NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey **Hydrographic**

Field No. **David Evans and Associates, Inc.**

Registry No. **H12045**

LOCALITY

State **Virginia**

General Locality **Southern Chesapeake Bay**

Sublocality **3nm South of Tangier Island**

2009

CHIEF OF PARTY

Jonathan L. Dasler, PE (OR) , PLS (OR,CA)

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY No

HYDROGRAPHIC TITLE SHEET

H12045

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No

David Evans and Associates, Inc.

State: Virginia

General Locality: Southern Chesapeake Bay, VA

Sub-Locality: 3nm South of Tangier Island

Scale: 1:10,000

Date of Survey: July 19, 2009 to December 14, 2009

Instructions dated: June 1, 2009

Project No.: OPR-E349-KR-09

Vessel: R/V Theory and R/V Chinook

Chief of party: Jonathan L. Dasler, PE (OR) , PLS (OR,CA)

Surveyed by: David Evans and Associates, Inc.

Soundings by echo sounder, hand lead, pole: RESON 7125, R2 Sonic 2024, EdgeTech 4200-FS, EdgeTech 4200-HFL

Graphic record scaled by: N/A

Graphic record checked by: N/A

Automated Plot: N/A

Verification by: ***Atlantic Hydrographic Branch (bold, red, italic font)***

Soundings in: Meters at MLLW

REMARKS: All times are UTC.

The purpose of this contract is to provide NOAA with modern, accurate hydrographic survey data with which to update nautical charts of the assigned area.

SUBCONSULTANTS: Zephyr Marine, P.O. Box 1575, Petersburg, AK 99833

Geomatics Data Solutions, 4128 Ingalls Street, San Diego, CA 92103

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NOAA FORM 77-28 SUPERSEDES FORM C&GS-537

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Acronyms and Abbreviations

AML	Applied Microsystems, Ltd
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
CO-OPS	Center for Operational Oceanographic Products and Services
CTD	Conductivity, Temperature and Depth
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DEA	David Evans and Associates, Inc.
DN	Day Number
DTON	Danger to Navigation
ENC	Electronic Navigation Charts
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
IHO	International Hydrographic Organization
IAKAR	Inertially-Aided Kinematic Ambiguity Resolution
MLLW	Mean Lower-Low Water
MVP	Moving Vessel Profiler
NAD83	North American Datum of 1983
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NWLON	National Water Level Observation Network
OCS	Office of Coast Survey
OPUS	On-line Positioning User Service
POS/MV	Position and Orientation System for Marine Vessels
R/V	Research Vessel
SBET	Smooth Best Estimate and Trajectory
SVP	Sound Velocity Profiler
TPE	Total Propagated Error
ZDF	Zone Definition File

Descriptive Report to Accompany Hydrographic Survey H12045
Project OPR-E349-KR-09
Southern Chesapeake Bay, Virginia
3nm South of Tangier Island
Scale 1:10,000
July 2009 – December 2009
David Evans and Associates, Inc.
Lead Hydrographers: Jonathan L. Dasler, Jason C. Creech

A. AREA SURVEYED

David Evans and Associates, Inc. (DEA) conducted hydrographic survey operations in the Southern Chesapeake Bay, Virginia. The survey area (Figure 1) is 3 nautical miles south of Tangier Island and 3nautical miles west of Onancock Creek. ***Concur.***

Survey H12045 was conducted in accordance with the *Statement of Work* and *Hydrographic Survey Project Instructions* for *OPR-E349-KR-09* dated June 2009 and the *Draft National Ocean Service (NOS) Skunk Stripe Specifications* issued to DEA via email by the Chief of the Data Acquisition and Control Branch. A copy of this email is included in Appendix V - *Supplemental Records and Correspondence**. ***Concur. *Appended to this document.***

The project instructions required 200% side scan sonar coverage of the survey area with multibeam sonar data acquired in conjunction with side scan sonar operations. The survey was conducted over 80-meters set line spacing and 130-meters set line spacing per 100% coverage (50-meters and 75-meters side scan sonar ranges, respectively). Significant contacts were developed with multibeam sonar to determine the least depth of the feature. The inshore limit of hydrography was defined as the most seaward of either the survey polygon depicted by the *OPR-E349-KR-09_region.shp* file provided by Office of Coast Survey (OCS) staff or the surveyed 18-foot contour. ***Concur.***

Nineteen (19) bottom samples were acquired for H12045 on July 19, 2009 (Day Number 200). One (1) AWOIS item investigations were assigned to this survey for full investigation. ***Concur.***

Table 1 lists specific dates of acquisition.

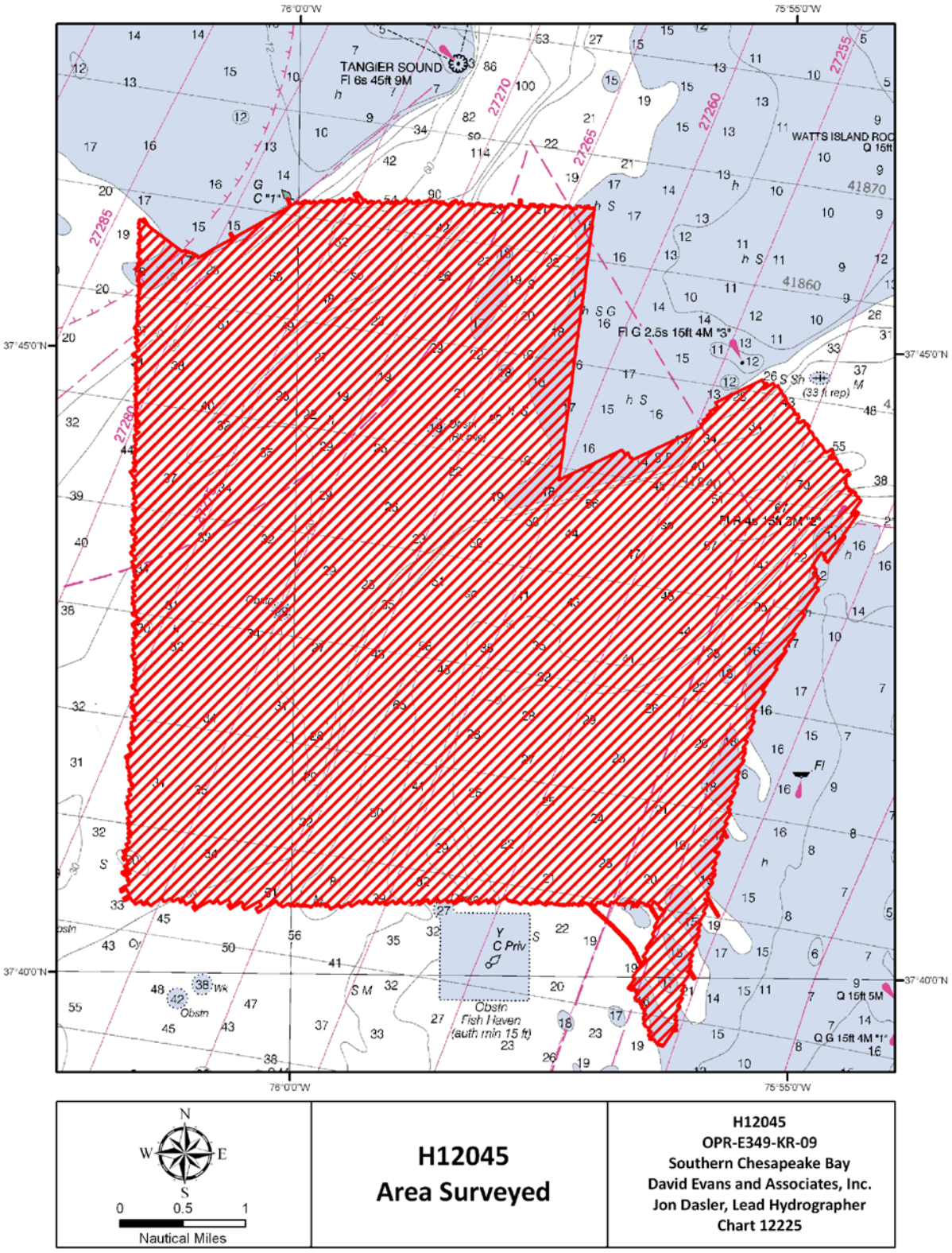


Figure 1. H12045 Survey Area

Table 1. H12045 Days of Acquisition

Dates of Acquisition	
Month	**Dates**
July	19
August	27
September	6,14,15,18,20-22
October	5,6,10,11,13,21
November	16,18,19,22
December	7,11,12,14

Concur with clarification. No days from July were included in the HDCS data project.

Detailed survey statistics of H12045 are provided in Table 2.

Table 2. H12045 Survey Statistics

Survey Statistics	Research Vessels (*R/V*) *Theory* and *Chinook*
MBES (mainscheme nm)	920.3
Crosslines (MBES nm)	40.4
Developments (MBES nm)	18.5
Number of Item Investigations that required additional survey effort	83
Total number of square nautical miles	25.95

B. DATA ACQUISITION AND PROCESSING

B1. Equipment

Equipment and vessels used for data acquisition and survey operations during this survey are listed below in Tables 3 and 4. ***Concur.***

Table 3. *R/V Theory* Equipment and Vessel Specifications

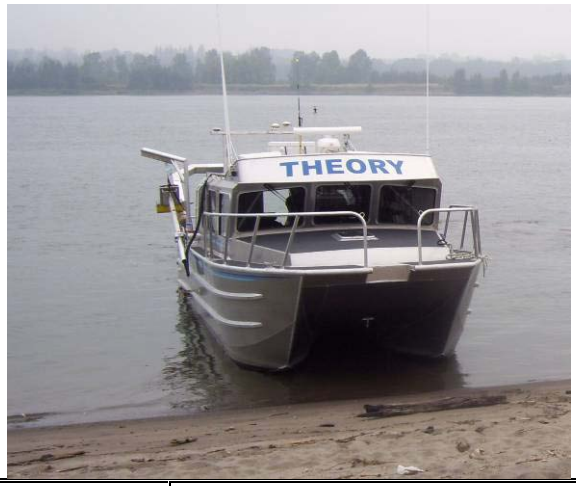
R/V Theory	
	
Hull Registration Number	IAR34CATA808
Official Number (O/N)	1217549
Builder	Armstrong Marine
Design	Catamaran
Year Built	2008
Length Overall	36’
Beam	13’
Draft, Maximum	3’
Cruising Speed	26 knots
Max Survey Speed	9 knots
Primary Echosounder	RESON 7125-B
Side Scan Sonar	Edgetech 4200-FS and 4200-HFL
Sound Velocity Equipment	Brooke Ocean MVP-30 with AML Smart SV & P Reson SVP-70 Sea-Bird SEACAT SB-19 CTD Profiler
Positioning & Attitude	Applanix POS/MV 320 v4

Table 4. *R/V Chinook* Equipment and Vessel Specifications

R/V Chinook	
	
Hull Registration Number	IAR28CATJ607
Official Number (O/N)	AK-8018-AG
Builder	Armstrong Marine
Design	Catamaran
Year Built	2008
Length Overall	28’
Beam	10.5’
Draft, Maximum	2’
Cruising Speed	27 knots
Max Survey Speed	9 knots
Primary Echosounder	R2Sonic 2024
Side Scan Sonar	Edgetech 4200-FS
Sound Velocity Equipment	Applied Microsystems MicroSV AML SVPlusV2 Sea-Bird SEACAT SB-19 CTD Profiler
Positioning & Attitude	Applanix POS/MV 320 v4

There were no vessel or equipment configurations used during data acquisition that deviated from those described in the *OPR-E349-KR-09 Data Acquisition and Processing Report* (DAPR)*. ***Concur. *Included with survey deliverables.***

B2. Quality Control

Quality control is discussed in detail in Section B of the DAPR*. The results from the positioning system comparison and bar-to-multibeam comparison are included in Separate I** *Acquisition and Processing Logs*. The sound velocity profile sensor weekly evaluation table can be found in Separate II *Sound Speed Data*** section of this report. Data were reviewed at multiple levels of data processing including: CARIS Hydrographic Information Processing System (HIPS) conversion, subset editing, and analysis of anomalies revealed in combined uncertainty and bathymetry estimator (CUBE) surfaces. Submerged significant features identified during survey were noted in the acquisition logs and saved to Hypack target files, Isis cursor log files, or Target Pro contact files and then displayed during HIPS editing to aid in the interpretation of data and act as a check during feature compilation. ***Concur. *Included with survey deliverables. **Filed with original field reports.***

B2.a Crosslines

A total of 40.4 nautical miles of crosslines, or 4.39% of main scheme lines, were run for analysis of survey accuracy. Crosslines were run in a direction perpendicular to main scheme lines across the entire surveyed area providing a good representation for analysis of consistency. All crosslines were used for crossline comparisons. ***Concur.***

Crossline analysis was performed using the CARIS HIPS QC Report tool, which compares crossline data to a gridded surface and reports results by beam number. Crosslines were compared to a 1 meter CUBE surface that encompassed the entire survey area. Because 200 kHz (*R/V Chinook*) and 400 kHz (*R/V Theory*) frequencies were used, the crossline analysis was done per frequency and using all the crosslines. Only 200kHz crosslines were acquired for survey H12045. These surfaces were not included with the deliverables due to file size. The QC Report tabular outputs and plots are included in Separate IV *Crossline Comparisons**. The results of the analysis meet the requirements as stated in the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2009) for all frequency comparisons. ***Concur. *Filed with original field reports.***

B2.b Uncertainty

The calculated uncertainty values of all nodes within the unfinalized CUBE surfaces range from 0.156 meters to 0.319 meters. The higher value is in deep water on the outer swath of a main scheme line with little overlap from adjacent survey lines. No area within the survey exceeds International Hydrographic Organization (IHO) Order 1 specifications for depth accuracy. ***Concur.***

During HIPS processing, the "greater of the two" option was selected, where the calculated uncertainty from total propagated error (TPE) is compared to the standard deviation of the soundings influencing the node, and the greater value is assigned as the final uncertainty of the node. As a result, the uncertainty of the finalized surface and associated Bathymetric Attributed Grids (BAGs) increased for nodes where the standard deviation of the node was greater than the calculated uncertainty. ***Concur.***

B2.c Junctions

H12045 junctions with survey H12044 to the west. The junction analysis between H12045 and H12044 is discussed in H12044 Descriptive Report. ***Concur.***

B2.d Unusual Conditions or Data Degradation

There is an error in the Reson 7125 bottom tracking algorithm that causes bottom detection (beams 86-115 and 140-168) to lock on to stronger sonar returns bleeding over from more nadir returns. This may be related to the amplitude bottom detection used near nadir and the bottom detection locking on to the strong nadir return signal, rather than the actual bottom return for that designated beam area. These artifacts occur in two areas near nadir and are more prevalent on a hard bottom, when the amplitude of the nadir return is the strongest. The artifacts run along track and can exceed 20 centimeters in the raw soundings, but are reduced to 5 to 10 centimeters in the CUBE surface. ***Concur.***

There is vertical offset between data collected using the Reson 7125 at 400 kHz (*R/V Theory*) and the R2Sonic 2024 at 200 kHz (*R/V Chinook*), where the 200 kHz data is approximately 10 to 20 centimeters deeper than the 400 kHz data. The frequency dependant offset appears to be the result of increased penetration by the 200 kHz into muddy unconsolidated sediments. The original vessel survey, vessel files, and weekly bar checks were reviewed to verify that the vertical offset was not a result of an incorrect offset entry. ***Concur.***

B2.e Object Detection and Coverage Requirements

Survey speeds were maintained to meet object detection requirements were met or exceeded throughout the survey. ***Concur with clarification. Submitted grids over features generated to complete coverage specifications, although the data density does support object detection specifications.***

Demonstration of 200% side scan sonar coverage was achieved by producing two separate 100% 50-centimeter mosaics. A fill plan was created for all holidays in water depths 18 feet or deeper. Occasional small areas were observed to have poor quality coverage resulting from biomass or crossing vessel wakes. ***Concur.***

Multibeam data were acquired in conjunction with side scan sonar. A fill plan was created for all significant holidays that extended across the multibeam trackline. The coverage requirement for the *Draft NOS Skunk Stripe Specifications** survey was achieved. The sounding density requirement of 95% of all nodes populated with at least 3 soundings per node was verified by exporting the density child layer of each CUBE surface (finalized using depth thresholds) to an ASCII txt file and compiling statistics on the density values. All 2 and 4 meter surfaces (H12045_1of6 to H12045_6of6) created using the *Draft NOS Skunk Stripe Specifications** were reviewed in this manner. Density statistics of individual item investigation surfaces using Complete Coverage requirements were not created but there was a manual review to ensure that each significant feature had either a designated sounding from a nadir beam or the node overlying the least depth had a density of at least three soundings. ***Concur. *Included in Appendix V, appended to this document.***

B3. Corrections to Echo Soundings

Data reduction procedures for survey H12045 are detailed in the *OPR-E349-KR-09 DAPR**, submitted under separate cover. The Reson 7125 acquired data using the 400 kHz frequency and the R2Sonic 2024 acquired data using the 200 kHz frequency. Both datasets were filtered using the CARIS surface filter with error values from Standard Deviation at 2.6 (99.06%) Confidence Level. More detailed information pertaining to applied filters is included in the multibeam processing logs in Separate I *Acquisition and Processing Logs***. ***Concur. *Included with survey deliverables. **Filed with original field reports.***

B3.a Deviations from DAPR

An additional patch test for the *R/V Theory* was run on December 16, 2009 (DN350) as the DAPR* was being prepared for delivery to AHB and therefore was not reported in that document. This was a close out patch test run prior to removing the survey vessel from the water for storage over the winter. ***Concur. *Included with survey deliverables.***

The DAPR* incorrectly lists *R/V Chinook*'s TPE latencies as 0.05(s). The correct value, as applied in the HVF, is 0.005(s). ***Concur. *Included with survey deliverables.***

A reporting error was found in the DAPR* after it was submitted where the *R/V Theory* roll and yaw columns in Table 14 are incorrectly labeled. The column labeled *Yaw* (°) actually reports roll values and the column labeled *Roll* (°) lists yaw values. This error has been corrected in Table 5 on the following page. Additionally, the values from December 16, 2009 (DN350) patch test have been added to the table. ***Concur. *Included with survey deliverables.***

Table 5. *R/V Theory* biases applied when using POS/MV

DN	Latency	Pitch (°)	Roll (°)	Yaw (°)	X (m)	Y (m)	Z (m)	Comments
167	0.000	-3.300	-0.550	-0.900	1.950	-0.516	1.000	200 kHz, Patch values are from DN337 of NOAA11
170	0.000	-3.800	-0.300	-1.100	1.950	-0.516	1.000	200 kHz, Confidence Checks
170	0.000	-4.300	-0.600	-1.500	1.860	-0.513	1.000	400 kHz, Confidence Checks
170	0.000	-3.800	-0.300	-1.100	1.950	-0.516	1.000	200 kHz, Confidence Checks - Wreck Test
170	0.000	-4.300	-0.600	-1.500	1.860	-0.513	1.000	400 kHz, Confidence Checks - Wreck Test
171	0.000	-3.800	-0.300	-1.100	1.950	-0.516	1.000	200 kHz, Patch Test
171	0.000	-4.300	-0.600	-1.500	1.860	-0.513	1.000	400 kHz, Patch Test
172	0.000	-3.800	-0.300	-1.100	1.950	-0.516	1.000	200 kHz, Start of Survey
189	0.000	-2.629	-0.574	-1.279	1.860	-0.513	1.000	400 kHz, Patch Test - New Reson Rx Installed
189	0.000	-3.043	-0.405	-1.000	1.950	-0.516	1.000	200 kHz, Patch Test - New Reson Rx Installed
190	0.000	-2.629	-0.574	-1.279	1.860	-0.513	1.000	400 kHz, Restart Survey
262	0.000	-2.586	-0.588	-1.320	1.860	-0.513	1.000	400 kHz, Patch Test
294	0.000	-2.588	-0.532	-1.400	1.860	-0.513	1.000	400 kHz, Boat pulled (Patch Values from Day 304)
304	0.000	-3.150	-0.344	-1.540	1.950	-0.516	1.000	200 kHz, Patch Test
305	0.000	-2.588	-0.532	-1.400	1.860	-0.513	1.000	400 kHz, Patch Test
315	0.000	-2.650	-0.539	-1.200	1.860	-0.513	1.000	400 kHz, Patch Test - Reson 7P upgraded from MR6 to MR6.3
324	0.000	-2.944	-0.522	-1.400	1.860	-0.513	1.000	400 kHz, Patch Test
338	0.000	-3.085	-0.499	-1.370	1.860	-0.513	1.000	400 kHz, Patch Test
350	0.000	-3.640	-0.499	-1.433	1.860	-0.513	1.000	400 kHz, Patch Test

B3.b Additional Calibration Tests

The initial system calibration tests were performed for the *R/V Theory* on June 19, 2009 (DN170) and for the *R/V Chinook* on August 4, 2009 (DN216). Additional tests were performed periodically to verify the adequacy of the known system biases. Additional discussion on calibration tests can be found in the *OPR-E349-KR-09 DAPR**. ***Concur. *Included with survey deliverables.***

B4. Data Processing (Data Representation)

B4.a Multibeam

CUBE surface resolutions and depth ranges were set in accordance with the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2009) and the *Draft NOS Skunk Stripe Specifications**. ***Concur with clarification. Feature investigations in less than 22m submitted at 1m resolution (not the 0.5m resolution as directed in NOS HSSDM for object detection, however least depths are designated hence the final grids honor the shoal soundings. *Included in Appendix V, appended to this document.***

In order to keep CUBE surfaces at a manageable size, the main survey area was broken up into six (6) Field Sheets (H12045_1of6, etc.). When combined the Field Sheets encompass the entire area of acquired multibeam bathymetry. CUBE surfaces using complete coverage specifications were created over each multibeam investigation of a significant contact. The name of each Field Sheet corresponds to the primary side scan sonar contact name. A BAG was created for each finalized CUBE surface and both the CUBE and BAG surfaces have been included with the digital data. All investigation CUBE surfaces were combined into a single grid prior to BAG creation. ***Concur.***

C. HORIZONTAL AND VERTICAL CONTROL

Traditional zoning from water level stations was used for *OPR-E349-KR-09* with zoning and verified water level files provided by The Center for Operational Oceanographic Products and Services (CO-OPS). ***Concur.***

Prior to survey acquisition, a global positioning system (GPS) base station with a dual frequency (L1/L2) receiver was established to enable post-processing of survey vessel navigation and attitude data. The base station was located at the Smith residence on Tangier Island (TANGIER) and logged raw dual frequency (L1/L2) GPS observables at one second epochs. A base station position relative to the North American Datum of 1983 (NAD83) (CORS96) (Epoch 2002) was derived from the National Geodetic Survey (NGS) On-line Positioning User Service (OPUS) and based on a 24-hour data file, with one second-epoch logging prior to commencement of survey operations. ***Concur.***

DGPS navigation was logged during acquisition but ultimately overwritten with a post-processed Inertially-Aided Kinematic Ambiguity Resolution (IAKAR) navigation solution. The HIPS Load Attitude and Navigation tool was used to load position, heading and attitude data from a smoothed best estimate trajectory (SBET) file created from Applanix POSPac 5.2 MMS. Post-

processed uncertainty estimates for position, attitude and heading were applied using the HIPS Load Error Tool and used during the calculation of TPE. ***Concur.***

The TANGIER base station was not operating during survey acquisition on December 11 and December 15, 2009 (DN 345 and 348). As a result there was no base station data available to post-process the navigation solution in Single Base mode. Instead, data were post-processed using the Applanix POSPac MMS SmartBase option which creates a virtual reference station from a network of GPS base stations. The network was created from NGS Continuously Operating Reference Stations (CORS) VIMS, MDSI, HNPT, VAGP, DRV5, VAWI, DRV6, and LOY1. Post-processing with the SmartBase option generated an IAKAR navigation solution in SBET format and an associated error file. After the solution was created the POSPac NAVDIF routine was used to compare the SmartBase solution to real-time DGPS navigation as a check to the input base station coordinates and the quality of the final solution. SBET files created from SmartBase processing were loaded in Caris HIPS just like their Single Base counterparts. Table 6 lists the NAD83 coordinates of the base stations used in the GPS network. ***Concur.***

Table 6. CORS Base Stations Used During SmartBase Processing

CORS Base Stations	Coordinates NAD83(CORS) ARP (NGS Data Sheet)		
	Latitude	Longitude	Ellipsoid Height (m)
VIMS*	37/36/30.045 N	075/41/13.207 W	-27.739
MDSI	38/19/08.073 N	076/27/13.956 W	-16.774
HNPT	38/35/19.711 N	076/07/49.333 W	-26.645
VAGP	37/14/55.009 N	076/29/57.731 W	-19.809
DRV5	36/57/31.136 N	076/33/23.903 W	-21.358
VAWI	37/56/03.500 N	075/28/15.949 W	-22.315
DRV6	36/57/30.556 N	076/33/23.214 W	-21.425
LOY1	37/03/43.812 N	076/24/12.356 W	-22.722

* Primary station

A complete description of horizontal and vertical control for survey H12045 can be found in the *OPR-E349-KR-09 Horizontal and Vertical Control Report**, submitted under separate cover. A summary of horizontal and vertical control for this survey follows. ***Concur. *Included with survey deliverables.***

C1. Vertical Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary water level stations at Windmill Point, Virginia (863-6580) and Lewisetta, Virginia (863-5750) served as control for datum determination and provided water level correctors for the project. ***Concur with clarification. Final surfaces generated from ERS-VDatum data, in lieu of the data corrected via the above referenced water level station.***

C2. Discussion of Tide Zoning

Tide zoning was included within the Tide and Water Levels Instructions for OPR-E349-KR-2009. A modified version of the HIPS Zone Definition File (ZDF) *E349KR2009_RevisedCORP*

provided by CO-OPS was used to apply zoned tides to the multibeam data. The modified file, named *E349KR2009_RevisedCORP*_1s, used a HIPS Interval value of 1 second rather than the default value of 360 seconds which was used in the file received by CO-OPS. The interval value controls the frequency of tide zoning interpolation. The default value of 360 seconds is too infrequent to properly correct for the assigned zoning boundaries where it would be possible for the survey vessel to pass through a zone without a zoned tide corrector being applied if the vessel was not within the zone boundary for longer than 359 seconds. No modifications were made to zone boundaries or time and range correctors. ***Concur with clarification. Final surfaces generated from ERS-VDatum data, in lieu of data corrected with the above referenced ZDF.***

Table 7 includes the zoning information for each zone used for the survey.

