H13962

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13962

LOCALITY

State(s):	Maryland
General Locality:	Tangier Sound
Sub-locality:	Nanticoke and Wicomico Rivers

2024

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	**H13962**

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):	**Maryland**
General Locality:	**Tangier Sound**
Sub-Locality:	**Nanticoke and Wicomico Rivers**
Scale:	**20000**
Dates of Survey:	**07/06/2024 to 12/20/2024**
Instructions Dated:	**06/21/2024**
Project Number:	**OPR-E352-KR-24**
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. H13962 covers approximately 17.26 square nautical miles of Tangier Sound, Maryland.

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 H13962

Project: OPR-E352-KR-24

Locality: Tangier Sound

Sublocality: Nanticoke and Wicomico Rivers

Scale: 1:20000

July 2024 - December 2024

eTrac

Chief of Party: David Neff, C.H.

A. Area Surveyed

eTrac conducted hydrographic survey operations in Tangier Sound, Maryland. H13962 covers approximately 17.26 square nautical miles of survey area in the Nanticoke and Wicomico Rivers. 1679.31 linear nautical miles were acquired during the survey.

Survey was conducted within these limits between July 6, 2024 (DN188) and December 20, 2024 (DN355).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
38° 38' 14.7" N 76° 8' 8.35" W	38° 11' 44.42" N 75° 36' 14.71" W

Table 1: Survey Limits

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

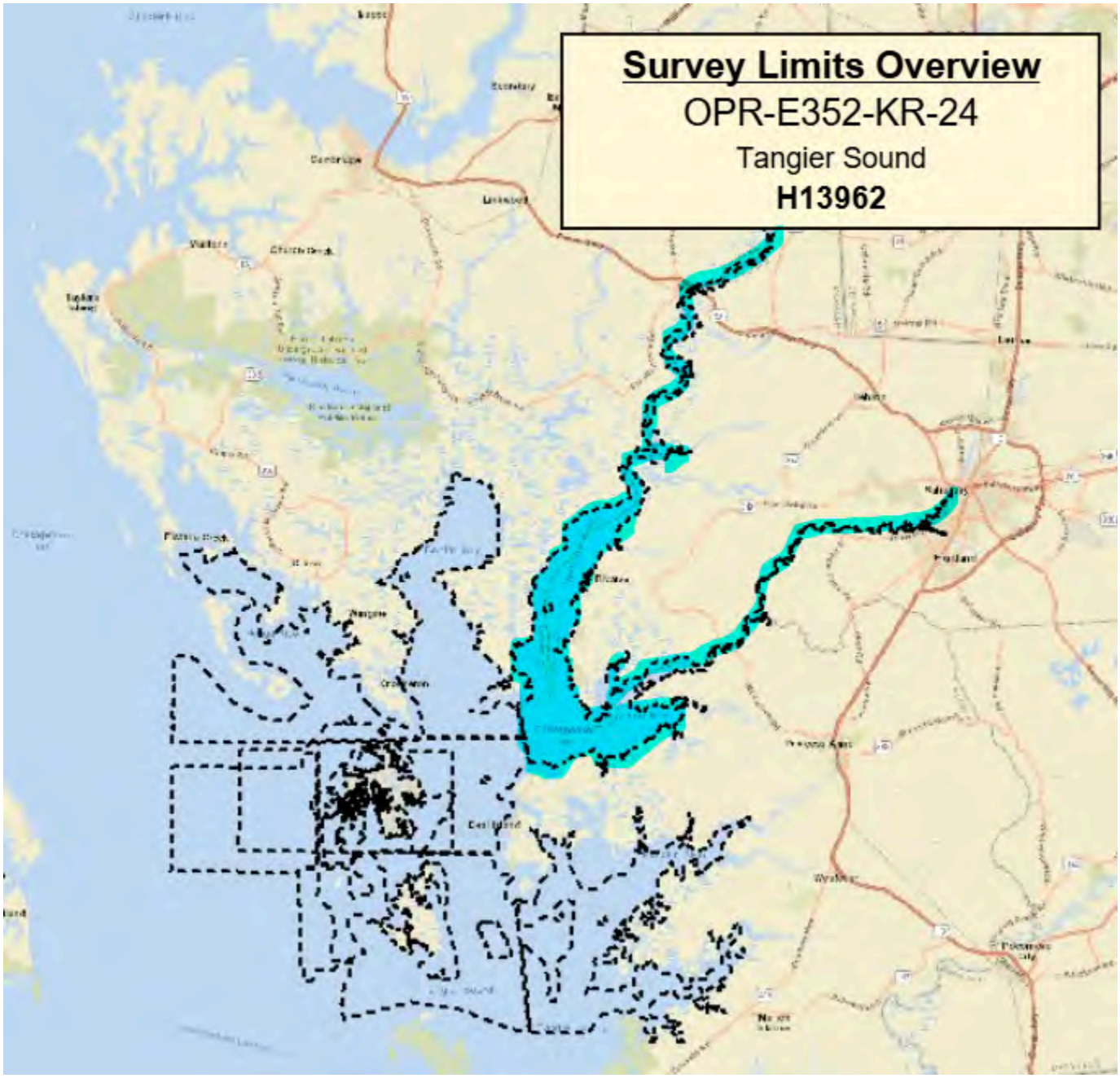


Figure 1: Survey Limits Overview (light blue area)

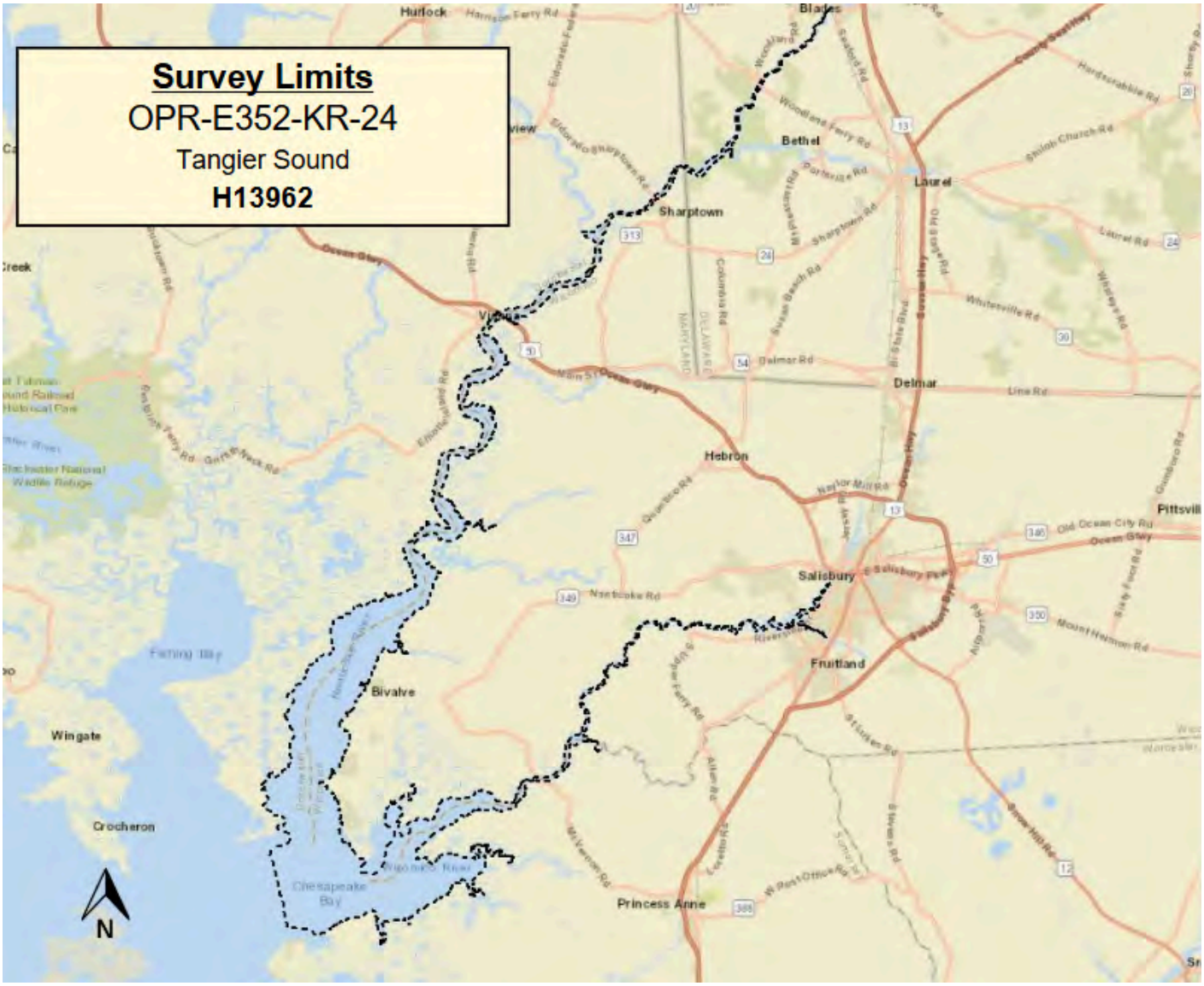


Figure 2: Survey Limits (black line)

A.2 Survey Purpose

The principal objective of the Tangier Sound project is manifold. This survey will provide NOAA's National Water Center with bathymetric data to support hydrodynamic modeling efforts. The data from this project will provide modern bathymetry for updating NOAA nautical charting products, improving the safety of maritime traffic and commerce, as well as supporting the Seabed 2030 global mapping initiative. This survey will also contribute to the ongoing underwater archaeological exploration and investigation efforts of the USACE Oyster Habitat Preservation and Restoration working group.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey H13962 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
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

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.

Gaps in complete survey coverage exist due to the presence of transportation infrastructure that prevent the collection of data up to the NALL.

