the field through discussions with our COR. Detailed information and images of the bottom samples are located in the Final Feature File (FFF). Each bottom sample has been given a unique identifier in the "userid" field of the .000 S-57 file (format GX).

D.2.4 Overhead Features

There were 5 overhead features assigned to H13771. Assigned overhead features were visually confirmed and no discrepancies were found. The overhead features were not included in the FFF following investigation requirements.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

There were 13 offshore platforms assigned to H13771 that are included in the Final Feature File (FFF). Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 7XXXXX). Refer to the FFF for determinations and recommendations of each feature.

D.2.7 Ferry Routes and Terminals

There was 1 Ferry Routes assigned to H13771. The feature was visually confirmed and there were no discrepancies found. The feature was not included in the FFF following investigation requirements.

D.2.8 Abnormal Seafloor or Environmental Conditions

Hundreds of circulars to oblong mounds with heights up to 3m have been identified. The mounds are found in water depths ranging from 5 to 15 meters, although 6 to 9 meters appears to be the most common depth. The individual mounds and groupings of mounds tend to be elongate in the direction of current flow with long axis length of individual mounds ranging from a few meters to hundreds of meters. Groupings of mounds can be many kilometers in length. The mounds have a significantly higher acoustic reflectivity than the surrounding riverbed. Riverbed scouring is commonly observed along the margins of mounds.

Where the Merry Point Ferry Route crosses the Corrotoman River, riverbed scouring is observed. Scouring is up to 1m deep and 25 meter wide.

Abnormal seafloor depressions were detected adjacent to the north and south ends of the Robert O Norris Jr. Bridge. The features up to 150m long and 2m deep. Based on analysis of the bathymetry and side scan data as well as a review of historic satellite photos, these features may be related to directional drilling or other marine construction methods associated with the installation of subsea utilities.

Abnormally large shifting sand waves were detected at the mouth of the Rappahannock River. Sand waves with amplitudes up to 0.5m and wavelengths up to 25m are observed to be shifting based on comparison with H11693 from 2007.

