

H12216

NOAA FORM 76-35A

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

## DESCRIPTIVE REPORT

*Type of Survey* Hydrographic Survey

*Field No.*

*Registry No.* H12216

### LOCALITY

*State* Washington

*General Locality* Central Puget Sound

*Sublocality* Pt. Bolin to Port Madison

**2010**

### CHIEF OF PARTY

Captain David O. Neander, NOAA

### LIBRARY & ARCHIVES

DATE

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;"><b>HYDROGRAPHIC TITLE SHEET</b></p>	<p>REGISTRY No</p> <p style="text-align: center;"><b>H12216</b></p>
<p><b>INSTRUCTIONS</b> – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.</p>	<p>FIELD No:</p>
<p>State <u>Washington</u></p> <p>General Locality <u>Central Puget Sound</u></p> <p>Sub-Locality <u>Pt. Bolin to Port Madison</u></p> <p>Scale <u>1:5,000</u> Date of Survey <u>3/25/2010 - 4/9/2010</u></p> <p>Instructions dated <u>3/23/2010</u> Project No. <u>OPR-N395-FA-10</u></p> <p>Vessel <u>Fairweather Launches 2805 and 2806</u></p> <p>Chief of party <u>Captain David O. Neander, NOAA</u></p> <p>Surveyed by <u>Fairweather Personnel</u></p> <p>Soundings by <u>Reson SeaBat 7125</u></p> <p>SAR by <u>Tyenne Faulkes</u> Compilation by <u>Peter Holmberg</u></p> <p>Soundings compiled in <u>Feet</u></p>	
<p>REMARKS: <u>All times are UTC. UTM Zone 10</u></p> <p><u>The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Revisions and end notes in red were generated during office processing. Page numbering may be interrupted or non sequential.</u></p> <p><u>All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via <a href="http://www.ngdc.noaa.gov/">http://www.ngdc.noaa.gov/</a>.</u></p>	



Complete multibeam echosounder (MBES) coverage was obtained to the Navigable Area Limit Line (NALL) as defined in the NOS Hydrographic Survey Specifications and Deliverables dated; April, 2009 (HSSD). Data were acquired as close to shore as safely possible. Additional coverage was obtained in order to determine least depths over features or shoals. Where appropriate, shoreline features were given S-57 attribution and included for submission in Notebook .hob files. Additionally, the Puget Sound VDatum model was used to reduce this survey from the ellipsoid to mean lower-low water after a comparison between TCARI-reduced MLLW data and VDATUM-reduced MLLW data was performed and authorization given by the Hydrographic Surveys Division (HSD) in accordance with the Project Instructions (see the *H12216 VDatum Validation Report* in Appendix V).

Mainscheme and crossline mileage for MBES and shoreline acquisition were calculated and are displayed in Table 1 below.

<b>MAIN SCHEME - Mileage</b>	
0	Single Beam MS
181.22	Multibeam MS mileage
0.00	FAIRWEATHER S-220
55.94	Launch 2805
125.27	Launch 2806
0.00	Launch 2807
0.00	Launch 2808
0	SideScan MS
181.22	Total MS
<b>CROSSLINE - Mileage</b>	
0	Single Beam XL
9.74	Multibeam XL
0.00	FAIRWEATHER S-220
9.45	Launch 2805
0.29	Launch 2806
0.00	Launch 2807
0.00	Launch 2808
9.74	Total XL
<b>OTHER</b>	
0.51992969	Developments/AWOIS - Mileage
0	Shoreline/Nearshore Investigation - Mileage
27	Total # of Investigated Items
14	Total Bottom Samples
5.71	Total SNM
3/25, 3/26, 3/29, 3/30, 3/31, 4/1, 4/5, 4/6, 4/9, 2010	Specific Dates of Acquisition
Dn's 084, 085, 088-091, 095, 096, 099	Specific Dn#s of Acquisition

**Table 1: H12216 Survey Statistics**

## B. DATA ACQUISITION AND PROCESSING

A complete description of data acquisition, processing systems and survey vessels along with quality control procedures and data processing methods are included and described in the *NOAA Ship Fairweather 2010 Data Acquisition and Processing Report (DAPR)*, submitted under separate cover. Items specific to this survey and any deviations from the aforementioned report are discussed in the following sections. This hydrographic survey was completed as specified by Hydrographic Survey Project Instructions OPR-N395-FA-10, dated March 23, 2010, including Appendix I OPR-N395-FA-10 Test and Evaluation Deliverables.