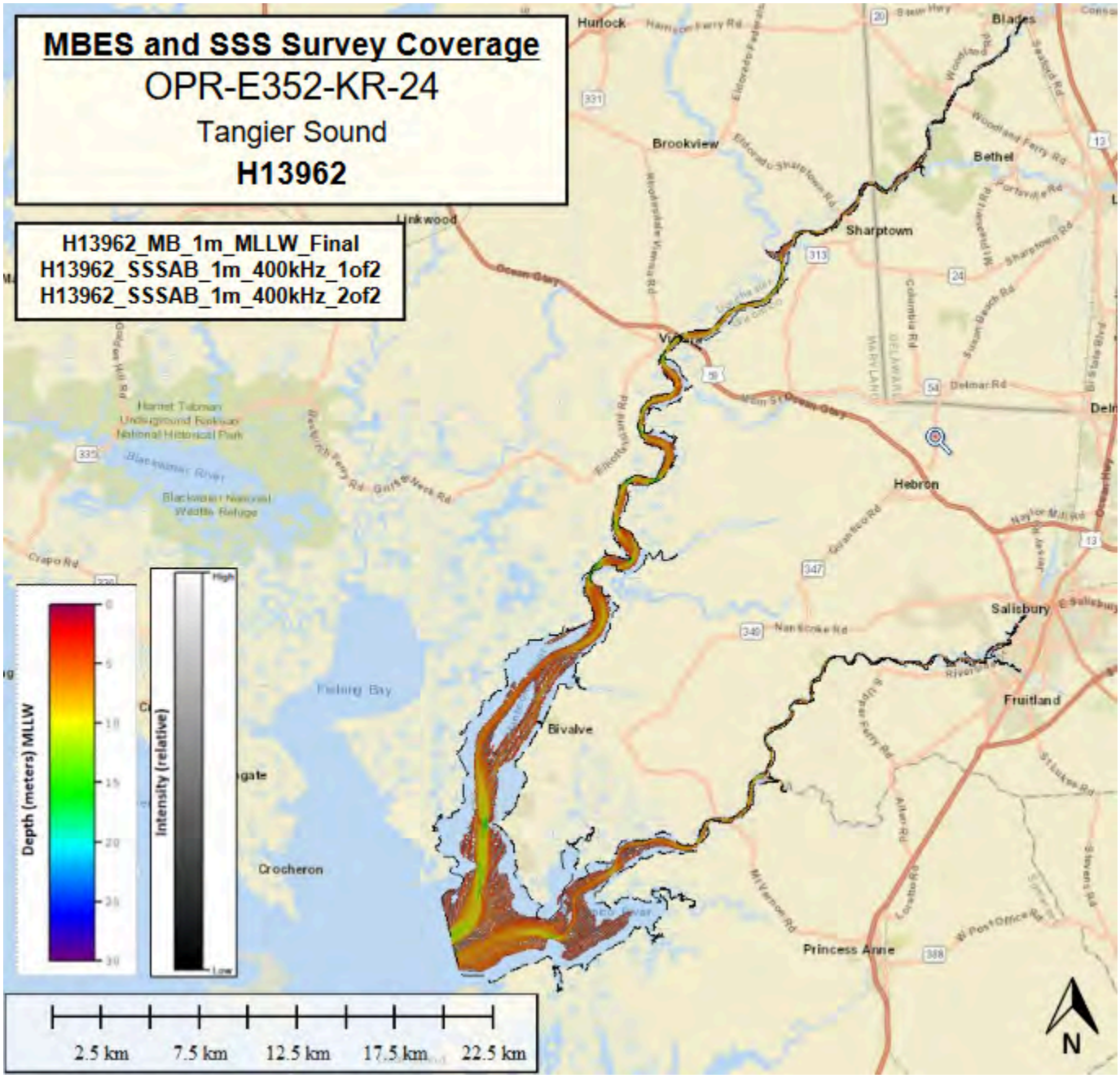


Figure 3: Survey Coverage with combined MBES and SSS

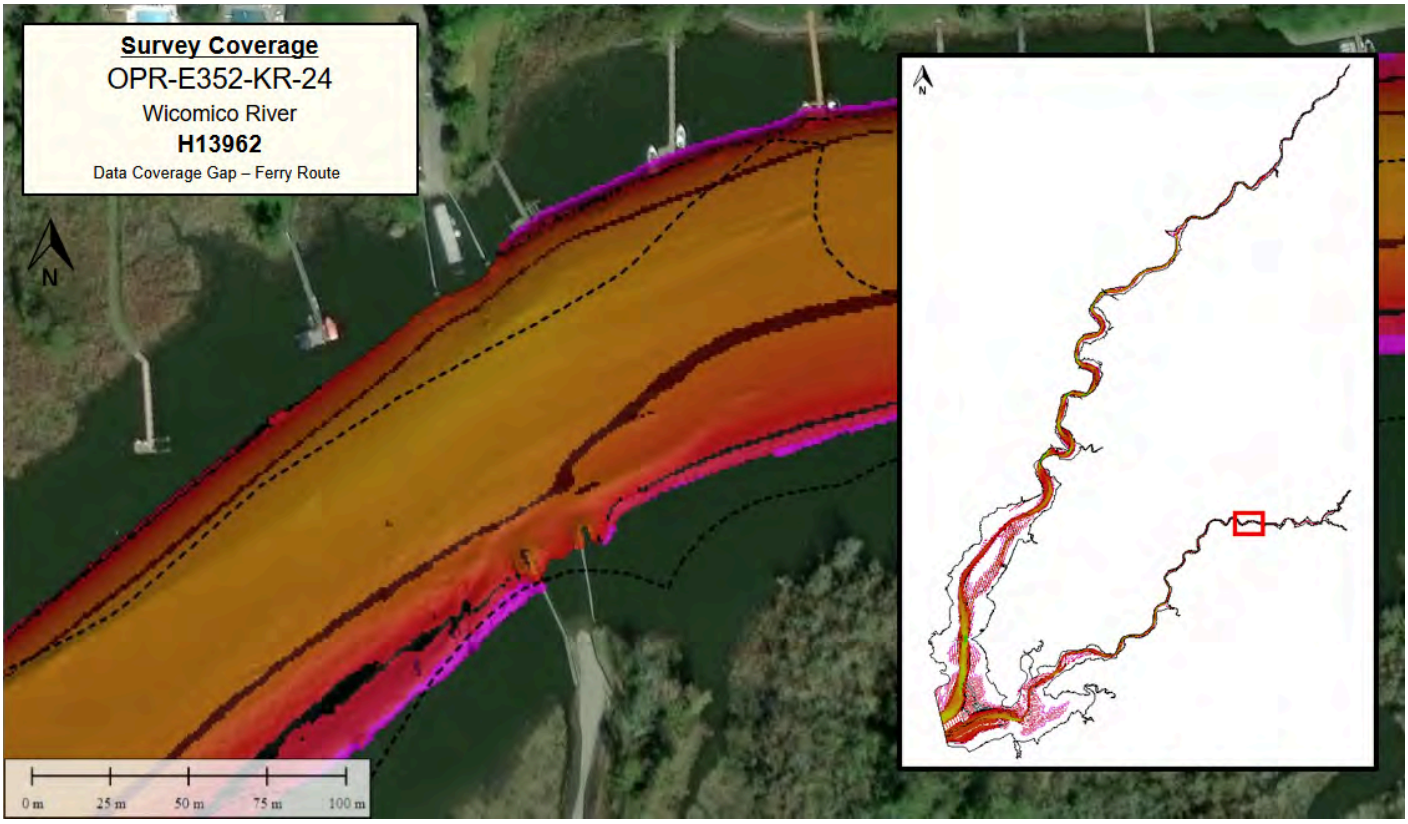


Figure 4: Data Coverage Gap caused by Ferry Infrastructure

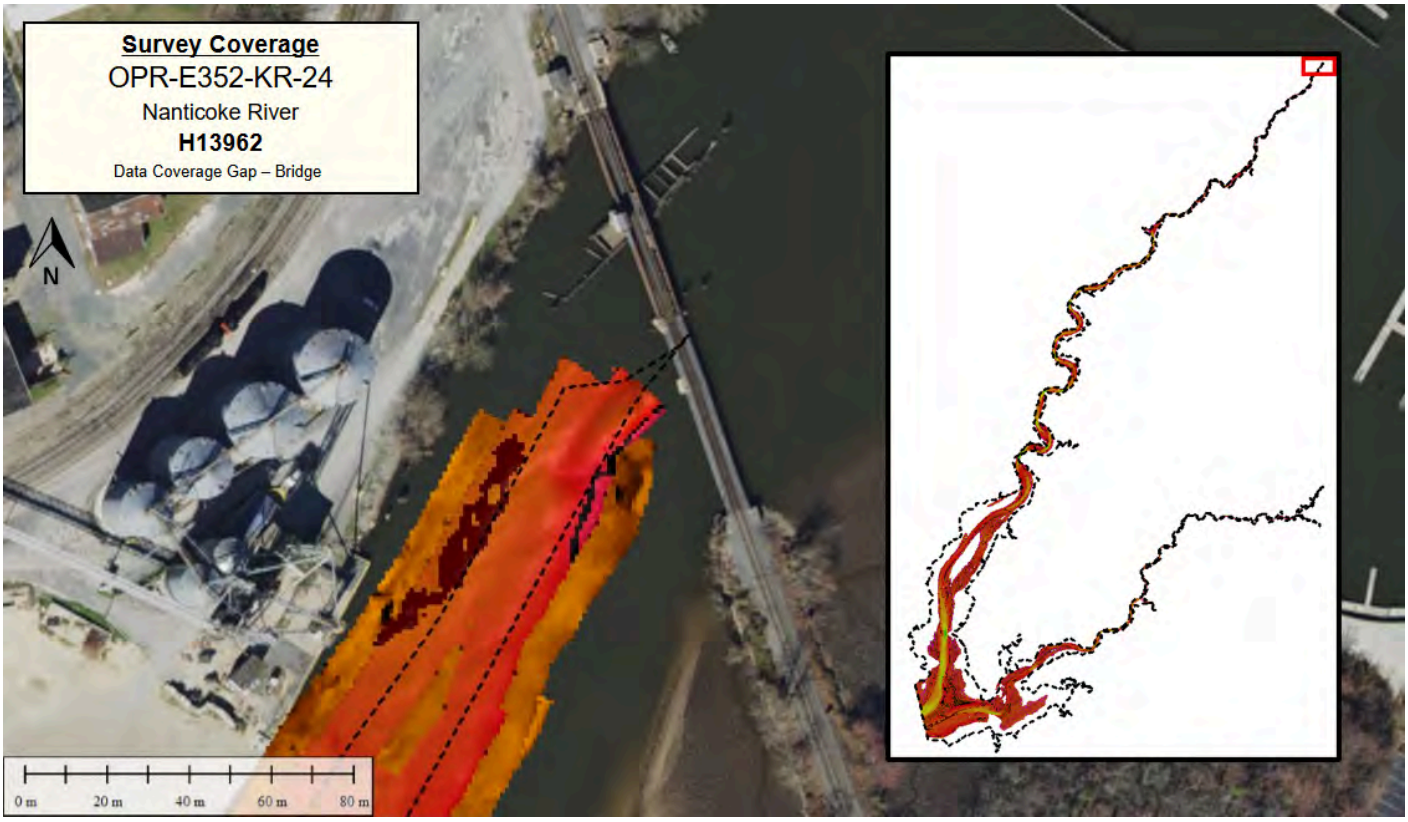


Figure 5: Data Coverage Gap caused by Nanticoke River Movable Railroad Bridge

A.6 Survey Statistics

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

	HULL ID	*R/V Thunder*	*Current*	*Pulse*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0	0.0
	MBES Mainscheme	735.97	0.0	0.0	735.97
	Lidar Mainscheme	0.0	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	229.57	648.37	877.94
	SBES/MBES Crosslines	0.0	47.05	18.35	65.4
	Lidar Crosslines	0.0	0.0	0.0	0.0
Number of Bottom Samples					8
Number Maritime Boundary Points Investigated					0
Number of DPs					0
Number of Items Investigated by Dive Ops					0
Total SNM					17.26