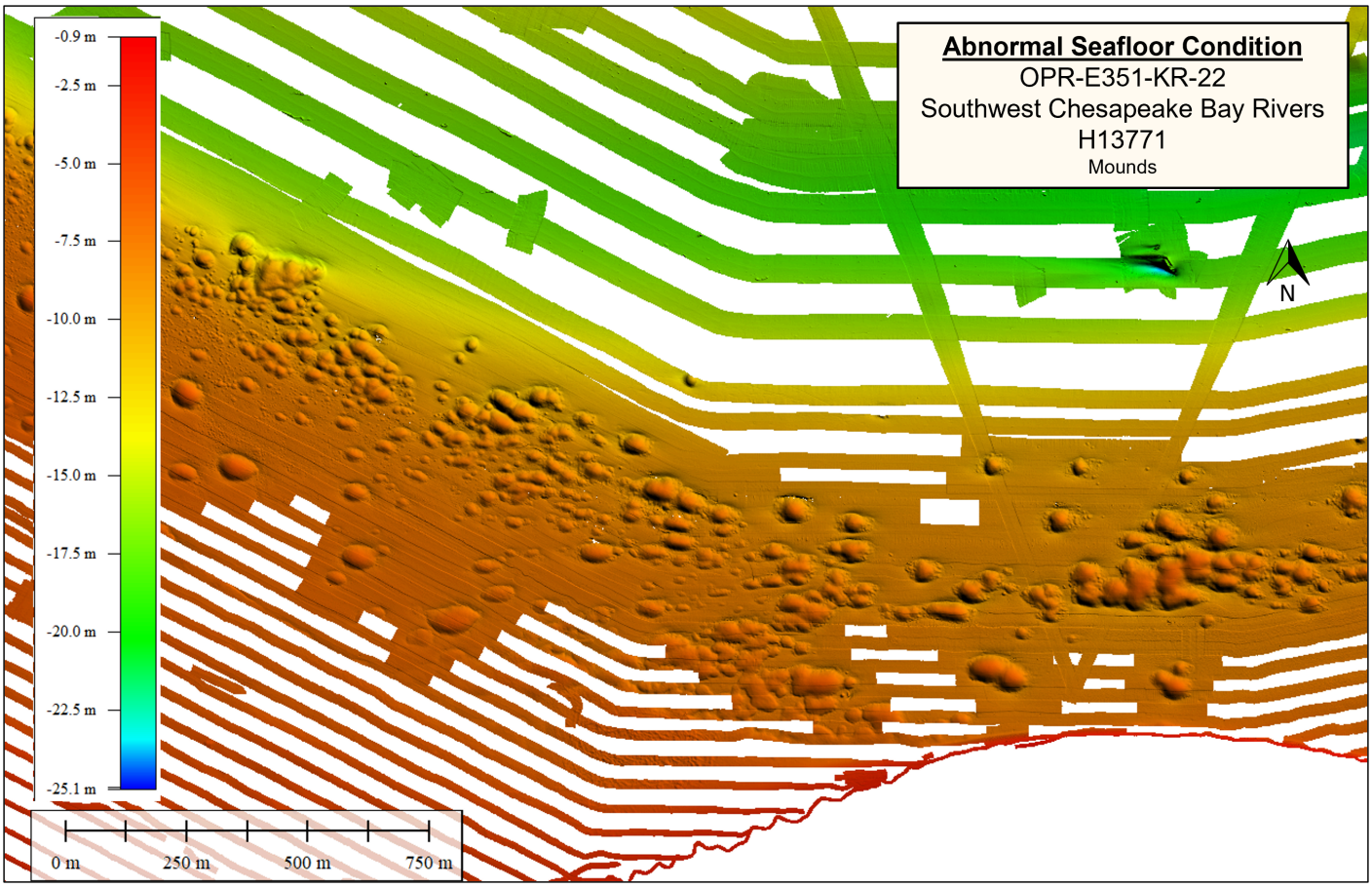


Figure 21: H13771 Abnormal Seafloor Condition - Mounds

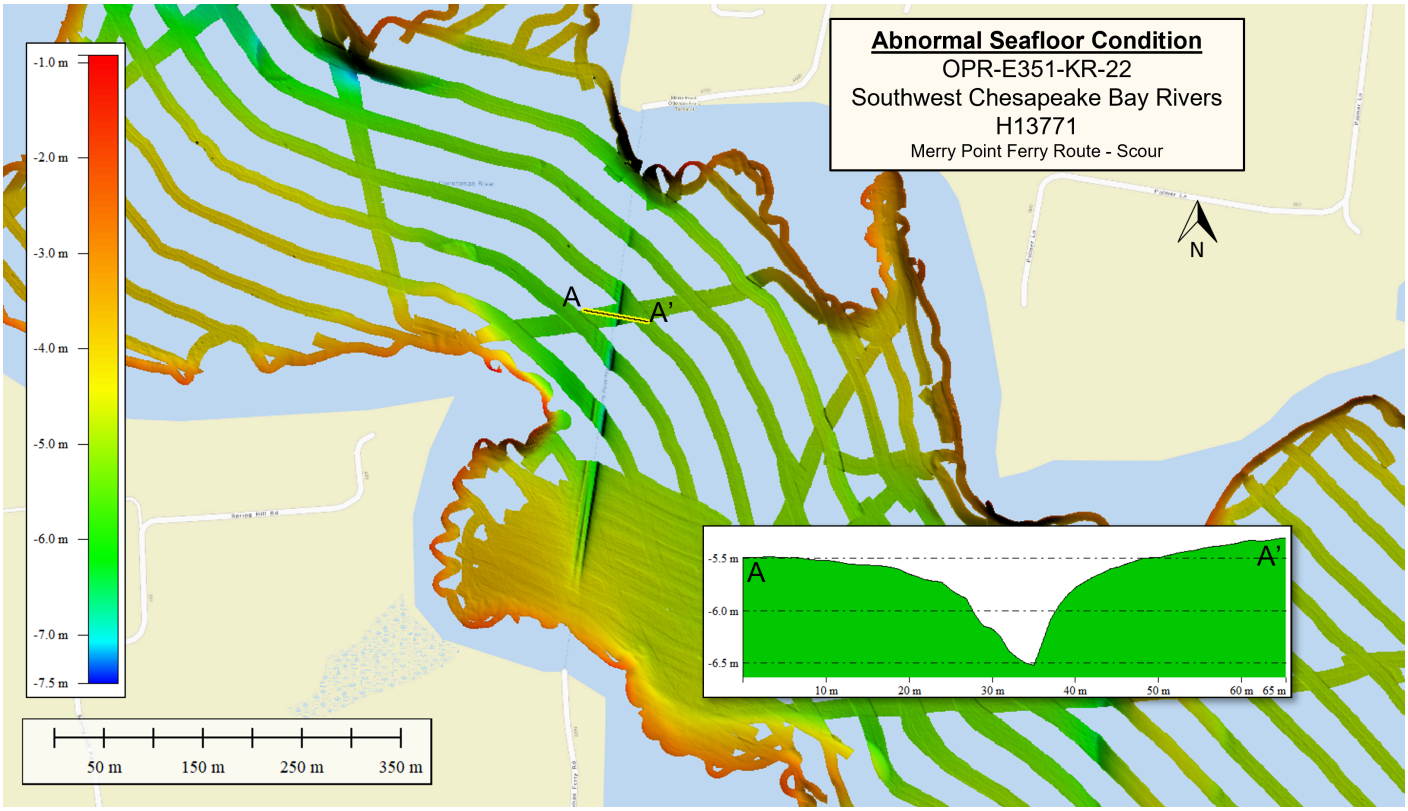


Figure 22: H13771 Abnormal Seafloor Condition - Scour

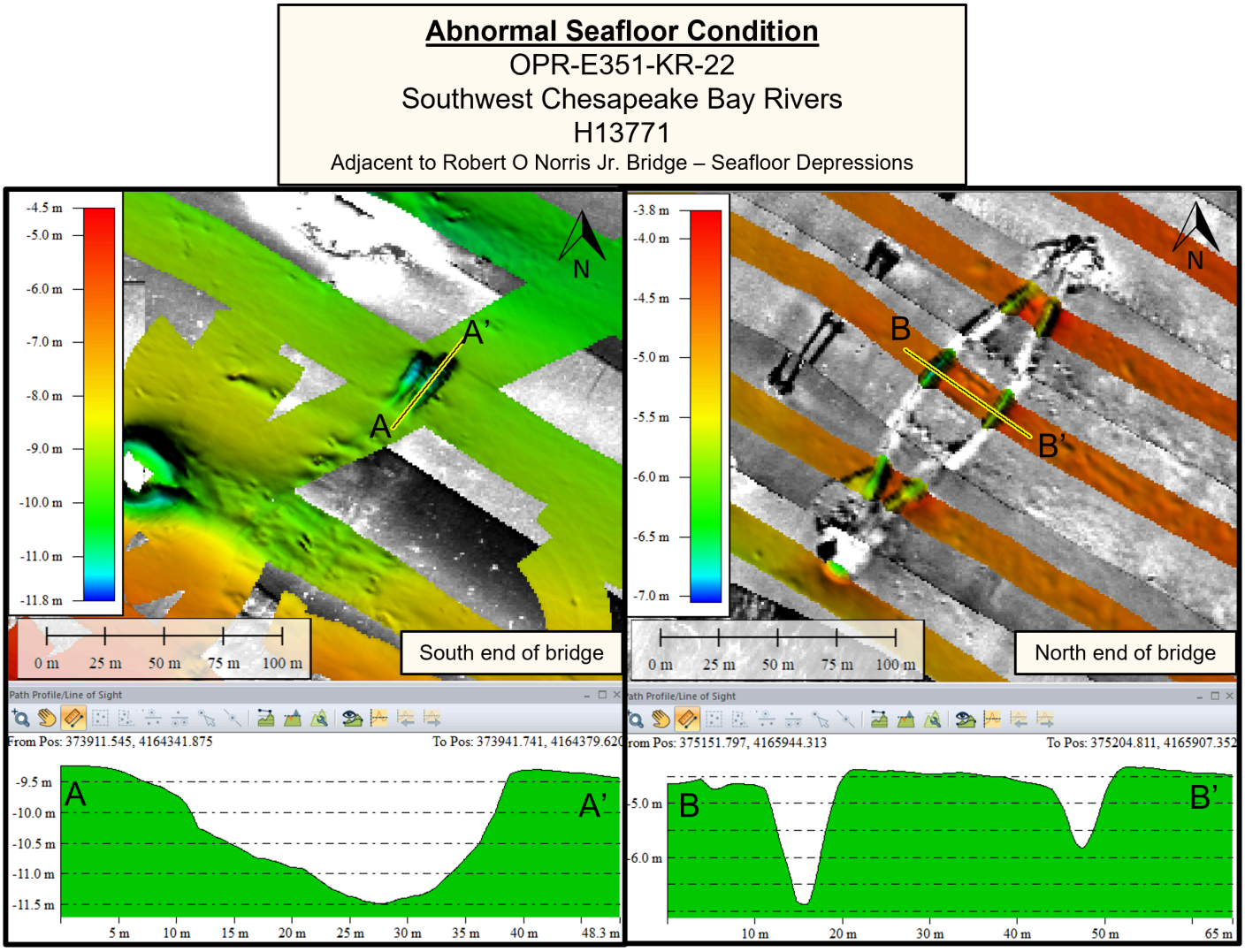


Figure 23: H13771 Abnormal Seafloor Conditions - Seafloor Depressions

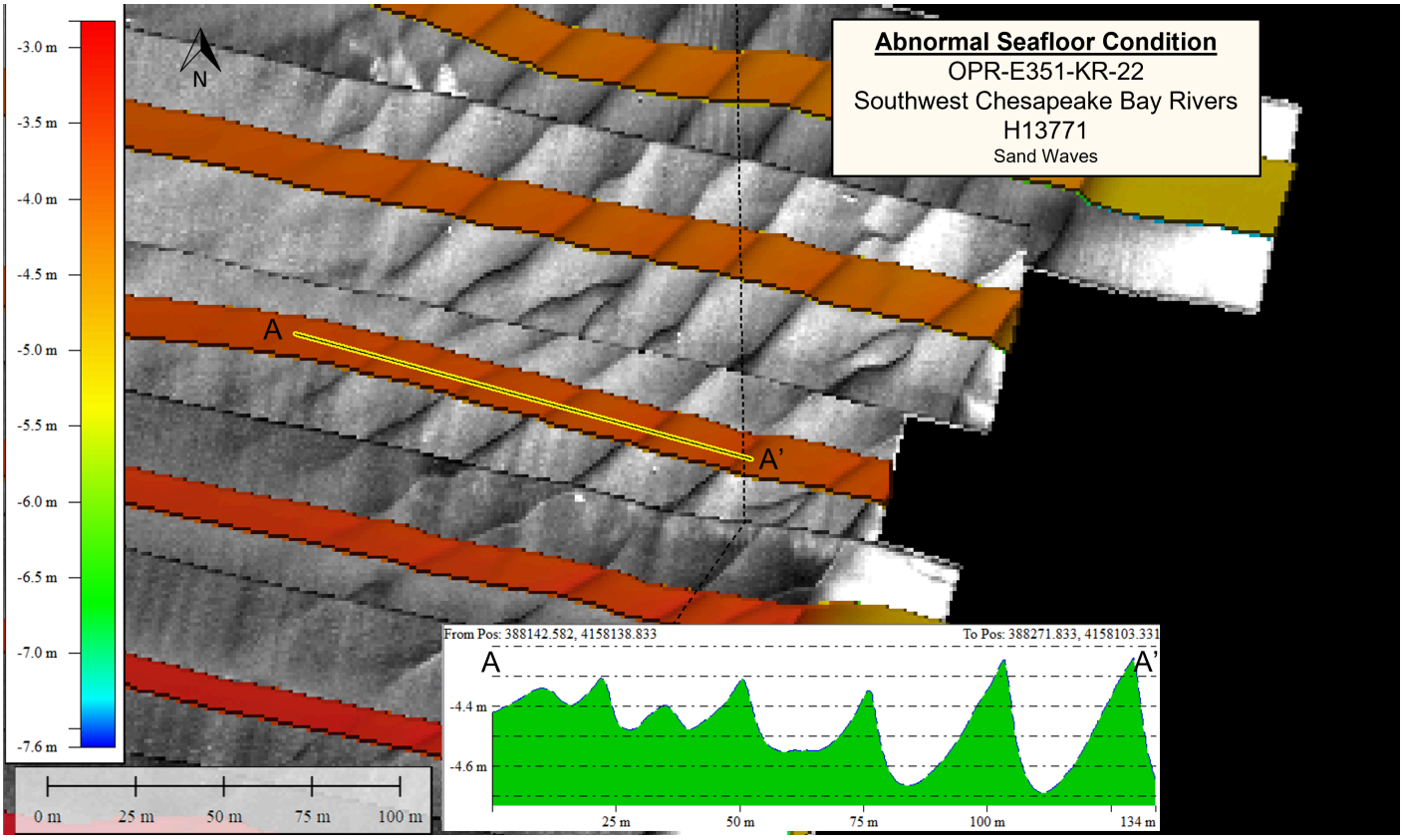


Figure 24: H13771 Abnormal Seafloor Conditions - Sand Waves

D.2.9 Construction and Dredging

There were 119 shoreline construction features assigned to H13771 that are in the Final Feature File (FFF). There was 1 new shoreline construction feature added to the FFF. Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 7XXXXX). Refer to the FFF for determinations and recommendations of each feature.

4 dredge areas were assigned to H13771. The Hunton Creek Channel, Greenvale Creek (Outer), Broad Creek Channel, and Parrotts Creek Channel were not addressed as they were all beyond th NALL.

D.2.10 New Survey Recommendations

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

D.2.11 ENC Scale Recommendations

No new ENC scales 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 CUBE surfaces, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

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

Approver Name	Approver Title	Approval Date	Signature
David Neff, CH	Chief of Party	02/15/2024	David Neff, CH Digitally signed by David Neff, CH DN: C=US, E=dave.neff@woolpert.com, O="eTrac, A Woolpert Company", OU="eTrac, A Woolpert Company", CN="David Neff, CH" Date: 2024.02.17 00:19:18-08'00'

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