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. **H12042**

LOCALITY

State **Virginia**

General Locality **Southern Chesapeake Bay**

Sublocality **3nm East of Bluff Point**

2009

CHIEF OF PARTY

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

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

HYDROGRAPHIC TITLE SHEET

REGISTRY No

H12042

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 East of Bluff Point

Scale: 1:10,000 — Date of Survey: July 19, 2009 to December 15, 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, R2Sonic 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*

Soundings in: Meters at MLLW

Compilation Units: Feet 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.

UTM Zone 18N

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

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

John Oswald and Associates, LLC, 2000 E. Dowling Road, Suite 10, Anchorage, AK 99507

Notes in Red, Bold, Italic made during Office Processing.

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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 H12042
Project OPR-E349-KR-09
Southern Chesapeake Bay, Virginia
3nm East of Bluff Point
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) extends from the entrance to Great Wicomico River to Bluff Point.

Survey H12042 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**. ***Included with HCell deliverables***

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). Automated Wreck and Obstruction Information System (AWOIS) items and significant side scan contact investigations were acquired to meet complete coverage requirements. 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 H12042 on July 19, 2009 (Day Number 200). One (1) AWOIS item investigation was assigned to this survey for full investigation. ***Concur***

Data acquisition was conducted from July 19, 2009 (Day Number 200) to December 15, 2009 (Day Number 349). Table 1 lists specific dates of acquisition. ***Concur***

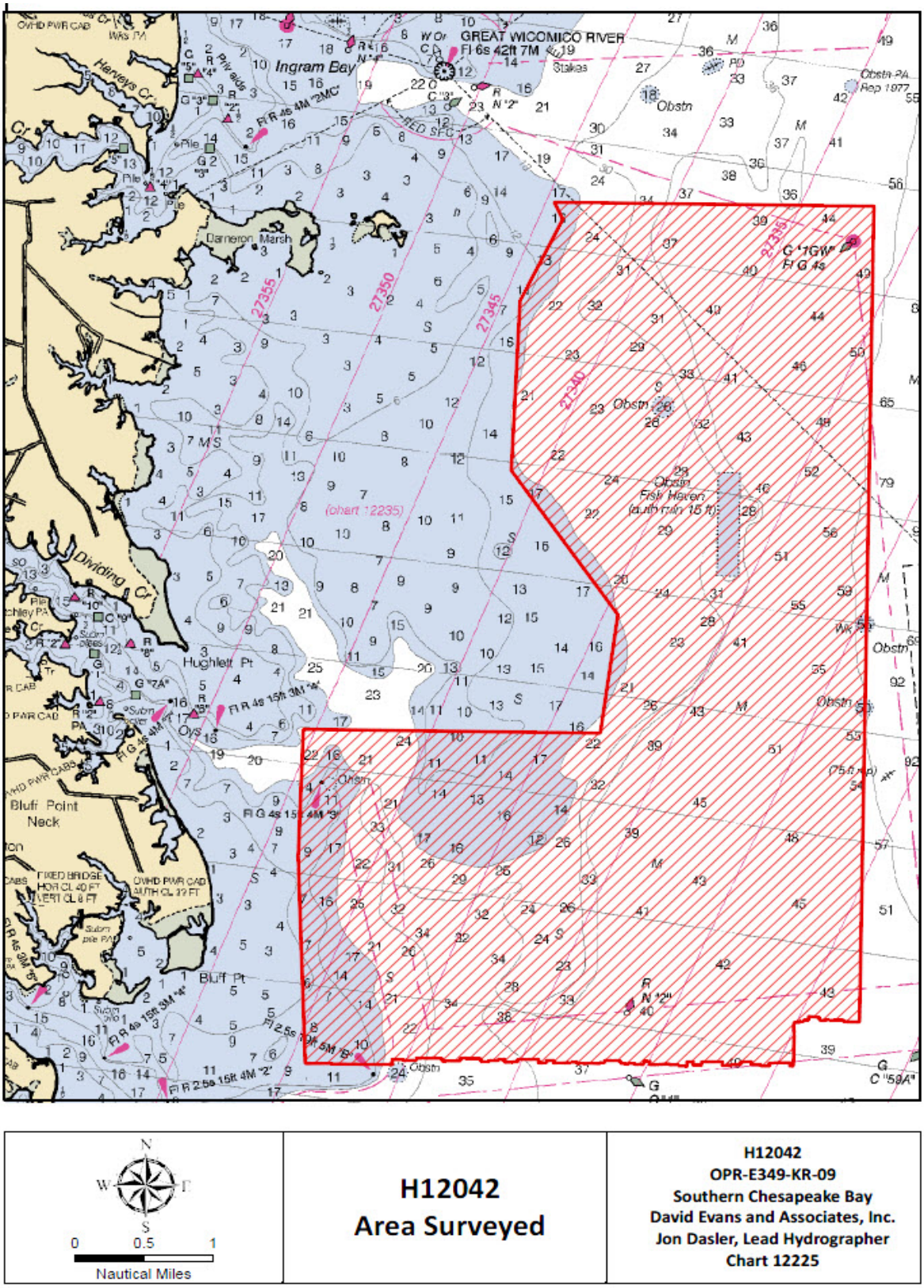


Figure 1. H12042 Survey Area

Table 1. H12042 Days of Acquisition

Dates of Acquisition	
Month	**Dates**
July	19
August	5-8, 10-13, 15, 16, 26, 27
October	27, 28
November	18, 19
December	10,15

Detailed survey statistics of H12042 are provided in Table 2.

Table 2. H12042 Survey Statistics

Survey Statistics	***Research Vessels (R/V) Theory and Chinook***
MBES (mainscheme nm)	652.79
Crosslines (MBES nm)	38.18
Developments (MBES nm)	38.70
Number of Item Investigations that required additional survey effort	115
Total number of square nautical miles	19.24

B. DATA ACQUISITION AND PROCESSING *See also H-Cell Report*

B1. Equipment

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

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)***.**

****Included with HCell 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.
Submitted with original field records

B2.a Crosslines

A total of 38.2 nautical miles of crosslines, or 5.85% 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 200 kHz crosslines were acquired for survey H12042. 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. **** Submitted with original field records***

B2.b Uncertainty

The calculated uncertainty values of all nodes within the unfinalized CUBE surfaces range from 0.186 meters to 0.293 meters. The higher value is in deep water on the outer swath of a main scheme line with no 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

H12042 junctions with survey H12040 to the north, and with survey H12043 to the east.

Survey junction analysis with H12042 was performed by visually reviewing survey data in Caris HIPS subset mode and by performing a surface to surface comparison in Caris Bathy DataBASE. In general, the depth differences between H12042 and H12040, as well as the depth differences between H12042 and H12043 are within 20 centimeters. ***Concur***

The 20 centimeter disagreement occurs when comparing 400 kHz data (H12043) from the R/V Theory to 200 kHz data (H12042) from the R/V Chinook and is caused by increased penetration by the 200 kHz sonar into muddy unconsolidated sediments. This discrepancy is a known issue which is discussed in Section B2.d and well within the allowable 50 centimeter IHO Order 1 maximum allowable total vertical uncertainty (95% Confidence Level) for these survey depths. ***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 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.

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.

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 (H12042_1of6 to H12042_of6) 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.

Due to the shoal nature of the charted fish haven, (authorized minimum depth of 15 feet) multibeam coverage was obtained prior to side scan sonar acquisition. After determining safe water depths 200% side scan sonar coverage was also obtained. ***Concur***

B3. Corrections to Echo Soundings

Data reduction procedures for survey H12042 are detailed in the *OPR-E349-KR-09 DAPR**, submitted under a separate cover. The Reson 7125 acquired using the 400 kHz frequency and the R2Sonic 2024 acquired using the 200 kHz frequency. Both datasets were filtered using the CARIS surface filter with errors values from Standard Deviation at 2.6 (99.06%) Confidence Level. For detailed information pertaining to applied filters please refer to the multibeam processing logs in Separate I *Acquisition and Processing Logs**.

**** Submitted with original field records***

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 the document. This was a close out patch test run prior to removing the survey vessel from the water for storage over the winter.

Due to a corrupt True Heave file the first ten lines acquired on the *R/V Theory* on August 7, 2009 (DN 219) do not have True Heave applied.

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).

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 HCell 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*.

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*.

In order to keep CUBE surfaces at a manageable size, the main survey area was broken up into six (6) Field Sheets (H12042_1of6, etc.). When combined the Fields 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. In addition a CUBE surface was created using object detection coverage specifications over the charted fish haven. 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 ***See also H-Cell Report***

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

Prior to survey acquisition, a global positioning system (GPS) base station with a dual frequency (L1/L2) receiver were established to enable post-processing of survey vessel navigation and attitude data. The base station was near the Dameron Marsh spit (SMITH) 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.

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.

A complete description of horizontal and vertical control for survey H12042 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**.**
Included with HCell 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.

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.

Table 6 includes the zoning information for each zone used for the survey.

Table 6. Tide Zones

Zone	Reference Station	Corrector (min.)	Ratio
SCB93	8636580	18	0.99
SCB94	8636580	18	0.99
SCB104	8636580	36	0.99
SCB105	8636580	36	0.99
SCB106	8636580	48	0.99
SCB107	8636580	48	0.99

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. Though vertical errors are still visible in the data they are small and are generally 10 centimeters or less as this survey is relatively close to the Windmill Point NWLON station. 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 with clarification. Discrete zoning data was reviewed by the Survey Acceptance Review (SAR) personnel and no data offsets and/or artifacts were present in the submitted data. As a result, the discrete zoning tide corrected data was accepted at the Atlantic***

Hydrographic Branch as this method of water level correction was the intended deliverable for survey H12042. GPS tide corrected data is considered an ancillary submission for process evaluation and documentation.

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.

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) and are for reference only. 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**.
Submitted with original field records.

D. RESULTS AND RECOMMENDATIONS *See also H-Cell Report*

D1. Chart Comparison

D1.a Survey Agreement with Chart

During the course of data acquisition and processing H12042 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.

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.

In addition, a surface was generated from the ENCs that correspond 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.

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.

H12042 contours and soundings were compared in CARIS HIPS to the depths and contours on the charts listed in Table 7.

Table 7. Charts compared to H12042

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
12228	1:40,000	32	03/01/2008	---	03/10	01/12/2010
12235	1:40,000	32	05/01/2008	---	01/10	01/05/2010
12280	1:200,000	09	06/01/2009	---	03/10	01/12/2010
US5VA16M	---	16	---	01/06/2010	---	01/05/2010
US4VA40M	---	4	---	01/06/2010	---	01/05/2010
US5VA41M	---	20	---	01/06/2010	---	01/05/2010

Surveyed H12042 depths are generally zero to three feet (0.00 to 0.914-meters) deeper than charted (Figure 2) with the some shoaling occurring on a steep charted ridge (Figure 4). ***Concur***

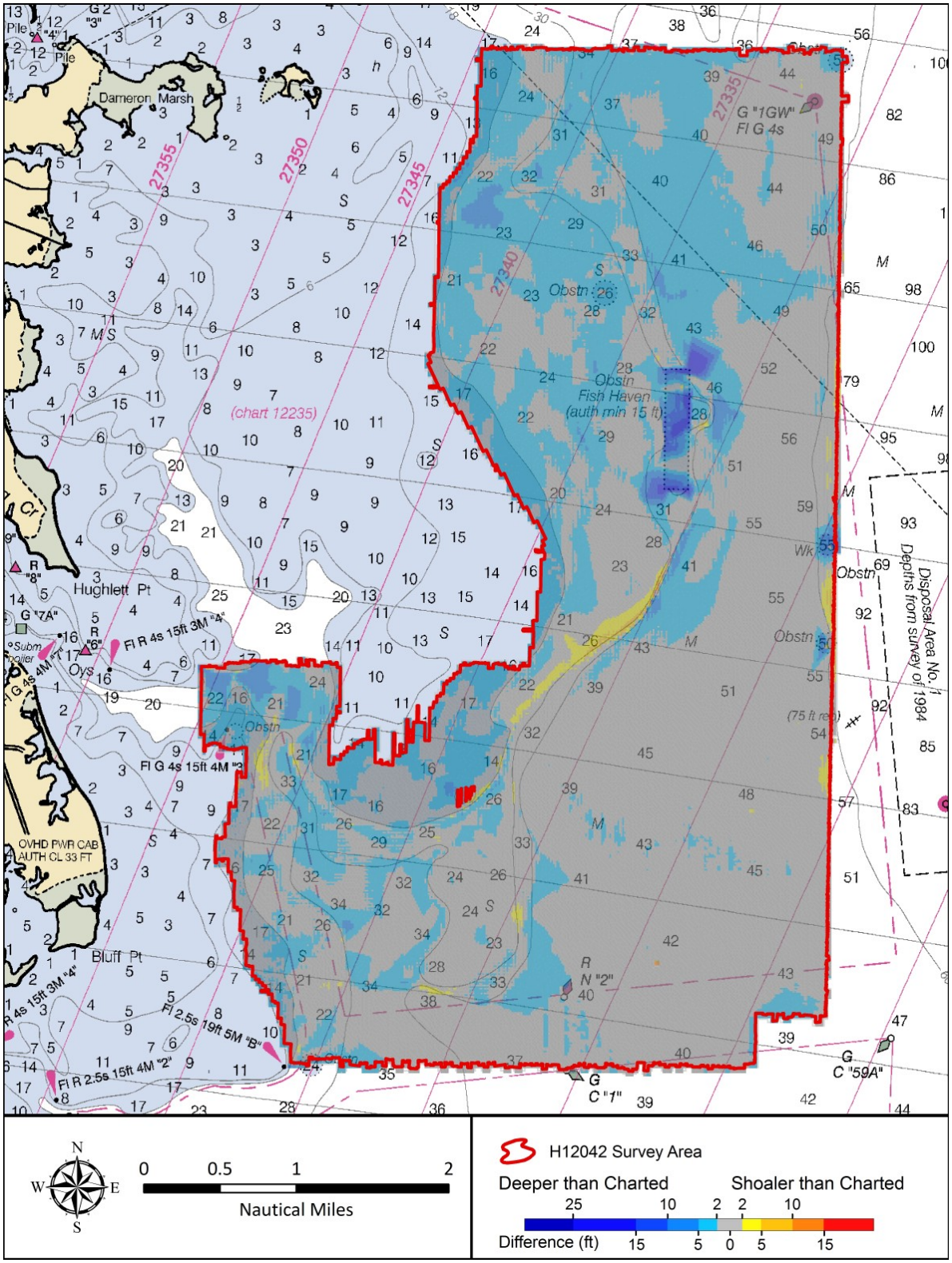


Figure 2. Difference image of depth discrepancies between H12042 and combined ENCs. Chart 12225 displayed.