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/06/2024	188

Survey Dates	Day of the Year
07/07/2024	189
07/10/2024	192
07/11/2024	193
07/12/2024	194
07/13/2024	195
08/02/2024	215
08/03/2024	216
08/04/2024	217
08/05/2024	218
08/07/2024	220
08/17/2024	230
08/18/2024	231
08/23/2024	236
08/24/2024	237
08/31/2024	244
09/01/2024	245
09/02/2024	246
09/08/2024	252
09/18/2024	262
09/19/2024	263
09/20/2024	264
09/21/2024	265
09/23/2024	267
09/24/2024	268
09/25/2024	269
09/27/2024	271
09/28/2024	272
10/09/2024	283
10/10/2024	284
10/11/2024	285
10/12/2024	286
10/13/2024	287

Survey Dates	Day of the Year
10/15/2024	289
10/16/2024	290
10/17/2024	291
10/20/2024	294
10/21/2024	295
10/22/2024	296
10/23/2024	297
10/24/2024	298
10/25/2024	299
10/26/2024	300
10/31/2024	305
11/01/2024	306
11/04/2024	309
11/05/2024	310
11/06/2024	311
12/02/2024	337
12/03/2024	338
12/04/2024	339
12/05/2024	340
12/06/2024	341
12/07/2024	342
12/08/2024	343
12/09/2024	344
12/10/2024	345
12/12/2024	347
12/13/2024	348
12/16/2024	351
12/17/2024	352
12/19/2024	354
12/20/2024	355

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	*Current*	*Pulse*	*R/V Thunder*
LOA	7.6 meters	7.3 meters	21.3 meters
Draft	0.6 meters	0.6 meters	0.8 meters

Table 5: Vessels Used

Current is a 7.6 meter ribbed safeboat equipped with a Universal Sonar Mount (USM) starboard multibeam pole mount and davit.

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

The R/V Thunder is a 21.3 meter aluminum catamaran equipped with two Universal Sonar Mount High-Tower (USMHT) over-the-side sonar pole mounts.

B.1.2 Equipment

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

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

Table 6: Major Systems Used

Note: Current utilized a single head R2Sonic 2022 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 Ocean Master for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS). Beginning in October 2024 Current utilized an AML 3 LRG for the sound speed system.

Pulse utilized a single head R2Sonic 2024 multibeam echosounder system (MBES), an AML Micro.X for the surface sound speed system, an AML 3 LGR for the sound speed system, an Applanix POSMV Wave Master for the positioning and attitude system, and an EdgeTech 4125 side scan sonar (SSS). Beginning in late August 2024 Pulse utilized an R2Sonic I2NS for the positioning and attitude system in order to receive Applanix Real-time Centerpoint RTX corrections. Beginning in October 2024 Pulse utilized an R2Sonic 2022 MBES.

R/V Thunder utilized a dual 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, and an Applanix POSMV OceanMaster for the positioning and attitude system.

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 4.05%

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.

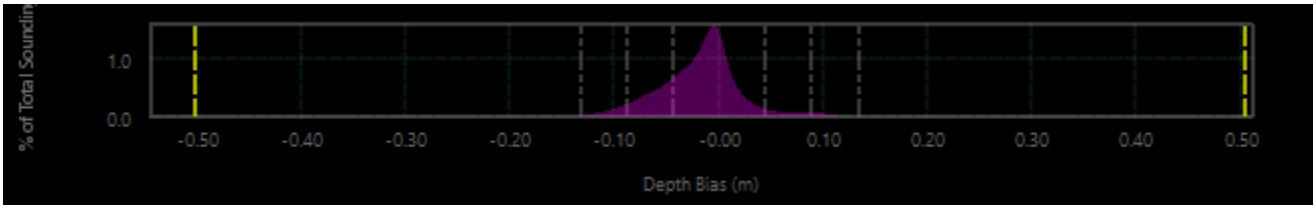


Figure 6: H13962 Crossline Comparison

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.1 meters	N/A

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
Current	0.05 meters/second	N/A	N/A	0.2 meters/second
Pulse	0.05 meters/second	N/A	N/A	0.2 meters/second
R/V Thunder	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 the user has the ability to export the Dynamic Surface to a Bathymetric Attributed Grid (BAG) with the TVU 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. The TVU was also reviewed using the Colormap Range in the Qimera TVU surface layer. This image is also included below.

Complete Coverage Option B MBES (Finalized 1m CUBE weighted Dynamic Surface in NOAA QC Tools) = 100% of nodes are within the allowable TVU.

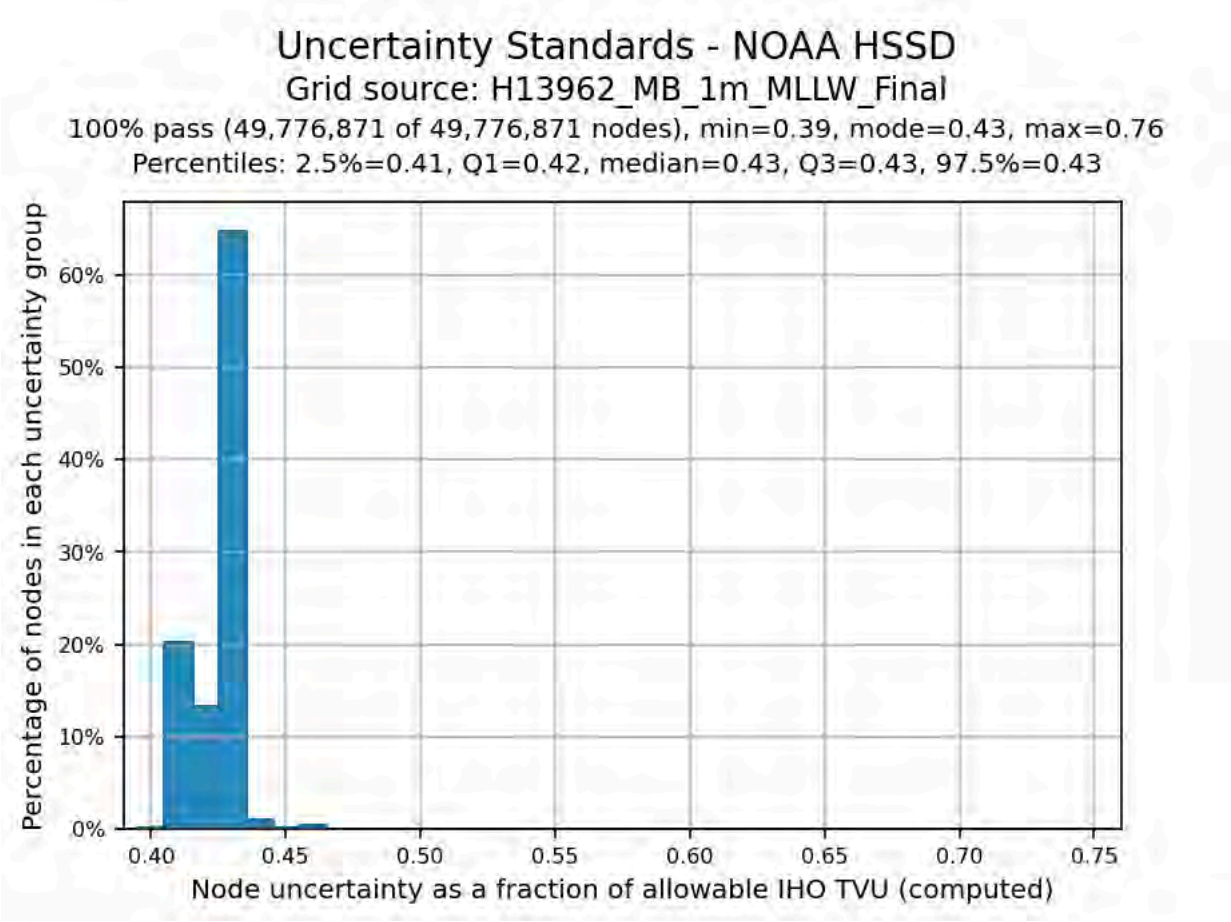


Figure 7: H13962 Finalized 1m MBES TVU Statistics

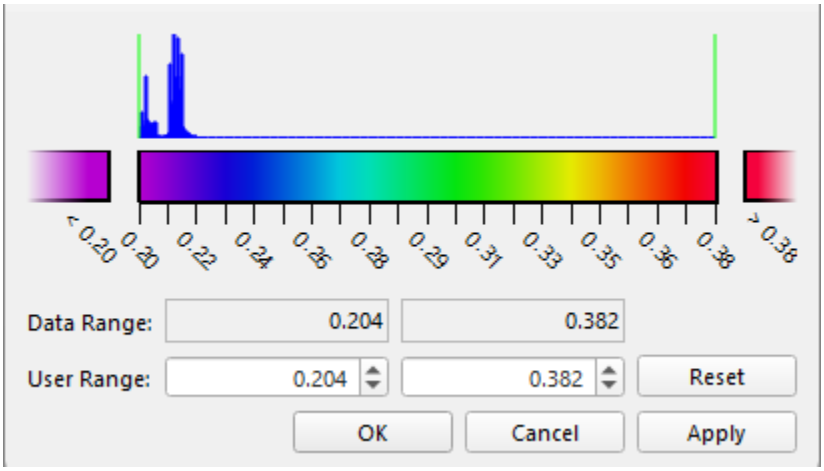


Figure 8: H13962 Qimera TVU Colormap Range

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
H13965	1:20000	2024	eTrac	SW
H13966	1:20000	2024	eTrac	W
VA2203-TB-C	1:1	2023	Woolpert	W

Table 9: Junctioning Surveys

H13965

The junction comparison between H13962 and H13965 was analyzed in the H13965 DR. Reference the H13965 DR for junction comparison results.