Table 7. Tide Zones

Zone	Reference Station	Corrector (min.)	Ratio
SCB85	8636580	0	1.42
SCB96	8636580	18	1.29
SCB97	8636580	18	1.42
SCB101	8636580	30	1.47
SCB102	8636580	30	1.29
SCB109	8636580	48	1.29

It is difficult to associate a precise vertical error due to tides. However, this survey included the logging of GPS water levels and follow-on deliverables will include soundings reduced to chart datum from GPS observations. Errors observed are a composite from various sources such as measurement error, tides, heave, refraction, transducer draft, and settlement and squat. In addition, there is a known frequency dependent offset between the R2Sonic 2024 at 200 kHz (*R/V Chinook*) and the Reson 7125 at 400 kHz (*R/V Theory*) which is not related to tides, but still manifests itself as a vertical offset when comparing overlapping data from the two survey vessels. The survey area, which lies on the eastern side of the Chesapeake Bay, is over 14 nautical miles from the controlling NWLON station Windmill Point which sits in an embayment on the western side of the bay. Vertical errors resulting from the limitations of tide zoning are visible in the data and are generally 10 to 15 centimeters. In some extreme cases errors exceeding 30 centimeters were observed (Figure 2). This offset is within the 20 to 45 centimeters maximum allowable error for tides and water levels. The largest contributing factor to water level errors in the Chesapeake Bay is meteorological influences which cannot be accounted for by zoning. The hydrographer strongly recommends the application of GPS tides to improve vertical accuracy when applying this survey to the nautical chart. ***Concur. GPS tides incorporated into the final grid solutions.***

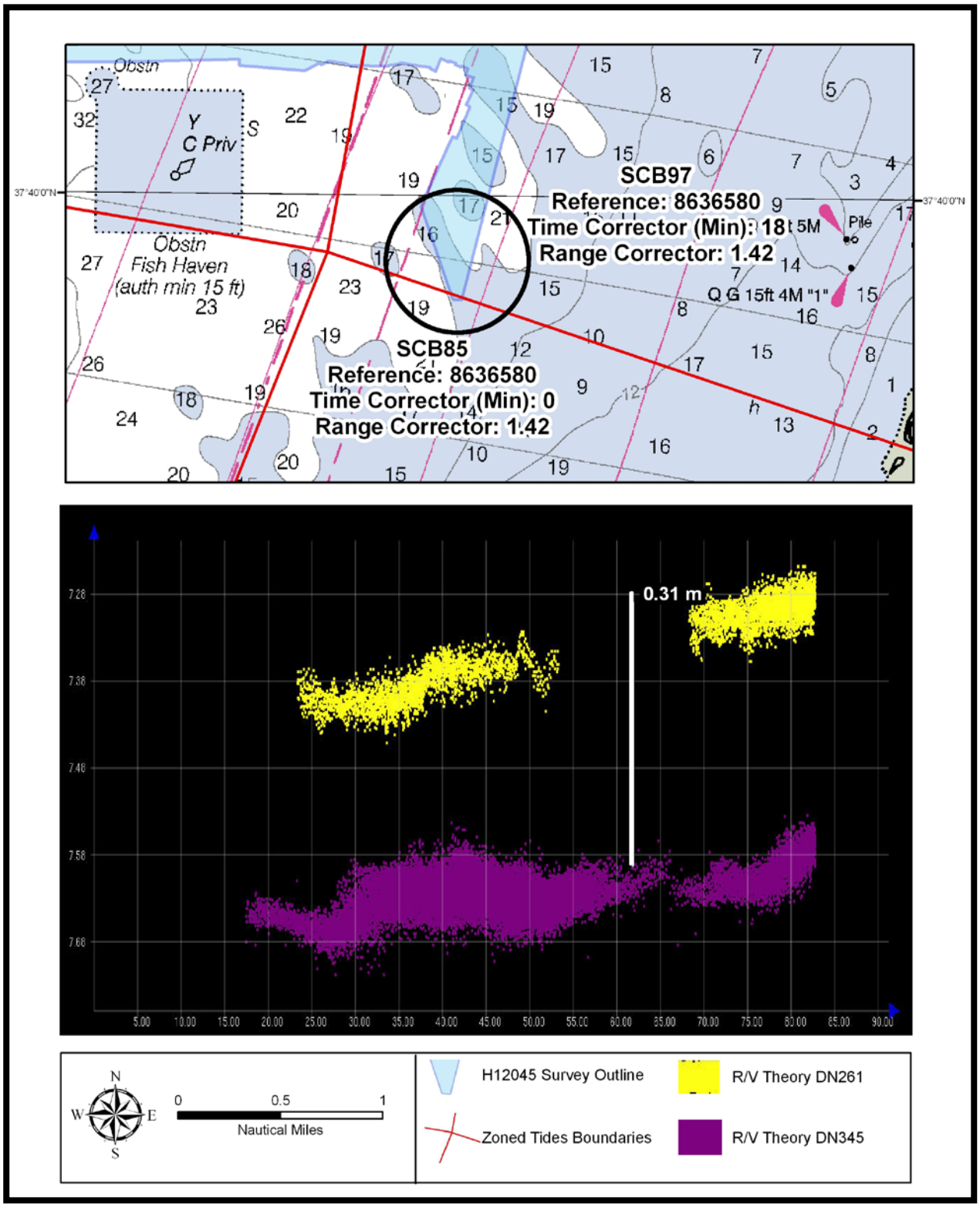


Figure 2. Vertical error at zone boundary .

C3. Horizontal Control

The horizontal datum for this project is NAD83. Differential GPS (DGPS) corrections were received from the U.S. Coast Guard (USCG) beacon at Driver, Virginia (301 kHz) or from the secondary beacon at Annapolis, MD (289 kHz). Some DGPS outages from the primary beacon occurred during survey operations. The system was set up to automatically switch to the secondary beacon when the primary signal was lost. All of the primary navigation data were collected in DGPS mode. Additionally, during acquisition GPS base stations were constructed and logged data simultaneously with acquisition to provide post-processed IAKAR navigation solutions. ***Concur.***

Navigation and attitude data were post-processed using Applanix POSPac MMS software, which produced an IAKAR navigation solution relative to NAD83. The real-time navigation and attitude logged during acquisition was overwritten with post-processed data during HIPS processing. Post-processed navigation, attitude and GPS heights were applied to all HIPS data though only the navigation and attitude were used in the creation of the survey deliverables. As discussed in the DAPR*, post-processed GPS heights were used to compute a GPS tide using an ellipsoid to MLLW separation file created using VDatum. Though present for each survey line GPS Tides were not applied to the survey data during the merge process (the Apply GPS Tides box was not checked during merge in Caris HIPS), are for reference only, and should not be used. Further discussion on the computation of GPS tides and the creation of the separation model can be found in the pending *OPR-E349-KR-09 Ellipsoid Referenced Survey Deliverables**. ***Concur. Final surfaces generated from the ERS-VDatum data. *Included with survey deliverables.***

D. RESULTS AND RECOMMENDATIONS

D1. Chart Comparison

D1.a Survey Agreement with Chart

During the course of data acquisition and processing H12045 was compared to the largest scale raster and electronic navigation charts (ENC). The results of these comparisons are described below, as well as in Sections D1.b through D1.f of this report. ***Concur.***

Contours and soundings used during the chart comparison were generated from combined HIPS product surfaces. Soundings and contours were generated from a 50-meter HIPS product surface (1:10,000) of the entire survey area, which was compiled from all finalized CUBE surfaces for the survey. The product surfaces, contours, and soundings were created solely for the chart comparison and have not been submitted as a final deliverable. ***Concur.***

The latest electronic and raster versions of the relevant charts were reviewed to ensure that all U.S. Coast Guard Local Notice to Mariners (LNM) issued during survey acquisition, impacting the survey area, were applied and addressed by this survey. ***Concur.***

In addition, a surface was generated from the ENCs that corresponds to the largest scale raster charts in the area. A Difference surface was produced using the ENC and the 50-meter combined surface to aid in the chart comparison.

H12045 contours and soundings were compared in CARIS HIPS to the depths and contours on the charts listed in Table 8.

Table 8. Charts compared to H12045

Chart	Scale	Edition	Edition Date	Issue Date	Latest LNM	Cleared Through Date
12225	1:80,000	59	12/01/2009	---	03/10	01/12/2010
12226	1:40,000	18	07/01/2009	---	03/10	01/12/2010
12228	1:40,000	32	03/01/2008	---	03/10	01/12/2010
12280	1:200,000	09	06/01/2009	---	03/10	01/12/2010
US5VA16M	---	16	---	01/06/2010	---	01/05/2010
US5VA41M	---	20	---	01/06/2010	---	01/05/2010

Concur with clarification. US5VA41M does not coincide with H12045. Applicable ENC's are US5VA16M and US5VA10M.

Surveyed H12045 depths are generally zero to five feet (0.00 to 1.524 meters) deeper than charted (Figure 3), with the most significant difference occurring on a steep charted ridge. ***Concur.***

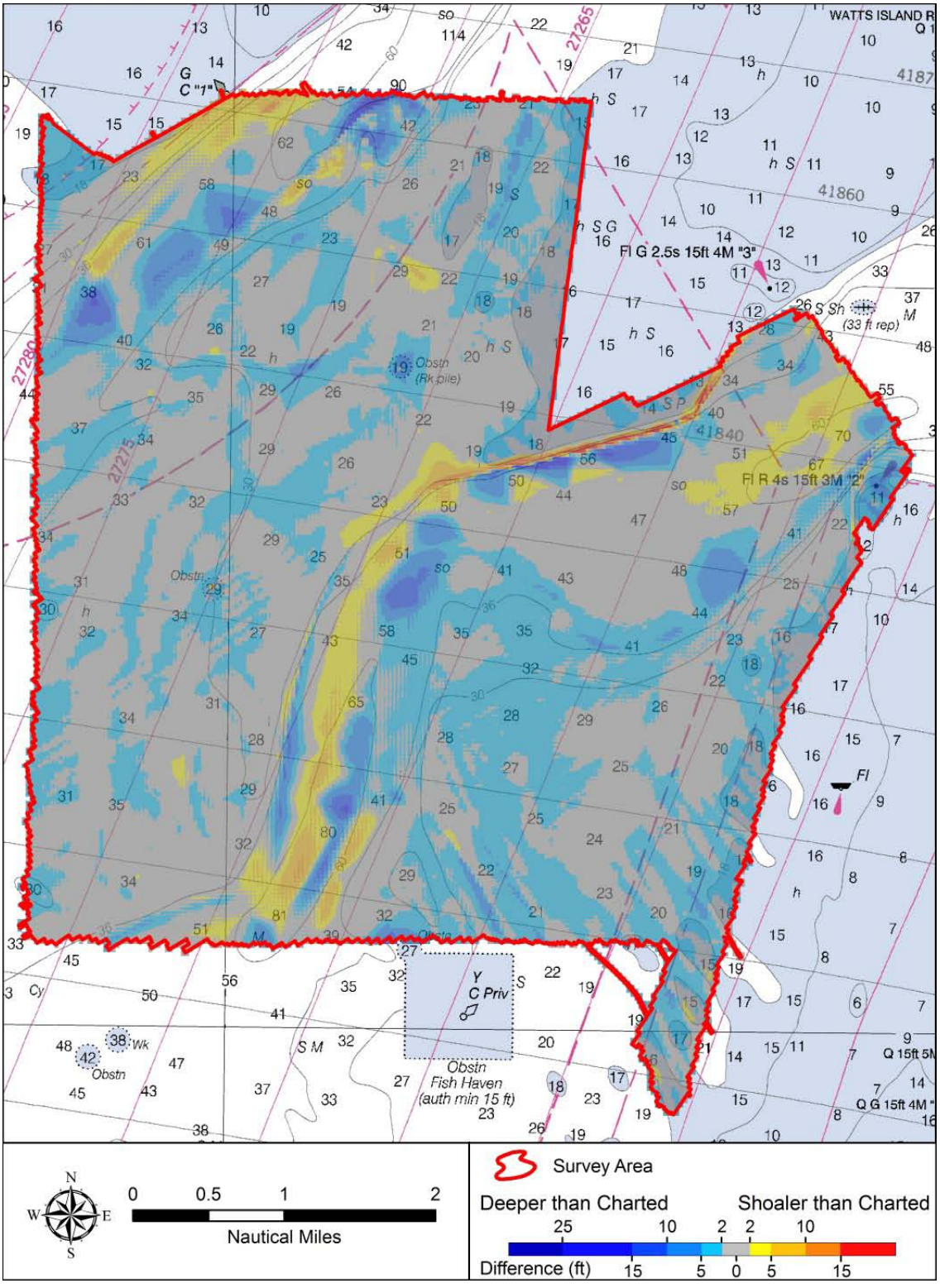


Figure 3. Difference image of depth discrepancies between H12045 and Chart 12225.

The most significant discrepancies between the chart and H12045 are discussed below.

1. Shoaling of up to 29.9 feet (9.10 meters) and deepening of up to 13.6 feet (4.14 meters) was observed along the southern slope of the charted shoal southwest of Watts Island. These significant differences result from minor migration of the shoal approximately 50 meters to the southeast. Shoaling and deepening continues south from the slope along the 36-foot contour and east along the 60-foot contour. ***Concur.***
2. In the vicinity of Green Can Buoy "1" the current survey located a least depth of 33 feet (10.05 meters) seaward of the charted 36-foot contour. ***Concur.***

D1.b Comparison to Significant Shoals

The H12045 survey area contains numerous charted shoals depicted by the 18-foot contour. The charted shoals were found to be in their general charted location, but since surveyed depths in these areas are generally one to two feet (0.30 meters to 0.61 meters) deeper than charted, the shoals are now depicted by the surveyed 19-foot and 20-foot contours. This scenario impacts the following charted shoals:

1. The charted 17-foot and 18-foot shoals at the entrance of Tangier Sound, ~~east~~ ***west*** of Green Can Buoy. ***Concur.***
2. The charted shoal southwest of Watts Island which separates the entrances to Tangier and Pocomoke Sounds. With the exception of the southern extent of the shoal which has migrated approximately 50 to the southeast. ***Concur.***
3. The charted shoal south of Tangier Island. ***Concur.***
4. The charted 18-foot contour and small finger shoals along the entire eastern extent of the survey boundary. ***Concur.***

Current bathymetry located a 14-foot (4.27 meters) depth at 37/40/08.63 N, 75/56/08.57 W at the charted 15-foot shoal near the southeastern extent of H12045. ***Concur with clarification. 14 foot sounding not observed in ERS acquired, VDatum shifted data.***

D 1.c Comparison to Charted Features

One (1) AWOIS item was assigned for investigation to H12045 (Figure 4). A complete description is available in Appendix II *Survey Feature Report**. ***Concur. *Appended to this document.***

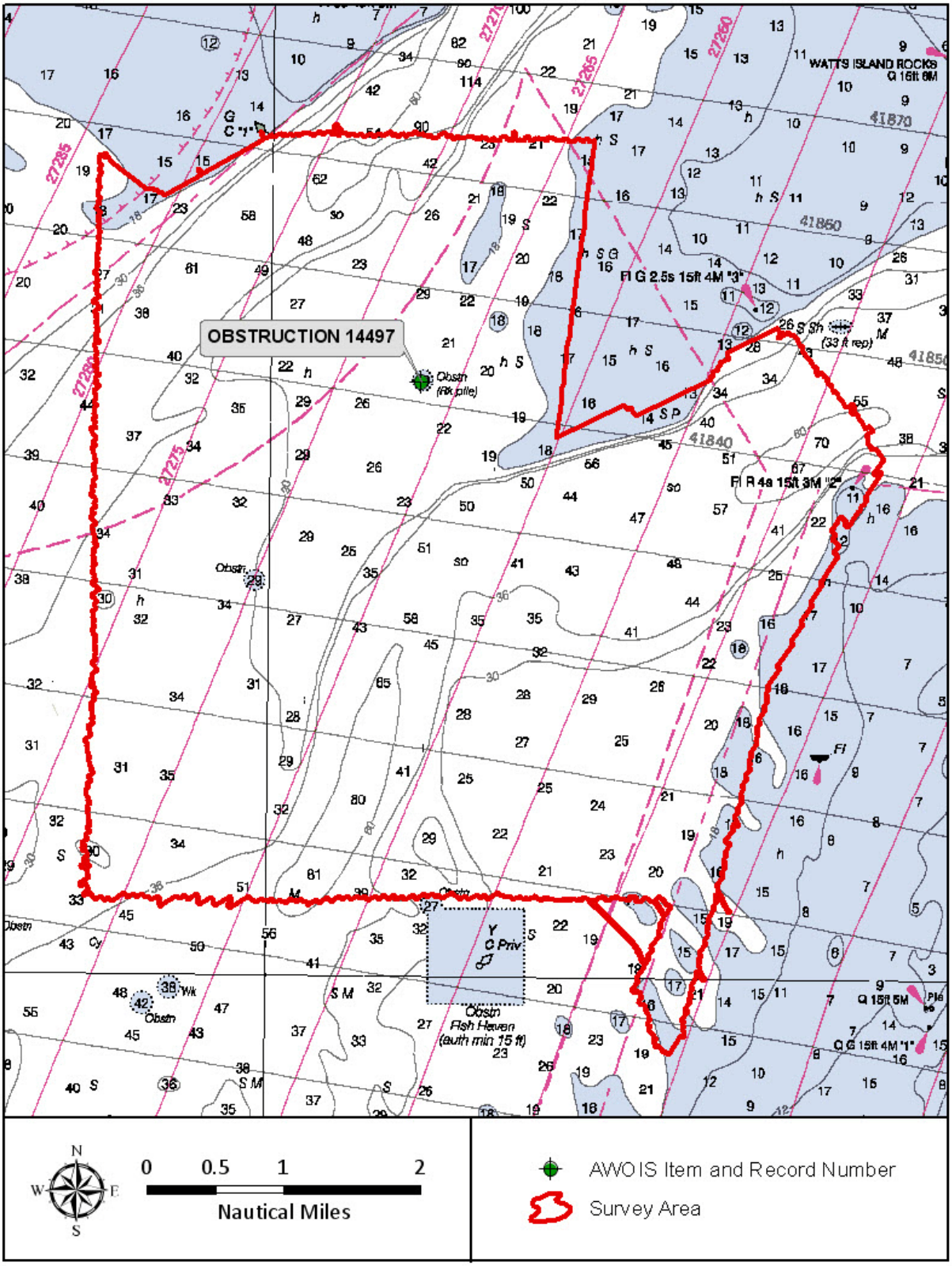


Figure 4. H12045 AWOIS Items

Assigned AWOIS items for H12045 are listed as follows:

- AWOIS 14497 is a charted 19-foot *Obstrn (Rk pile)*. The obstruction was found charted correctly at position 37/44/21.580N, 75/58/35.102W with two hundred percent side scan sonar coverage and complete multibeam coverage. The least depth is 18.7 feet (5.74 meters). ***Concur with clarification. From the ERS acquired, VDatum shifted data, the obstruction was found to have a least depth of 19.3ft (5.89m).***

D1.d Comparison of Soundings in Designated Anchorages and Along Channels
H12045 survey area does not contain any anchorage areas or channels. ***Concur.***

D1.e New Submerged Features
New submerged features are listed in tabular format in Appendix II *Survey Feature Report**. The most significant features were reported in the S-57 feature file**. ***Concur. *Appended to this document. ** Included with survey deliverables.***

D1.f Dangers to Navigation (DtoN)
Three (3) Dangers to Navigation (DtoNs) were located during survey H12045 and have been submitted to AHB. All DtoNs were reviewed by AHB and forwarded on to the Marine Chart Division (MCD). ***Concur.***

DtoN 2.3 was reported with the wrong imagery. All DtoNs are included in the S-57 feature file and should be charted as depicted in the file (Table 9). ***Concur with clarification. Each of the submitted DTONs now currently resides on the chart.***

Table 9. H12045 DtoN Charting Status

DtoN	Feature	Applied to Raster Chart	Applied to ENC	AHB Submitted to MCD
1.1	Obstruction	Yes	Yes	Yes
2.1	Obstruction	Not Yet Published	Not Yet Published	Yes
2.2	Obstruction	Not Yet Published	Not Yet Published	Yes
2.3	Obstruction	Not Yet Published	Not Yet Published	Yes
2.4	Obstruction	Not Yet Published	Not Yet Published	Yes
3.1	Obstruction	Not Yet Published	Not Yet Published	Yes

D.2 Additional Results

D2.a Shoreline Investigations
Shoreline investigation was not required for OPR-E349-KR-09. ***Concur.***

D2.b Comparison with Prior Surveys
Comparison with prior surveys was not required under this task order. ***Concur.***

D2.c Aids to Navigation (AtoN)

All U.S. Coast Guard aids to navigation (AtoN) within the survey limits were found to be correctly charted and serving their intended purpose. ***Concur.***

D2.d Overhead Clearance

There are no overhead bridges, cables or other structures, which would impact overhead clearance in the survey area. ***Concur.***

D2.e Cables, Pipelines and Offshore Structures

There were no charted or observed submarine cables or pipelines, drilling structures, production platforms, or well heads within the survey area. ***Concur.***

D2.f Environmental Conditions Impacting the Quality of the Survey

Although the survey exceeds IHO Order 1 accuracy requirements, environmental conditions degraded the quality of the survey data. The open waters of the Chesapeake Bay are notorious for localized wind-driven tides that can not always be recorded or modeled with stationary gauges. The hydrographer recommends that any future surveys in areas frequently subjected to meteorological conditions that locally affect tidal ranges, and which require stringent survey accuracies, such as Object Detection surveys, use kinematic GPS methodology for water level correction. ***Concur.***

D2.g Construction Projects

No active construction projects were observed in H12045 survey area. ***Concur.***

D2.h Bottom Characteristics

Nineteen (19) bottom samples were obtained on July 19, 2009 (Day Number 200) and are included in the S-57 attributed feature file in the *Supporting Data* folder. A table listing the position and description of each bottom sample is included in Appendix V *Supplemental Survey Records and Correspondence&**, along with photographs of each sample. ***Concur. *Appended to this document.***

E. LETTER OF APPROVAL

The letter of approval for this report and accompanying data follows on the next page.