D1.b Comparison to Significant Shoals

In general, H12042 located depths deeper than charted soundings. In Figure 3 below the 18-foot and 30-foot contour have migrated north, thereby reducing the extent of the shoal. ***Concur***

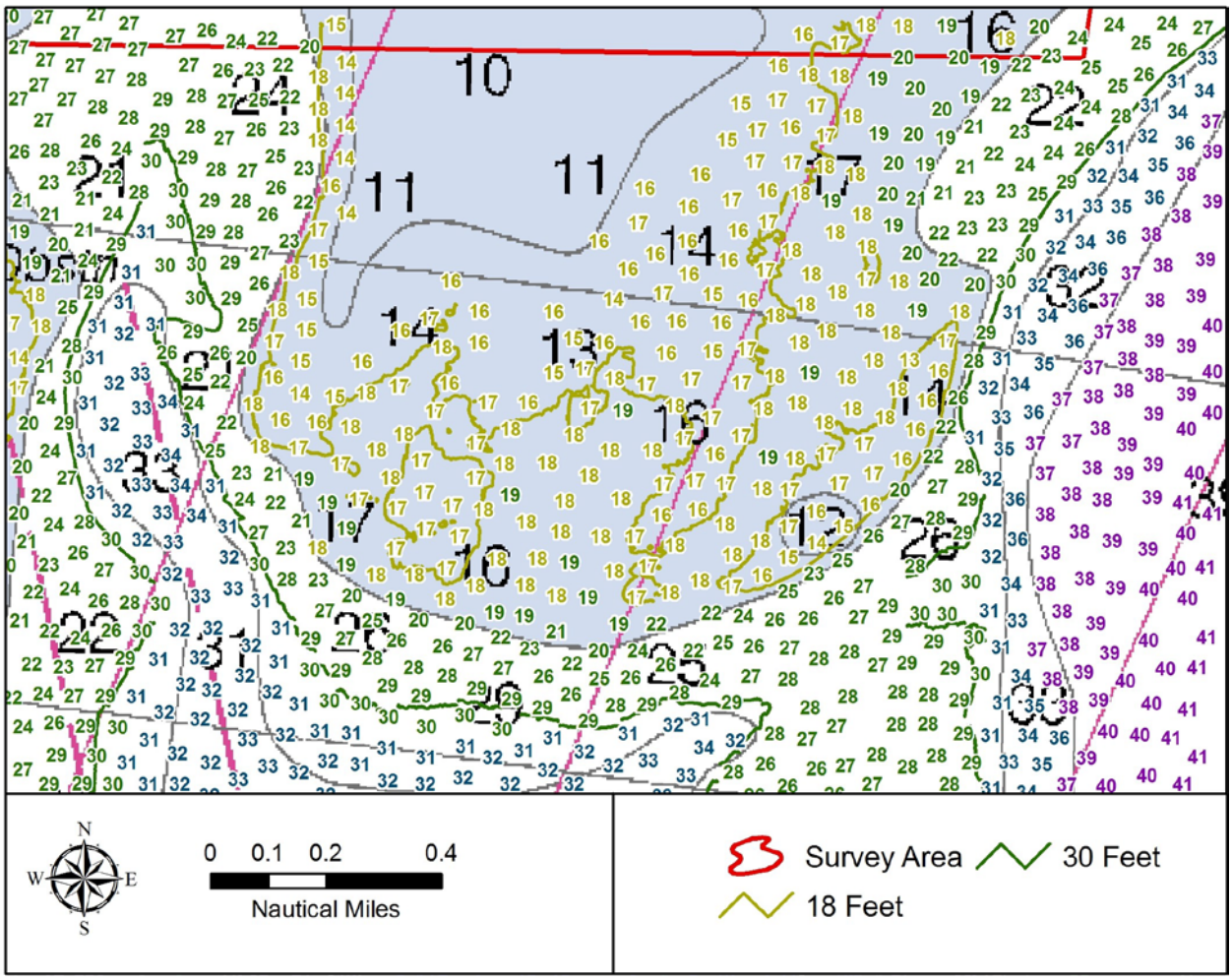


Figure 3. H12042 Shoal Migration

D1.c Comparison to Charted Features

One (1) AWOIS items were assigned for investigation to H12042 (Figure 4). A complete description is available in Appendix II *Survey Feature Report**.

Attached to this report

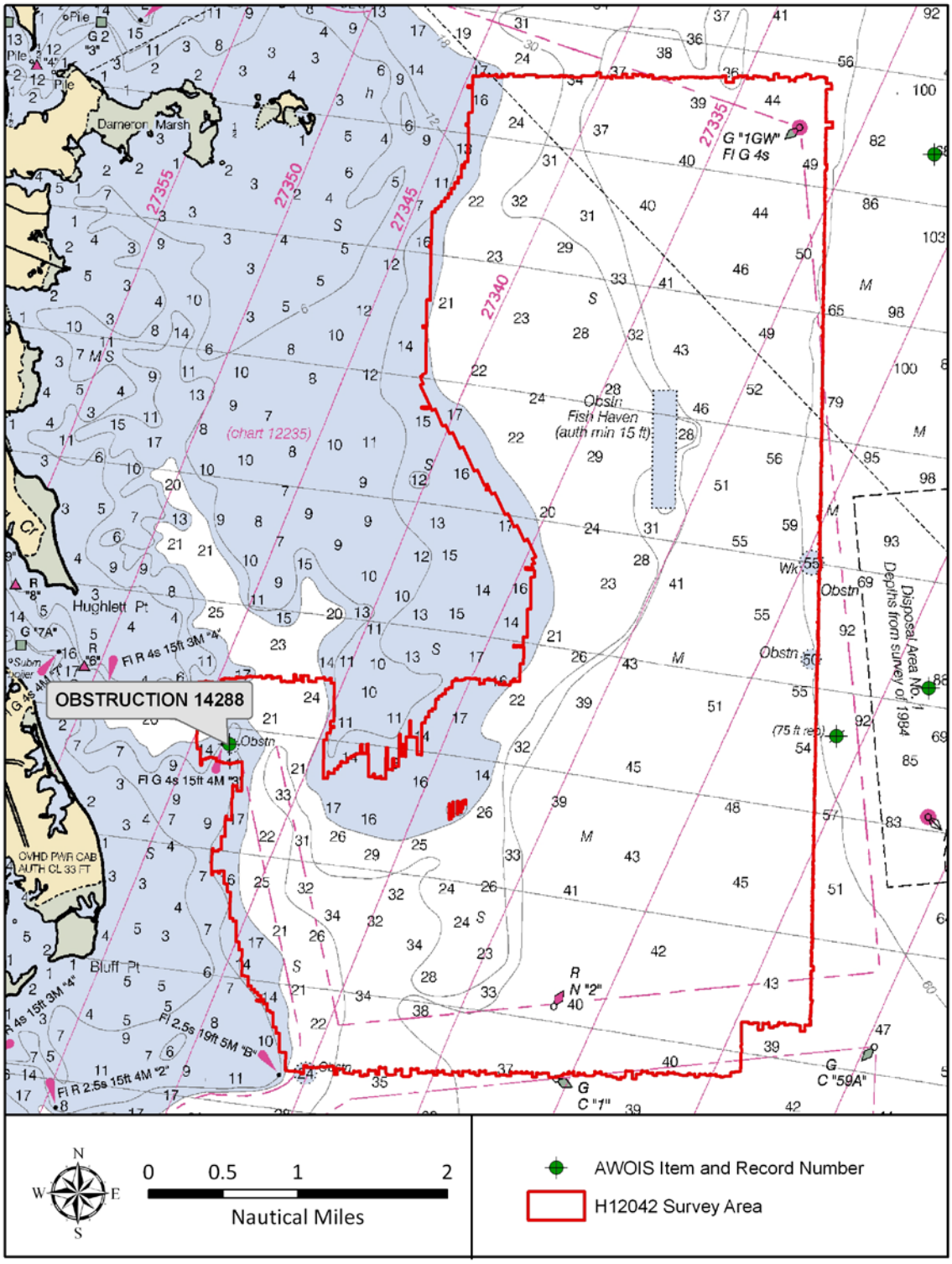


Figure 4. H12042 AWOIS Items

The Assigned AWOIS item for H12042 is listed as follows:

- AWOIS 14288* is a charted *Obstrn*. The search radius was surveyed with two hundred percent side scan sonar. All contacts were investigated with full multibeam coverage. Several contacts were discovered within the radius, however many appear to be crab pots as surface buoys were present during the first site acquisition. Upon return for investigation, two of the five original contacts suspected as crab pots had been retrieved, and all visible buoys were removed from the area. Contacts 301-125023-S, 301-130457-P and 301-133635-S resemble derelict crab pots. There are no other significant contacts within the radius. The least depth is 11.1ft (3.38-meters) within the entire radius found on contact 301-130457-P. The AWOIS radius also contains Dividing Creek Entrance Light "3" (LLN 16120), which is visible and functional. Contact 301-130531-S. The hydrographer recommends charting this shoal according to current survey depths and removing the charted *Obstn* symbol and annotation.
  **** See also Appendix II of this report***

D1.d Comparison of Soundings in Designated Anchorages and Along Channels

H12042 survey area does not contain any anchorage area 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. ****Attached to this report***

D1.f Dangers to Navigation (DtoN)

Three (3) Dangers to Navigation (DtoN) were located during survey H12042 and have been submitted to AHB. All DtoNs were reviewed by AHB and forwarded on to the Marine Chart Division (MCD). ***Concur***

All DtoNs* are included in the S-57 feature file and should be charted as depicted in the file and listed in Table 8 below. ****See also Appendix II of this report***

Table 8. H12042 DtoN Charting Status

DtoN	Feature	Applied to Raster Chart	Applied to ENC	AHB Submitted to MCD
1	Wreck	Yes	Yes	Yes
2	Buoy	No	No	Yes
3	Obstruction	Yes	Yes	Yes

D2. 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 H12042 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. ***Attached to this report***

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. H12042

This report and the accompanying data are respectfully submitted.

Field operations contributing to the accomplishment of survey H12042 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: 2010.04.01 14:15:15 -07'00'

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: 2010.04.01 14:15:46 -07'00'

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	12/18/2009
OPR-E349-KR-09 Horizontal and Vertical Control Report	04/01/2010

APPENDIX I

Dangers to Navigation

Appendix I - Danger to Navigation Report

Registry Number: H12042
State: Virginia
Locality: Southern Chesapeake Bay
Sub-locality: 3nm East of Bluff Point
Project Number: OPR-E349-KR-09
Survey Dates: 20090719 - 20091215

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
12235	32nd	05/01/2008	1:40,000 (12235_1)	[L]NTM: ?
12285	39th	03/01/2008	1:40,000 (12285_19) 1:40,000 (12285_18)	[L]NTM: ?
12225	58th	05/01/2009	1:80,000 (12225_1)	USCG LNM: 06/16/2009 (06/30/2009) NGA NTM: 08/02/2008 (07/04/2009)
12280	8th	03/01/2008	1:200,000 (12280_2)	[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	H12042 DtoN #1 - 55ft WRECK	Wreck	16.94 m	37° 44' 01.7" N	076° 12' 03.3" W	---
1.2	H12042 DtoN #2 - Private BOYSPP "AP VMRC"	GP	[None]	37° 44' 46.8" N	076° 13' 22.6" W	---
1.3	H12042 DtoN #3 - 26ft SOUNDG	Shoal	7.98 m	37° 45' 40.0" N	076° 13' 55.8" W	---

1 - Dangers To Navigation

1.1) H12042 DtoN #1 - 55ft WRECK

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 44' 01.7" N, 076° 12' 03.3" W

Least Depth: 16.94 m (= 55.58 ft = 9.264 fm = 9 fm 1.58 ft)

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

Timestamp: 2009-217.15:13:56.000 (08/05/2009)

GP Dataset: H12042_DtoN_1.xls

GP No.: 1

Charts Affected: 12235_1, 12285_18, 12285_19, 12225_1, 12280_2, 13003_1

Remarks:

The feature is a wreck with approximate dimensions of 35m x 12m (114.8ft x 39.4ft) rising 4.4m (14.4ft) above the natural bottom. The least depth was acquired with an R2Sonic 2024 shallow water multibeam sonar, and reduced to MLLW.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12042_DtoN_1.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting a 55ft wreck at the surveyed position.