The interim deliverable *H12216 Vdatum Validation Report* was completed and submitted to HSD on July 16, 2010. The report and all associated correspondence is submitted in Appendix V. The use of VDatum to reduce the soundings from H12216 to MLLW for final data submission was endorsed by HSD on July 29, 2010.

### B.1. Equipment and Vessels

Equipment and vessels used for data acquisition and survey operations during this survey are listed below in Table 2.

	Launch 2805	Launch 2806	Ambar 2302
<b>Hull Registration Number</b>	2805	2806	2302
<b>Builder</b>	All American Marine, Inc	All American Marine, Inc	Marine Silverships, Inc
<b>Length Overall</b>	28' 10"	28' 10"	23'
<b>Beam</b>	10' 8"	10' 8"	9' 4"
<b>Draft, Maximum</b>	4' 0" DWL	4' 0" DWL	1' 4"
<b>Cruising Speed</b>	24 knots	24 knots	22 knots
<b>Max Survey Speed</b>	7 knots	7 knots	
<b>Primary Echo-sounder(s)</b>	RESON 7125	RESON 7125	
<b>Sound Velocity Equipment</b>	SBE 19plus	SBE19plus	
<b>Attitude &amp; Positioning Equipment</b>	POS/MV V4	POS/MV V4	
<b>Type of operation</b>	MBES, Bottom Samples	MBES	Shoreline

**Table 2: Vessel Inventory**

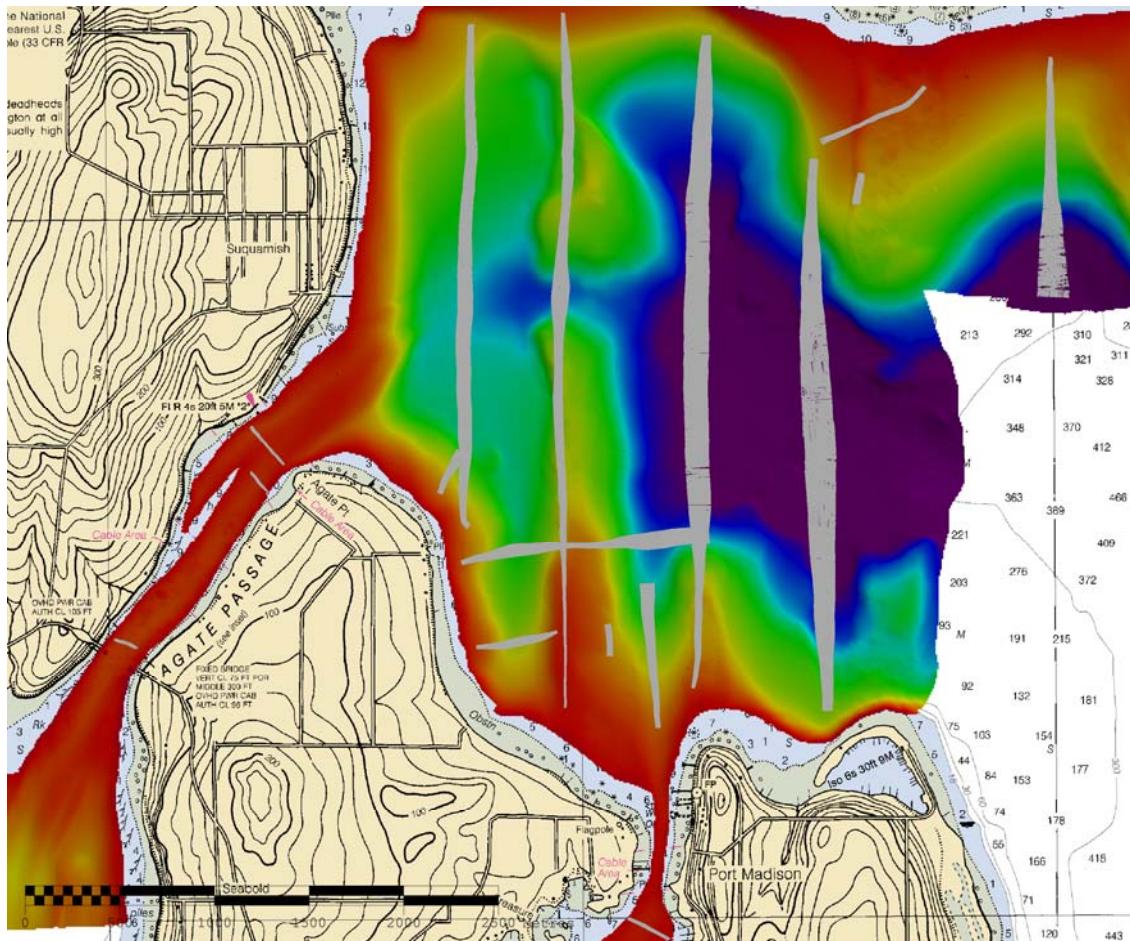
No vessel configurations used during data acquisition deviated from the DAPR.