DAVID EVANS AND ASSOCIATES INC.

LETTER OF APPROVAL

OPR-E349-KR-09
REGISTRY NO. H12045

This report and the accompanying data are respectfully submitted.

Field operations contributing to the accomplishment of survey H12045 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and associated data have been closely reviewed and are considered complete and adequate as per the *OPR-E349-KR-09 Statement of Work Statement* and *Hydrographic Survey Project Instructions* dated June 2009.

Digitally signed by Jon Dasler
DN: cn=Jon Dasler, email=jld@deainc.com, o=David Evans and Associates, Inc., c=US
Date: 2010.03.04 11:15:54 -08'00'

Jonathan L. Dasler, PE (OR), PLS (OR, CA)
ACSM/THSOA Certified Hydrographer
Chief of Party

Digitally signed by Jason Creech
DN: cn=Jason Creech, email=jasc@deainc.com, o=David Evans and Associates, Inc., c=US
Date: 2010.03.04 11:16:25 -08'00'

Jason Creech
Lead Hydrographer

David Evans and Associates, Inc.
December 2009

F. SUPPLEMENTAL REPORTS

Listed below are supplemental reports submitted separately that contain additional information relevant to this survey:

Title	**Submittal Date**
OPR-E349-KR-09 Data Acquisition and Processing Report	12/18/09
OPR-E349-KR-09 Horizontal and Vertical Control Report	TBD

APPENDIX I
DANGER TO NAVIGATION REPORTS

H12045 Danger to Navigation

Registry Number: H12045

State: Virginia

Locality: Southern Chesapeake Bay

Sub-locality: 3NM South of Tangier Island

Project Number: OPR-E349-KR-09

Survey Dates: 09/06/2009 - 12/07/2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
12226	17th	12/01/2007	1:40,000 (12226_1)	[L]NTM: ?
12285	39th	03/01/2008	1:40,000 (12285_19) 1:40,000 (12285_18)	[L]NTM: ?
12228	32nd	03/01/2008	1:40,000 (12228_1)	USCG LNM: 10/27/2009 (10/27/2009) NGA NTM: 08/02/2008 (10/31/2009)
12225	58th	05/01/2009	1:80,000 (12225_1)	USCG LNM: 10/27/2009 (10/27/2009) NGA NTM: 08/02/2008 (10/31/2009)
12280	9th	06/01/2009	1:200,000 (12280_2)	USCG LNM: 10/27/2009 (10/27/2009) NGA NTM: 11/23/2002 (10/31/2009)
12200	49th	06/01/2007	1:419,706 (12200_1)	[L]NTM: ?
13003	49th	04/01/2007	1:1,200,000 (13003_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	8.78m Obstruction	Obstruction	8.78 m	37° 42' 53.8" N	076° 00' 07.9" W	---
1.2	31ft OBSTRN	Obstruction	9.39 m	37° 40' 58.6" N	076° 00' 43.2" W	---
1.3	43ft OBSTRN	Obstruction	13.12 m	37° 43' 58.5" N	075° 55' 35.8" W	---
1.4	19ft OBSTRN	Obstruction	6.00 m	37° 44' 38.2" N	075° 57' 56.7" W	---
1.5	29ft OBSTRN	Obstruction	8.98 m	37° 44' 27.9" N	075° 55' 43.2" W	---
1.6	19ft OBSTRN	Obstruction	5.83 m	37° 44' 08.3" N	075° 58' 01.6" W	---

1 - Danger To Navigation

1.1) 8.78m Obstruction

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 42' 53.8" N, 076° 00' 07.9" W

Least Depth: 8.78 m (= 28.81 ft = 4.801 fm = 4 fm 4.81 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-249.12:57:09.000 (09/06/2009)

GP Dataset: H12045_DtoN#1.xls

GP No.: 1

Charts Affected: 12226_1, 12228_1, 12285_18, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depth was acquired with a Reson 7125 shallow water multibeam sonar, reduced to Mean Lower Low Water using post-processed GPS water levels, and should be considered preliminary.

Positions are referenced from post-processed navigation using a GPS base station and are on NAD83.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#1.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

DtoN 1.1 is an uncharted object that rises 1.4m above the natural bottom. There are several features in the immediate vicinity. Additional investigation coverage will be acquired to better define the least depth.

Cartographically-Rounded Depth (Affected Charts):

29ft (12226_1, 12228_1, 12285_18, 12285_19, 12225_1, 12280_2)

4 ¾fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 8.78m Obstruction

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 8.78 m

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12226_1; 18th Ed., Jul 2009 and smaller scale charts as 29 foot obstruction. Delete 29 foot obstructionat Latitude 37° 42' 53.800" N, Longitude 076° 00' 07.900" W. Chart 26 foot area obstruction to encompass all features in the vicinity at the present survey position near Latitude 37° 42' 53.800" N, Longitude 076° 00' 07.900" W with least depth of 26.2959 ft.

Feature Images

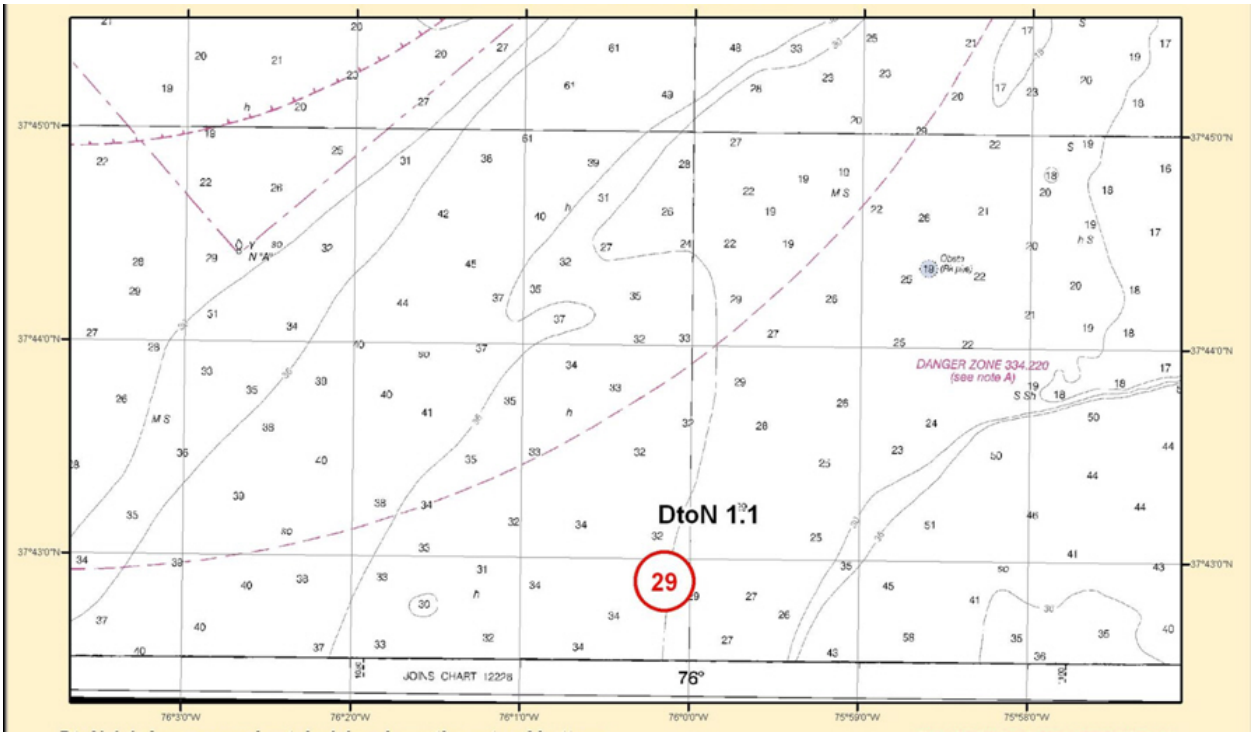


Figure 1.1.1

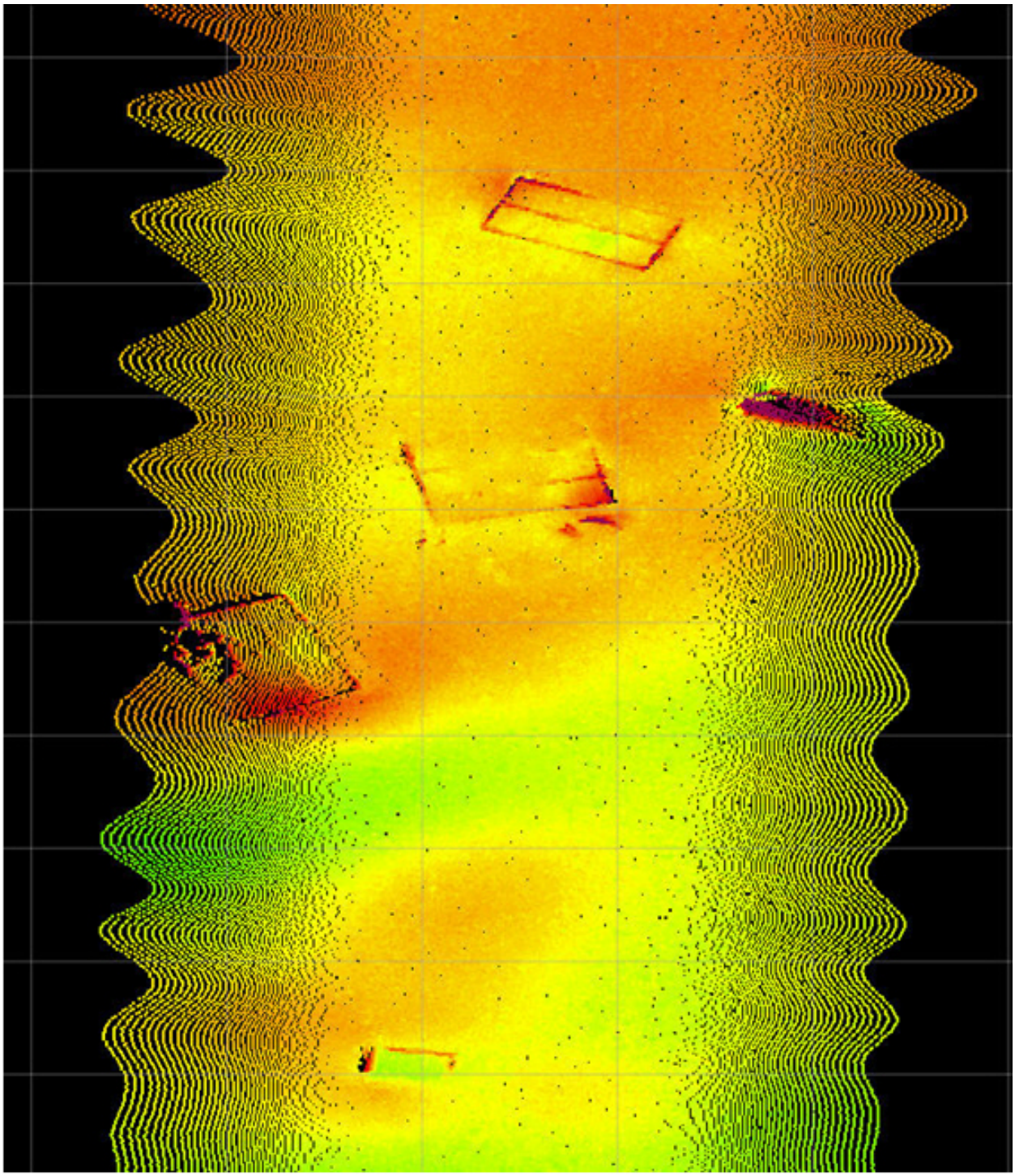


Figure 1.1.2

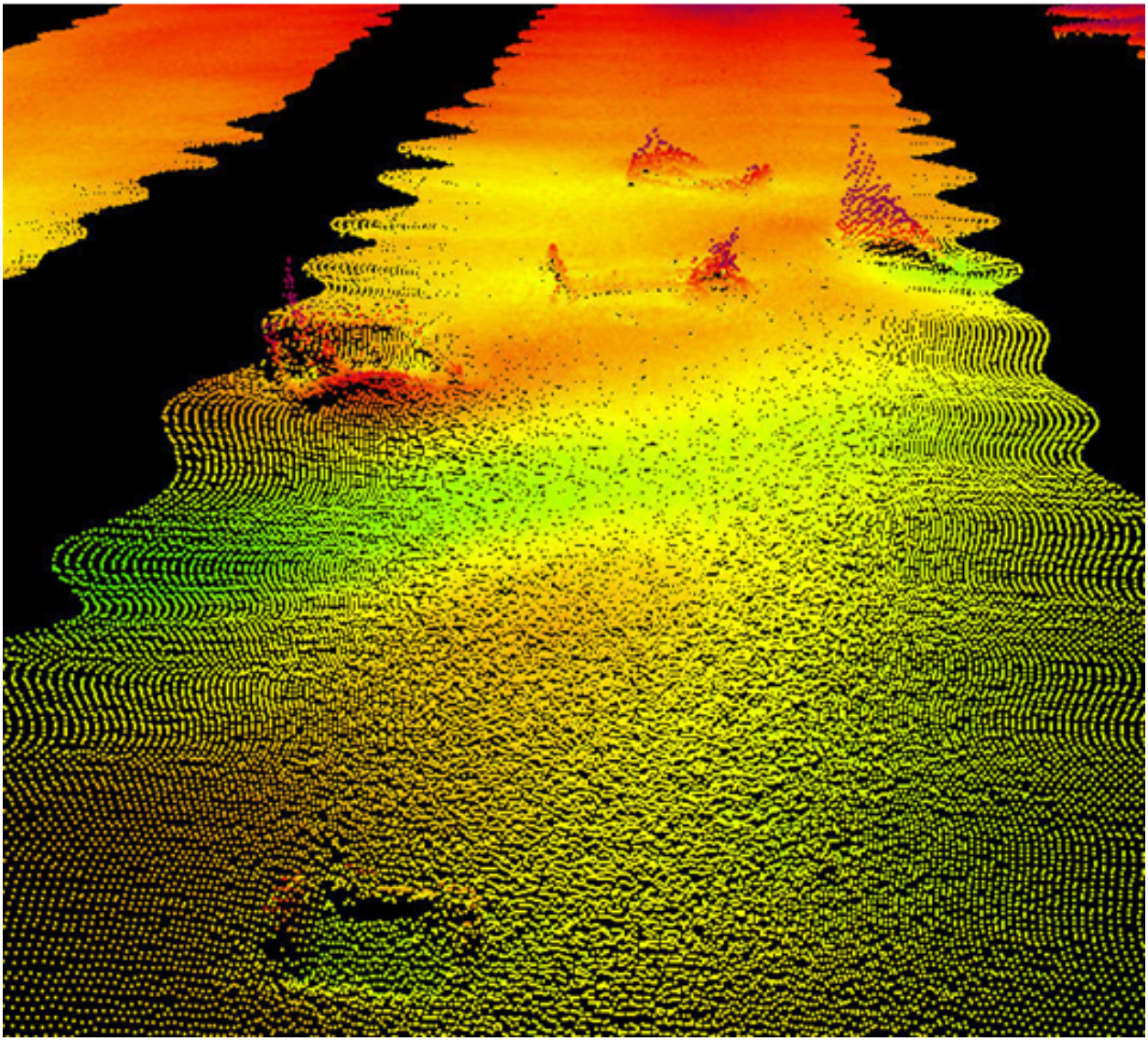


Figure 1.1.3

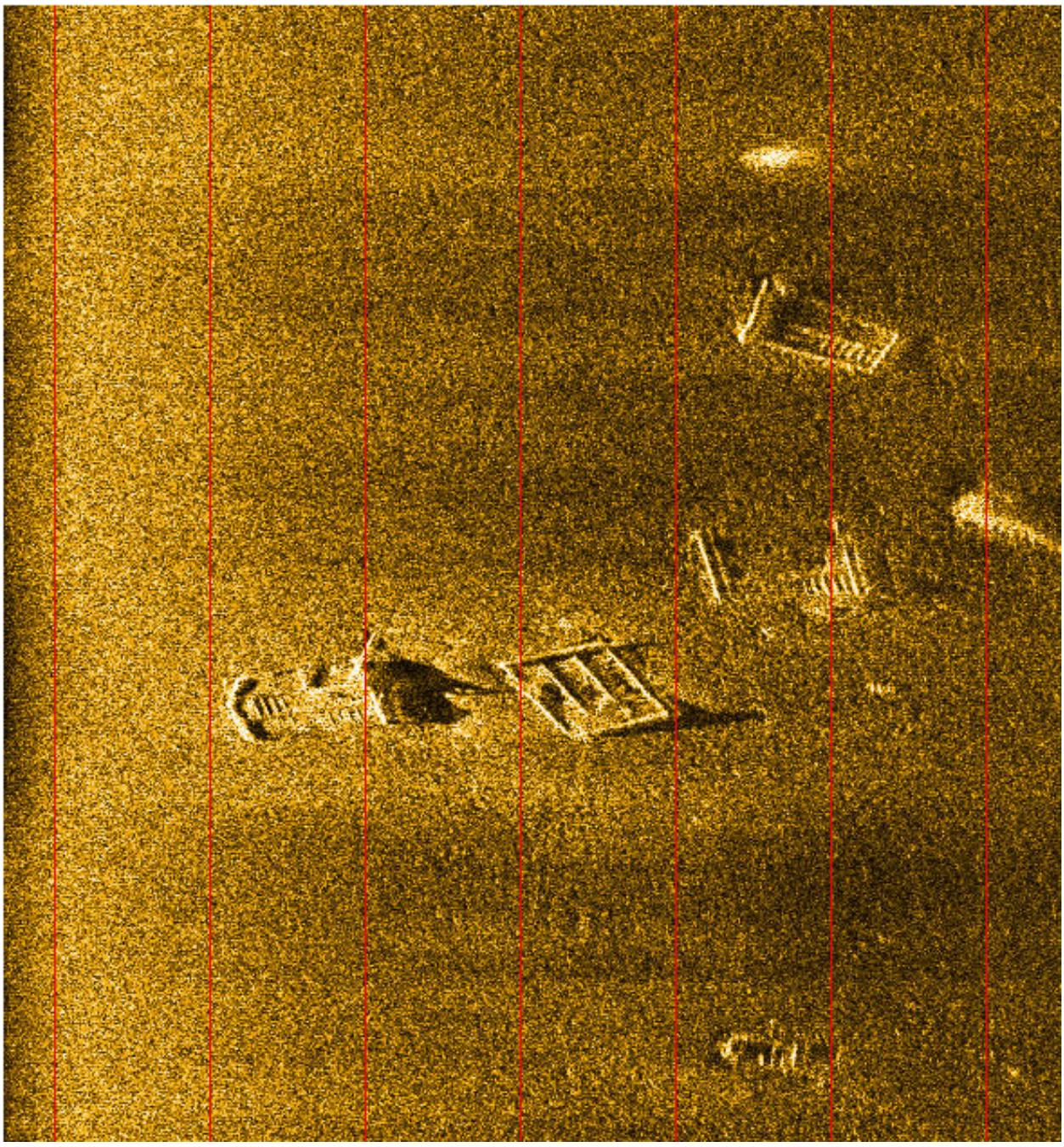


Figure 1.1.4

1.2) 31ft OBSTRN

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 40' 58.6" N, 076° 00' 43.2" W

Least Depth: 9.39 m (= 30.79 ft = 5.132 fm = 5 fm 0.79 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-249.16:53:42.000 (09/06/2009)

GP Dataset: H12045_DtoN#2.xls

GP No.: 1

Charts Affected: 12226_1, 12285_18, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depths were acquired with a Reson 7125 and an R2Sonic 2024 shallow water multibeam sonar and reduced to Mean Lower Low Water using zoning verified water levels.

Positions are referenced from post-processed navgiation using a contractor installed GPS base station and are on NAD83.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#2.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting DtoN 2.1: 31ft OBSTRN at current survey location.

Cartographically-Rounded Depth (Affected Charts):

31ft (12226_1, 12285_18, 12285_19, 12225_1, 12280_2)

5fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 31 ft OBSTRN

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 9.386 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12226_1; 18th Ed., Jul 2009 and smaller scale charts as 31 foot obstruction. Delete 31 foot obstructionat Latitude 37° 40' 58.600" N, Longitude 076° 00' 43.200" W. Chart 29 foot obstruction at the present survey position at Latitude 37° 40' 58.786" N, Longitude 076° 00' 42.959" W with least depth of 29.4685 ft.