Cartographically-Rounded Depth (Affected Charts):

55ft (12235_1, 12285_18, 12285_19, 12225_1, 12280_2)

9 ¼fm (13003_1)

S-57 Data

Geo object 1: Wreck (WRECKS)

Attributes: CATWRK - 2:dangerous wreck

QUASOU - 6:least depth known

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

VALSOU - 16.942 m

WATLEV - 3:always under water/submerged

Office Notes

AHB SAR: Retain as charted.

AHB Compile: Concur with clarification. Shown on chart 12235 (33rd Edition, Jul 2011). The 55ft least depth is from junctioning survey H12043. Retain as charted.

Feature Images

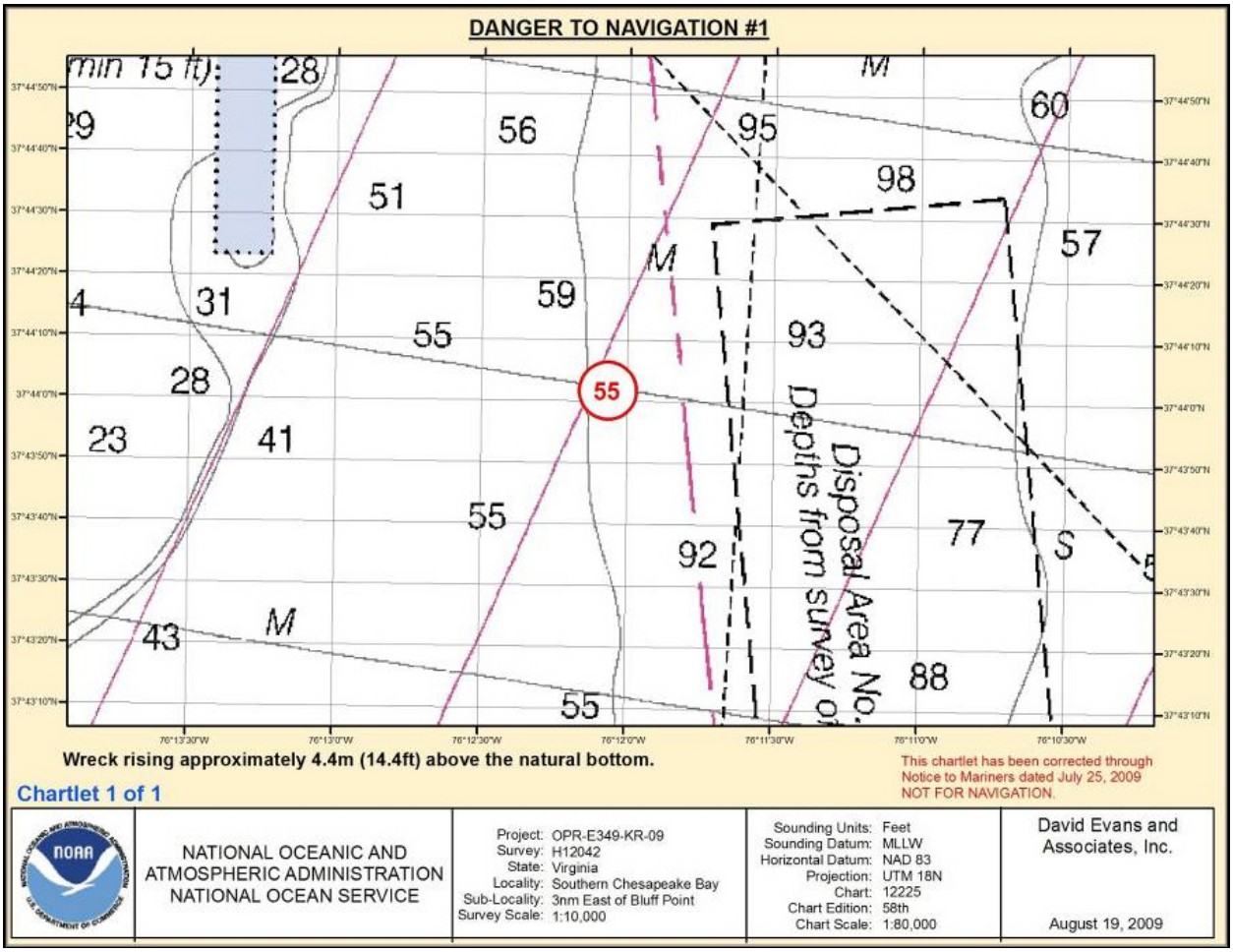


Figure 1.1.1

DtoN #1.1 MBES 2d View

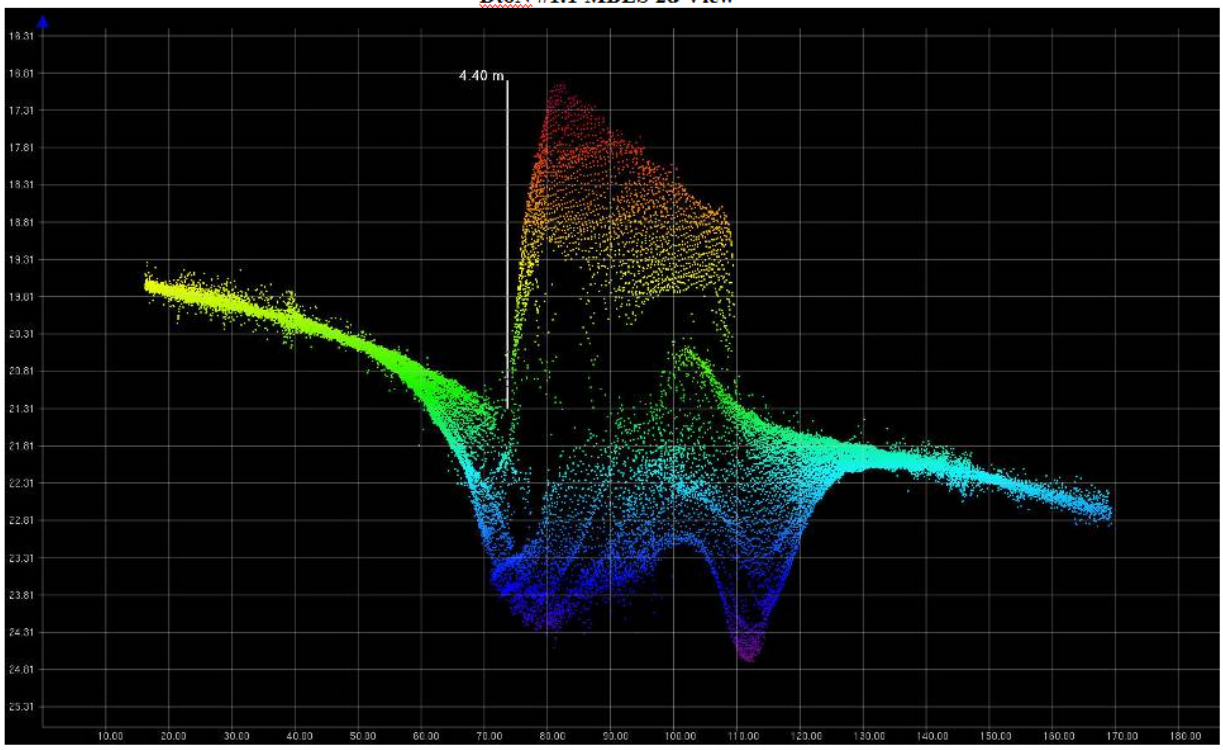


Figure 1.1.2

DtoN #1.1 MBES 3d View

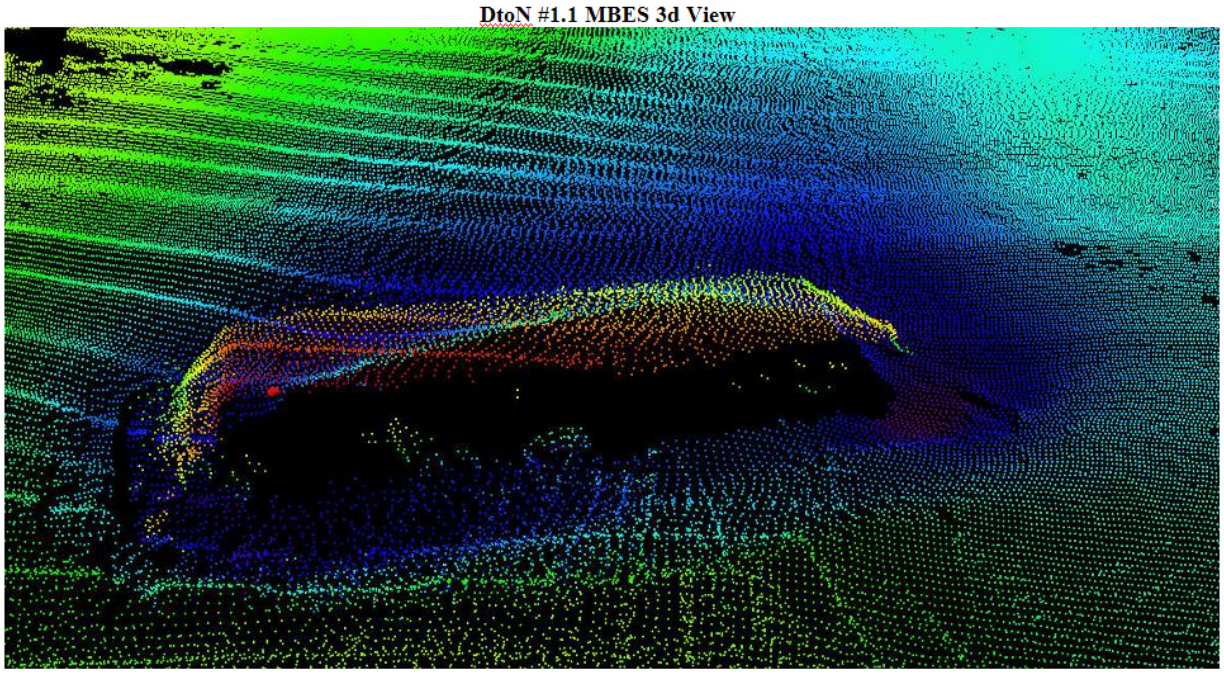


Figure 1.1.3

DtoN #1.1 Sidescan Sonar View

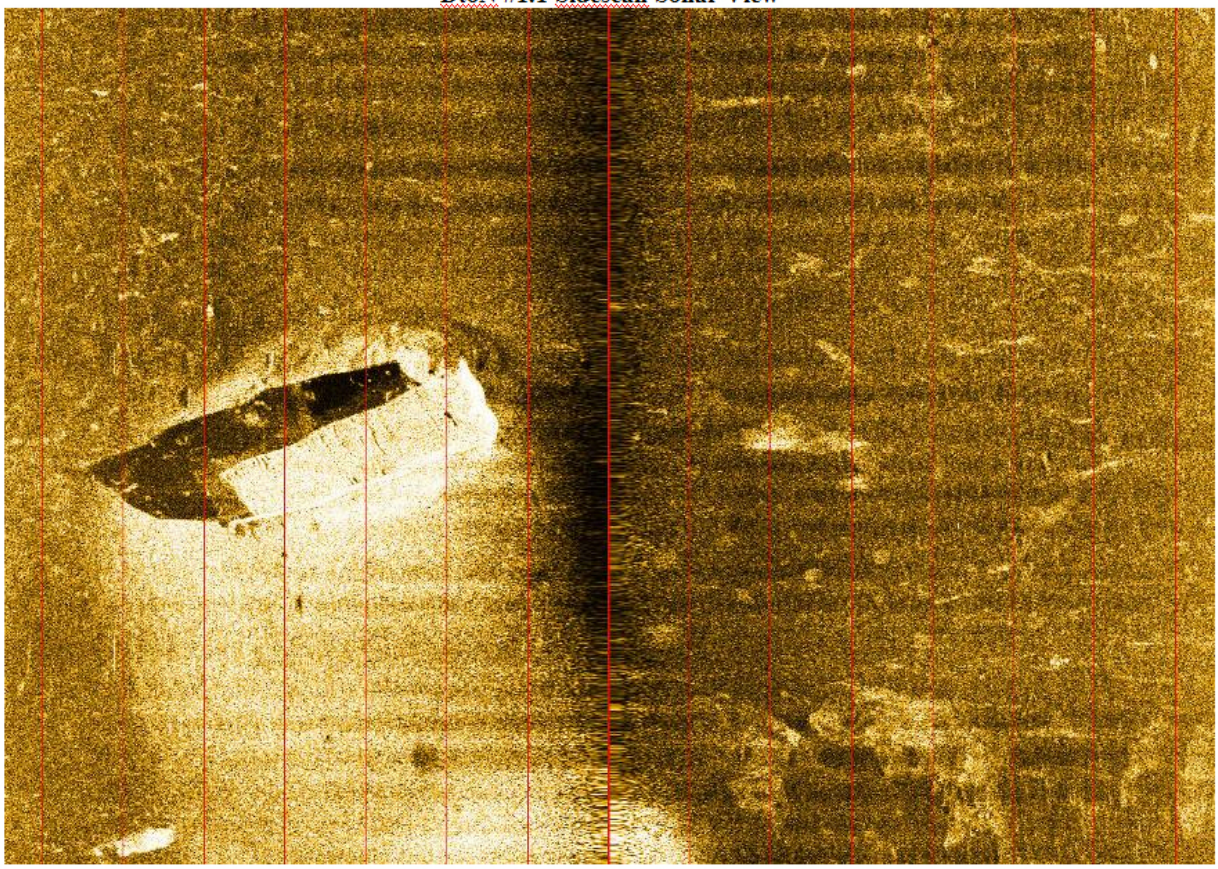


Figure 1.1.4

1.2) H12042 DtoN #2 - Private BOYSPP "AP VMRC"

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 44' 46.8" N, 076° 13' 22.6" W

Least Depth: [None]

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

Timestamp: 2009-300.13:01:46.000 (10/27/2009)

GP Dataset: H12042_DtoN_2.xls

GP No.: 1

Charts Affected: 12235_1, 12285_18, 12285_19, 12225_1, 12280_2, 13003_1

Remarks:

The feature is an uncharted private buoy which lies inside the charted "Obstn Fish Haven (authorized min 15ft)". The buoy is yellow and marked with "AP VMRC" which identifies the Asphalt Pile Reef managed by the Virginia Marine Resources Commission (VMRC).