## B.2. Quality Control

### B.2.1. Crosslines

Multibeam crosslines for this survey totaled 9.7 linear nautical miles (lnm), comprising 5.4% of the 181.2 lnm of mainscheme MBES hydrography. Both main scheme and crossline mileage are summarized in Table 1 above.

Surface differencing in CARIS Bathy DataBase was used to assess crossline agreement with main scheme. Figure 3 shows a visual depiction of the differences spatially. Using TCARI (Tidal Constituents and Residual Interpretation) surfaces, agreement was excellent with 95% of crossline nodes in agreement within 0.2 meters of mainscheme<sup>1</sup>, as shown in figure 2. The areas of highest difference, 0.3 to 0.5 meters, were located in Port Madison and were deeper than 60 meters. Shoal areas, such as Port Madison harbor and Agate Passage, showed the best agreement, with data generally agreeing within 0.1 meters. See the *H12216 Vdatum Validation Report* submitted in Appendix V regarding the agreements between TCARI and Vdatum surfaces.



**Figure 2: Crossline and main scheme differences (grey indicates agreement, yellow colors indicate a XLs shallower than mainscheme and blue colors indicate XLs are deeper).**

**B.2.2. Junctions**

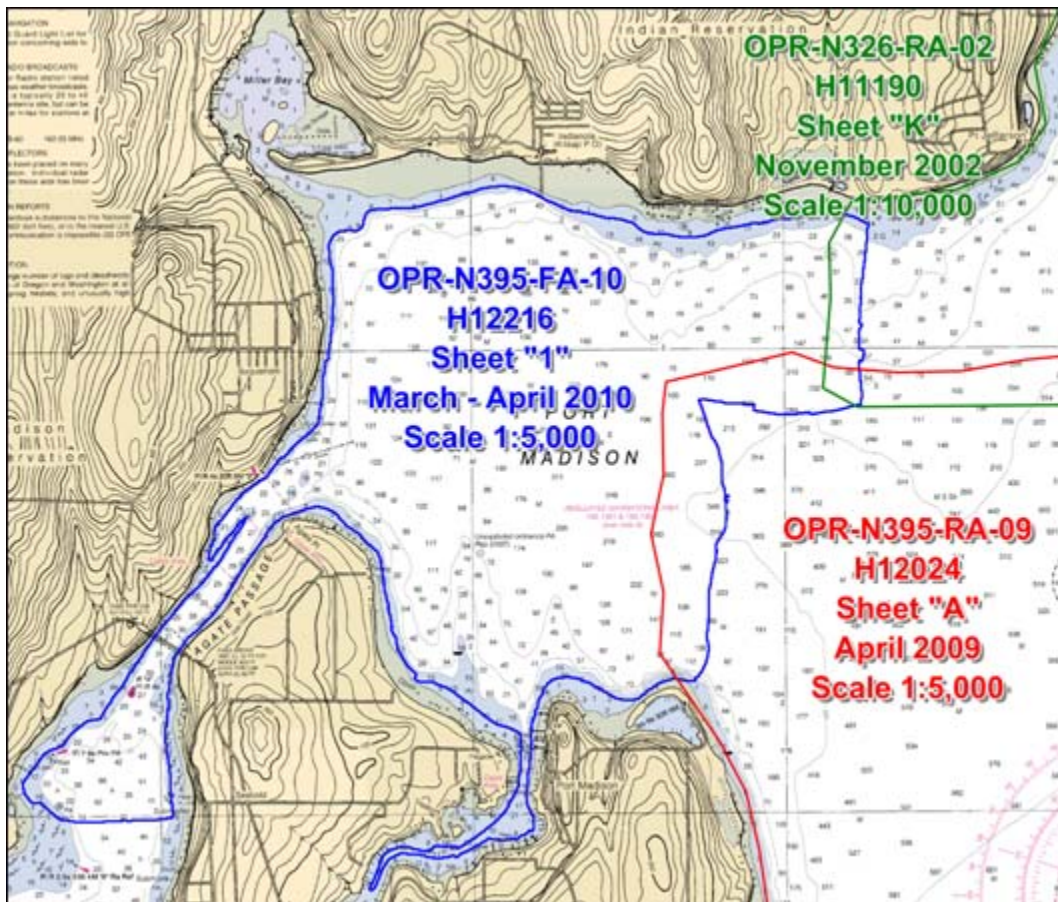
Survey H12216 junctions with surveys H11190 and H12024 acquired by NOAA Ship *Rainier* in 2002 and 2009 respectively. The area of overlap between the sheets was reviewed in CARIS Subset Editor for consistency and data were found to be in good general agreement with 95% of nodes agreeing within 0.5 meters.<sup>2</sup> The sheet limits and area of overlap for H12216, H12024, and H11190 are shown in Figure 3.