H13966

The junction comparison between H13962 and H13966 was analyzed in the H13966 DR. Reference the H13966 DR for junction comparison results.

VA2203-TB-C

VA2203-TB-C junctions with H13962 in all directions. The junction comparison was performed using all overlapping data between H13962 and the Topobathy Lidar. Below is a histogram of junction comparison statistics showing the difference between the junctioning surfaces and allowable TVU as well as difference statistics. 99.7989% of nodes were within allowable TVU.

The Junction Comparison was performed at a 4m resolution due to the large size of the dataset, however the percentage of nodes within the allowable TVU should remain consistent and representative of the final 1m surface resolution. The difference statistic was performed on a 1m surface.

0.2011% outside of allowable TVU results from small THU discrepancies from the different collection methodology of Lidar and MBES, shown mostly on slopes, as well as interpolation between sparse data points in the Lidar and interpolation of MBES data in the NAVD88 product created as one of the additional deliverables.

In some instances, features with a set custom hypothesis create a node with a difference greater than 0.5 m.

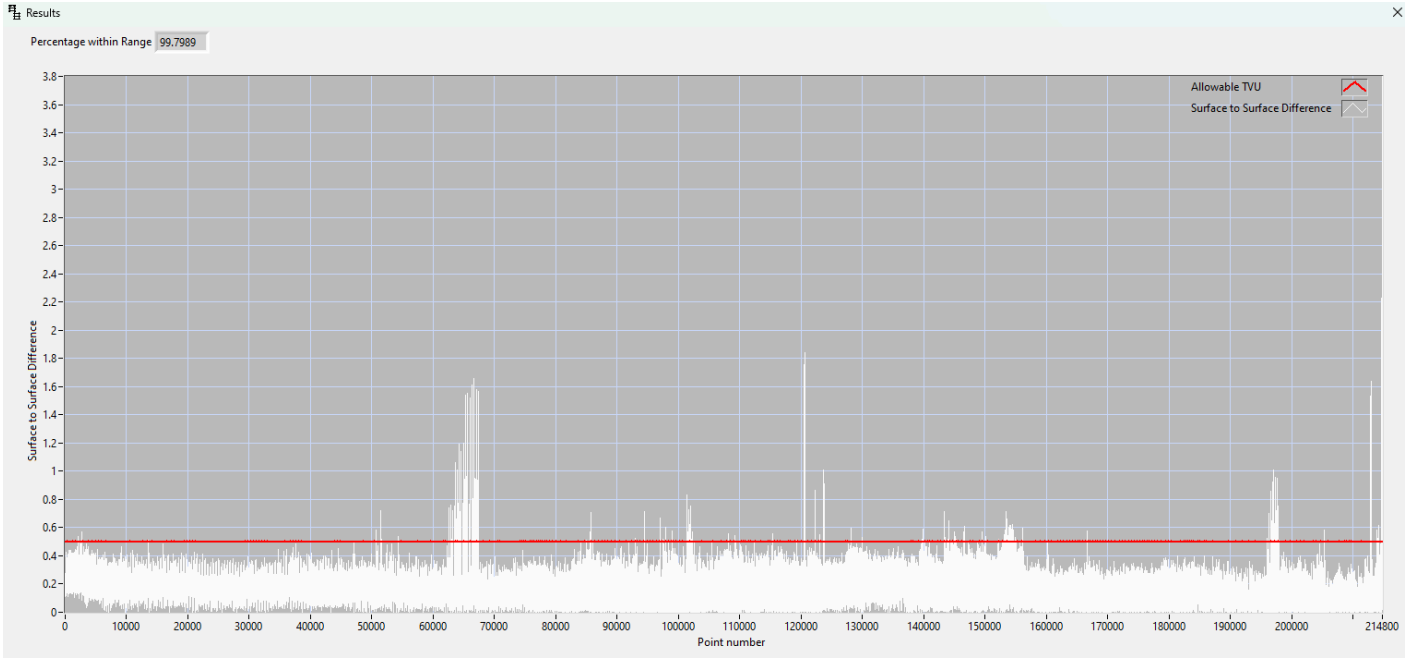
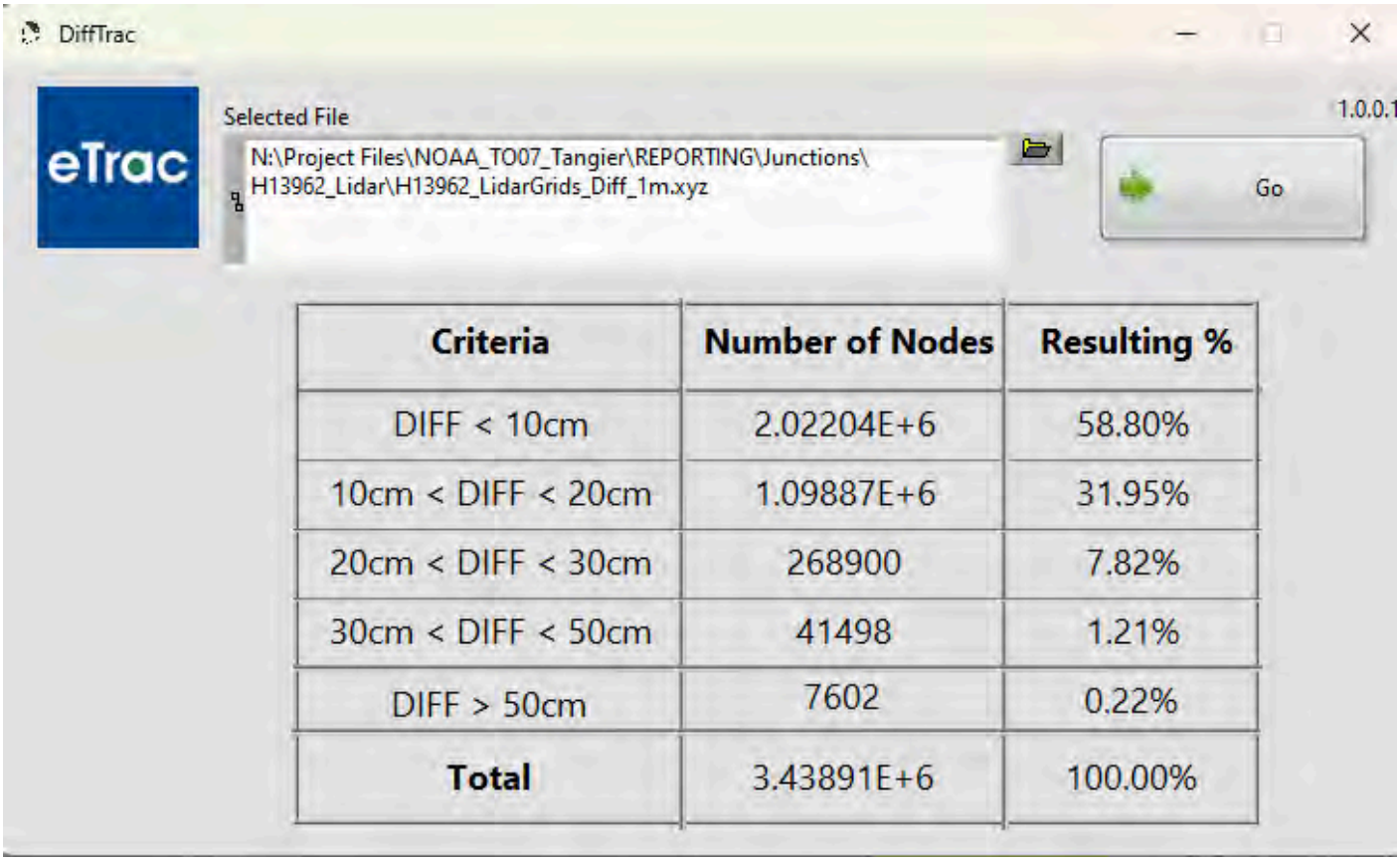


Figure 9: H13962 - Topobathy Lidar Junction Comparison



Criteria	Number of Nodes	Resulting %
DIFF < 10cm	2.02204E+6	58.80%
10cm < DIFF < 20cm	1.09887E+6	31.95%
20cm < DIFF < 30cm	268900	7.82%
30cm < DIFF < 50cm	41498	1.21%
DIFF > 50cm	7602	0.22%
Total	3.43891E+6	100.00%

Figure 10: H13962 - Topobathy Lidar 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 Current, Pulse, and R/V Thunder 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 the Grid Statistics tool in Qimera.