Feature Images

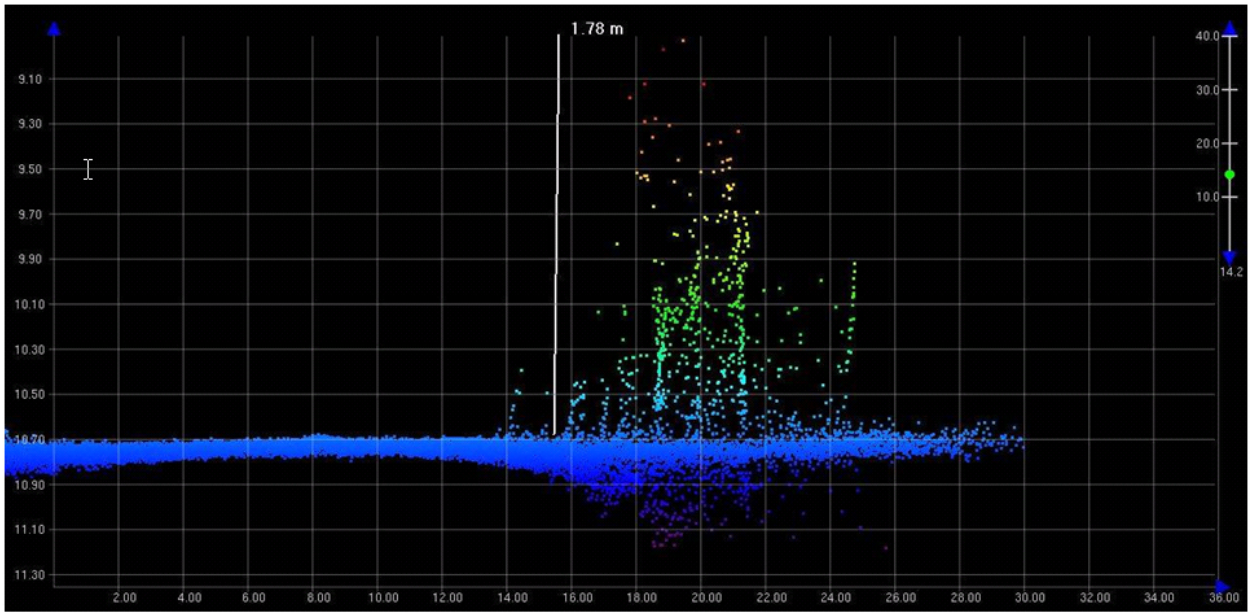


Figure 1.2.1

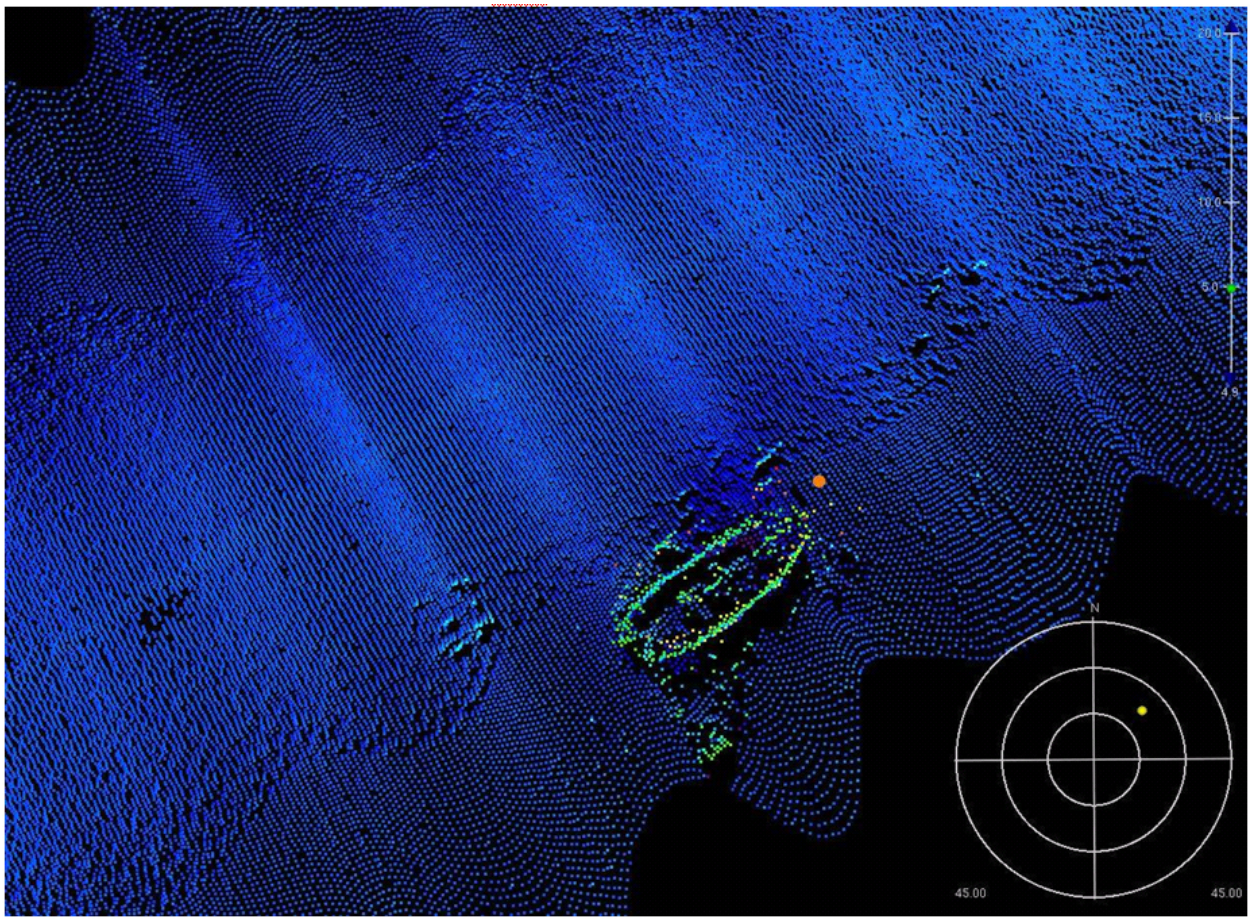


Figure 1.2.2

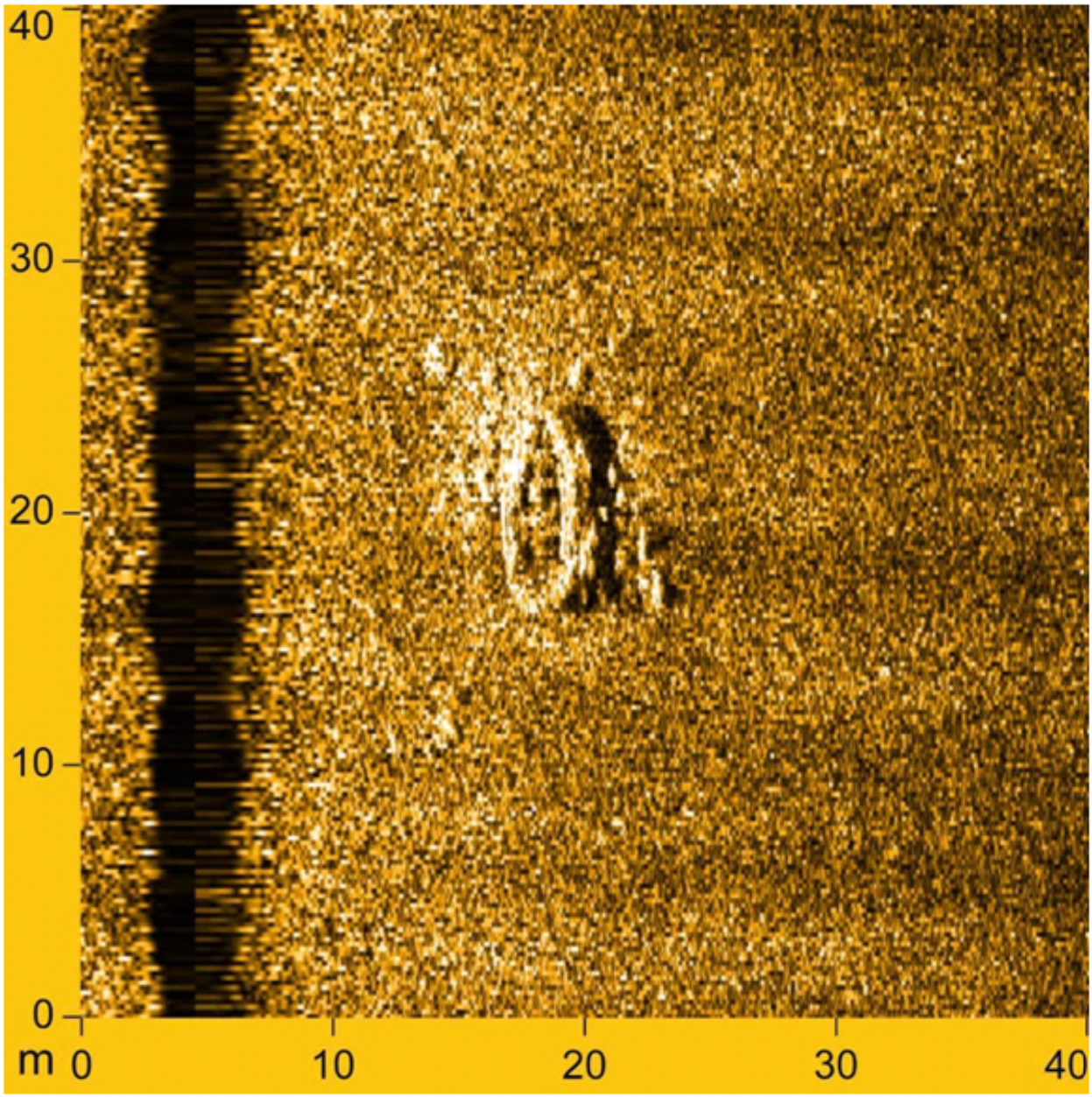


Figure 1.2.3

1.3) 43ft OBSTRN

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 43' 58.5" N, 075° 55' 35.8" W

Least Depth: 13.12 m (= 43.03 ft = 7.172 fm = 7 fm 1.03 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-341.20:11:22.000 (12/07/2009)

GP Dataset: H12045_DtoN#2.xls

GP No.: 2

Charts Affected: 12226_1, 12228_1, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depths were acquired with a Reson 7125 and an R2Sonic 2024 shallow water multibeam sonar and reduced to Mean Lower Low Water using zoning verified water levels.

Positions are referenced from post-processed navgiation using a contractor installed GPS base station and are on NAD83.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#2.xls	2	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting DotN 2.2: 43ft OBSTRN at current survey location.

Cartographically-Rounded Depth (Affected Charts):

43ft (12226_1, 12228_1, 12285_19, 12225_1, 12280_2)

7fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 43ft OBSTRN

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 13.116 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12226_1; 18th Ed., Jul 2009 and smaller scale charts as 43 foot obstruction. Delete 43 foot obstructionat Latitude 37° 43' 58.500" N, Longitude 075° 55' 35.800" W. Chart 43 foot obstruction at the present survey position at Latitude 37° 43' 58.483" N, Longitude 075° 55' 35.796" W with least depth of 43.4547 ft.

Feature Images

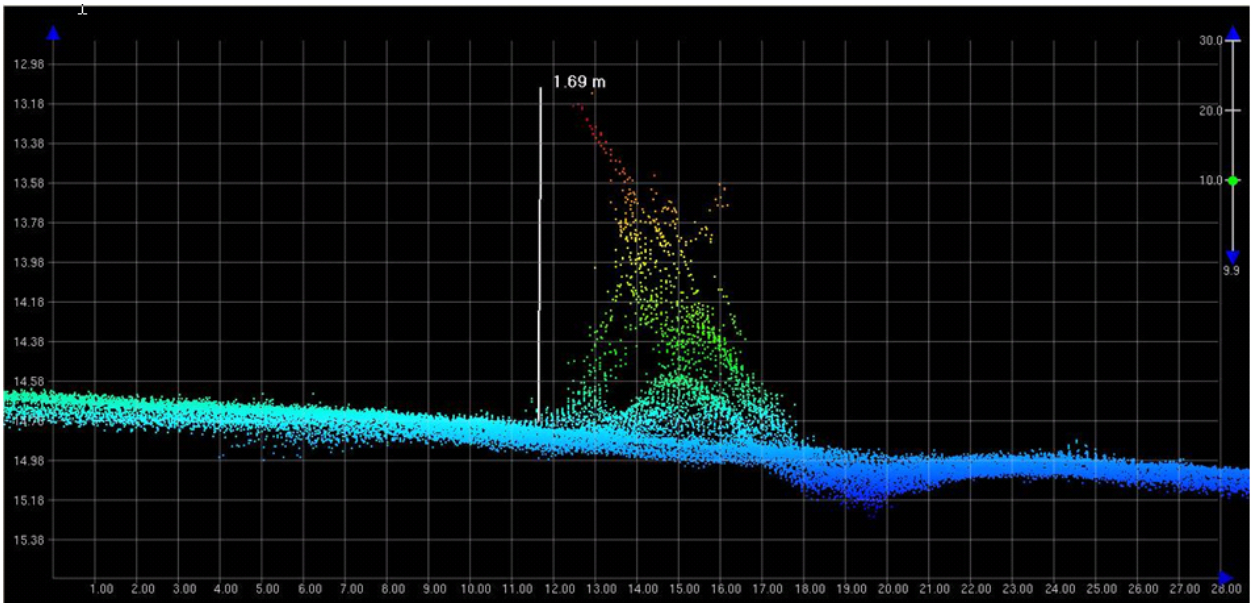


Figure 1.3.1

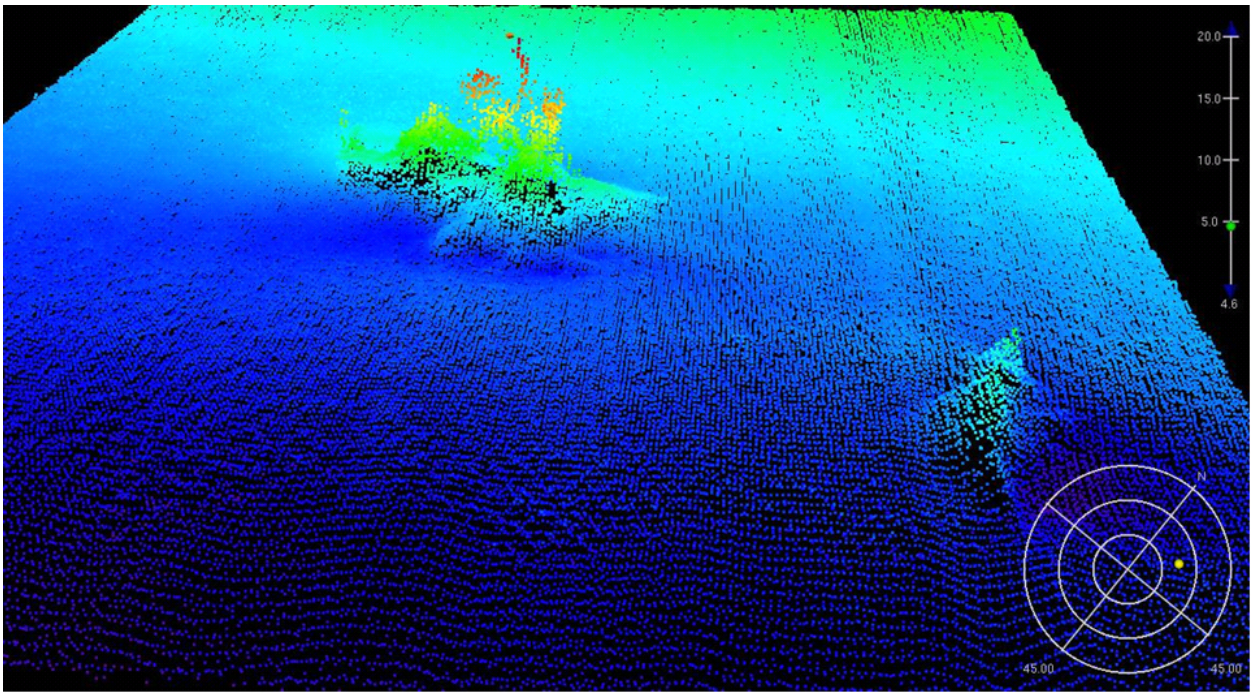


Figure 1.3.2

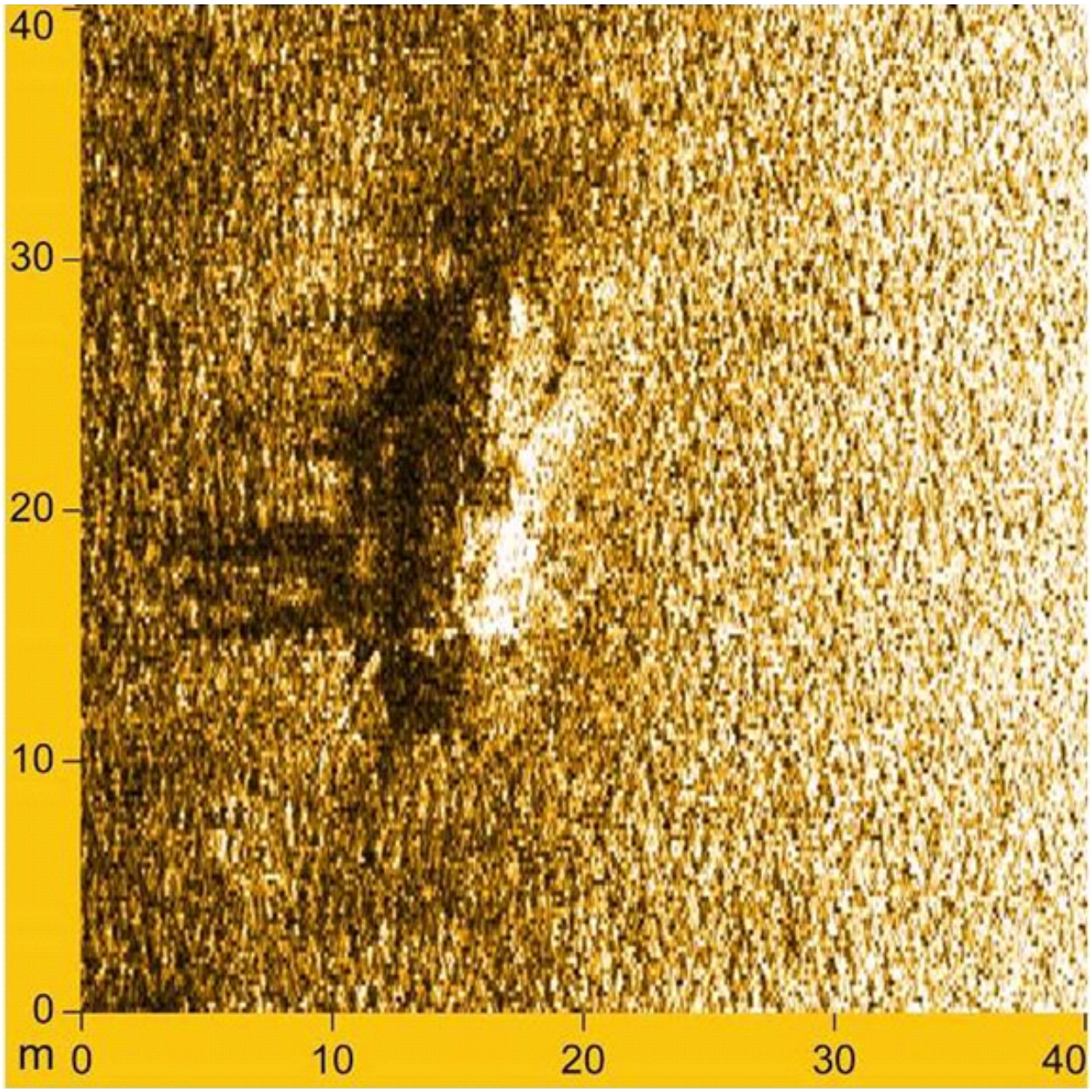


Figure 1.3.3

1.4) 19ft OBSTRN

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 44' 38.2" N, 075° 57' 56.7" W

Least Depth: 6.00 m (= 19.70 ft = 3.283 fm = 3 fm 1.70 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-278.14:09:21.000 (10/05/2009)

GP Dataset: H12045_DtoN#2.xls

GP No.: 3

Charts Affected: 12228_1, 12285_18, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depths were acquired with a Reson 7125 and an R2Sonic 2024 shallow water multibeam sonar and reduced to Mean Lower Low Water using zoning verified water levels.

Positions are referenced from post-processed navgiation using a contractor installed GPS base station and are on NAD83.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#2.xls	3	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting DtoN 2.3: 19ft OBSTRN at current survey location.

Cartographically-Rounded Depth (Affected Charts):

19ft (12228_1, 12285_18, 12285_19, 12225_1, 12280_2)

3 ¼fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 19ft OBSTRN

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 6.004 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12228_1; 32nd Ed., Mar 2008 and smaller scale charts as 19 foot obstruction. Delete 19 foot obstructionat Latitude 37° 44' 34.996" N, Longitude 075° 57' 43.759" W. Chart 20 foot obstruction at the present survey position at Latitude 37° 44' 38.198" N, Longitude 075° 57' 56.475" W with least depth of 19.8097 ft.