Junction Survey	Survey Scale	Date of Survey	Survey Location
H11190	1:10000	2002	Point Jefferson to Kingston
H12024	1:10000	2009	Approaches to Port Madison and Shilshole Bay

**Table 3: Junction Surveys**

Data from H12216 generally agree within 0.3 meters to adjoining data from H12024. The largest differences were noticed in depths greater than 90 meters, where data from H12216 was an average of one meter shoaler.<sup>3</sup>

Data from H12216 agree with data from H11190 generally within two to four meters. The comparison was performed in MapInfo 10.0, due to H11190 predating Combined Uncertainty and Bathymetry Estimator (CUBE) and having no existing Bathymetry Associated with Statistical Error (BASE) surfaces. Due to the point features of the data supplied, junction examination was treated as a chart comparison.<sup>4</sup>



**Figure 3: Junction Between H12216, H11190, and H12024**

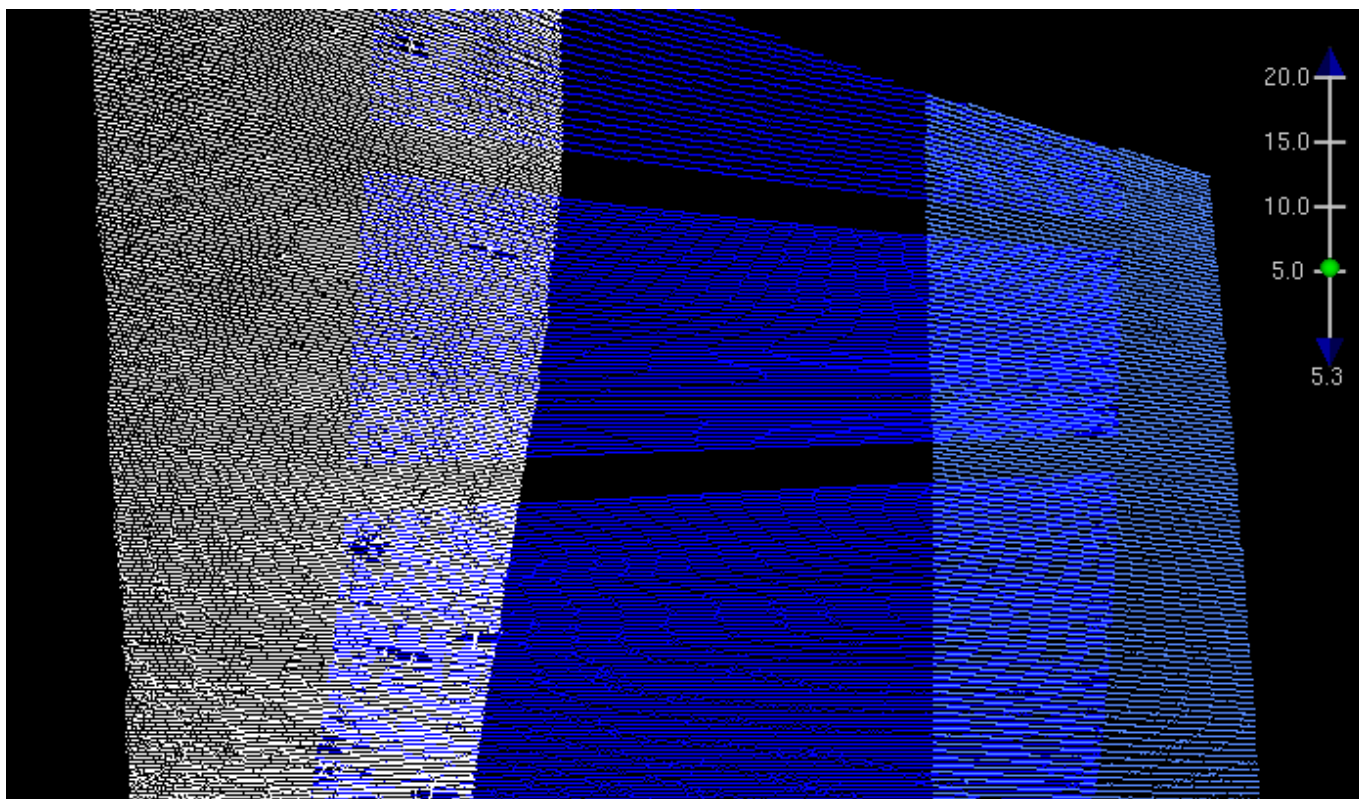
### B.2.3. Quality Control Checks

MBES quality control checks were conducted as discussed in the quality control section B of the DAPR.