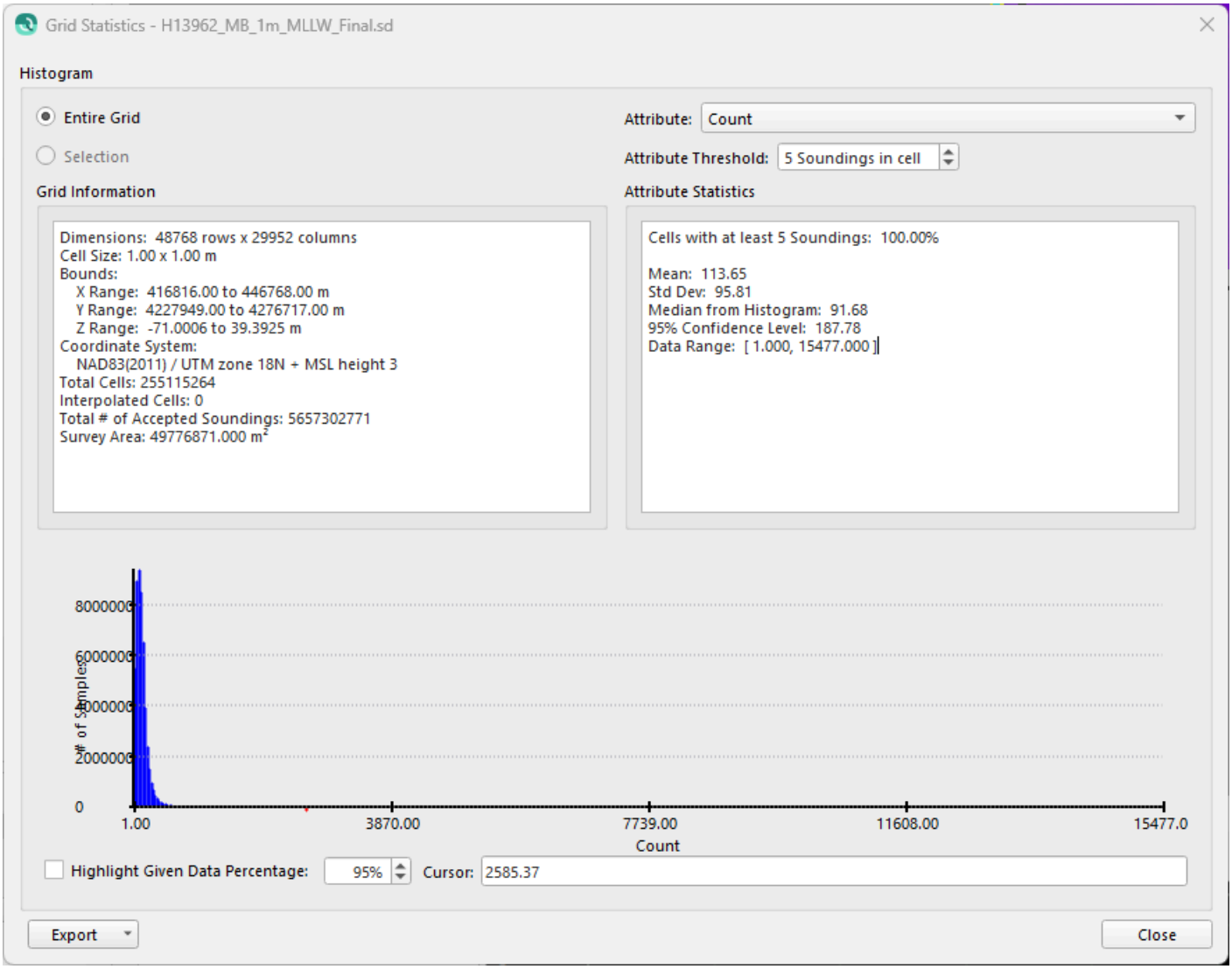


Figure 11: H13962 Grid Statistic Histogram

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 were 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
H13962_MB_1m_MLLW_Final	BAG	1 meters	0.09 meters - 17.61 meters	NOAA_1m	Complete MBES
H13962_MBAB_2m_TH_400kHz_1of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13962_MBAB_2m_PU_400kHz_2of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13962_MBAB_2m_CU_400kHz_3of3	MB Backscatter Mosaic	2 meters	-	N/A	Complete MBES
H13962_SSSAB_1m_400kHz_1of2	SSS Mosaic	1 meters	-	N/A	100% SSS
H13962_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 H13962.

A 1m mosaic is provided meeting complete coverage with 100% SSS specifications for H13962.