Feature Images

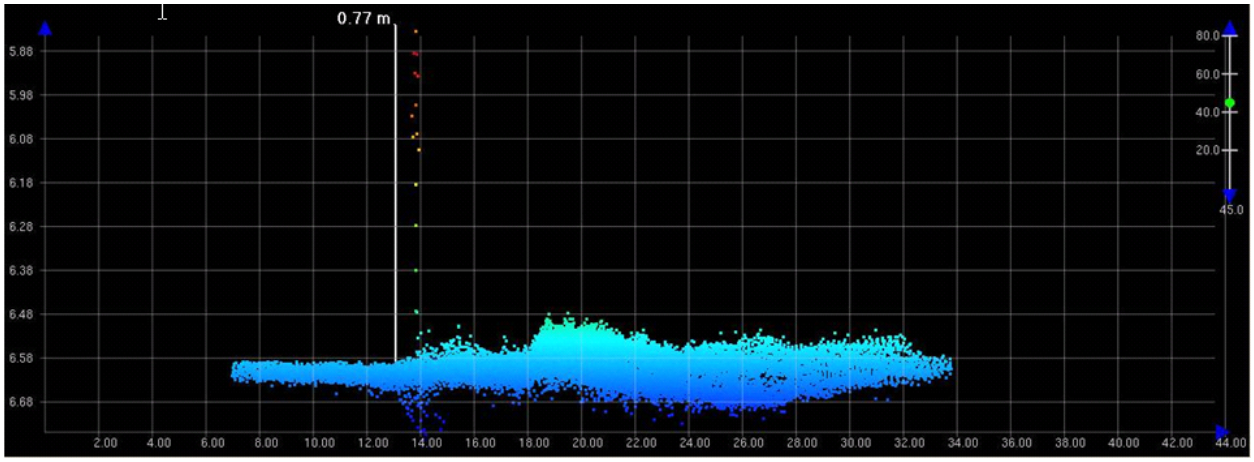


Figure 1.4.1

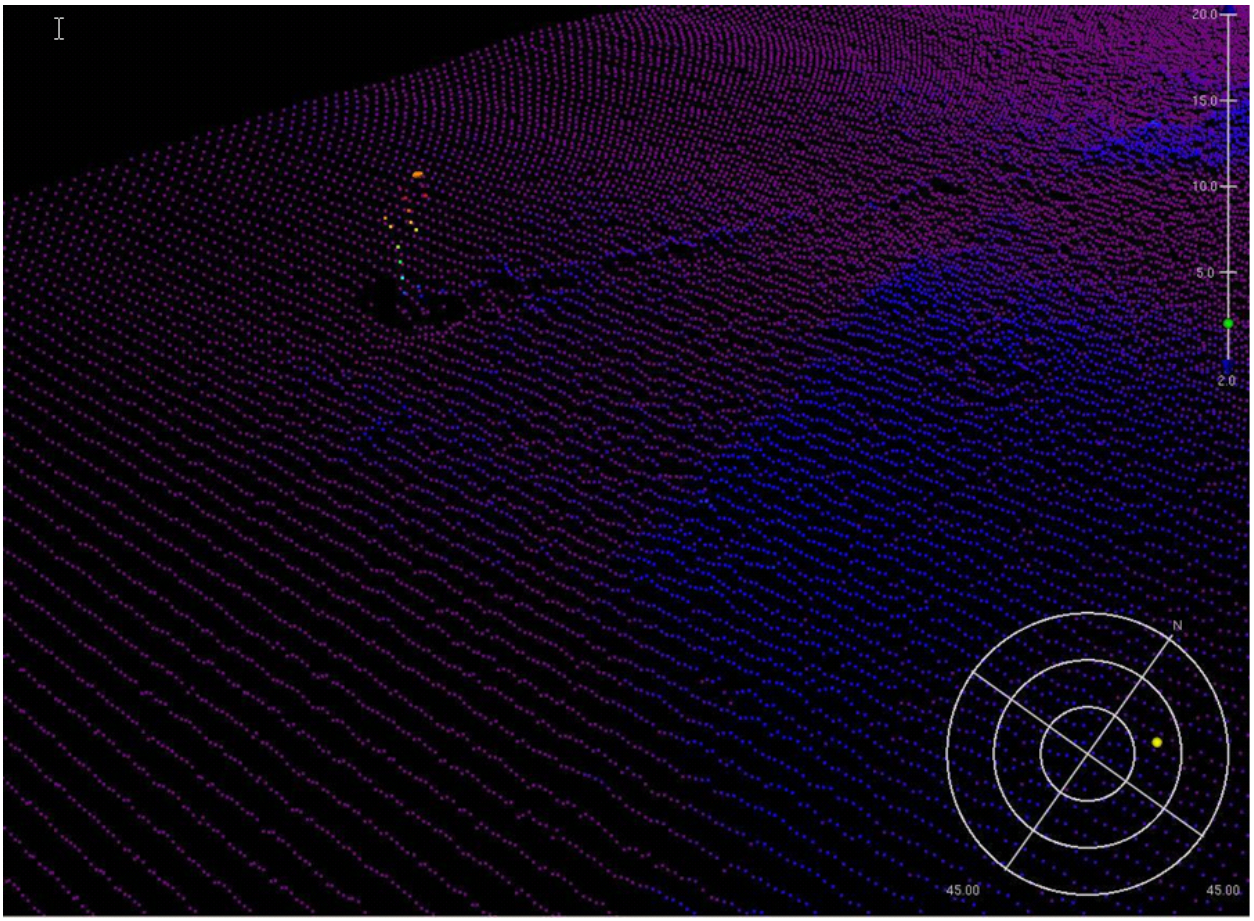


Figure 1.4.2

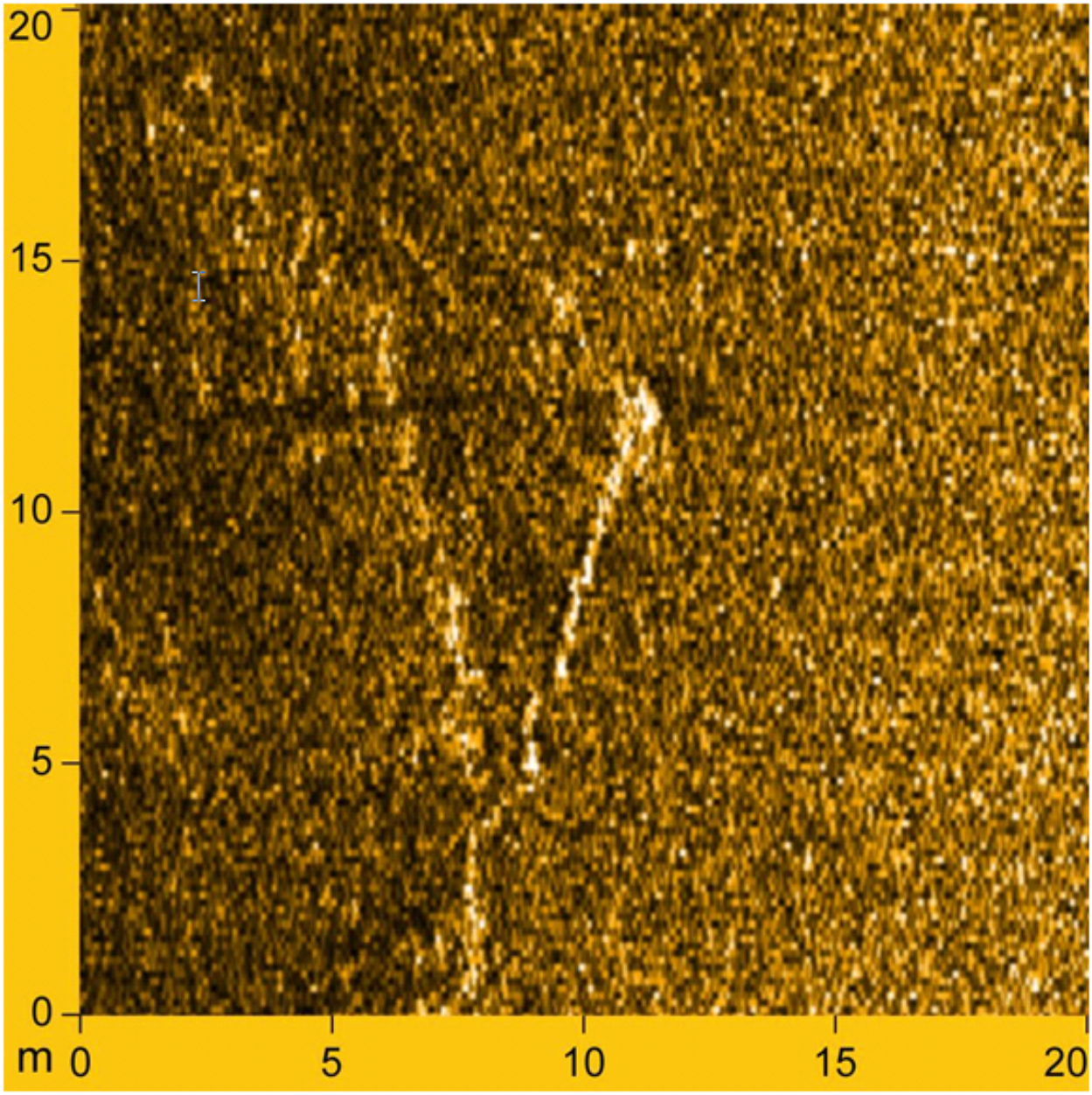


Figure 1.4.3

1.5) 29ft OBSTRN

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 44' 27.9" N, 075° 55' 43.2" W

Least Depth: 8.98 m (= 29.45 ft = 4.909 fm = 4 fm 5.45 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-286.18:23:06.000 (10/13/2009)

GP Dataset: H12045_DtoN#2.xls

GP No.: 4

Charts Affected: 12228_1, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depths were acquired with a Reson 7125 and an R2Sonic 2024 shallow water multibeam sonar and reduced to Mean Lower Low Water using zoning verified water levels.

Positions are referenced from post-processed navgiation using a contractor installed GPS base station and are on NAD83.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#2.xls	4	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting DotN 2.4: 29ft OBSTRN at current survey location.

Cartographically-Rounded Depth (Affected Charts):

29ft (12228_1, 12285_19, 12225_1, 12280_2)

4 ¾fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 29ft OBSTRN

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 8.977 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12228_1; 32nd Ed., Mar 2008 and smaller scale charts as 29 foot obstruction. Delete 29 foot obstructionat Latitude 37° 44' 27.900" N, Longitude 075° 55' 43.200" W. Chart 30 foot obstruction at the present survey position at Latitude 37° 44' 27.874" N, Longitude 075° 55' 43.234" W with least depth of 29.836 ft.

Feature Images

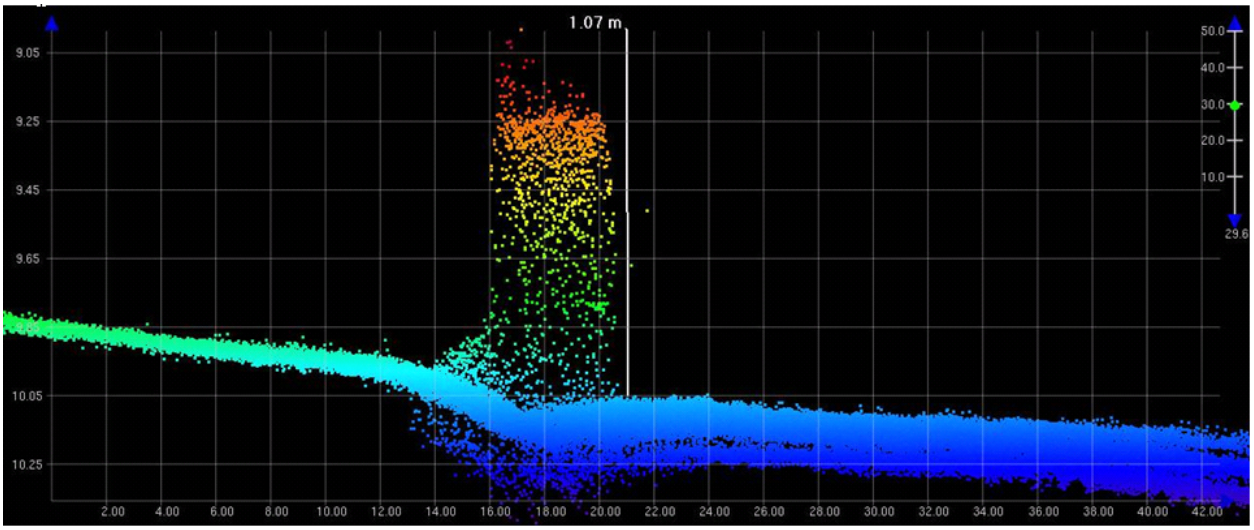


Figure 1.5.1

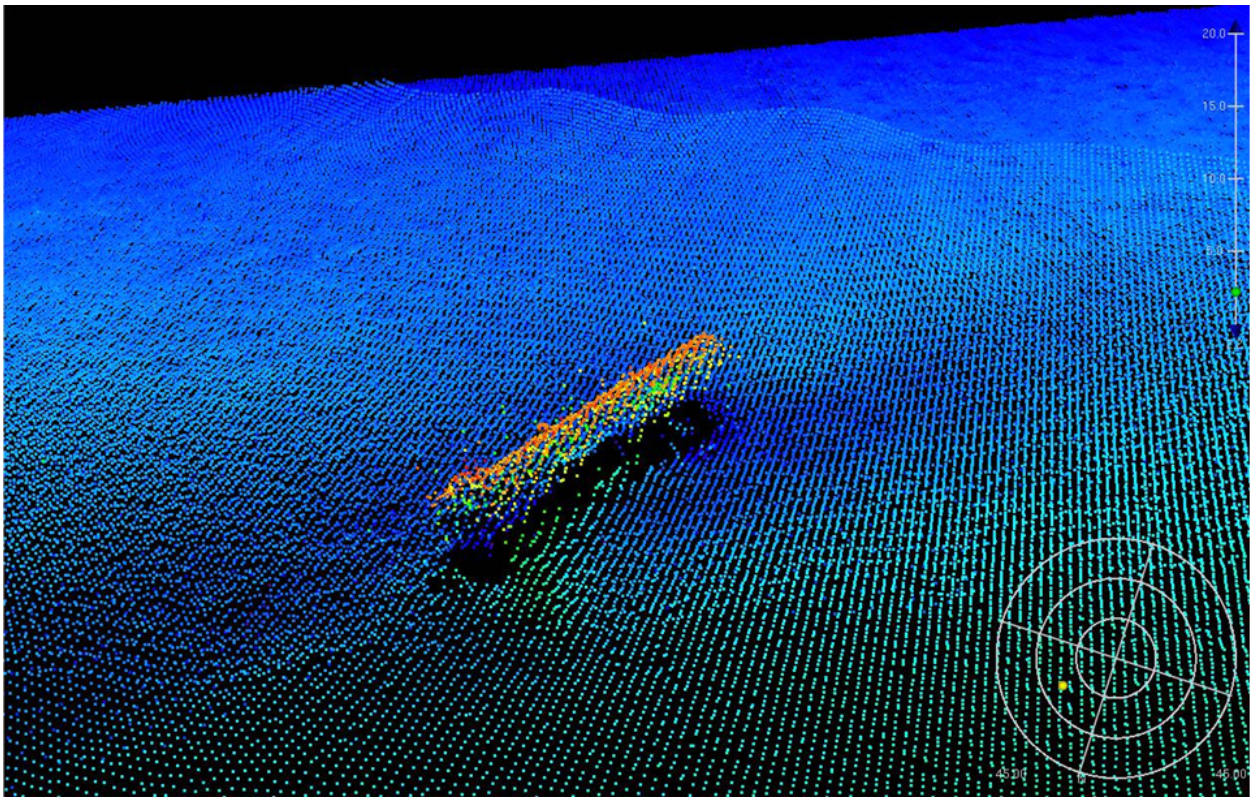


Figure 1.5.2

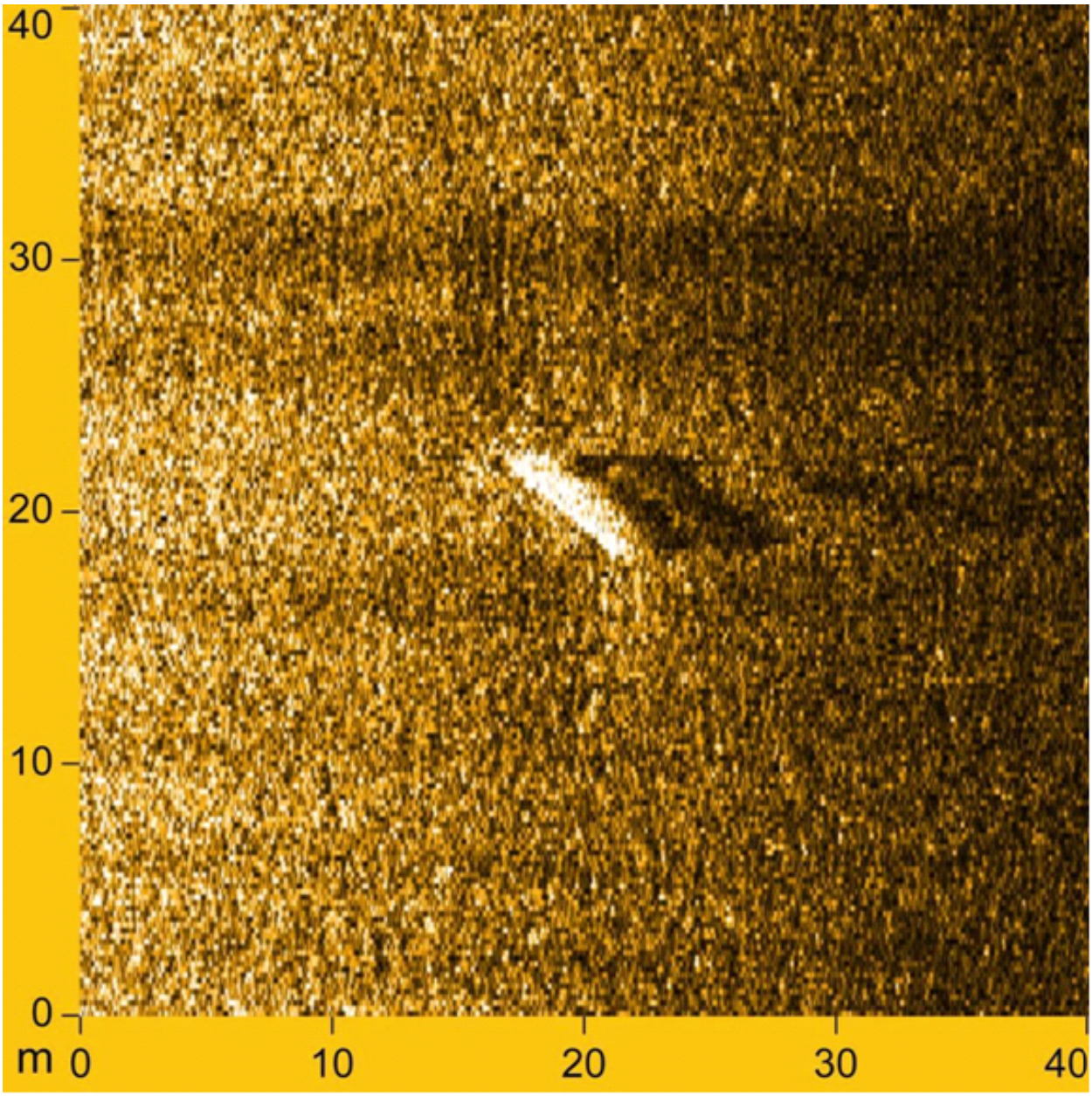


Figure 1.5.3

1.6) 19ft OBSTRN

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 44' 08.3" N, 075° 58' 01.6" W

Least Depth: 5.83 m (= 19.12 ft = 3.187 fm = 3 fm 1.12 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2009-278.14:05:10.000 (10/05/2009)

GP Dataset: H12045_DtoN#3.xls

GP No.: 1

Charts Affected: 12226_1, 12228_1, 12285_18, 12285_19, 12225_1, 12280_2, 12200_1, 13003_1

Remarks:

The least depths were acquired with a Reson 7125 shallow water multibeam sonar and reduced to Mean Lower Low Water using zoned verified water levels.

Positions are referenced from post-processed navigation using a contractor installed GPS base station and are on NAD83.

DtoN3 is an uncharted object that rises approximately 0.8m above the natural bottom.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12045_DtoN#3.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting a 19ft Obstruction at the current survey location.

Cartographically-Rounded Depth (Affected Charts):

19ft (12226_1, 12228_1, 12285_18, 12285_19, 12225_1, 12280_2)

3fm (12200_1, 13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: OBJNAM - 19ft OBSTRN

QUASOU - 6:least depth known

SORDAT - 20091214

SORIND - US,US,graph,H12045

TECSOU - 2,3:found by side scan sonar,found by multi-beam

VALSOU - 5.829 m

VERDAT - 12:Mean lower low water

WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. Shown on chart 12226_1; 18th Ed., Jul 2009 and smaller scale charts as 19 foot obstruction. Delete 19 foot obstructionat Latitude 37° 44' 08.308" N, Longitude 075° 58' 01.603" W. Chart 19 foot obstruction at the present survey position at Latitude 37° 44' 08.308" N, Longitude 075° 58' 01.603" W with least depth of 19.377 ft.