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12042_DtoN_2.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting an unlit buoy (PRIV AID) at the surveyed position.

S-57 Data

Geo object 1: Buoy, special purpose/general (BOYSPP)

Attributes: BOYSHP - 4:pillar

COLOUR - 6:yellow

STATUS - 8:private

Office Notes

AHB SAR: Charted as part of a DTON Report. Retain as charted.

AHB Compile: Concur with clarification. Shown on chart 12235 (33rd Edition, Jul 2011). Retain as charted.

Feature Images

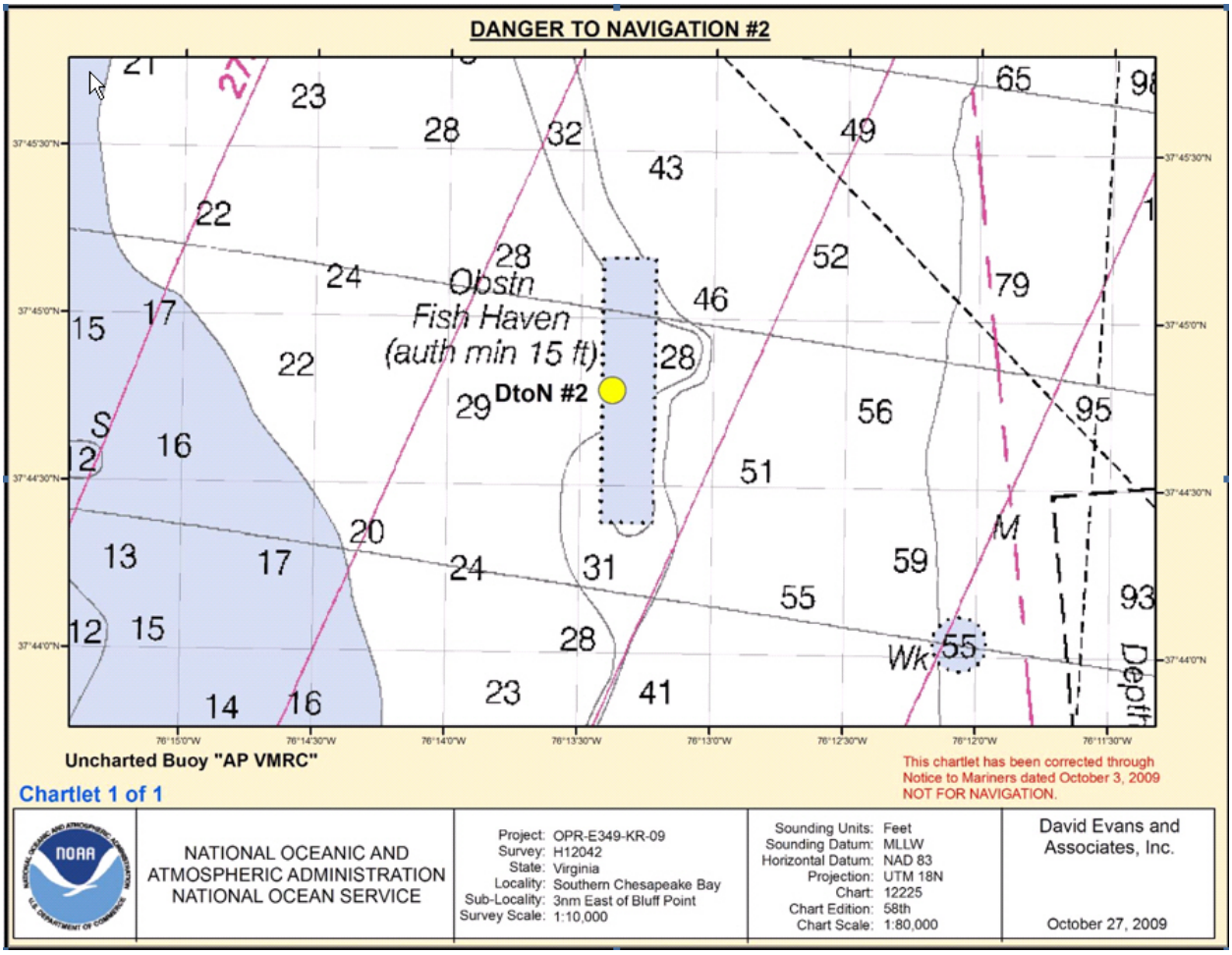


Figure 1.2.1

Figure 1.2.2

1.3) H12042 DtoN #3 - 26ft SOUNDG

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 45' 40.0" N, 076° 13' 55.8" W

Least Depth: 7.98 m (= 26.17 ft = 4.362 fm = 4 fm 2.17 ft)

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

Timestamp: 2009-322.13:39:20.000 (11/18/2009)

GP Dataset: H12042_DtoN_3.xls

GP No.: 1

Charts Affected: 12235_1, 12285_18, 12225_1, 12280_2, 13003_1

Remarks:

The feature is an obstruction that stands approximately 1.0m (3.281ft) above the surrounding seafloor. The least depth was acquired with a Reson 7125 shallow water multibeam sonar, and reduced to MLLW.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H12042_DtoN_3.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting a 26ft obstruction at the surveyed position.

Cartographically-Rounded Depth (Affected Charts):

26ft (12235_1, 12285_18, 12225_1, 12280_2)

4 ¼fm (13003_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)

Attributes: QUASOU - 6:least depth known

TECSOU - 3:found by multi-beam

Office Notes

AHB SAR: H12042 DTON #3. Obstruction. Rises approximately 1.1m above the natural seafloor. Contact FS 224-164631-P.

AHB Compile: Concur with clarification. Shown on chart 12235 (33rd Edition, Jul 2011) as a 26ft obstruction. Office verification determined that this feature is not significant. Delete charted 26ft obstruction. Chart as 26ft shoal sounding.