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

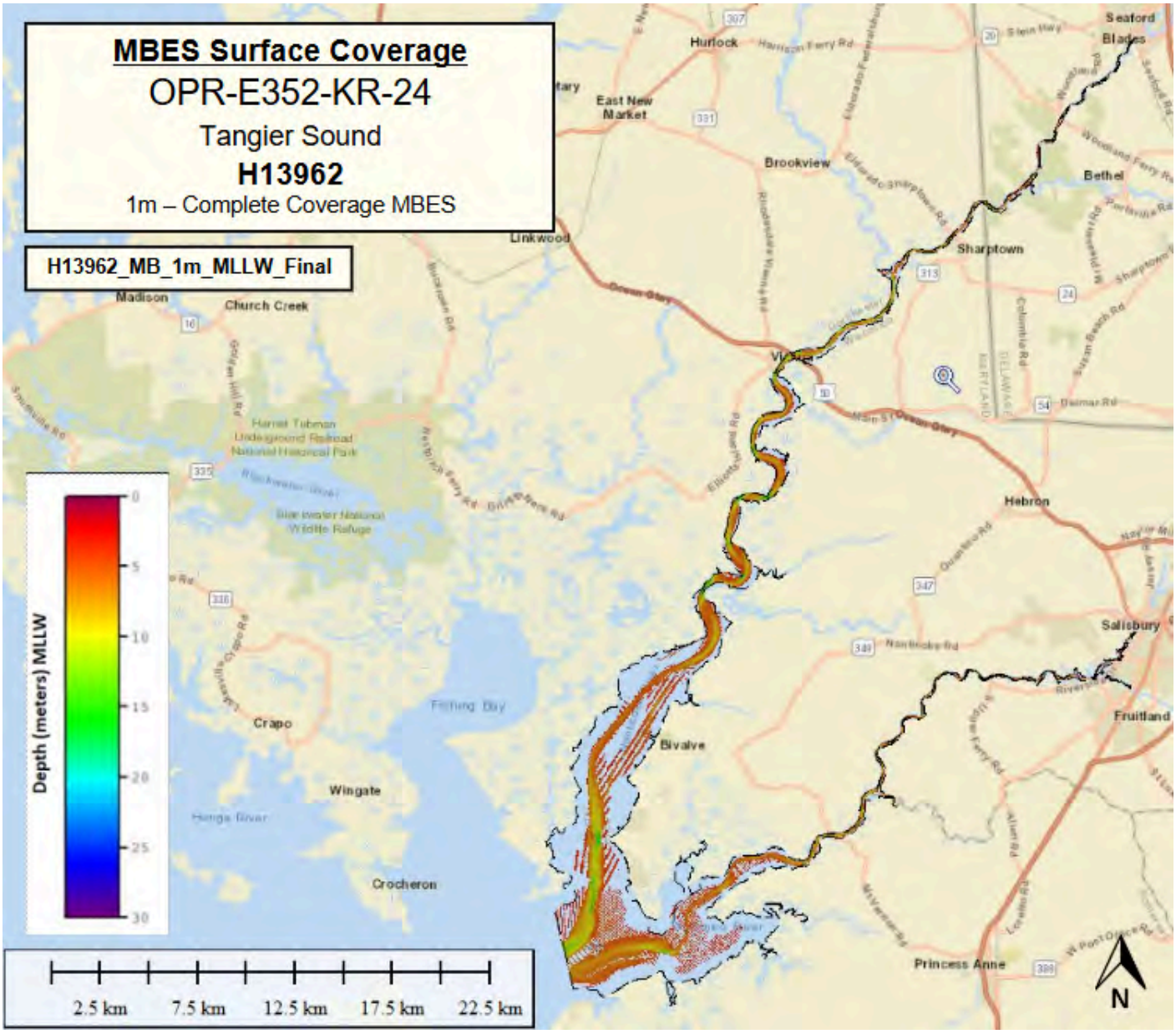


Figure 12: H13962 Finalized 1m CUBE Weighted Dynamic Surface Coverage

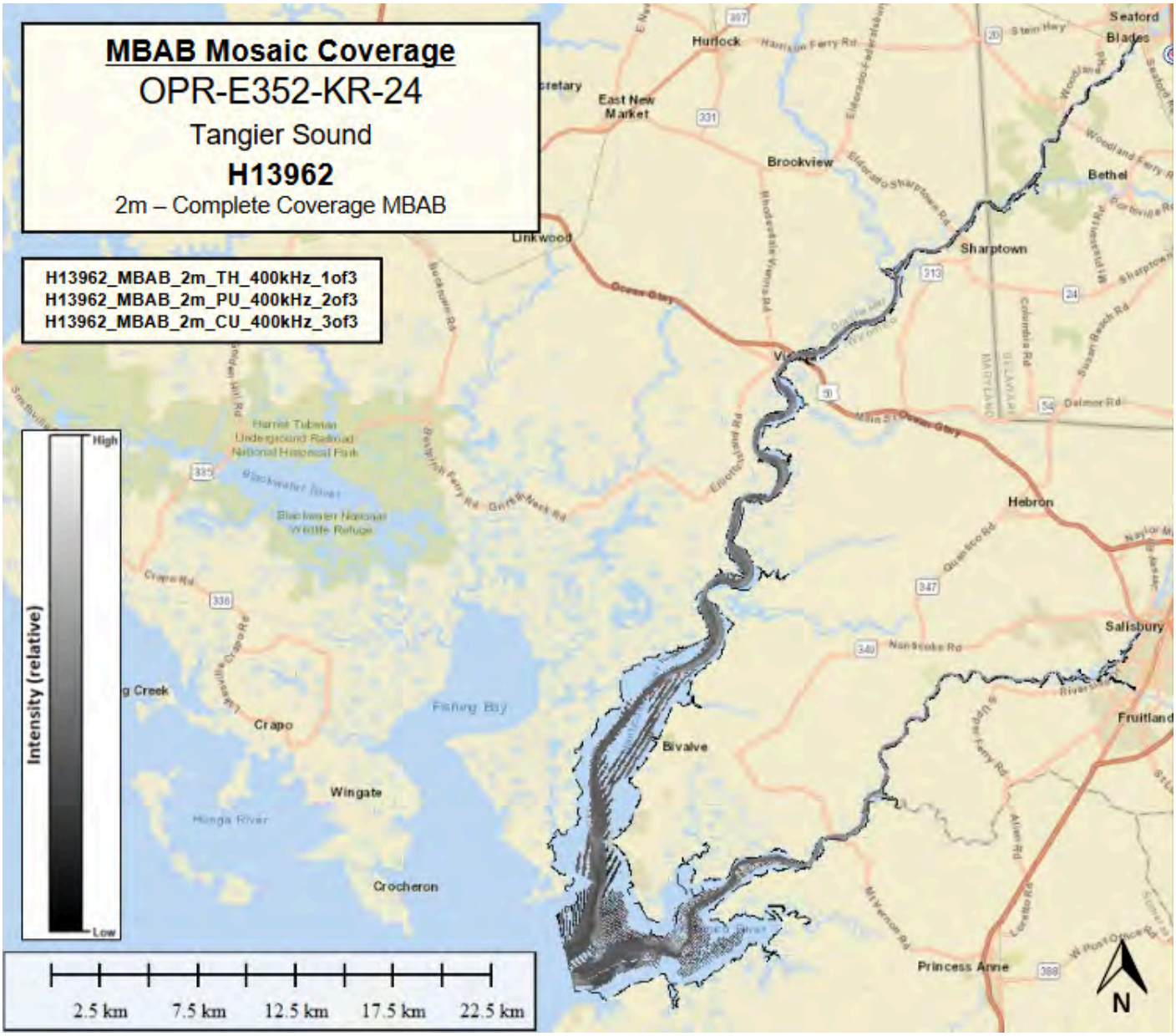


Figure 13: H13962 Finalized 2m Backscatter Mosaic

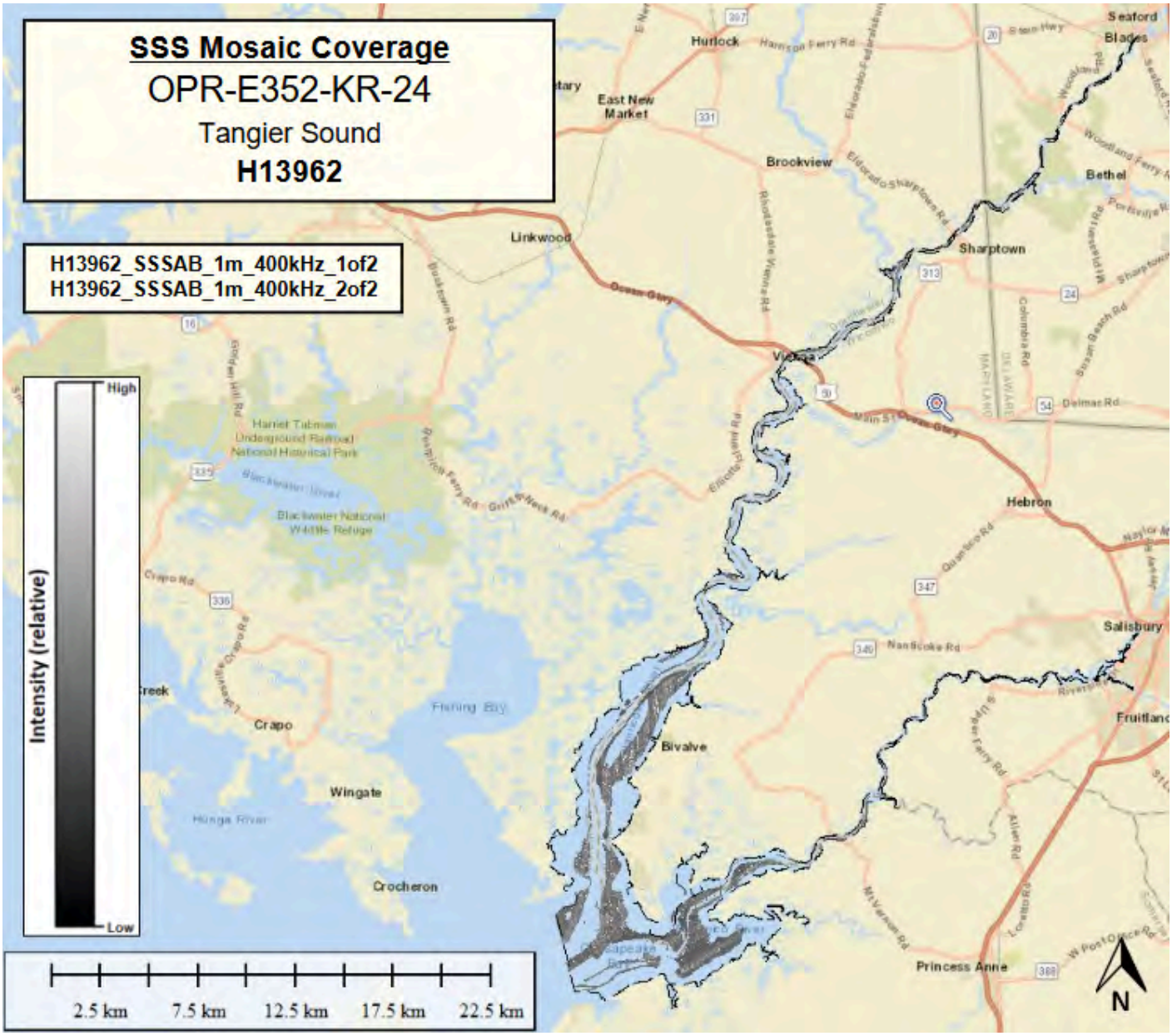


Figure 14: H13962 Finalized 1m SSS Mosaic

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. Additional information discussing the interpolated grids for this survey can be found in the accompanying DAPR.

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 VDATUM	OPR-E352-KR-24_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 applied to the Qinsy DB files via a .qgfvom separation file in the acquisition software.

Note: The separation model nodes didn't extend fully to the tip of the boundary in the Nanticoke River. The area affected was less than 10 square meters. using the separation value of the adjacent node, data outside of the separation model extents were manually shifted in Qimera from NAD83(2011) to MLLW. Reference item number nine in project correspondence.

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 the G2+ and G4+ carrier signal from the Marinestar Global Correction System maintained by Fugro, or over the Trimble Real-Time Centerpoint RTX carrier signal.

C.3 Additional Horizontal or Vertical Control Issues

C.3.1 Additional Task: Final Data Submission- Grids

An additional assigned task for this project was to include interpolated grids in Mean Lower Low Water (MLLW) and North American Vertical Datum of 1988 (NAVD88) datum. To accomplish this task, MLLW XYZ data were exported from Qimera and loaded into Hypack for interpolation. The MLLW interpolated grids were then exported from Hypack and brought back into Qimera. In order to reference soundings to NAVD88 Datum, a separation model was provided by NOAA and was applied to the gridded MLLW data within Qimera. Additional information discussing the interpolated grids for this survey can be found in the accompanying DAPR.

D. Results and Recommendations

D.1 Chart Comparison

A chart comparison was conducted for H13962 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 other charts were used to complete the chart comparison. Details of the ENCs used are listed below.

US5MD23M, scale: 40000, edition: 21, update application date: 01/06/2022, issue date: 01/23/2025

US5VA21M, scale: 40000, edition: 28, update application date: 10/16/2024, issue date: 12/19/2024

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

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

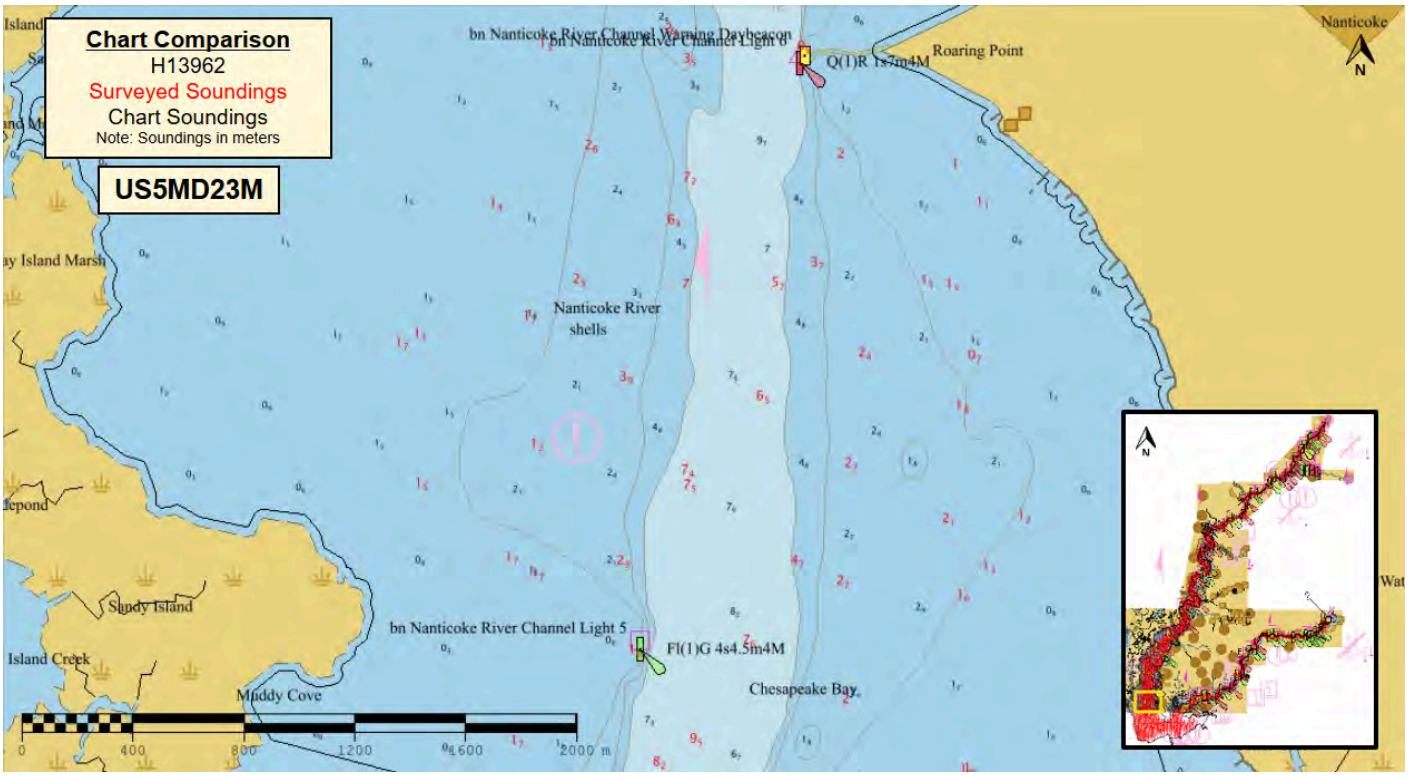


Figure 15: Generated Soundings used for Chart Comparison (US5MD23M)