Feature Images

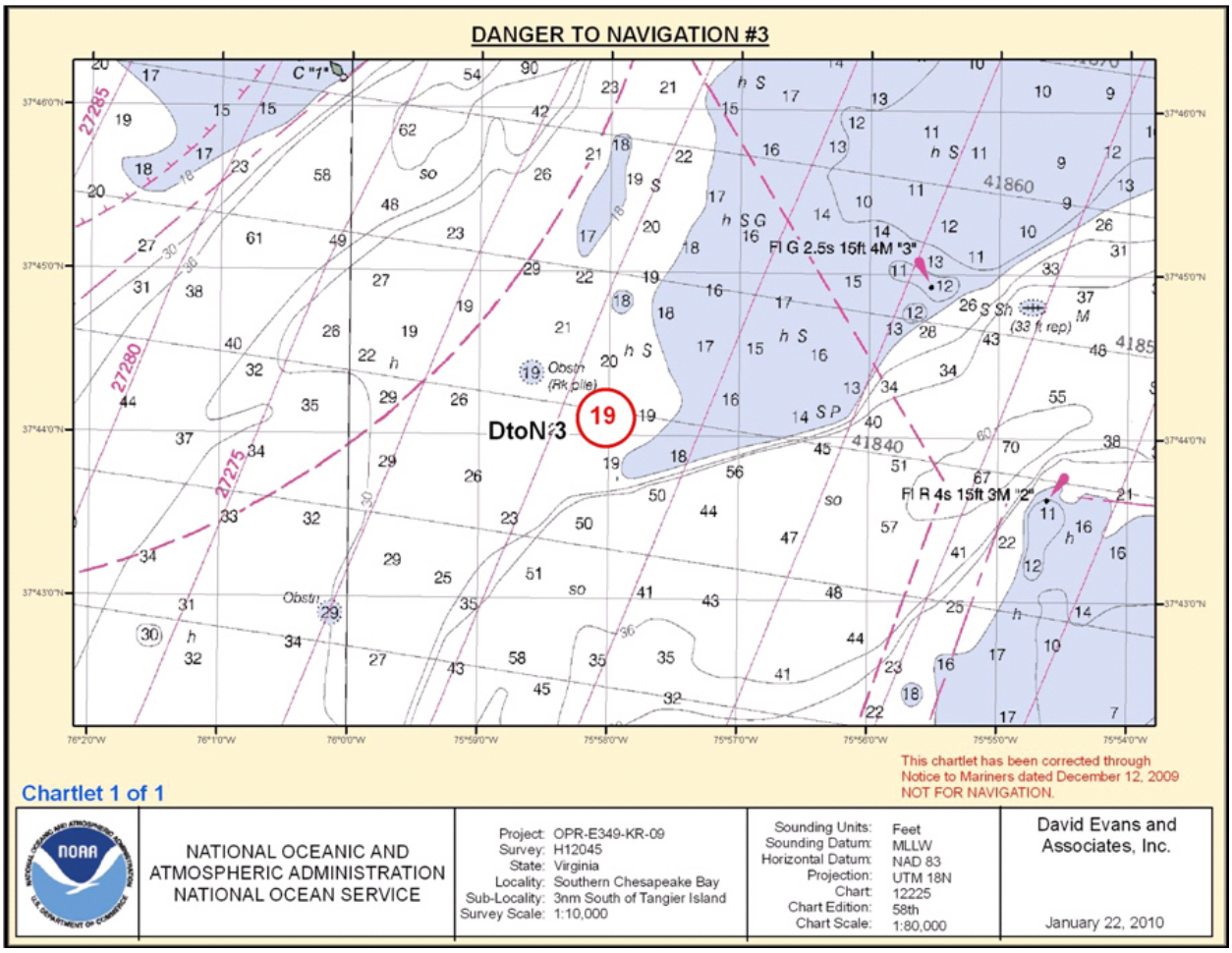


Figure 1.6.1

DtoN #3 MBES 2d View

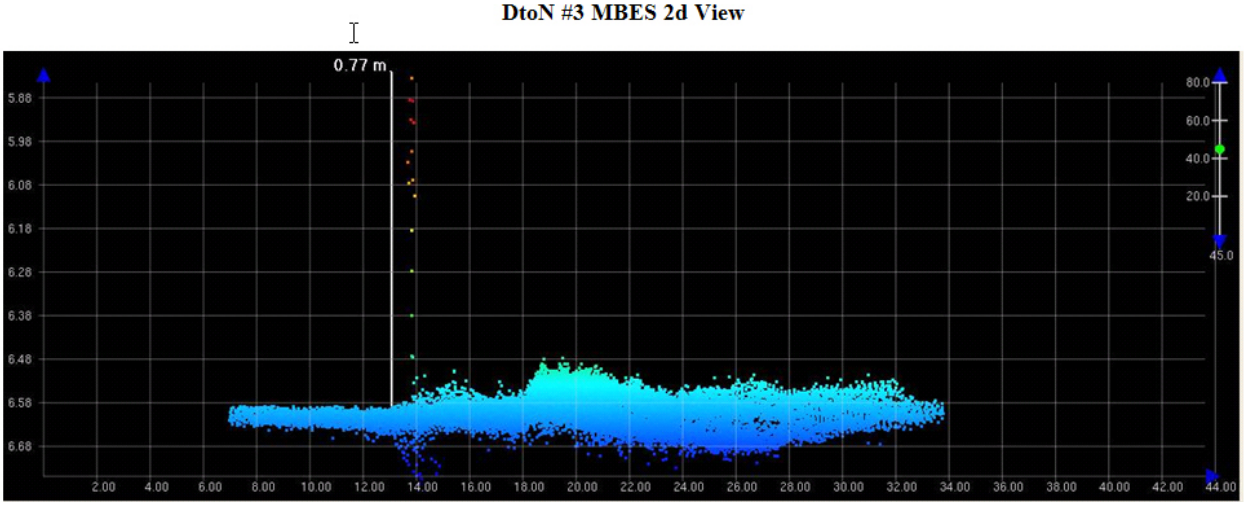


Figure 1.6.2

DtoN #3 MBES 3d View

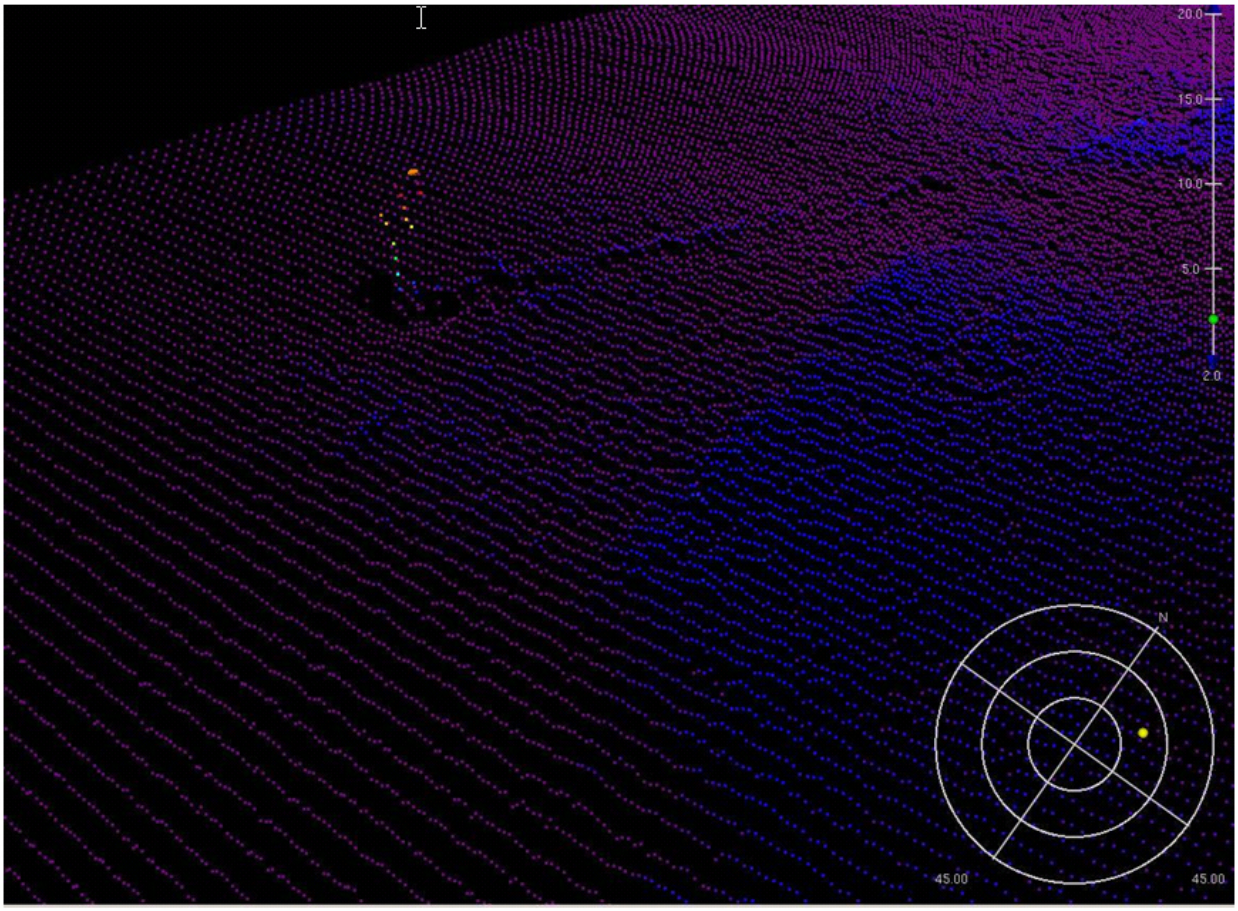


Figure 1.6.3

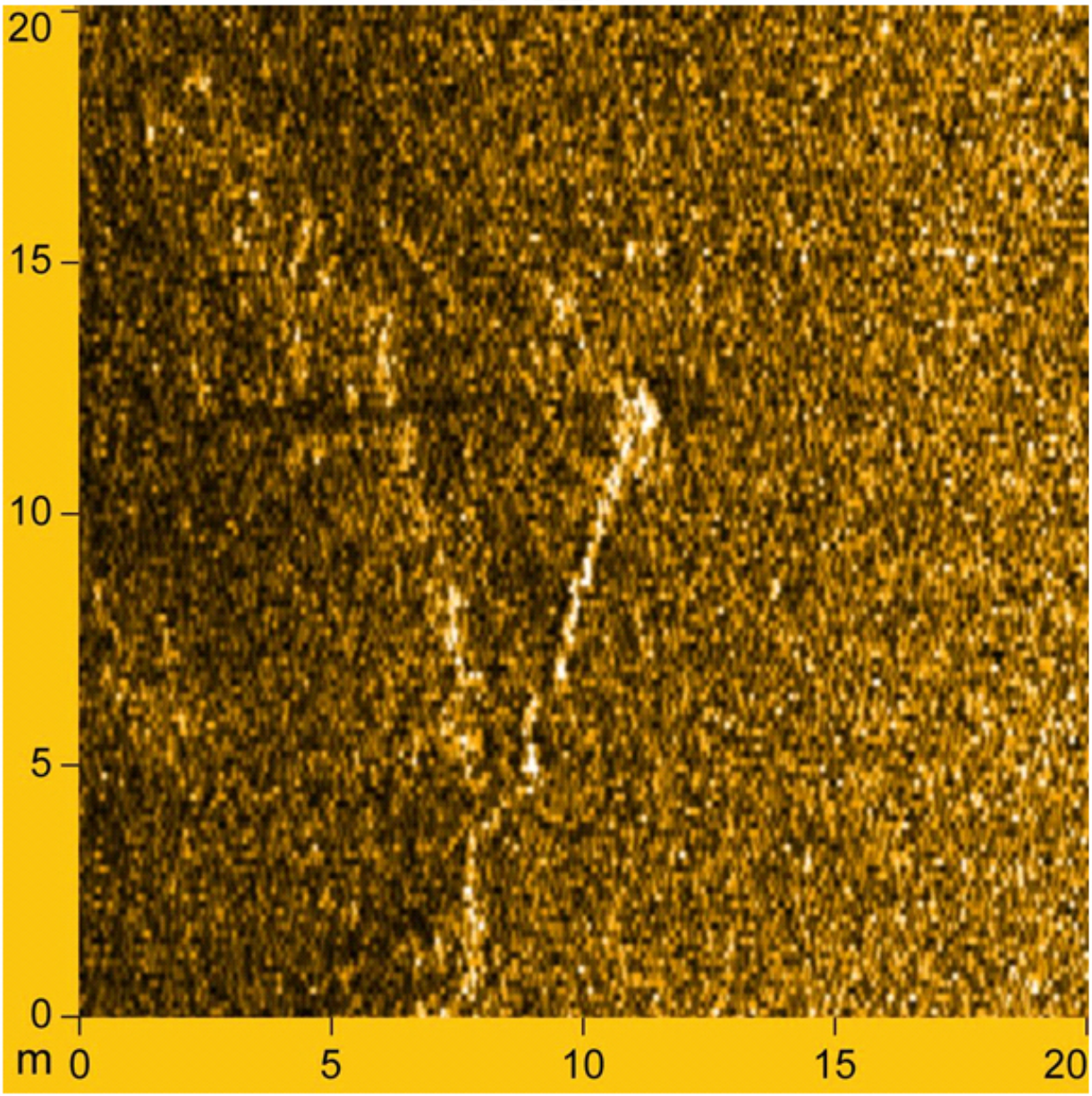


Figure 1.6.4

APPENDIX II
SURVEY FEATURE REPORT

Registry Number: H12045
State: Virginia
Locality: Southern Chesapeake Bay, Virginia
Sub-locality: 3nm South of Tangier Island
Project Number: OPR-E349-KR-09
Survey Date: July 19, 2009 to December 14, 2009

List of Features

List of Figures

AWOIS 14497

REPORTED

FEATURE	RADIUS	LATITUDE (N)	LONGITUDE (W)
AWOIS 14497	200m	37/44/22.12	75/58/36.19

SURVEYED

FEATURE	LEAST DEPTH	LATITUDE (N)	LONGITUDE (W)
OBSTRUCTION	18.8ft (5.74m)	37/44/21.582	75/58/35.099

Remarks:
AWOIS 14497 is a charted 19-foot *Obstrn (Rk pile)*. The obstruction was found charted correctly at position 37/44/21.582N, 75/58/35.099W with two hundred percent side scan sonar coverage and complete multibeam coverage. The least depth is 18.8ft (5.74). Contact 264-185436-S.

Hydrographer Recommendation:
No action necessary.

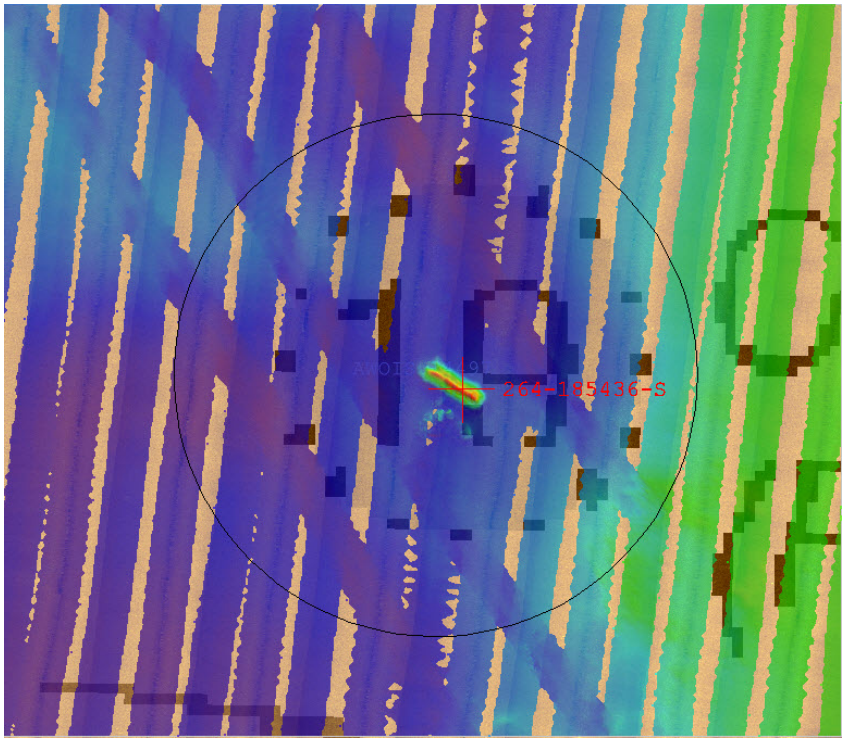


Figure 1. AWOIS 14497 radius, Chart 12225, SSS, MBES, and contact.

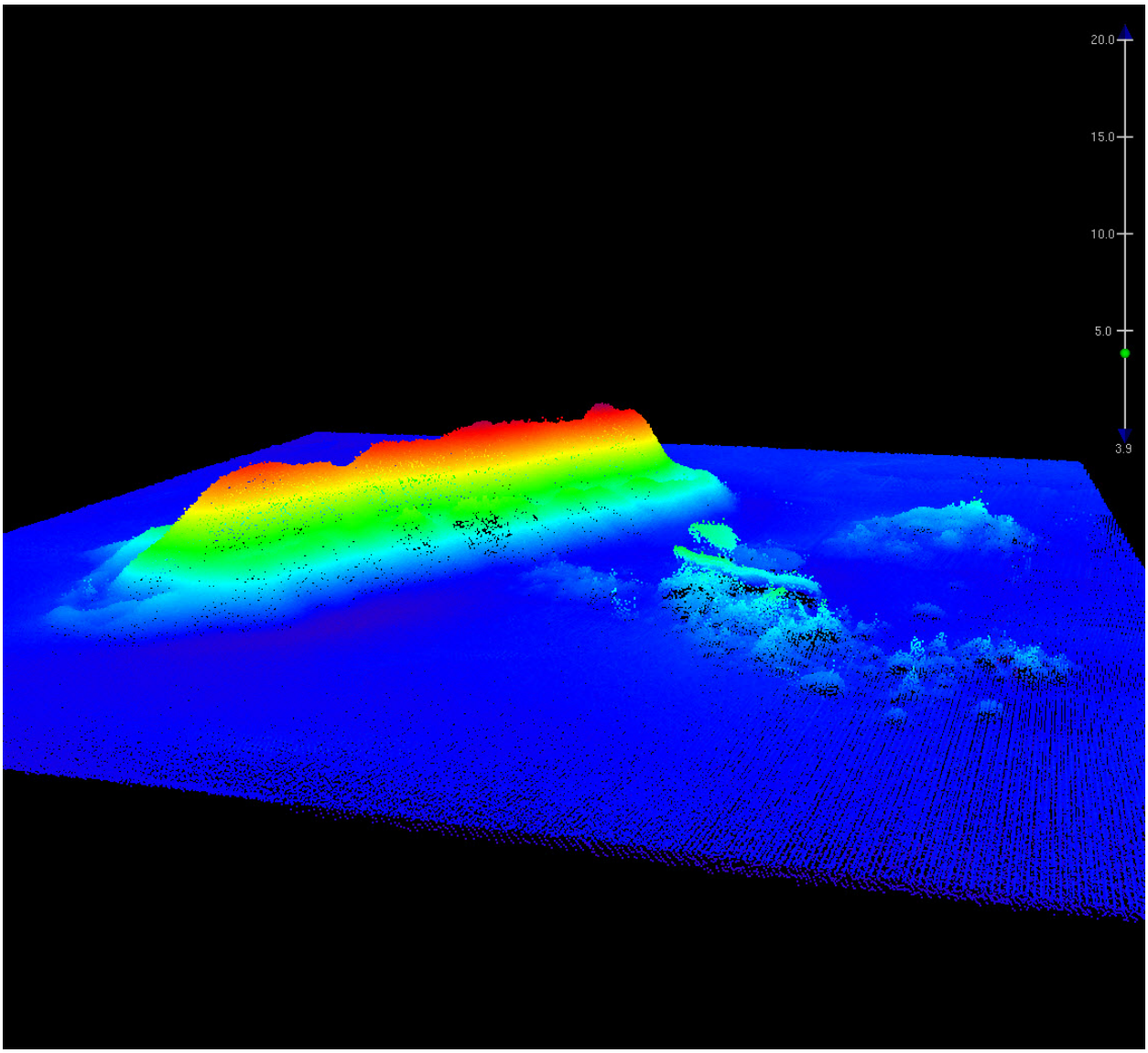


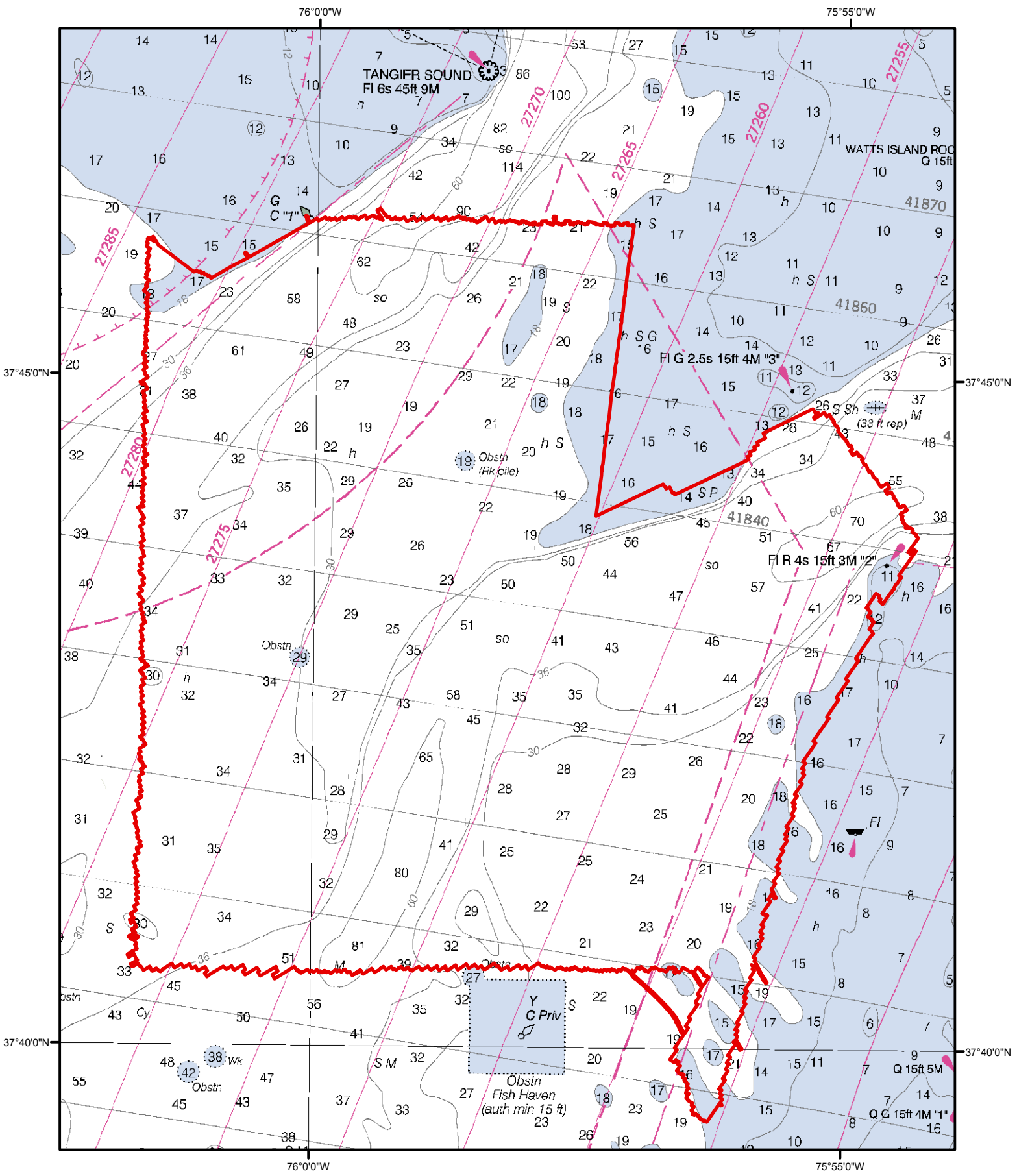
Figure 2. AWOIS 14497 CARIS 3D View

H12045
Survey Features
OBSTRN

NEW:

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	37.735641	75.967112	H12045 DTON # 3, Obstruction. Object rises approximately 0.75m off the natural bottom. FS 265-133223-P
				Concur. DTON resides on chart. Update least depth and position of charted obstruction per present survey findings.
--	--	37.7273	75.94589	FS 279-130727-S, Feature is approximately 1.05m off the natural bottom.
				Concur. Chart obstruction per present survey findings.
--	--	37.741076	75.928676	H12045 DTON # 2.4, Obstruction. Linear feature rising approximately 1m proud. FS 279-153731-S
				Concur. DTON resides on chart. Update least depth and position of charted obstruction per present survey findings.
--	--	37.714786	76.002885	FS 283-131617-S, Man made rectangular feature rises approximately 0.3m from the surrounding sea floor and is 32m from submitted DTON # 1.
				Concur with clarification. Recommend to encompass these 5 obstructions into an area obstruction with a least depth of 26.2959 ft.
--	--	37.767403	75.959649	FS 265-144750-S, Feature rises approximately 0.70 m off the natural bottom.
				Do not concur. Insignificant height off the bottom. Do not chart obstruction.
--	--	37.714937	76.002204	H12045 DTON # 1, Obstructions. Numerous man made rectangular features rise approximately 0.3m from the surrounding sea floor.FS 283-131639-S
				Concur with clarification. Recommend to encompass these 5 obstructions into an area obstruction with a least depth of 26.2959 ft.
--	--	37.743944	75.965743	H12045 DTON #2.3, Object rising 0.62m proud.FS 265-134911-P
				Concur. DTON resides on chart. Update least depth and position of charted obstruction per present survey findings.
--	--	37.709648	75.929137	FS 263-134017-S, Small feature stands 0.5m proud.
				Do not concur. Insignificant height off the bottom. Do not chart obstruction.
--	--	37.732912	75.92661	H12045 DTON # 2.2, Obstruction. Features rise approximately 1.7m from surrounding sea floor. FS 257-190432-P
				Concur. DTON resides on chart. Update least depth and position of charted obstruction per present survey findings.
--	--	37.739328	75.976417	FS 264-185436-S, AWOIS 14497. Charted obstruction is approximately 2.2m off the natural bottom. DEA Charted Feature# 115.
				Concur. Update least depth and position of charted obstruction per present survey findings.
--	--	37.715199	76.024631	FS 249-144310-S, Man-made object that stands 0.78m proud off the natural bottom. Also reported in H12044 Feature File.
				Do not concur. Insignificant height off the bottom. Do not chart obstruction. Chart as CS sounding.
--	--	37.7139	76.002613	FS 283-143012-S, Man made rectangular feature rises approximately 0.3m from the surrounding sea floor and is 120m from submitted DTON # 1. This contact is approximately 54m from 249-125743-P. Numerous features designated in this area.
				Concur with clarification. Recommend to encompass these 5 obstructions into an area obstruction with a least depth of 26.2959 ft.
--	--	37.715133	76.002692	FS 249-125719-S, Obstructions. Several man-made features in this location rising approximately 1.5m above the natural seafloor near DTON #1.
				Concur with clarification. Recommend to encompass these 5 obstructions into an area obstruction with a least depth of 26.2959 ft.
--	--	37.682996	76.011933	H12045 DTON # 2.1, Obstruction. Possible net seen in both 200% SSS and MBES. Stands approximately 1.7m proud. FS 249-165345-S
				Concur. DTON resides on chart. Update least depth and position of charted obstruction per present survey findings.
--	--	37.711089	75.925545	FS 258-180310-S, Feature rises approximately 0.63m from the surrounding sea floor.
				Do not concur. Insignificant height off the bottom. Do not chart obstruction.
--	--	37.713348	75.927983	FS 263-143915-S, Object stands 0.72m proud.
				Do not concur. Insignificant height off the bottom. Do not chart obstruction. Chart as CS sounding
--	--	37.661835	75.939927	FS 261-183619-P, Feature stands 1.35m proud.
				Do not concur. Depth insignificant due to surrounding depths. Chart digital data.
--	--	37.714076	76.003109	FS 249-125743-P, Man made rectangular feature rises approximately 0.3m from the surrounding sea floor and is 120m from submitted DTON # 1. This contact is 40m from 283-143012-S. Numerous features designated in this area.
				Concur with clarification. Recommend to encompass these 5 obstructions into an area obstruction with a least depth of 26.2959 ft.