Feature Images

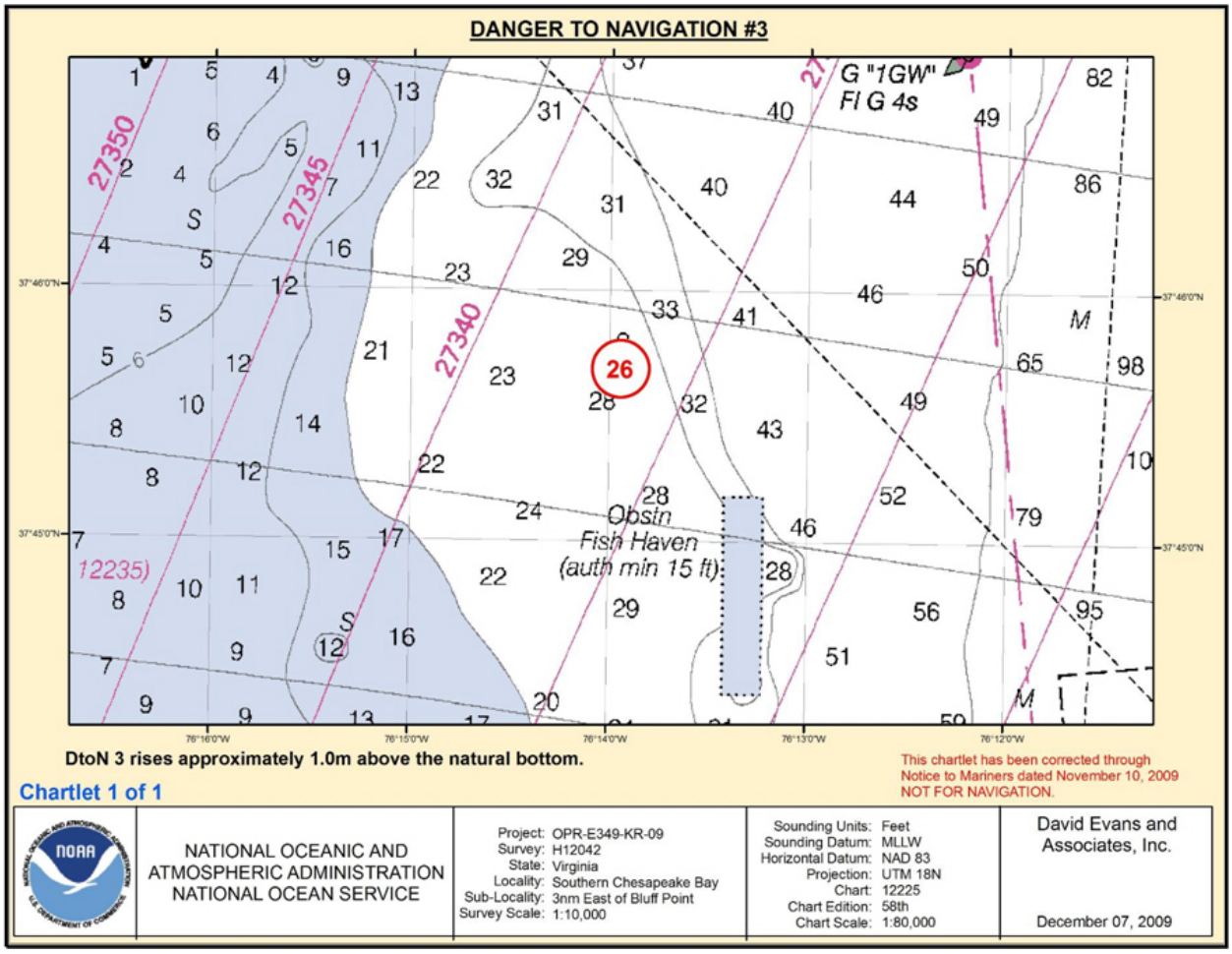


Figure 1.3.1

DtoN #3.1 2D

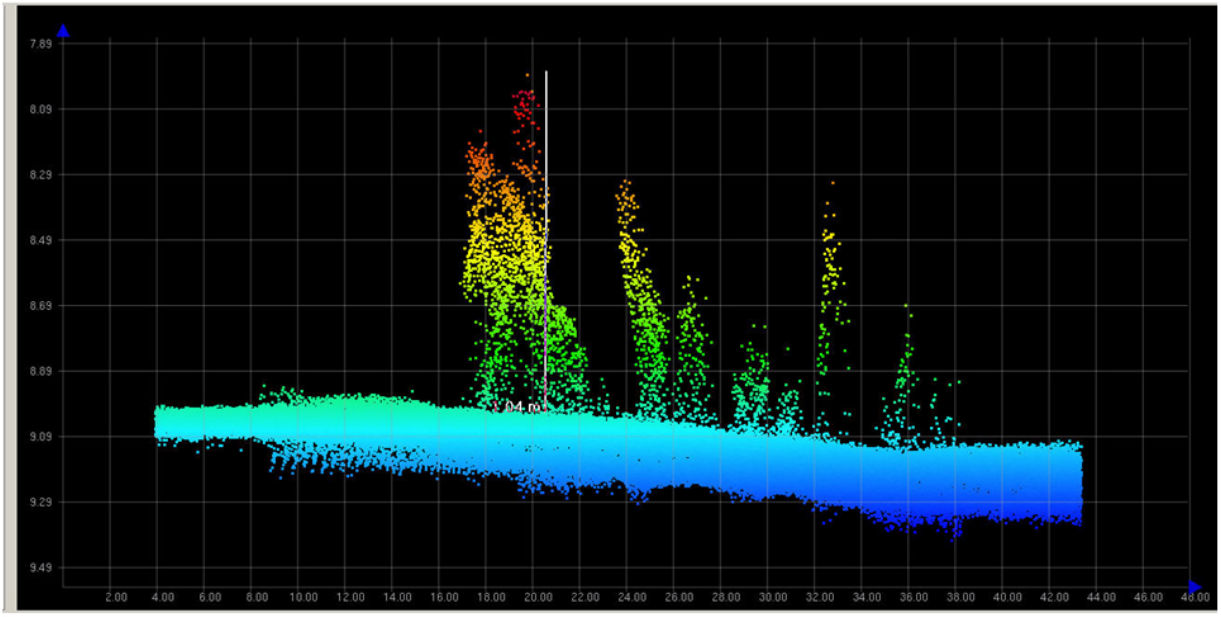


Figure 1.3.2

DtoN #3.1 3D

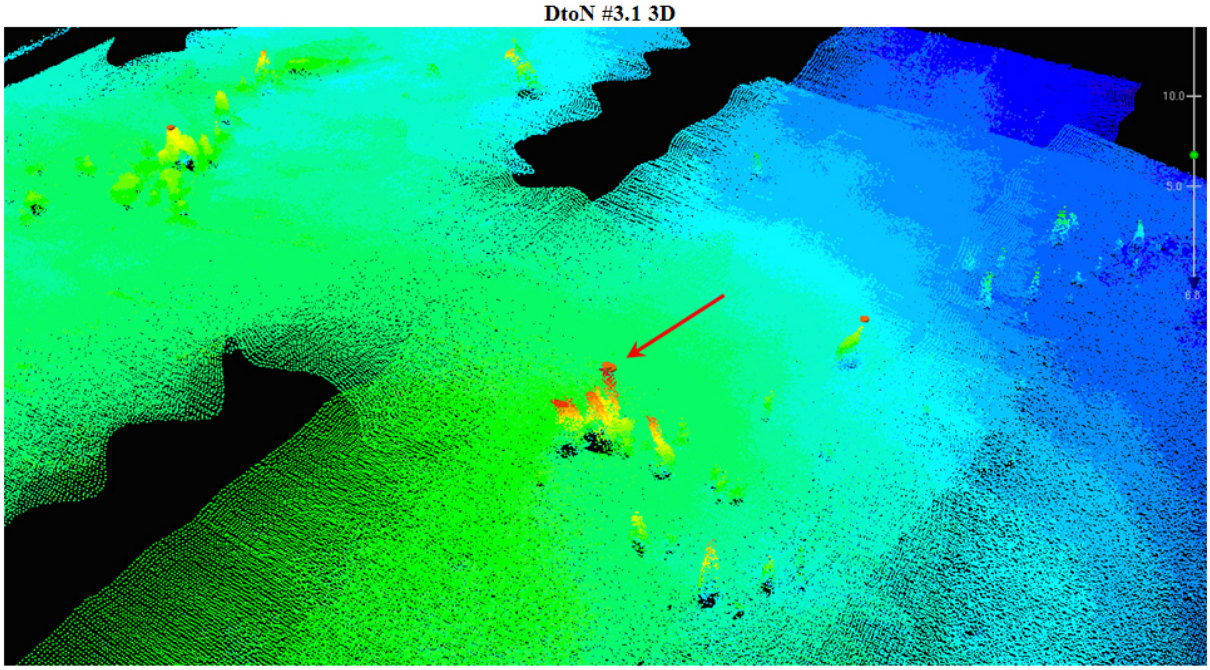


Figure 1.3.3

DtoN #3.1 Sidescan Sonar View
224-164631-P

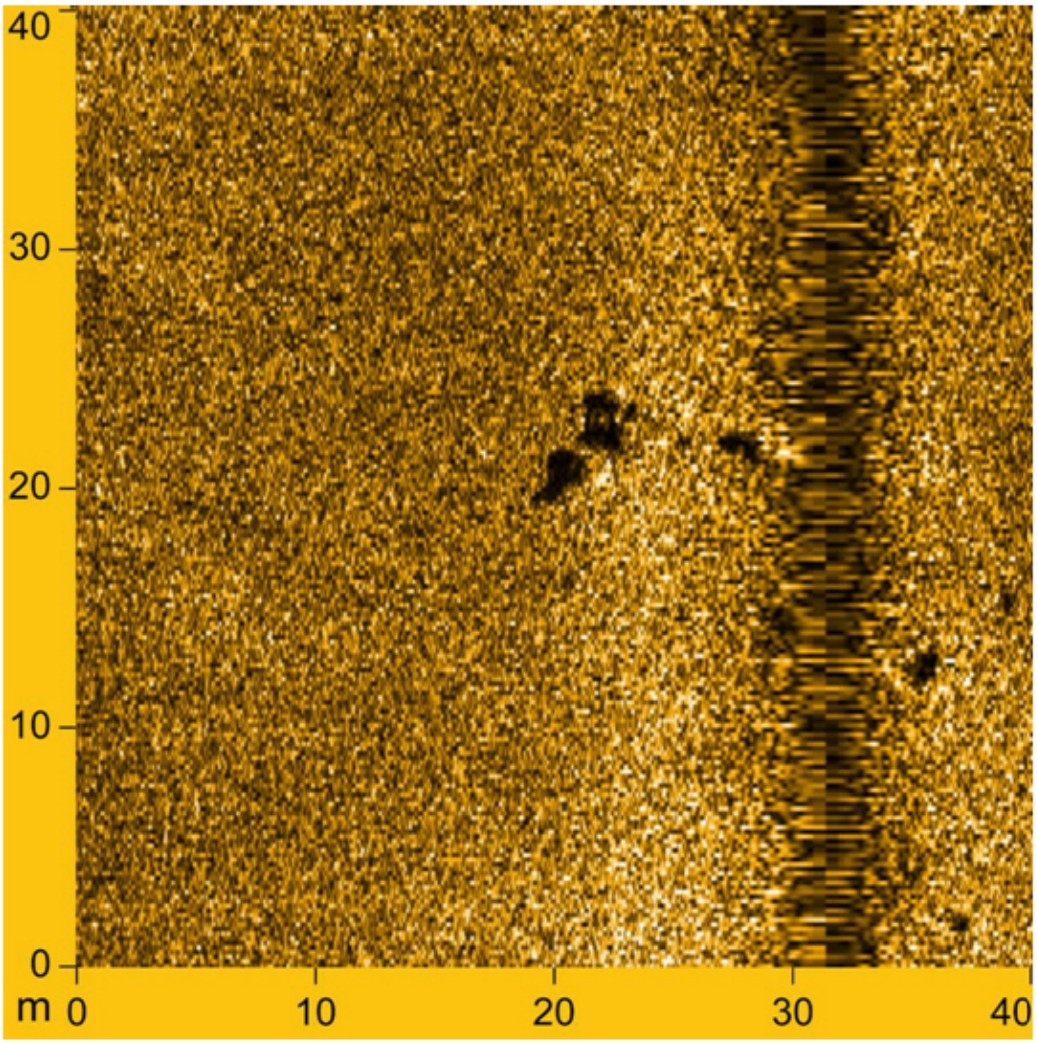


Figure 1.3.4

APPENDIX II
SURVEY FEATURE REPORT

Appendix II - AWOIS Features

Registry Number: H12042
State: Virginia
Locality: Southern Chesapeake Bay
Sub-locality: 3nm East of Bluff Point
Project Number: OPR-E349-KR-09
Survey Dates: 19 JUL 2009 - 15 DEC 2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
12235	32nd	05/01/2008	1:40,000 (12235_1)	[L]NTM: ?
12285	39th	03/01/2008	1:40,000 (12285_19) 1:40,000 (12285_18)	[L]NTM: ?
12225	57th	05/01/2008	1:80,000 (12225_1)	[L]NTM: ?
12280	8th	03/01/2008	1:200,000 (12280_2)	[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	AWOIS 14288 - disproval	GP	[None]	37° 42' 45.5" N	076° 16' 56.0" W	14288

1 - DR_AWOIS

1.1) AWOIS 14288 - disproval

Survey Summary

Survey Position:	37° 42' 45.5" N, 076° 16' 56.0" W
Least Depth:	[None]
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2007-213.00:00:00.000 (08/01/2007)
GP Dataset:	AHB_H12042 / SAR / SAR AHB HOB Files / H12042_Disproved.000
GP No.:	FFFE0000053C0001
Charts Affected:	12235_1, 12285_18, 12285_19, 12225_1, 12280_2, 13003_1

Remarks:

AWOIS 14288 is a charted Obstn. The search radius was surveyed with two hundred percent side scan sonar. All contacts were investigated with full multibeam coverage. Several contacts were discovered within the radius. However, many appear to be crab pots as surface buoys were present during the first site acquisition. Upon return for investigation, two of the five original contacts suspected as crab pots had been retrieved, and all visible buoys were removed from the area. Contacts 301-125023-S, 301-130457-P and 301-133635-S resemble derelict crab pots. There are no other significant contacts within the radius. The least depth is 11.1ft (3.38m) within the entire radius found on contact 301-130457-P.

The AWOIS radius also contains Dividing Creek Entrance Light “3” (LLN 16120), which is visible and functional. Contact 301-130531-S.

Feature Correlation

Address	Feature	Range	Azimuth	Status
AHB_H12042/SAR/SAR AHB HOB Files/H12042_Disproved.000	FFFE0000053C0001	0.00	000.0	Primary

Hydrographer Recommendations

Recommend removing the feature from the chart.

S-57 Data

Geo object 1:	Cartographic symbol ($CSYMB)
Attributes:	SORDAT - 20091215
	SORIND - US,US,graph,H12042

Office Notes

AHB SAR: Ensonified with OD MBES, verified with 200% SSS. AWOIS 14288 is considered disproved.

AHB Compile: Concur. Delete AWOIS Item #14288, dangerous obstruction, least depth unknown.

Appendix II - Uncharted Features

Registry Number: H12042
State: Virginia
Locality: Southern Chesapeake Bay
Sub-locality: 3nm East of Bluff Point
Project Number: OPR-E349-KR-09
Survey Dates: 19 JUL 2009 - 15 DEC 2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
12235	32nd	05/01/2008	1:40,000 (12235_1)	[L]NTM: ?
12285	39th	03/01/2008	1:40,000 (12285_19) 1:40,000 (12285_18)	[L]NTM: ?
12225	57th	05/01/2008	1:80,000 (12225_1)	[L]NTM: ?
12280	8th	03/01/2008	1:200,000 (12280_2)	[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	13ft OBSTRN	Obstruction	4.17 m	37° 42' 38.9" N	076° 14' 50.5" W	---

1 - DR_UnCharted

1.1) 13ft OBSTRN

Survey Summary

Survey Position: 37° 42' 38.9" N, 076° 14' 50.5" W

Least Depth: 4.17 m (= 13.69 ft = 2.282 fm = 2 fm 1.69 ft)

TPU (±1.96σ): **THU (TPEh)** ±0.074 m ; **TVU (TPEv)** ±0.186 m

Timestamp: 2009-239.12:09:00.722 (08/27/2009)

Survey Line: h12042 / opre349-kr-09_mbes_th / 2009-239 / 2009th2391208

Profile/Beam: 249/46

Charts Affected: 12235_1, 12285_18, 12285_19, 12225_1, 12280_2, 13003_1

Remarks:

AHB SAR: Feature is real. Contact FS 224-144520-S, object is approximately 1.24m above natural seafloor.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h12042/opre349-kr-09_mbes_th/2009-239/2009th2391208	249/46	0.00	000.0	Primary
H12042_Contacts.xls	48	14.57	022.4	Secondary

Hydrographer Recommendations

Cartographically-Rounded Depth (Affected Charts):

13ft (12235_1, 12285_18, 12285_19, 12225_1, 12280_2)

2 ¼fm (13003_1)

S-57 Data

Geo object 1: Obstruction (OBSTRN)

Attributes: CATOBS - 1:snag / stump

QUASOU - 6:least depth known

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

VALSOU - 4.173 m

WATLEV - 3:always under water/submerged

Office Notes

AHB SAR: Contact FS 224-144520-S, object is approximately 1.24m above natural seafloor. Ensonified with OD MBES, verified with 200% SSS. This feature is GREATER than 10% of the surrounding water depths and GREATER than 1/2 the IHO AE.

AHB Compile. Concur with clarification. Chart dangerous obstruction "Pile", least depth 13ft, at the survey position.