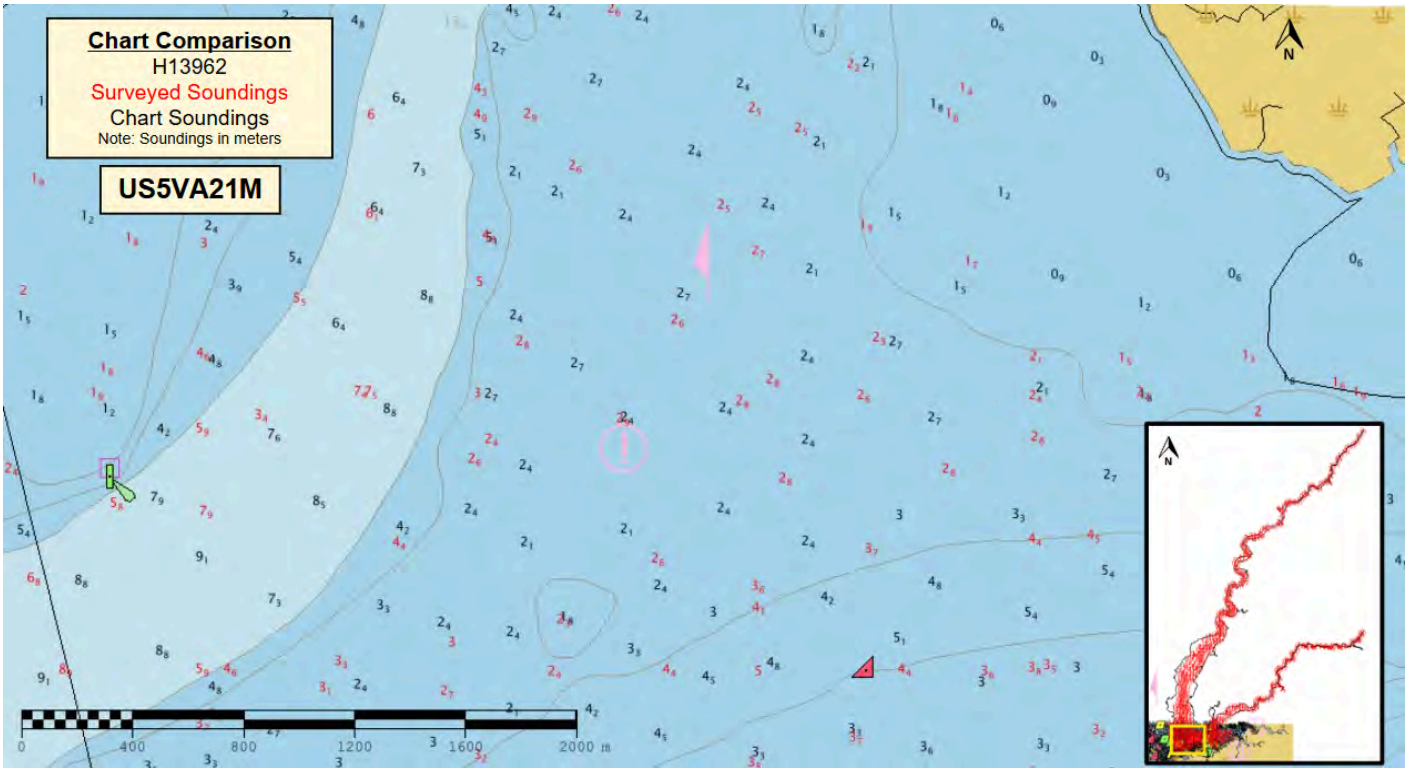


Figure 16: Generated Soundings used for Chart Comparison (US5VA21M)

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
US5MD23M	1:40000	21	01/06/2022	01/23/2025
US5VA21M	1:40000	28	10/16/2024	12/19/2024

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

There were 13 DtoNs found in H13962, 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 1XXXX). Refer to the FFF for determinations and recommendations of each feature. The DtoNs were submitted in the following Danger to navigation reports:

H13962_DtoN_02-04

H13962_DtoN_05

H13962_DtoN_06-14

D.1.3 Charted Features

There were 117 charted features assigned to H13962 and 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 1XXXX).

56 of the charted features were evaluated using junctioning Lidar Grid DEM and or Lidar Point Cloud data and observations were included in the FFF.

Refer to the FFF for determinations and recommendations of each feature.

D.1.4 Uncharted Features

79 new features were found in H13962, and were 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 1XXXX). Refer to the FFF for determinations and recommendations of each feature.

Note: Some features identified in H13962 did not have reliable least depth values stemming from the inability to develop the features safely. Non-standard combinations of TECSOU and QUASOU have been used in these cases to most effectively represent these features. DtoNs are not included in the number of new features in this section. DtoNs can be found separately in section D.1.2.

D.1.5 Channels

Nanticoke River Channel, Hawks Nest Shoal Channel, and two of five sections of the Wicomico River Reach were assigned as dredge areas.

Nanticoke River Channel extending approximately 3.9 km from north of Nanticoke River Channel Light 63 to the Railroad Swing Bridge in Seaford, DE has a reported depth range value of 3.6 m MLLW. Surveyed depths along a profile traversing the middle of the channel identified depths shoaler than 3.6 m in multiple locations. The shoalest point along the profile traversing the middle of the channel is 2.5 m MLLW. An image of the profile is shown below. Our survey extents did not cover the entirety of the northernmost section of the Nanticoke River Channel.

Hawks Nest Shoal Channel extends approximately 1.1 km in the Nanticoke river between Nanticoke River Channel Light 46 and the mouth of Broad Creek with a reported depth range value of 3.6 m MLLW. Surveyed depths along a profile traversing the middle of the channel identified depths shoaler than 3.6 m.The

shoalest point along the profile traversing the middle of the channel is 3.5 m MLLW. An image of the profile is shown below.

The first assigned section of the Wicomico River Reach extends approximately 10 km between Wicomico River Channel Daybeacon 41 and Salisbury, MD with a reported depth range of 2.8 m MLLW. No discrepancies were found within our survey extents along a profile traversing the middle of the channel. Our survey extents did not cover the entirety of the northernmost section of the Wicomico River Reach.

The second assigned section of the Wicomico River Reach extends approximately 0.6 km between Wicomico River Channel Light 37 and Wicomico River Channel Light 38 with a reported depth range of 3.8 m MLLW. No discrepancies were found within our survey extents along a profile traversing the middle of the channel.

The following sections of the Wicomico River Reach with controlling depths were not assigned but fell within the bounds of our survey.

The first unassigned section of the Wicomico River Reach extends approximately 0.4 km between Wicomico River Channel Light 35 and Wicomico River Channel Light 37 with a reported depth range of 4.4 m MLLW. No discrepancies were found within our survey extents along a profile traversing the middle of the channel.

The second unassigned section of the Wicomico River Reach extends approximately 1.4 km between Wicomico River Channel Light 32 and Wicomico River Channel Light 35 with a reported depth range of 4.1 m MLLW. No discrepancies were found within our survey extents along a profile traversing the middle of the channel.

The third unassigned section of the Wicomico River Reach extends approximately 8.3 km between Wicomico River Channel Buoy 7 and Wicomico River Channel Daybeacon 24 with a reported depth range of 3.0 m MLLW. No discrepancies were found within our survey extents along a profile traversing the middle of the channel.

Bivalve Harbor Channel, Bivalve Harbor Basin Channel, Nanticoke Cut River Channel, and Webster Cove Channel were not fully addressed as they were inshore of NALL.

These areas were not included in the FFF following investigation requirements.

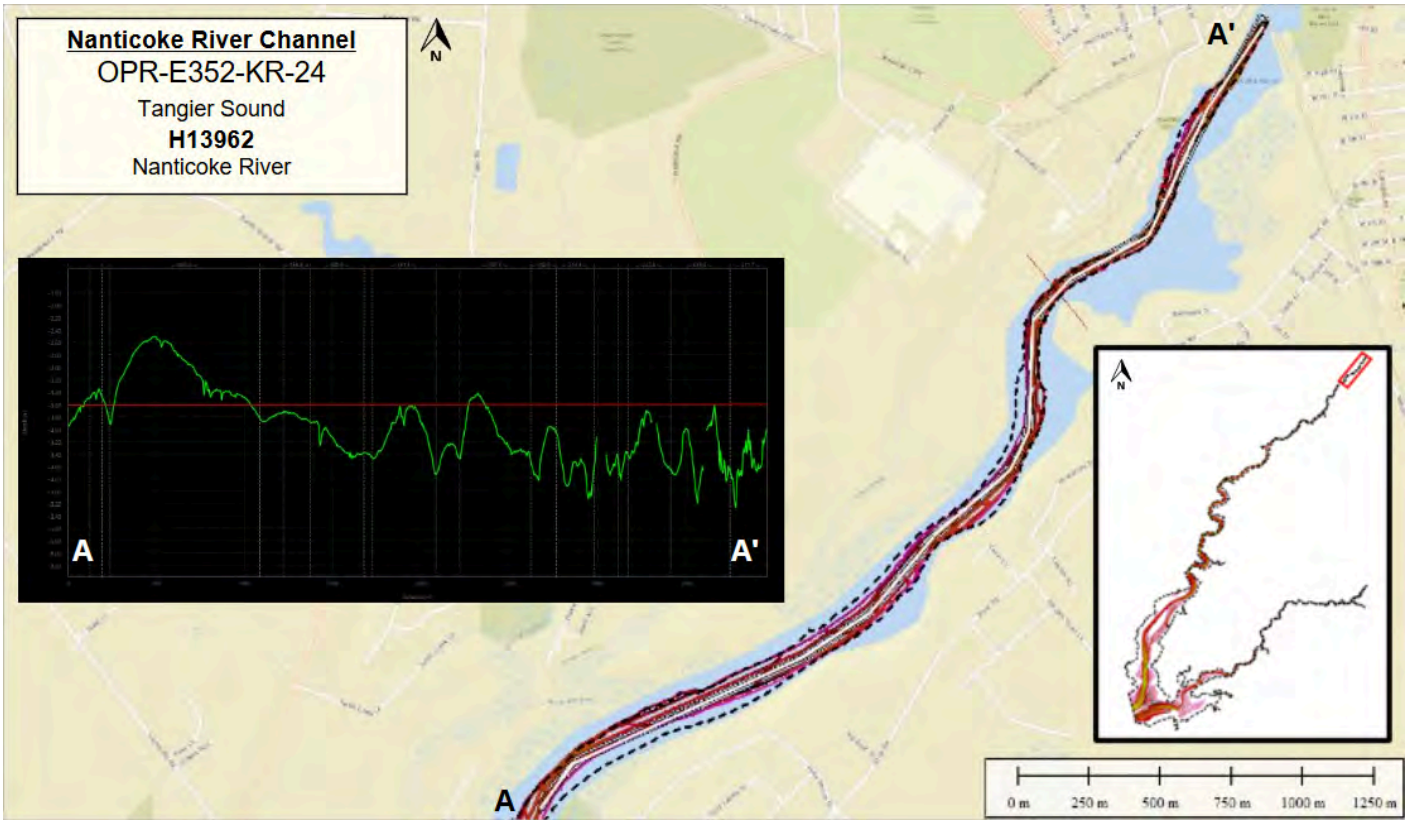


Figure 17: Profile traversing the middle of Nanticoke River Channel. Red line in cross section of A-A' represents reported depth of 3.6 m MLLW. The shoalest point along the profile is 2.5 m and the deepest point along the profile is 5.3 m.