APPENDIX III
FINAL PROGRESS SKETCH AND SURVEY OUTLINE

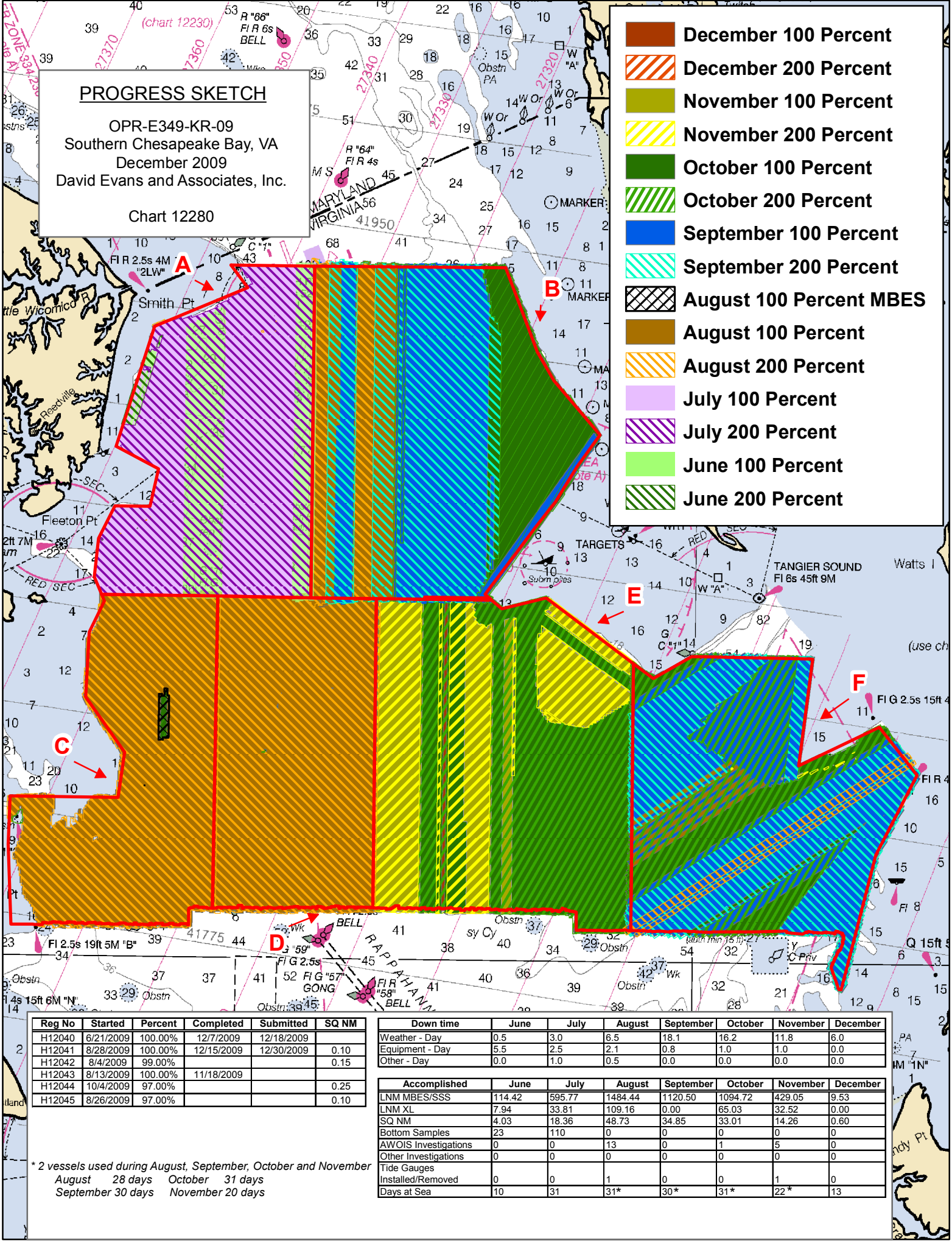


N
W E
S

0 0.5 1
Nautical Miles

Survey Outline

H12045
OPR-E349-KR-09
Southern Chesapeake Bay
David Evans and Associates, Inc.
Jon Dasler, Lead Hydrographer
Chart 12225



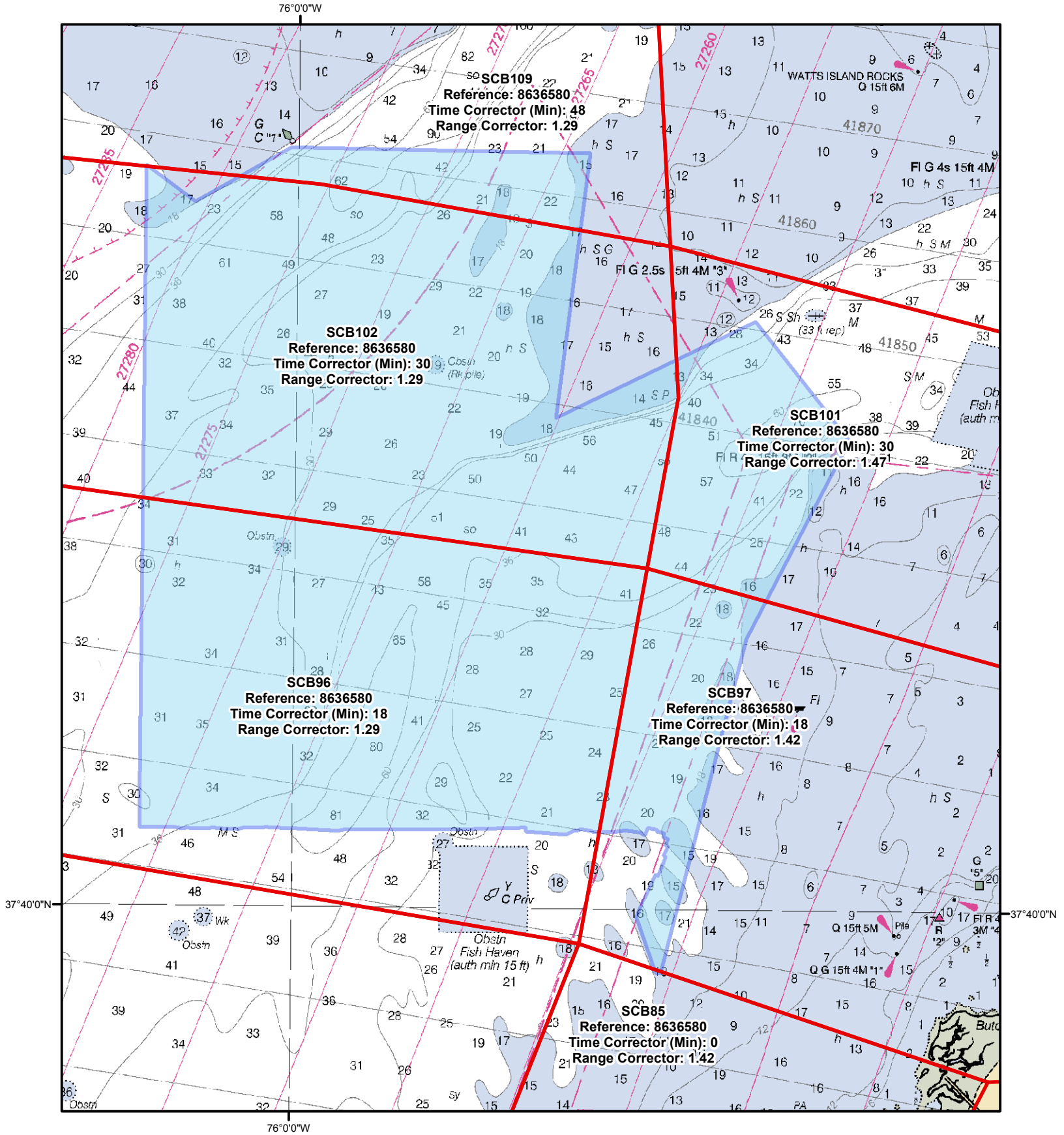
Reg No	Started	Percent	Completed	Submitted	SQ NM
H12040	6/21/2009	100.00%	12/7/2009	12/18/2009	
H12041	8/28/2009	100.00%	12/15/2009	12/30/2009	0.10
H12042	8/4/2009	99.00%			0.15
H12043	8/13/2009	100.00%	11/18/2009		
H12044	10/4/2009	97.00%			0.25
H12045	8/26/2009	97.00%			0.10

Down time	June	July	August	September	October	November	December
Weather - Day	0.5	3.0	6.5	18.1	16.2	11.8	6.0
Equipment - Day	5.5	2.5	2.1	0.8	1.0	1.0	0.0
Other - Day	0.0	1.0	0.5	0.0	0.0	0.0	0.0

Accomplished	June	July	August	September	October	November	December
LNM MBES/SSS	114.42	595.77	1484.44	1120.50	1094.72	429.05	9.53
LNM XL	7.94	33.81	109.16	0.00	65.03	32.52	0.00
SQ NM	4.03	18.36	48.73	34.85	33.01	14.26	0.60
Bottom Samples	23	110	0	0	0	0	0
AWOIS Investigations	0	0	13	0	1	5	0
Other Investigations	0	0	0	0	0	0	0
Tide Gauges Installed/Removed	0	0	1	0	0	1	0
Days at Sea	10	31	31*	30*	31*	22*	13

** 2 vessels used during August, September, October and November*
August 28 days October 31 days
September 30 days November 20 days

APPENDIX IV
TIDES AND WATER LEVELS



N W E S 0 0.5 1 Nautical Miles	**H12045** **Final Tide Zoning**	**H12045** **OPR-E349-KR-09** **Southern Chesapeake Bay** **David Evans and Associates, Inc.** **Jon Dasler, Lead Hydrographer** **Chart 12225**

OPR-E349-KR-09

H12045

Times of Hydrography

Date	Julian Date	Min Time	Max Time
08/27/2009	239	12:21	21:42
09/06/2009	249	12:15	21:25
09/14/2009	257	12:57	14:00
09/15/2009	258	12:27	21:41
09/18/2009	261	12:37	21:37
09/20/2009	263	12:27	21:41
09/21/2009	264	12:32	21:54
09/22/2009	265	12:29	21:54
10/05/2009	278	12:22	21:14
10/06/2009	279	12:26	21:29
10/10/2009	283	12:17	16:30
10/11/2009	284	12:44	21:54
10/13/2009	286	12:12	21:21
10/21/2009	294	12:10	21:40
11/16/2009	320	12:23	21:09
11/18/2009	322	12:25	15:54
11/19/2009	323	15:52	18:32
11/22/2009	326	12:30	14:59
12/07/2009	341	17:50	21:04
12/11/2009	345	16:06	16:38
12/14/2009	348	13:59	14:28

FINAL TIDE ZONING
H12045
OPR-E349-KR-09

Zone	Time Corrector (Mins)	Range Ratio	Reference Station
SCB109	48	1.29	**8636580**
SCB102	30	1.29	**8636580**
SCB101	30	1.47	**8636580**
SCB96	18	1.29	**8636580**
SCB97	18	1.42	**8636580**
SCB85	0	1.42	**8636580**

NOTE: Global Positioning System (GPS) water levels were acquired directly at the survey vessel however, traditional zoning from water level stations were used for submittal. Zoning and verified water level files were provided by CO-OPS.

Shyla Allen

From: Gerald.Hovis [Gerald.Hovis@noaa.gov]
Sent: Tuesday, October 27, 2009 2:16 PM
To: Jason Creech
Cc: Ben Evans; Lori.Knell
Subject: Re: [Fwd: Discrete Zoning error for OPR-E349-KR-2009]

Jason,

Yes you are correct.....all measurement errors should be 0.02. My mistake.

Jerry

Creech wrote:
> Jerry
>
> Thanks for the zoning uncertainty estimates. I'd like to have a value
> checked before we move forward.
>
> Windmill Point and Tangier Island
> Is the 0.04 m Processing Error correct? If so the TPE (95% CI) should
> be 0.172m. If the TPE (95% CI) is truly 0.156 then the Processing
> error should be 0.02 (the same as Lewisetta to WP).
>
> Thanks again.
>
> Jason
>
>
>
>
>
> -----Original Message-----
> From: Ben Evans [mailto:Benjamin.K.Evans@noaa.gov]
> Sent: Friday, October 23, 2009 10:31 AM
> To: Jason Creech
> Cc: Lori.Knell
> Subject: [Fwd: Discrete Zoning error for OPR-E349-KR-2009]
>
> Jason,
>
> See below for zoning uncertainty estimates.
>
> Ben
>
>
> -------- Original Message --------
> Subject: Discrete Zoning error for OPR-E349-KR-2009
> Date: Fri, 23 Oct 2009 13:27:56 -0400
> From: Gerald.Hovis <Gerald.Hovis@noaa.gov>
> To: Lori.Knell <Lori.Knell@noaa.gov>, Benjamin K Evans
> <Benjamin.K.Evans@noaa.gov>
> CC: NOS.COOPS.HPT@noaa.gov
> References: <4AD491FE.7080805@noaa.gov> <4ADF3E09.9010800@noaa.gov>
> <4ADF629B.9000209@noaa.gov> <4AE0BDE1.7060106@noaa.gov>
>
>
>
> Ben/Lori/Jason,

>
> Please pass on to Jason Creech.
>
> Below is a summary of the errors we compute when providing the TPE for
> a
>
> project. Remember that our error at 95% CI is given as:
>
> @ 95% CI = b + 1.96s
> b = systematic errors and biases.
> s = random errors at the one-standard deviation level.
>
> Where
> TPE @ 95% CI = Datum Error + 1.96*SQT((Measurement Error)2+(Processing
> Error)2+(Zoning Error)2)
>
> And
> Zoning Error (at the 95% confidence interval) = 1.96 * SQT((Sum of
> differences2)/(# of measurements))
>
> Datum Error being a bias is not included in the root mean square,
> however, Processing Error ,Measurement Error, and Tidal Zoning Error
> being random errors are included.
>
> Also see.....http://vdatum.noaa.gov/docs/est_uncertainties.html
>
> The specific errors you requested are below but remember that one
> cannot
>
> just take the arithmetic sum of all values to get the total error.
>
> The Error Estimation between Lewisetta and Windmill Point:
> Datum Error (tertiary station) = 0.03 m (idealized based
> on 3 months of data)
> Datum Error (Windmill Pt) = 0.018 m (actual)
> Measurement Error = 0.01 m
> Processing Error = 0.02 m
> Zoning Error = 0.049 m
> _/*Zoning Error (95% CI) = 0.099 m */_
> TPE (95% CI) = 0.124 m
>
> The Error Estimation between Windmill Point and Tangier Island:
> Datum Error (tertiary station) = 0.03 m (idealized based
> on 3 months of data)
> Datum Error (Tangier Island) = 0.018 m (actual)
> Measurement Error = 0.01 m
> Processing Error = 0.04 m
> Zoning Error = 0.067 m
> /_*Zoning Errror (95% CI) = 0.133 m *_/
> TPE (95% CI) = 0.156 m
>
> Jerry
>
>
>
>
>

You replied on 10/21/2009 7:10 AM.
Attachments can contain viruses that may harm your computer. Attachments may not display correctly.

Jason Creech

From: Lori.Knell [Lori.Knell@noaa.gov] **Sent:** Tue 10/13/2009 10:23 AM
To: Jason Creech
Cc: Benjamin.K.Evans@noaa.gov; Jon Dasler
Subject: Revised tides for OPR-E349-KR-09
Attachments: E349KR2009_Rev.zip(592KB)

Jason,
These are the revised tide requirements for the Chesapeake Bay project.
This email contains a .ZIP file containing all pertinent MapInfo files,
as well as tidal zoning graphics in PDF, are attached to this email.
Six minute predictions for Lewisetta, VA (863-5750) and Windmill Point,
VA (863-6580) may be retrieved in one month increments over the internet
from the CO-OPS Home Page at http://tidesandcurrents.noaa.gov/olddata/
by clicking on "Predicted Water Level". Additionally, the files are
posted to the Sharepoint website under the project name
"OPR-E349-KR-2009 Revised Project Instructions" in Project Support
Templates > FY09 > TO CO-OPS > From HSD > KR > OPR-E349-KR-2009 Revised.
If you have any questions about this please let me know.
Thanks, Lori

--
Lori Knell
Physical Scientist, Data Acquisition Control Branch
Hydrographic Surveys Division
NOAA
Lori.Knell@noaa.gov
301.713.2700 x114

APPENDIX V
SUPPLEMENTAL RECORDS AND CORRESPONDENCE

Jason Creech

From: Matthew Wilson [Matthew.Wilson@noaa.gov]
Sent: Wednesday, June 17, 2009 12:20 PM
To: Jason Creech
Cc: Castle.E.Parker@noaa.gov
Subject: Re: Question Regarding Final Tide Notes

Jason,

Regarding your question about deliverables:

To rehash, for the upcoming Ches Bay sheets, DEA has planned a set line spacing survey (200%SSS w/ concurrent MB and MB developments). DEA inquired to AHB whether 1m res grids are acceptable, and if the "Deep"
CUBE setting is acceptable when creating the grids.

- for a "skunk stripe" survey of 200% SSS run concurrently with MB, according to the 2009 NOS Specs, the MB coverage requirements are the same within the swath as for Complete Coverage requirements. Complete MB requirements specify a resolution of 1m for Depth Range of 0-23m.
Hence, 1m res MB grids are acceptable.

- Deep CUBE setting is to be used when small features are located separately with SSS. SSS is your primary means of object detection, hence the Deep CUBE setting is appropriate.

--
Respectfully,

Matthew J. Wilson
Physical Scientist
NOAA Atlantic Hydrographic Branch
757-441-6746x112
matthew.wilson@noaa.gov

You replied on 10/21/2009 11:41 AM.

Jason Creech

From: Ben Evans [Benjamin.K.Evans@noaa.gov] **Sent:** Wed 9/23/2009 7:56 AM
To: Jason Creech
Cc: Lori.Knell; Jon Dasler
Subject: [Suspected Spam] Re: skunk stripe specs
Attachments:

Jason,

I was out of Coast Survey for advent of the new density requirements, so may not have the whole story on the reason they were introduced. However, my understanding of the history and the physics is that this requirement are not really related to object detection at all (that would be grid resolution), but rather improving the statistical confidence of the CUBE depth and uncertainty solutions for each node. So, in my opinion it is appropriate that a sounding density requirement apply to multibeam bathymetry associated with side scan.

I've addressed your more specific questions inline in red below.

I am not sure of the source of CAPT Lowell's comments on this issue, and it is certainly possible that he has been present for higher level discussions than I have been privy to. However, as chief of the marine chart division, this issue would not normally fall within his purview or authority.

Thanks - again, please let me know if I can answer any further questions. Once everything's clear, I'll ask Lor to summarize for the record.

Thanks,

Ben

Jason Creech wrote:

> Ben
>
> Thanks for getting back to me on this. We've had some discussion in-house on the proposed skunk stripe multibeam requirements and **I've included questions/comments in your original email below.**
>
> We do have a general question about the necessity to have any density requirements for skunk stripe data and are wondering if you can briefly discuss what is pushing this requirement? It may be helpful if you could bring us up to date on the new density requirements in general. We're getting lots of questions from our staff.
>
> Please let me know if I need to clarify any of my comments.
>
> Thanks again for having this conversation with us.
>
> Jason
>
> ---
>
> **From:** Ben Evans [mailto:Benjamin.K.Evans@noaa.gov]
> **Sent:** Friday, September 18, 2009 10:59 AM
> **To:** Jason Creech
> **Cc:** Lori.Knell
> **Subject:** skunk stripe specs
>
> Jason,
>
> Got your message, and am now back at my desk. We actually had some internal

discussions on skunk stripe multibeam requirements earlier this week, and arrived at a set of revised specifications which we think are more appropriate for this work:

For main scheme multibeam bathymetry acquired concurrently with 200% side scan coverage ("skunk stripe"):

- Grid resolutions of 2m for depths less than 20 meters and 4m for depths 20 - 40 meters are acceptable. **Ok, this is coarser than we are currently using but will minimize sounding density issues. We are in the process of updating our surfaces to meet this new standard.**
- Minimum sounding density shall be 3 soundings per node. **Is this a hard minimum or do you mean 95% of all nodes populated with 3 or more? With skunk stripe there will always be some nodes on the edge of the swaths that have less than 3 nodes. We've looked at some test lines with the resolutions proposed above and we see less than 1% of soundings with less than 3 soundings per node. Yes - sorry, I should have been more specific: 95% of nodes shall have 3 soundings (and you're right, the edge effects complicate this - again, part of the justification for relaxing the resolution and density specs)**
- Small holidays in the multibeam coverage due to mid-water targets or attitude dynamics are acceptable where adjacent soundings show no evidence of significant shoaling, and the 200% side scan coverage does not indicate the presence of a feature. **Ok, this is how we have always interpreted the specs. We don't fill small holidays where we have underlying 200% SSS that does not indicate the presence of a contact or shoal.**

For multibeam developments of targets identified in side scan sonar:

- Coverage as per the "Complete Multibeam Coverage" specification (Section 5.1.2.2) over the feature and the immediate surrounding seabed (with designated soundings as required). **As we read the Specs, Complete Coverage requires Object detection for significant shoals and features in waters shoaler than 30m. In water deeper than 30m we will use Complete Multibeam Coverage. We always designate significant features even if the grid represents the feature. We aren't currently running separate investigations if we feel that we get a valid least depth of significant features during mainscheme survey. If significant features are outside of the survey line or not completely ensonified we run an item investigation. We do have concerns about density requirements over significant features and the immediate seabed. Is there really the need to have more than 4 soundings on the seabed at the base of a significant feature if this feature is properly ensonified and the least depth is designated? Of course there may be areas on the edges of grids that could be out of spec. due to edge effect discussed above or due to shadows cast by the significant features that are being investigated. Again, I should have been more clear here. What was intended is that multibeam developments meet the baseline "complete" specification, i.e., for this purpose omit the 7th bullet on page 91.**

However, I do note that given the relaxed requirements for skunk stripe multibeam, a higher resolution and density grid (and possibly additional development lines to support it) may be required for near-nadir contacts covered by main scheme multibeam.
As for the "immediate seabed" statement - you have interpreted it correctly. The intent is that we would have "complete" multibeam coverage of the contact and the *immediate* area (no more than a couple of grid cells-width) around its base. This will provide at least some indication of the full relief and any scour associated with the feature, which can augment the side scan imagery interpretation and , if necessary or desired, feature identification.

Regarding tools for demonstrating sounding density:

- You may use any method to evaluate the density and resolution requirements you would like, provided that you can demonstrate these results to NOAA. **We are currently using ArcGIS to analyze the HIPS density layer exported to raster. I believe Caris is working on an update to the Surface QC Tool that will validate surface bases on user input density.**
- For the purposes of this requirement, NOAA will not differentiate between the soundings actually falling within the square grid cell, and the soundings within the circular capture radius (provided the maximum sounding propagation distance is set to no greater than the grid resolution divided by sqrt(2), as required by the Specs and Deliverables)
- We note that the density layer feature in CARIS may be helpful. **I see that you used the word "may" here. Are you aware of any issues where HIPS is not reporting density as defined by HSSD? No issues that I'm personally aware of - the intent here is to provide a possible solution (which it doesn't sound like you need, as you've already got your ArcGIS analysis) without being perscriptive.**

Let me know what you think - if this works for you, we'll formalize it in an email for the record. If you'd like to discuss this further, feel free to give me a call.