Feature Images

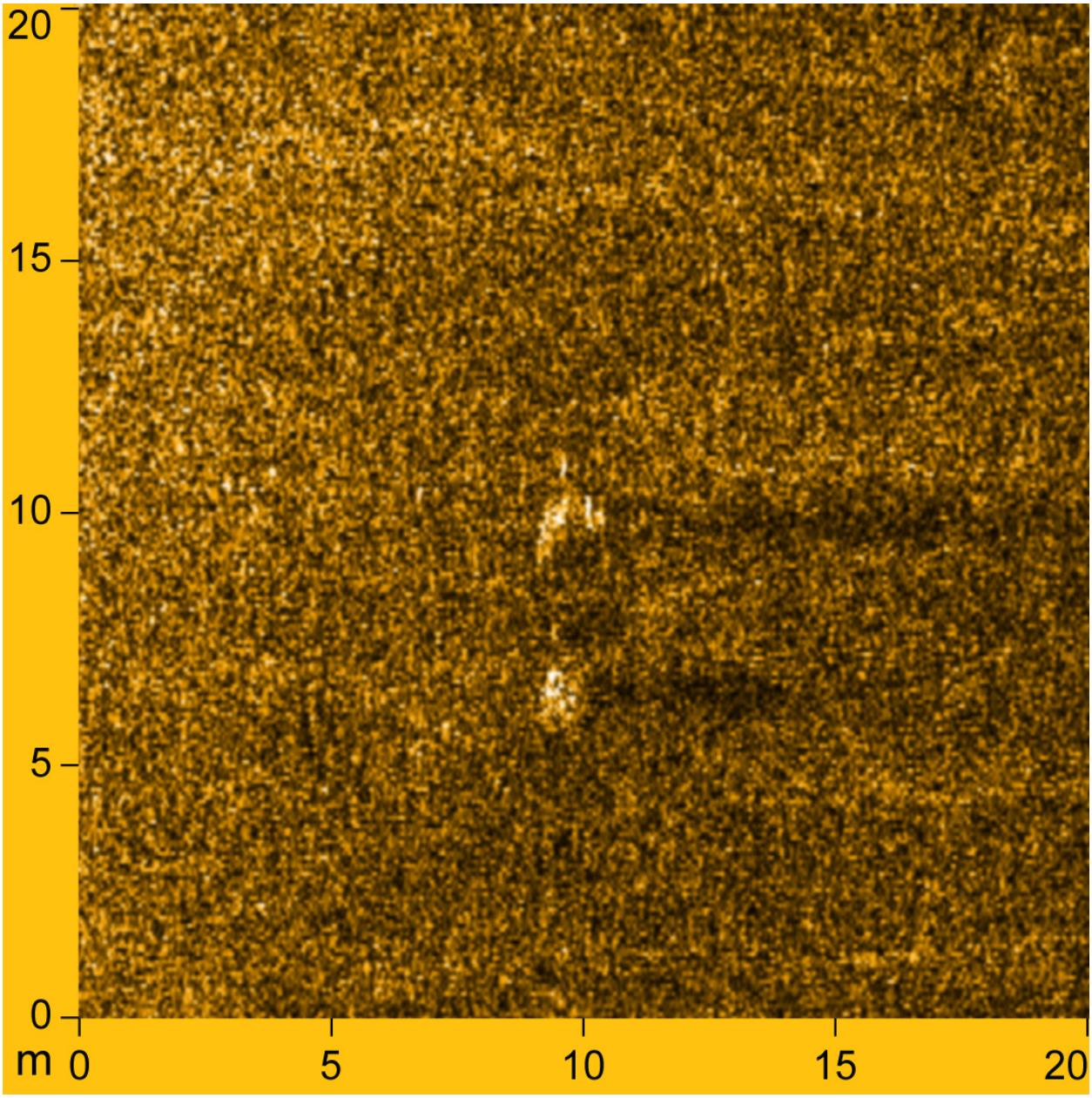


Figure 1.1.1

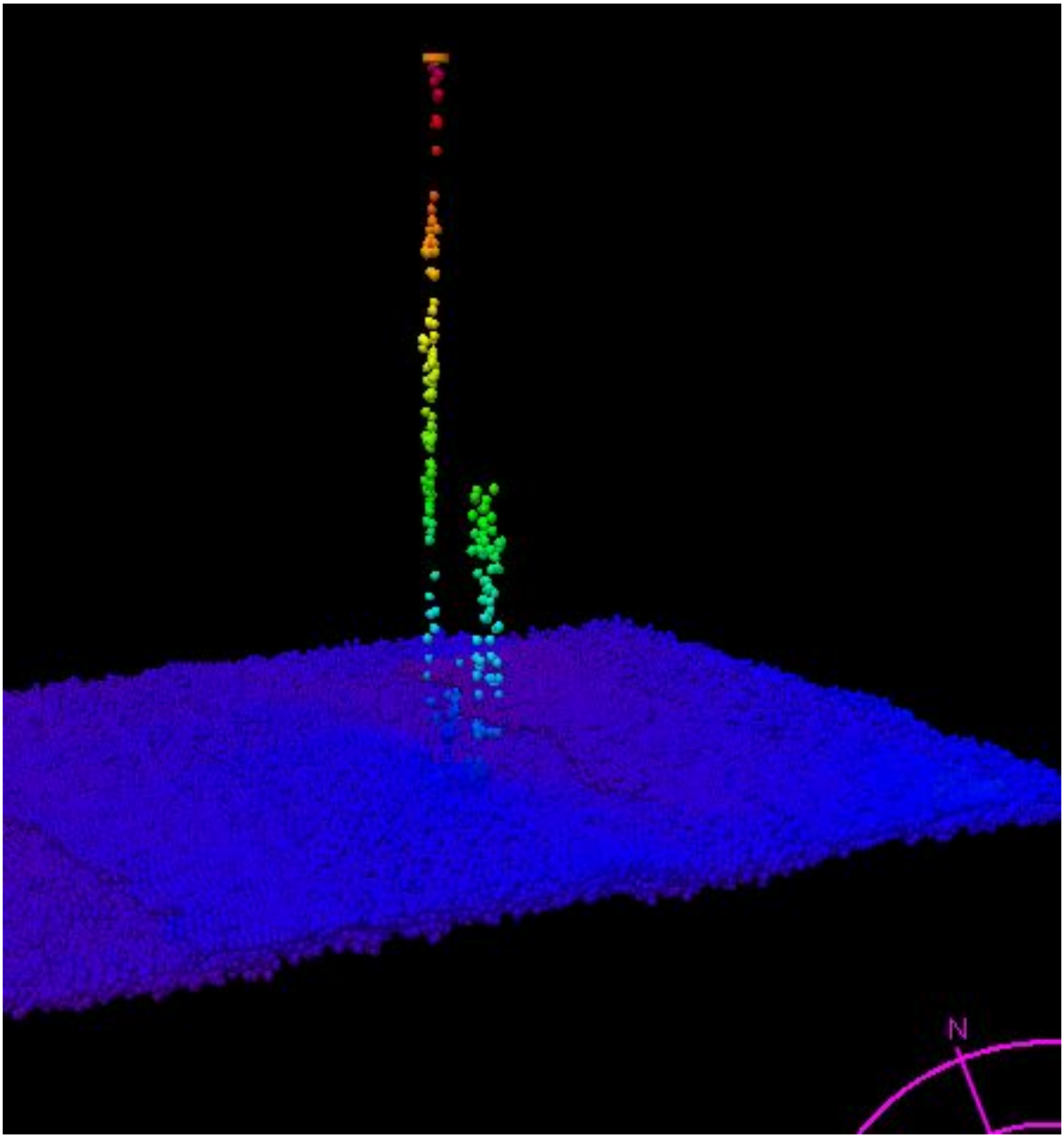
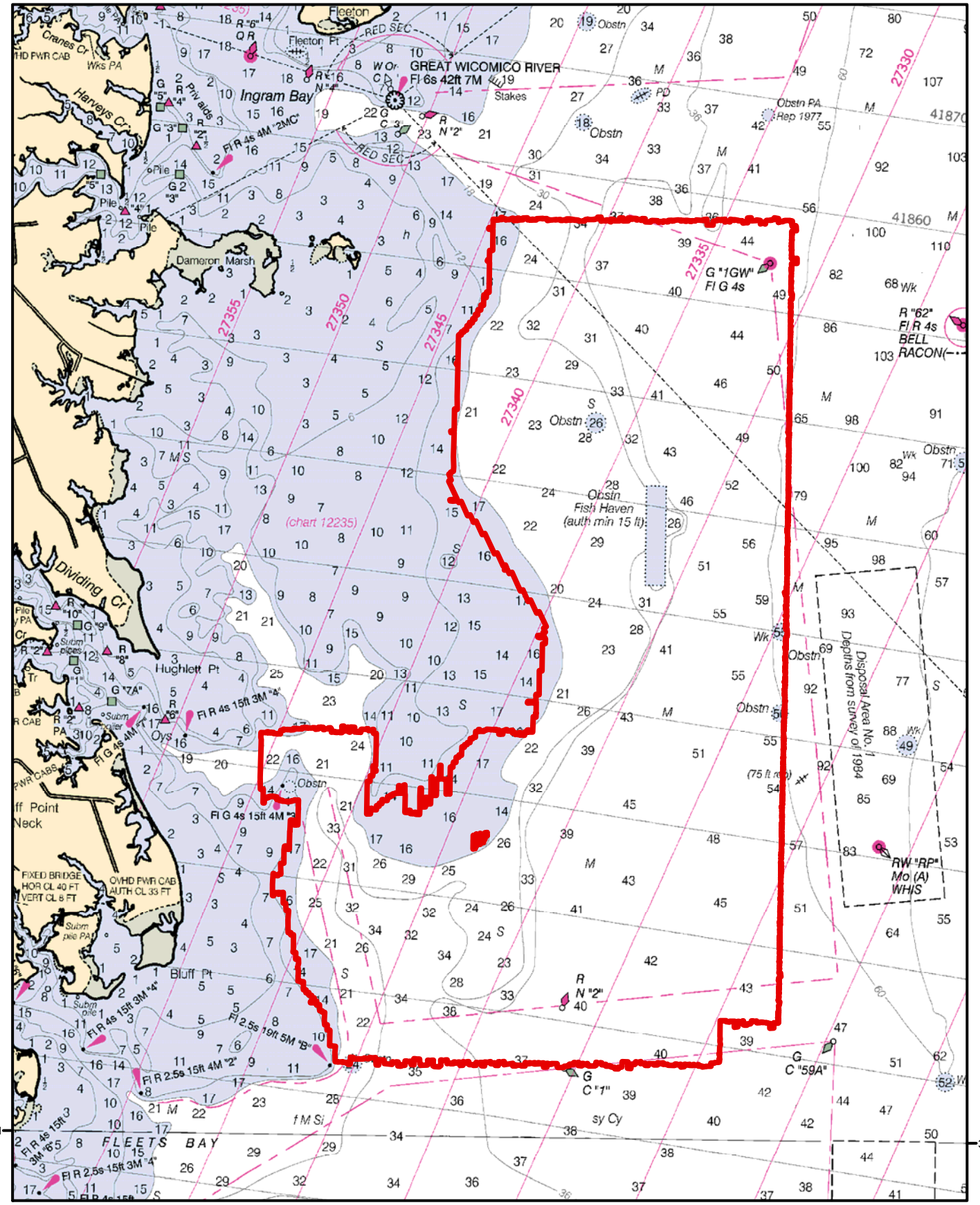


Figure 1.1.2

APPENDIX III
FINAL PROGRESS SKETCH AND SURVEY OUTLINE



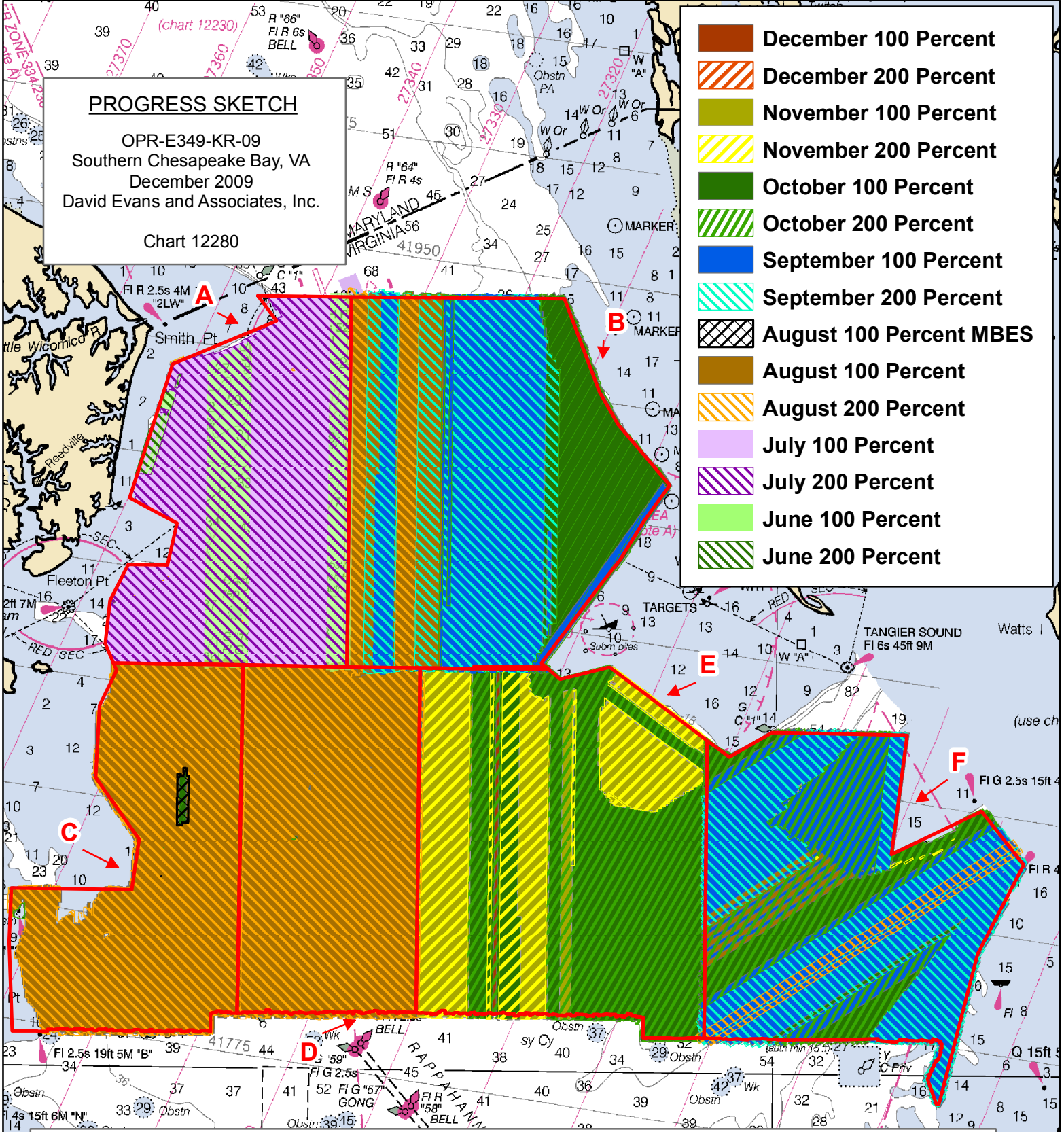
N
W E
S

0 0.45 0.9

Nautical Miles

Survey Outline

H12042
OPR-E349-KR-09
Southern Chesapeake Bay
David Evans and Associates, Inc.
Jon Dasler, Lead Hydrographer
Chart 12225