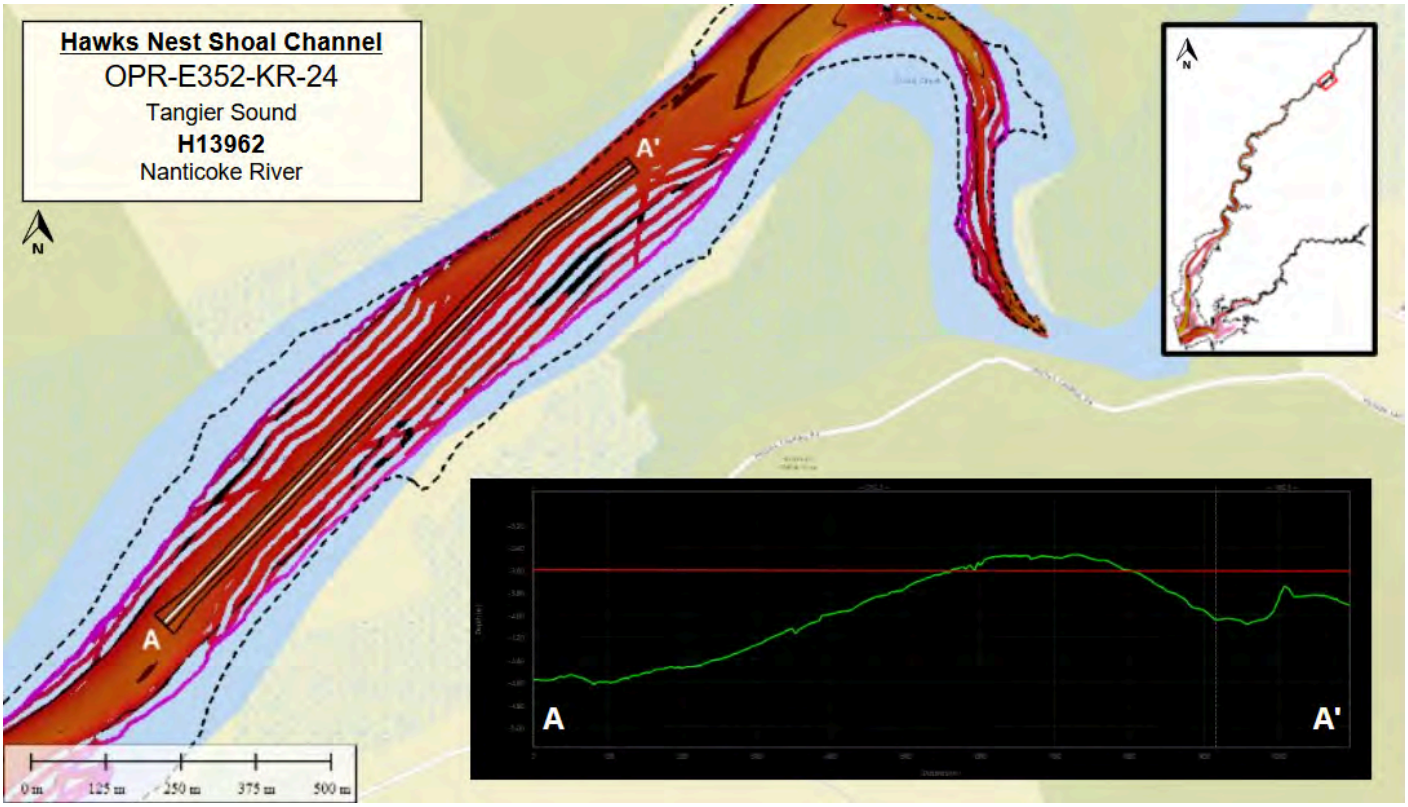


Figure 18: Profile traversing the middle of Hawks Nest Shoal Channel. Red line in cross section of A-A' represents reported depth of 3.6 m MLLW. The shoalest point along the profile is 3.5 m and the deepest point along the profile is 4.6 m.

D.2 Additional Results

D.2.1 Aids to Navigation

Nanticoke River Channel Light 54 was reported off station to US Coast Guard Navigation Center via their AtoN Discrepancy Report Form. Charted locations have not been updated as of January 2025.

Nanticoke River East Channel Buoy 2 was reported to MCD via the MCD assist program as being charted incorrectly on US5MD23M and should be updated to match the location in the USCG Light List. Charted locations have not been updated as of January 2025.

A charted special purpose buoy that was not found in the field was reported to MCD via the MCD assist program and removed from US5VA21M.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

8 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 H13962_X).

D.2.4 Overhead Features

There were 9 overhead features assigned to H13962. 5 overhead cables were visually confirmed and no discrepancies found. 2 bridges were visually confirmed and no discrepancies found, 1 bridge was not addressed as it was inshore of NALL, and 1 bridge in the Wicomico Creek was found to not exist. The overhead features were not included in the FFF following investigation requirements.

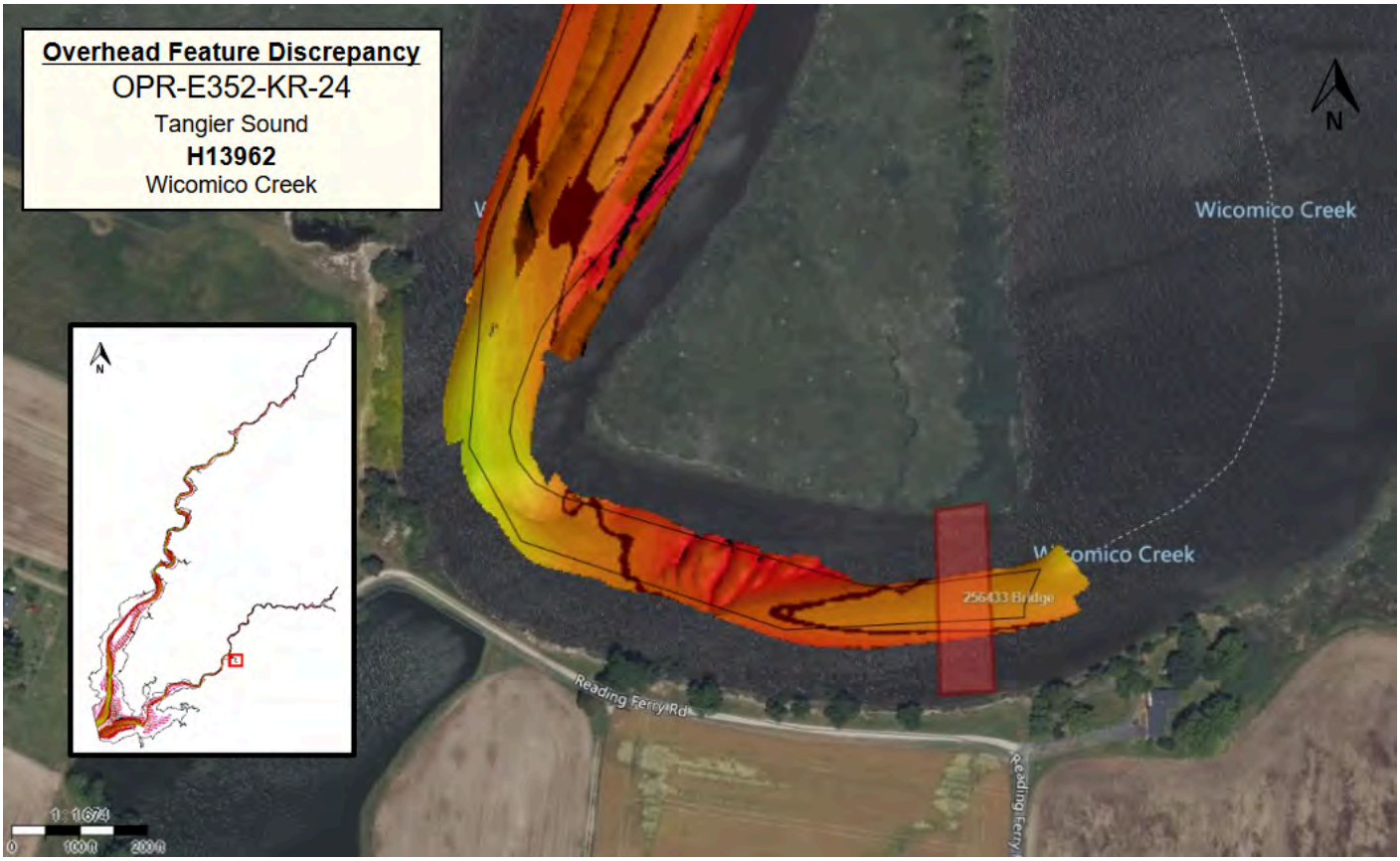


Figure 19: Assigned bridge not observed in Wicomico Creek.

D.2.5 Submarine Features

4 new pipelines were found in H13962. 2 were reported in H13962 Non-Dangerous Pipeline 01 by AHB. 2 were found in a charted pipeline corridor and per correspondence with COR and AHB they were not reported to NDB. All pipelines were reported to BSEE. Each feature in the FFF has been given a unique identifier in the "userid" field of the .000 S-57 file (format 1XXXX). Refer to the FFF for determinations and recommendations for each feature.

D.2.6 Platforms

There was 1 offshore platform assigned to H13962 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 1XXXX). Refer to the FFF for determinations and recommendations of each feature.

D.2.7 Ferry Routes and Terminals

There were 3 ferry routes assigned to H13962. Assigned ferry routes were visually confirmed and no discrepancies were found. The ferry routes were not included in the FFF following investigation requirements.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

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

D.2.10 New Survey 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, C.H.	Chief of Party	02/17/2025	David Neff Digitally signed by David Neff DN: C=US, E=dave.neff@woolpert.com, O=Woolpert Inc., OU=eTrac, CN=David Neff Date: 2025.02.18 19:49:46-08'00'

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