Thanks,

Ben

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LCDR Ben Evans, NOAA
Chief, Data Acquisition and Control Branch (N/CS35)
NOAA Office of Coast Survey
SSMC3, Station 6815
1315 East West Highway
Silver Spring, MD 20910
voice: (301) 713-2700 x111
fax: (301) 713-4533
cell: (240) 687-4602

Shyla Allen

From: Jason Creech
Sent: Friday, July 31, 2009 11:30 AM
To: Shyla Allen; Michael Christy; John Staly; Amanda Bittinger
Cc: Jon Dasler
Subject: AHB discussion

I just got off the phone with Matt Wilson at AHB and have answers **(my interpretation in red)** to our questions…

1. Early on we discussed submitting 1m CUBE surfaces over the survey area, but after reading more into the 2009 Specs propagation requirements and receiving the new CUBEparms.xlm file we are wondering if we should just follow the depth dependent grid-resolution thresholds that are in the 2009 specs? This would mean that we would create both 1 and 2 meter surfaces for some areas. We could also use thresholds when finalizing.

Matt said to create surfaces bases on the depth dependent grid-resolution thresholds. He will follow up with us regarding using the threshold option when finalizing. This is something that they do at the end of compilation but he is not sure if they need it at time of delivery.

I just got the following reply…
Just getting back to you regarding your question. The 1m and 2m surfaces will be fine as deliverables for the Chesapeake sheet we had discussed (you don't need to depth threshold). However please include the fieldsheets you use to create the surfaces.

2. We are currently preparing our MBES and SSS fill plans for H12040 and will most likely start acquiring fill tomorrow. We have a question about what truly constitutes a holiday in skunk stripe data. We are running fill if we have a large along track holiday (rejected line, disconnected sounder, etc), but do we need to worry about small 5 node holidays or gaps in the outer swath considering that we have 200 SSS?

Not a concern unless there is a significant contact that falls on the holiday. We don't have to meet the complete coverage MBES requirement for node population. If we have lots of outages or sparse data we should probably fill, but don't worry about isolated cases.

3. I asked about the following requirement in the 2009 specs.

If charted sounding falls between 2 sounding lines, and the charted depth is shoaler than adjacent depths from both lines, then the field unit must "split" the lines to verify or disprove the charted sounding.

Matt said not to do this unless there appears to be a feature or significant sounding that was missed by the skunk stripe data. If the whole chart or sections of the chart appear to be shoaler than the survey we should run spilts. That would be a lot of splits!

Please let me know if you have any questions.

Jason

Jason Creech
Lead Hydrographer

DAVID EVANS AND ASSOCIATES INC.

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jasc@deainc.com | www.deainc.com

OPR-E349-KR-09 Bottom Sampling

Sheet F, H12045

Sample	Time (UTC)	Day Number	Easting	Northing	COLOR	NATSUR	NATQUA
F1	20:44:33	200	411515.44	4171614.92	8	4	2
F2	20:50:20	200	413538.55	4171666.86	8-8	3-4	2-2
F3	20:56:14	200	415571.19	4171658.57	8	4	3
F4	21:01:16	200	417543.32	4171668.96	8	4	3
F5	20:39:12	200	411516.19	4173666.87	8	4	2
F6	20:32:27	200	413494.5	4173620.26	2	3	1
F7	20:25:58	200	415488	4173635.47	8	4	3
F8	20:19:33	200	417528.77	4173690.25	8	4	2
F9	19:48:23	200	411514.04	4175671.53	7-7	3-4	2-2
F10	19:54:29	200	413864.37	4175701.75	8	4	2
F11	19:59:30	200	415551.09	4175623.88	7	3	1
F12	20:05:15	200	417525.63	4175643.05	2	3	1
F13	20:12:59	200	419441.43	4175630.88	8	4	1
F14	19:41:12	200	411505.98	4177608.98	8	4	2
F15	19:35:26	200	413548.84	4177635.16	8	4	2
F16	19:29:55	200	415507.73	4177667.05	8	4	2
F17	19:11:39	200	411493.59	4179635.25	7	3	2
F18	19:17:41	200	413522.41	4179621.59	8	4	3
F19	19:23:54	200	415611.35	4179702.48	8	4	2


F 0 0 1


F 0 0 2
2 cm


F 0 0 3


F 0 0 4
2 cm
Rubbermaid


F 0 0 5
2cm
Rubbermaid
ROUGHNECK


F 0 0 6
2cm


F 0 0 7


F 0 0 8


F 0 0 9


F 0 1 0


F 0 1 1


F 0 1 2
2 cm


F 0 1 3
2 cm


F 0 1 4


F 0 1 5

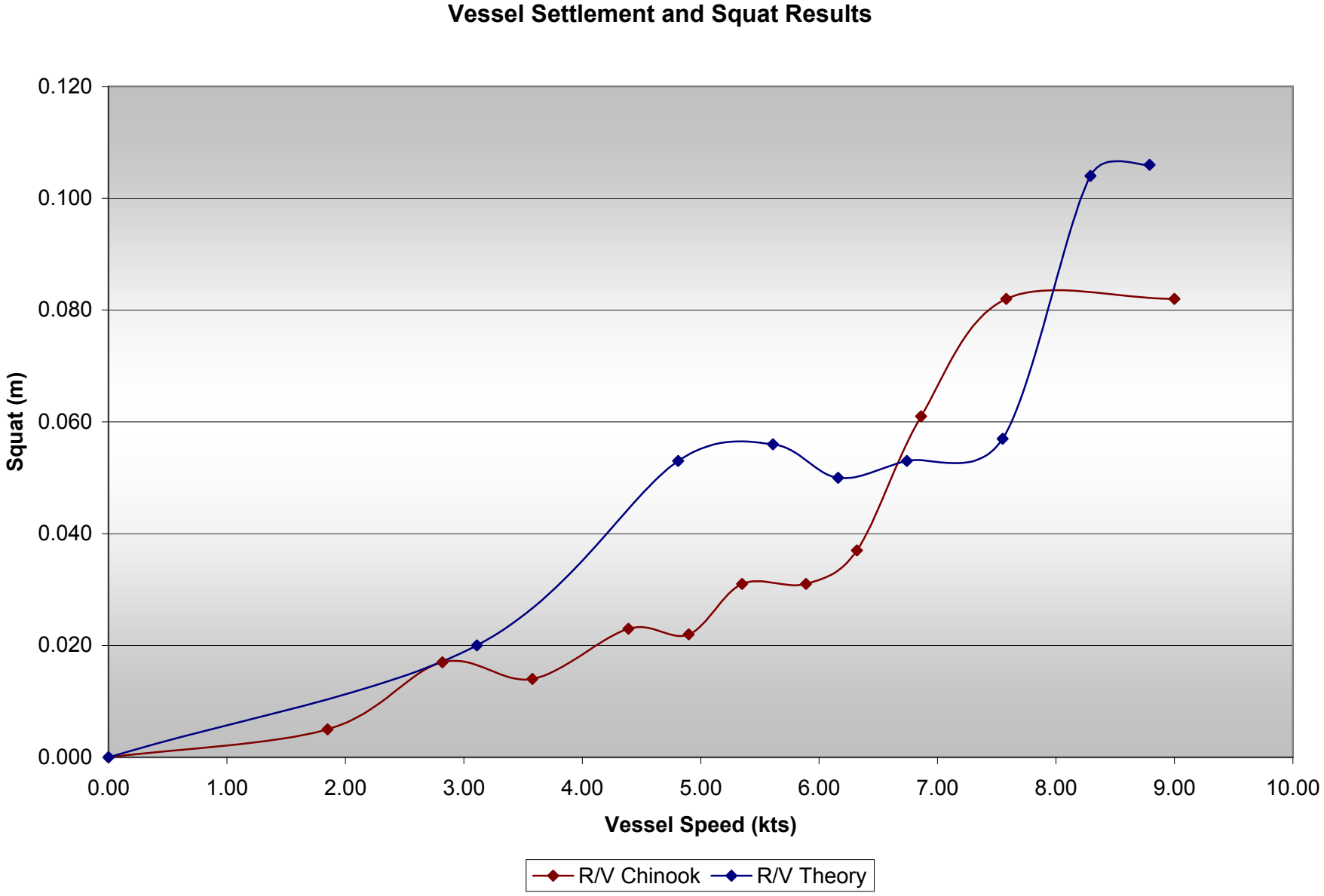

F 0 1 6


F 0 1 7


F 0 1 8


F 0 1 9

OPR-E349-KR-09 Settlement and Squat Results			
R/V Chinook		*R/V Theory*	
Speed (kts)	**Squat (m)**	**Speed (kts)**	**Squat (m)**
0.00	0.000	0.00	0.000
1.85	0.005	3.11	0.020
2.82	0.017	4.81	0.053
3.58	0.014	5.61	0.056
4.39	0.023	6.16	0.050
4.90	0.022	6.74	0.053
5.35	0.031	7.55	0.057
5.89	0.031	8.29	0.104
6.32	0.037	8.79	0.106
6.86	0.061		
7.58	0.082		
9.00	0.082		


Vessel Settlement and Squat Results
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Squat (m)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Vessel Speed (kts)
R/V Chinook
R/V Theory

AHB COMPILATION LOG

General Survey Information	
REGISTRY No.	H12045
PROJECT No.	OPR-E349-KR-09
FIELD UNIT	DAVID EVENS AND ASSOCIATES, INC.
DATE OF SURVEY	20090719 - 20091214
LARGEST SCALE CHART	***12226_1, edition 18th, 20090701, 1:40,000*** ***12228_1, edition 32nd, 20080301, 1:40,000***
ADDITIONAL CHARTS	***12225_1, edition 59th, 20091201, 1:80,000*** ***12280_2, edition 09th, 20090601, 1:200,000***
SOUNDING UNITS	**FEET**
COMPILER	John Kidd

Source Grids	**File Name** *H:\Compilation\H12045_E349_DEA\AHB_H12045\SAR Final Products\GRIDS*
	H12045_1m_MLLW_1of7_Final.csar **H12045_2m_MLLW_2of7_Final.csar** **H12045_2m_MLLW_3of7_Final.csar** **H12045_2m_MLLW_4of7_Final.csar** **H12045_2m_MLLW_5of7_Final.csar** **H12045_2m_MLLW_6of7_Final.csar** **H12045_2m_MLLW_7of7_Final.csar**
Surfaces	**File Name** *H:\Compilation\H12045_E349_DEA\AHB_H12045\COMPILE\Working*
Combined	**H12045_4m_Combined.csar**
Interpolated TIN	\Interpolated TIN**H12045_12m_InterpTIN.csar**
Shifted Interpolated TIN	\Shifted Surface**H12045_12m_InterpTIN_Shifted.csar**
Final HOBs	**File Name** *H:\Compilation\H12045_E349_DEA\AHB_H12045\COMPILE\Final_Hobs*
Survey Scale Soundings	**H12045_SS_Soundings.hob**
Chart Scale Soundings	**H12045_CS_Soundings.hob**
Contour Layer	**H12045_Contours.hob**
Feature Layer	**H12045_Features.hob**
Meta-Objects Layer	**H12045_MetaObjects.hob**
Blue Notes	**H12045_BlueNotes.hob**
ENC Retain Soundings	**NA**

Meta-Objects Attribution	
Acronym	**Value**
M_COVR	
CATCOV	1 – coverage available
SORDAT	20091214
SORIND	US,US,graph,H12045
M_QUAL	
CATZOC	6 – zone of confidence U (data not assessed)
INFORM	R/V Theory and R/V Chinook
POSACC	10.0 m
SORDAT	200091214
SORIND	US,US,graph,H12045
SUREND	20091214
SURSTA	20090719

DEPARE	
DRVALV 1	13.789 ft
DRVALV2	90.4800 ft
SORDAT	20091214
SORIND	US,US,graph,H12045
M_CSCL	
CSCALE	NA
SORDAT	NA
SORIND	NA

SPECIFICATIONS:

I. COMBINED SURFACE:
- a. Number of SAR Final Grids: 7
- b. Resolution of Combined (m): 4 m

II. SURVEY SCALE SOUNDINGS (SS):
- a. Attribute Name: Depth
- b. Selection criteria: Radius, Shoal bias
- c. Radius value is: mm at map scale
  - i. Use single-defined radius: NA
  - ii. And/Or use radius table file: H12148_SS_SSR_40K.txt

0	5.4864	1.2
5.48641	9.1440	1.25
9.14401	10.9728	1.3
10.9728	18.2880	1.4
18.2880	36.5760	1.5

- d. Queried Depth of All Soundings
  - i. Minimum: 4.2029 m
  - ii. Maximum: 27.5783 m

III. INTERPOLATED TIN SURFACE:
- a. Resolution (m): 12 m
- b. Interpolation method: Natural Neighbor
- c. Shift value: -0.75 ft

IV. CONTOURS:
- a. Attribute Name: Depth
- b. Use a Depth List: NOAA_depth_curves_list_FEET.txt
- c. Output Options: Create contour lines
  - i. Line Object: DEPCNT
  - ii. Value Attribute: VALDCO

V. FEATURES:
- a. Number of Chart Features: 28
- b. Number of Non-Chart Features: 10

VI. CHART SURVEY SOUNDINGS (CS):
- a. Number of ENC CS Soundings: 331
- b. Attribute Name: Depth
- c. Selection criteria: Radius, Shoal bias
- d. Radius value is: Distance on the ground (m)
  - i. Use single-defined radius: NA
  - ii. And/Or use radius table file: H12148_CS_SSR_40K.txt

0	5.4864	440
5.48641	9.1440	470
9.14401	10.9728	500
10.9728	18.2880	520
18.2880	36.5760	520

iii. Enable Filter: Interpolated !=1

e. Number Survey CS Soundings: 319

VII. NOTES:

ATLANTIC HYDROGRAPHIC BRANCH
H-CELL REPORT to ACCOMPANY
SURVEY H12045 (2009)

This H-Cell Report has been written to supplement and/or clarify the original Descriptive Report (DR) and pass critical compilation information to the cartographers in the Marine Chart Division. Sections in this report refer to the corresponding sections of the Descriptive Report.

B. DATA ACQUISITION AND PROCESSING

B.2 QUALITY CONTROL

The AHB source depth grids for the survey's nautical chart update were 1m and 2m resolution BASE surfaces (*.CSAR), which were combined at 4m resolution". The survey scale soundings were created from the combined surface using a sounding spacing range (SSR) file. A TIN was created from the survey scale soundings, from which an interpolated surface of 12m resolution was generated. The chart scale soundings were derived from only the non-interpolated nodes of this surface to preserve absolute continuity between the charted depths, the survey scale soundings, and the original source grid. The chart scale soundings were selected using a sounding spacing range (SSR) file. The chart scale soundings are a subset of the survey scale soundings. The surface model was referenced when selecting the chart scale soundings, to ensure that the selected soundings portray the bathymetry within the common area.

The interpolated TIN surface of 12m resolution was shifted by the NOAA sounding rounding value of -0.75 feet. The shifted interpolated TIN was used to generate depth contours in feet (18 ft, 30 ft, 36 ft, and 60 ft). The depth contours are forwarded to MCD for reference only. The contours were utilized during chart scale sounding selection and quality assurance efforts at AHB. The depth contours are incorporated into the SS H-Cell product as per 2009 H-Cell Specifications.

The compilation products (Final *.HOB files) for this survey are detailed in the H12045 AHB Compilation Log contained within this document. The Final HOB files include depth areas (DEPARE), depth contours (DEPCNT), soundings (SOUNDG), meta-objects (M_COVR and M_QUAL), cartographic Blue Notes ($CSYMB), and features (SBDARE, OBSTRN, WRECKS).

As dictated by Hydrographic Technical Directive 2008-8, the Final HOB files were combined into two separate H-Cell files in S-57 format. Both S-57 files were exported from CARIS Bathy DataBASE in meters, and then converted from metric units into feet using CARIS HOM ENC 3.3. Quality assurance and topology checks were conducted using CARIS S-57 Composer 2.2 and DKART Inspector 5.1 validation tests.

The final H-Cell products are two S-57 files, in Lat/Long NAD-83. The contents of these two H-Cell deliverables are listed in the table below:

TABLE 1 - Contents of H-Cell Files

H12045_CS.000			Scale 1:40,000
Object Class Types	**Geographic**	**Cartographic**	**Meta**
S-57 Object Acronyms	DEPARE	$CSYMB	M_COVR
	OBSTRN		M_QUAL
	SBDARE		
	SOUNDG		
	WRECKS		
H12045_SS.000			**Scale 1:10,000**
Object Class Types	**Geographic**		
S-57 Object Acronyms	DEPCNT		
	SOUNDG		

B.2.4 Junctions and Prior Surveys

Survey H12045 (2009) junctions with survey H12044 (2009) to the west. Most present survey depths compare within 1 foot of junctioning survey depths to the west. Most present survey depths to the north compare within 6 feet of the charted hydrography with one area that has deepened about 12 feet. Most present survey depths to the east and south compare within 4 feet of the charted hydrography.

B.4 DATA PROCESSING

The following software was used to process data at the Atlantic Hydrographic Branch:

CARIS Bathy DataBASE version 3.0/HF10
CARIS HIPS/SIPS version 7.0/SP2/HF6
CARIS S-57 Composer version 2.2/HF3
CARIS HOM ENC version 3.3/SP3/HF8
DKART Inspector version 5.1
HSTP Pydro version 10.11 (r3191)

C. HORIZONTAL AND VERTICAL CONTROL

The hydrographer makes adequate mention of horizontal and vertical control used for this survey in section C of the DR. The sounding datum for this survey is Mean Lower Low Water (MLLW), and the vertical datum is Mean High Water (MHW). Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD83), UTM projection zone 18 North.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

12226_1 (18st Edition, JUL/09)
Chesapeake Bay Wolf Trap to Pungoteague Creek
Corrected through NM 03/12/2011
Corrected through LNM 03/01/2011
Scale 1:40,000

12228_1 (32nd Edition, MAR/08)
Chesapeake Bay Posomoke and Tangier Sounds
Corrected through NM 03/12/2011
Corrected through LNM 03/01/2011
Scale 1:40,000

ENC COMPARISON

US5VA10M
Insert ENC name
Edition 17
Application Date 2011/02/22
Issue Date 2011/02/22
Chart 12226

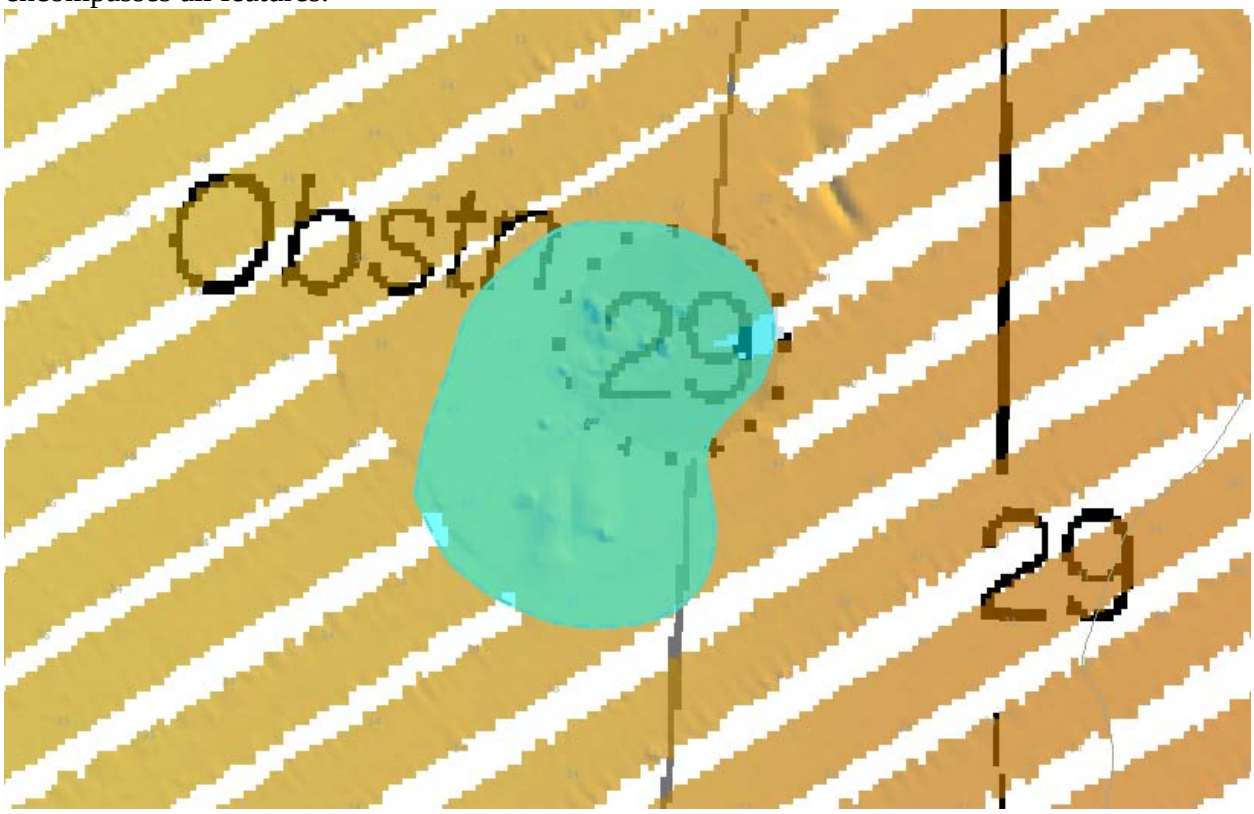
US5VA16M
ENC Name
Edition 22
Application Date 2010/12/20
Issue Date 2011/03/03

D.2 ADDITIONAL RESULTS

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section D and Appendix I and II of the DR. The hydrographer recommends that any charted features not specifically addressed either in the H-Cell files or the Blue Notes should be retained as charted. The following exceptions are noted:

a. The field unit collected a total of 19 bottom samples. Some charted seabed characteristics were retained as charted, but most of the charted seabed characteristics were superceded by the survey findings.

b. The field found multiple contacts and an area that is charted to have a 29 ft obstruction. The obstruction symbol does not cover all contacts. An area feature was created that encompasses all features.



D.6 MISCELLANEOUS

Chart compilation was completed by Atlantic Hydrographic Branch personnel in Norfolk, Virginia. Compilation data will be forwarded to the Marine Chart Division in Silver Spring, Maryland. See section D.1 of this report for a list of the Raster Charts and Electronic Navigation Charts (ENC) used for compiling the present survey.

D.7 ADEQUACY OF SURVEY

The present survey is adequate to supersede the charted bathymetry within the common area. Any features not specifically addressed either in the H-Cell files or the Blue Notes should be retained as charted. Refer to section D and Appendix I and II of the DR for further recommendations by the hydrographer.

APPROVAL SHEET
H12045 (2009)

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth contours, disposition of critical depths, cartographic symbolization, and verification or disproval of charted data. All revisions and additions made to the H-Cell files during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with National Ocean Service and Office of Coast Survey requirements except where noted in the Descriptive Report and the H-Cell Report.

All final products have undergone a comprehensive review per the Hydrographic Surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

2011.04.25
10:20:53 -04'00'

John Kidd
Hydrographic Intern
Atlantic Hydrographic Branch

I have reviewed the H-Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet National Ocean Service requirements and standards for products in support of nautical charting except where noted.

Richard T. Brennan
2011.05.27 02:05:35 -04'00'

Approved: _____

CDR Richard T. Brennan, NOAA
Chief, Atlantic Hydrographic Branch