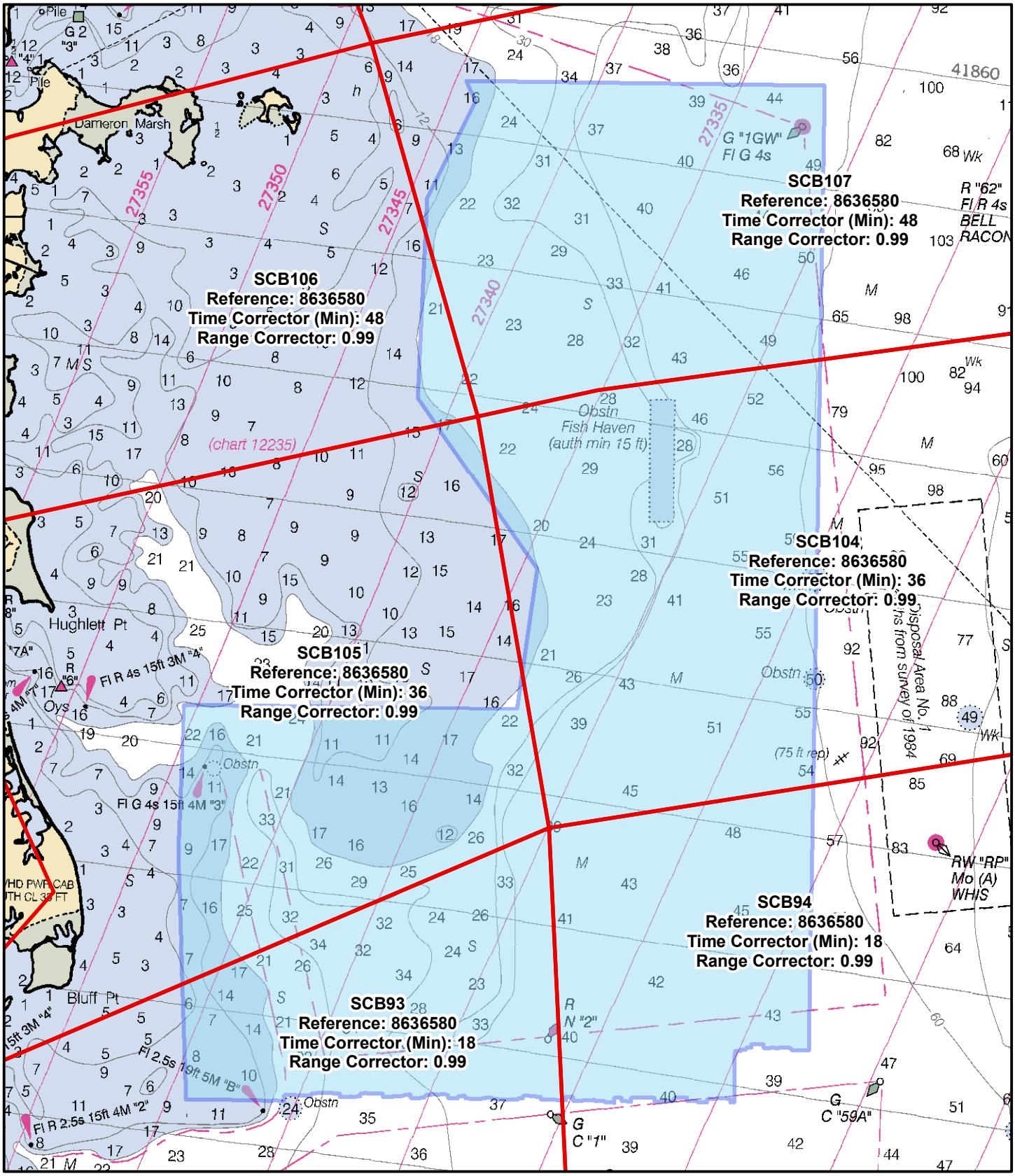
Reg No	Started	Percent	Completed	Submitted	SQ NM
H12040	6/21/2009	100.00%	12/7/2009	12/18/2009	
H12041	8/28/2009	100.00%	12/15/2009	12/30/2009	0.10
H12042	8/4/2009	99.00%			0.15
H12043	8/13/2009	100.00%	11/18/2009		
H12044	10/4/2009	97.00%			0.25
H12045	8/26/2009	97.00%			0.10

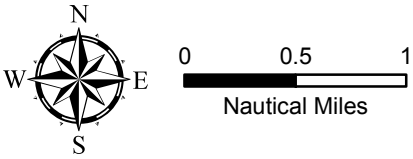
Down time	June	July	August	September	October	November	December
Weather - Day	0.5	3.0	6.5	18.1	16.2	11.8	6.0
Equipment - Day	5.5	2.5	2.1	0.8	1.0	1.0	0.0
Other - Day	0.0	1.0	0.5	0.0	0.0	0.0	0.0

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





H12042
Final Tide Zoning

H12042
OPR-E349-KR-09
Southern Chesapeake Bay
David Evans and Associates, Inc.
Jon Dasler, Lead Hydrographer
Chart 12225

OPR-E349-KR-09

H12042

Times of Hydrography

Date	Julian Date	Min Time	Max Time
08/05/2009	217	14:37	22:13
08/06/2009	218	12:10	21:00
08/07/2009	219	11:42	22:25
08/08/2009	220	12:51	19:55
08/10/2009	222	11:53	22:20
08/11/2009	223	11:53	22:27
08/12/2009	224	11:49	21:26
08/13/2009	225	12:02	22:40
08/15/2009	227	11:47	19:25
08/16/2009	228	11:46	19:40
08/26/2009	238	11:50	21:56
08/27/2009	239	11:59	13:49
10/28/2009	301	12:06	15:00
11/18/2009	322	13:06	17:24
11/19/2009	323	16:17	16:25
12/10/2009	344	15:30	18:05
12/15/2009	349	22:00	22:06

FINAL TIDE ZONING
H12042
OPR-E349-KR-09

Zone	Time Corrector (Mins)	Range Ratio	Reference Station
SCB106	48	0.99	**8636580**
SCB107	48	0.99	**8636580**
SCB105	36	0.99	**8636580**
SCB104	36	0.99	**8636580**
SCB93	18	0.99	**8636580**
SCB94	18	0.99	**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

--
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.

David Evans and Associates, Inc. | Marine Services Division
2801 SE Columbia Way, Ste. 130 | Vancouver, WA 98661
Office: 360.314.3200 | Direct: 804.516.7829 | Fax: 360.314.3250
jasc@deainc.com | www.deainc.com

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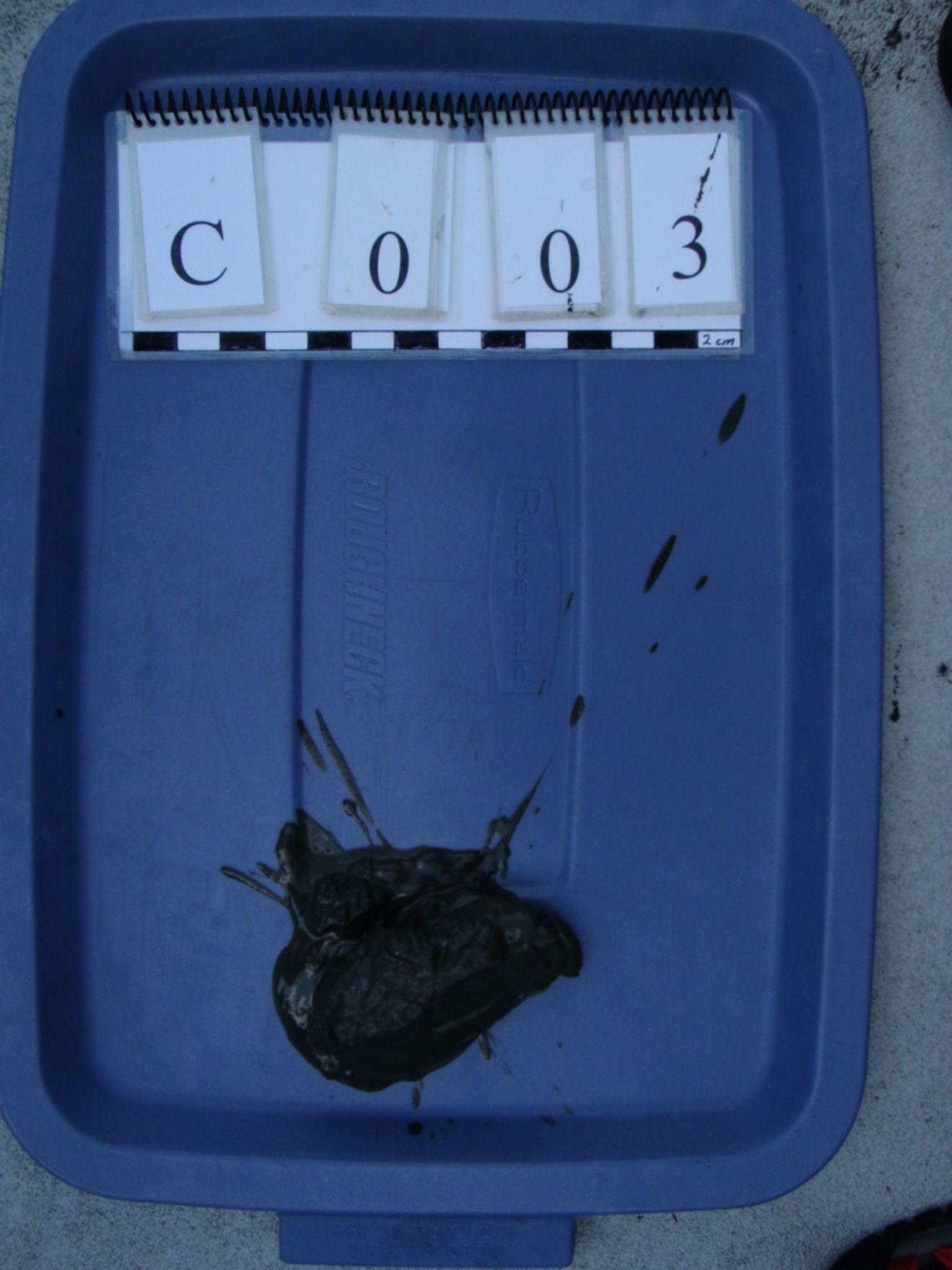
OPR-E349-KR-09 Bottom Sampling

Sheet C, H12042

Sample	Time (UTC)	Day Number	Easting	Northing	COLOR	NATSUR	NATQUA
C1	13:46:41	200	387533.42	4171639.72	8-8	4-4	2-3
C2	13:53:43	200	389524.09	4171650.58	8-8	4-4	2-3
C3	14:01:17	200	391506.79	4171654.32	4	3	2
C4	14:08:56	200	393509.20	4171677.92	4	3	2
C5	13:39:51	200	387568.87	4173632.66	7	4	2
C6	13:25:52	200	389529.46	4173663.67	8	4	2
C7	13:18:00	200	391567.78	4173670.20	7	3	2
C8	13:10:09	200	393507.74	4173677.63	7-7	3-2	2-2
C9	13:33:32	200	387624.87	4175220.83	7	3	2
C10	12:54:13	200	391560.52	4175688.53	4-4	3-4	1-1
C11	13:01:33	200	393504.43	4175692.07	7	3	1
C12	12:43:22	200	391578.90	4177682.58	8-7	4-3	2-1
C13	12:33:12	200	393519.84	4177643.82	4	3	1
C14	12:11:06	200	389527.47	4179641.26	8	4	2
C15	12:18:11	200	391525.78	4179689.76	7	2	2
C16	12:25:07	200	393525.87	4179687.42	4	3	1
C17	12:03:47	200	389741.03	4181628.74	9	4	2
C18	11:55:31	200	391590.04	4181705.11	2	4	1
C19	11:43:23	200	393505.19	4181617.89	2	4	1

C 0 0 1
2 cm
Rubbermaid

C 0 0 2
2 cm
Rubbermaid
ROUGHNECK


C 0 0 3
2 cm
ROTHENBERG
Rubbermaid

C 0 0 4
2 cm

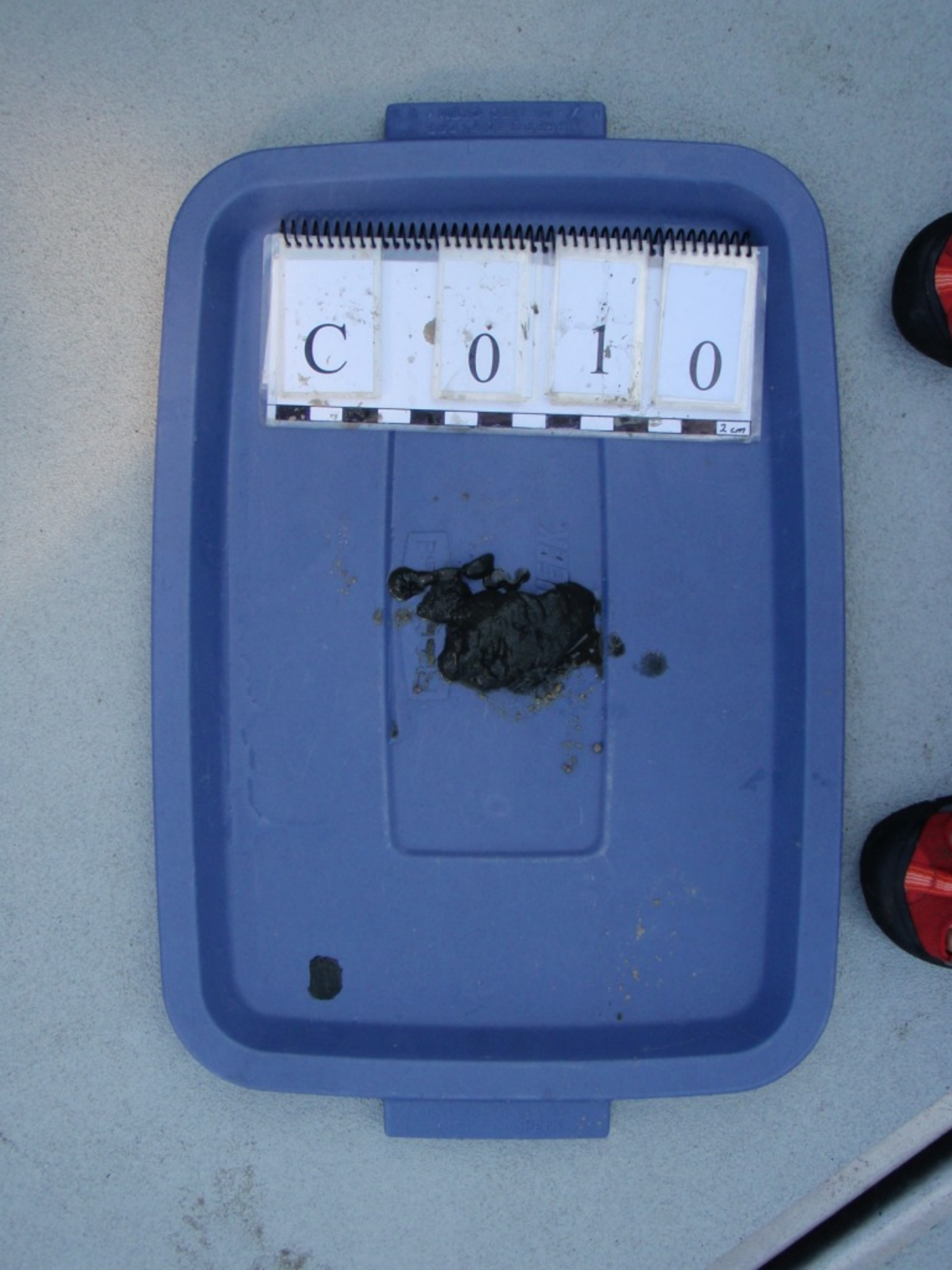
C 0 0 5
2 cm

C 0 0 6
2 cm
Rubbermaid
PRESS TO CLOSE
LIFT TO OPEN

C 0 0 7
2 cm

C 0 0 8
2 cm
PRESS TO CLOSE
LIFT TO OPEN

C 0 0 9
2 cm


C 0 1 0
2 cm

C 0 1 1
2 cm

C 0 1 2
2 cm
PRESS TO CLOSE
LIFT TO OPEN

C 0 1 3
2 cm

C 0 1 4
2 cm

C 0 1 5
2 cm

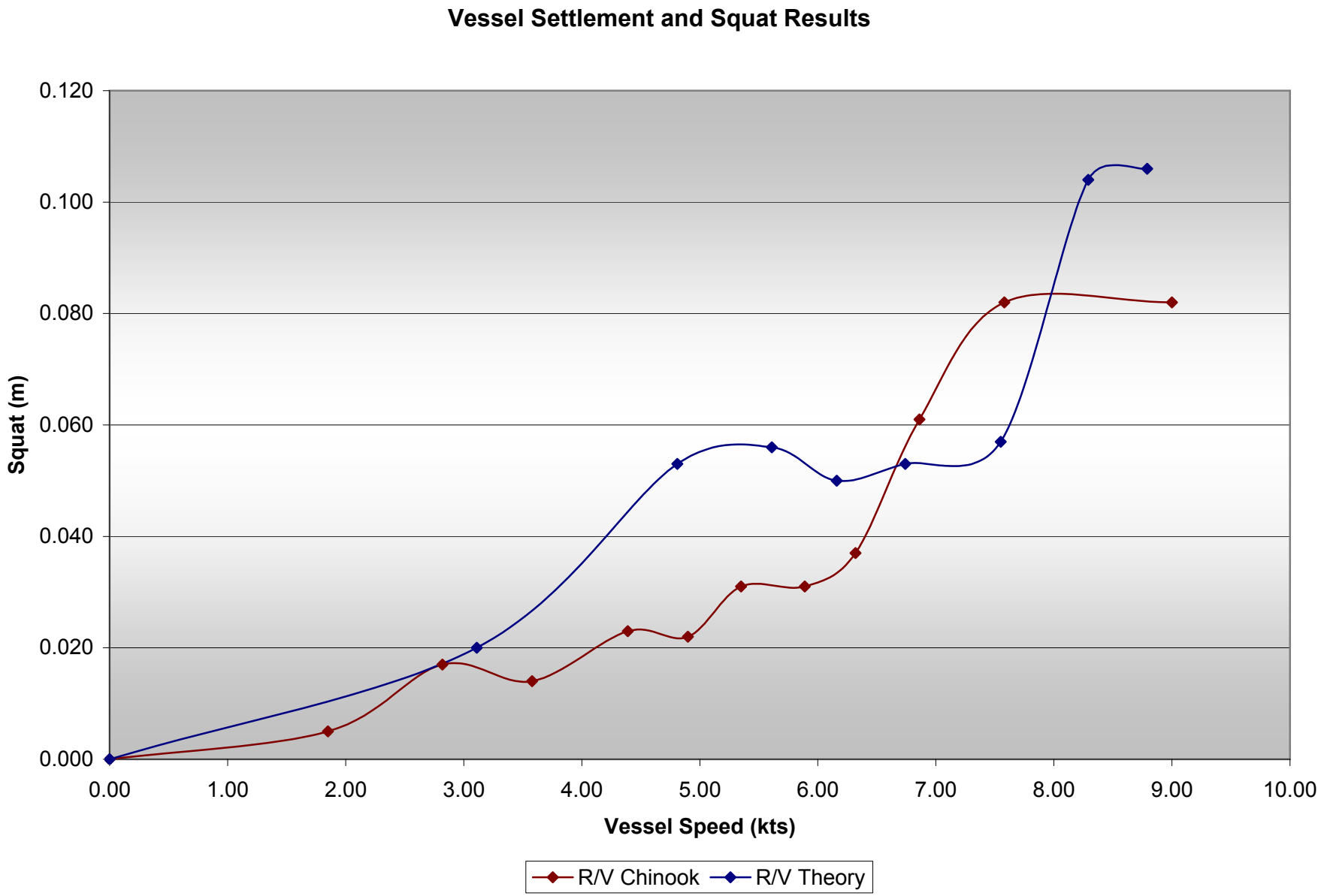
C 0 1 6
2 cm

C 017
2 cm

C 0 1 8
2 cm

C 0 1 9
2 cm

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

This Document is for Office Process use only and is intended to supplement, not supersede or replace, information/recommendations in the Descriptive or H-Cell Reports.

AHB COMPILATION LOG

General Survey Information	
REGISTRY No.	H12042
PROJECT No.	OPR-E349-KR-09
FIELD UNIT	DAVID EVANS & ASSOCIATES
DATE OF SURVEY	20090719 – 20091215
LARGEST SCALE CHART	***12235, edition 33, 20110701, 1:40,000***
ADDITIONAL CHARTS	N/A
SOUNDING UNITS	**FEET**
COMPILER	James J. Miller

Source Grids	**File Name** V:\SAR_Queue\H12042_E349_DEA\AHB_H12042\SAR Final Products\GRIDS	
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	H12042_2of6_2m_Final.csar	**H12042_6of6_2m_Final.csar**
	H12042_3of6_2m_Final.csar	**H12042_FishHaven_50cm_Final.csar**
	H12042_4of6_2m_Final.csar	**H12042_INV_combined_1m_Final.csar**

Surfaces	**File Name** V:\SAR_Queue\H12042_E349_DEA\AHB_H12042\COMPILE\Working
Combined	**H12042_4m_Combined.csar**
Interpolated TIN	\Interpolated TIN**H12042_12m_InterpTIN.csar**
Shifted Interpolated TIN	\Shifted Surface**H12042_12m_InterpTIN_Shifted.csar**

Final HOBs	**File Name** V:\SAR_Queue\H12042_E349_DEA\AHB_H12042\ COMPILE\Final_Hobs
Survey Scale Soundings	**H12042_SS_Soundings.hob**
Chart Scale Soundings	**H12042_CS_Soundings.hob**
Contour Layer	**H12042_Contours.hob**
Feature Layer	**H12042_Features.hob**
Meta-Objects Layer	**H12042_MetaObjects.hob**
Blue Notes	**H12042_BlueNotes.hob**

Meta-Objects Attribution	
Acronym	**Value**
M_COVR	
CATCOV	1 – coverage available
SORDAT	20091215
SORIND	US,US,graph,H12042
M_QUAL	
CATZOC	6 – zone of confidence U (data not assessed)
INFORM	R/V Theory and R/V Chinook
POSACC	10.0 m
SORDAT	20091215
SORIND	US,US,graph,H12042
SUREND	20091215
SURSTA	20090719
DEPARE	
DRVALV 1	10.000 ft
DRVALV2	75.000 ft
SORDAT	20091215
SORIND	US,US,graph,H12042

SPECIFICATIONS:

I. COMBINED SURFACE:
- a. Number of SAR Final Grids: 8
- 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: N/A
  - ii. And/Or use radius table file: H12042_SS_SSR.txt

H12042_SS_SSR.txt - Notepad

File Edit Format View Help

```
0        3.6576  0.9
3.65761  5.4864  1.0
5.48641  10.973  1.1
10.9731  18.288  1.2
18.2881  24.000  1.3
```

- d. Queried Depth of All Soundings
  - i. Minimum: 3.384 m
  - ii. Maximum: 22.636 m

III. INTERPOLATED TIN SURFACE:
- a. Resolution (m): 12 m
- b. Interpolation method: Natural Neighbor
- c. Shift value: -0.75 ft [*only include applicable shift values*] [*-0.75 feet* (And/Or) *-0.75 fathoms*]

IV. CONTOURS:
- a. Attribute Name: Depth
- b. Use a Depth List: H12042_depth_contours.txt
- c. Output Options: Create contour lines
  - i. Line Object: DEPCNT
  - ii. Value Attribute: VALDCO

V. FEATURES:
- a. Number of Chart Features: 2 [*all features included in H-Cell*]
- b. Number of Non-Chart Features: 24 [*all features submitted by field & not included in H-Cell*]

VI. CHART SURVEY SOUNDINGS (CS):
- a. Number of ENC CS Soundings: 278
- b. Attribute Name: Depth
- c. Selection criteria: Radius, Shoal bias
- d. Radius value is: Distance on the ground (m)
  - i. Use single-defined radius: N/A
  - ii. And/Or use radius table file: H12042_CS_SSR.txt

H12042_CS_SSR.txt - Notepad

File Edit Format View Help

```
0        3.6576  280
3.65761  5.4864  300
5.48641  9.1441  380
9.14411  10.973  450
10.9731  18.288  580
18.2881  54.864  610
```

- e. Number Survey CS Soundings: 275