### B.2.4. Data Quality Factors

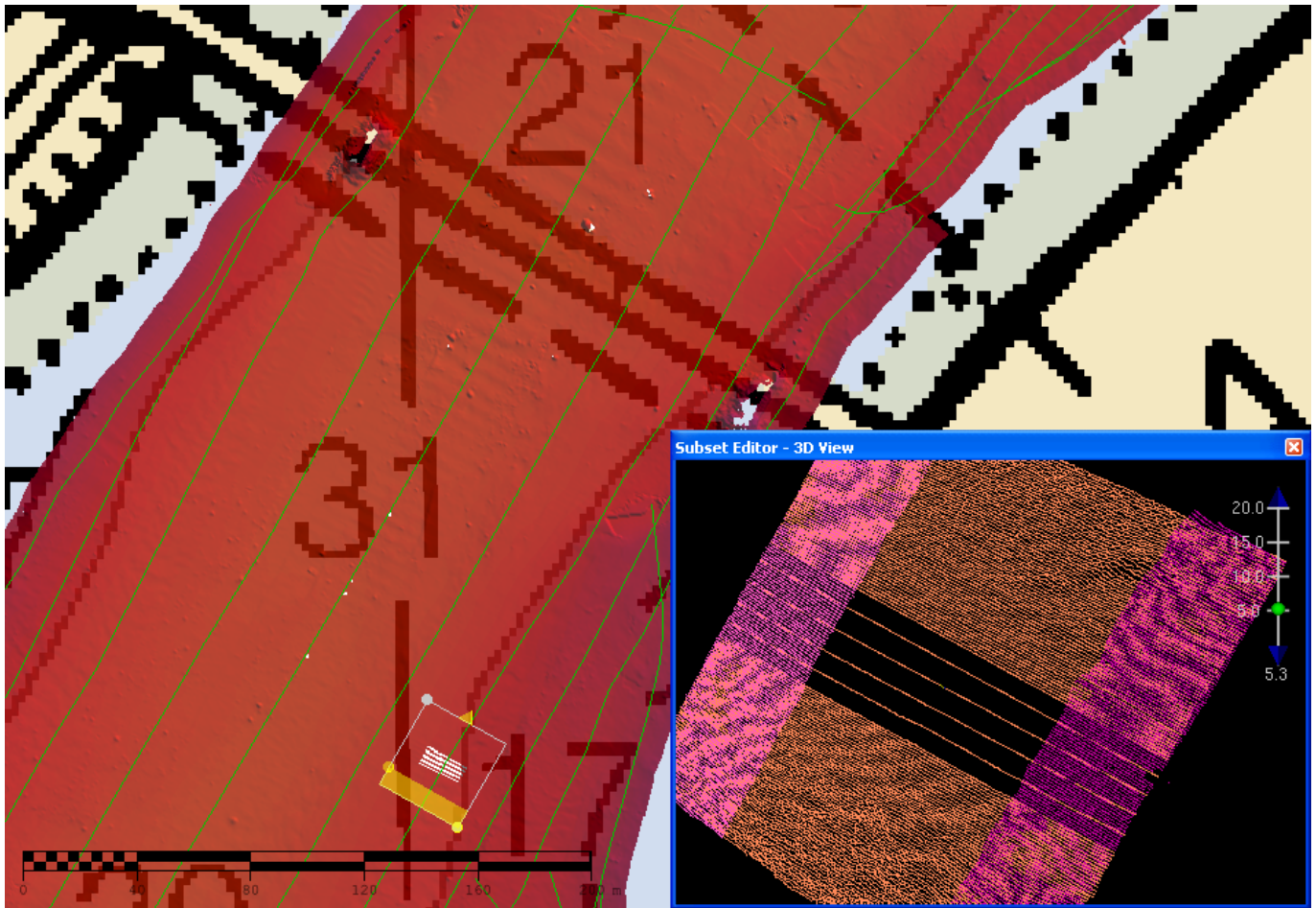
#### COVERAGE ASSESSMENT:

Data collected by all vessels would occasionally exhibit along-track holidays where several pings would appear missing, Figure 4. This issue was more noticeable in shoaler depths where it would create holidays due to finer resolution CUBE gridding. The error was most likely a network speed issue, where packets of information sent from the Reson would be dropped and not received by the acquisition computer. Following the completion of H12216 the data rates of the network were changed to prevent the issue in future surveys. For H12216, holiday lines were run over these areas for as many holidays as time would allow before departure from the survey area.



**Figure 4: Along-track holidays due to dropped network packets**

The majority of holidays in H12216 occur as a result of the along-track network data loss. There are 10 holidays remaining after completion of acquisition of H12216. Figure 5 shows the largest of these holidays which occurs near position 47.71 N, 122.57 W. The multibeam backscatter pseudo-side scan was examined for all holidays and no navigationally significant items were found.



**Figure 5: Holiday due to network data loss**

The *H12216 Vdatum Validation Report* submitted in Appendix V included the Hydrographer’s recommendation to remove vessel 2806 lines 2010\_0902112 and 2010\_0881954 from the VDatum project due to reduced satellite coverage at the time of data collection. The lines were recommended for removal from the VDatum sounding set because even though the temporary drop in SVs during data acquisition did not result in a poor horizontal solution (x,y), they did result in a poor ellipsoid height solution (z) in the SBET, which is required for reducing soundings from the ellipsoid to MLLW using the VDatum model. Ultimately line 2010\_0881954 was retained with the project because the vertical difference between it and adjacent lines is within the allowed total vertical uncertainty (TVU). Line 2010\_0881954 was removed from the project because the vertical difference between it and adjacent lines is outside allowable TVU. Removing line 2010\_0881954 from the project resulted in a holiday in the surface between adjacent lines no greater than six meters wide (Figure 6). No significant features were detected within the removed line and the line matched well with adjacent lines when reduced to MLLW via TCARI in the original sounding dataset so the VDatum-reduced MLLW surface can be interpolated without consequence. The removed line is submitted in zipped folders with the other Preprocess and CARIS HDCS data.<sup>5</sup>

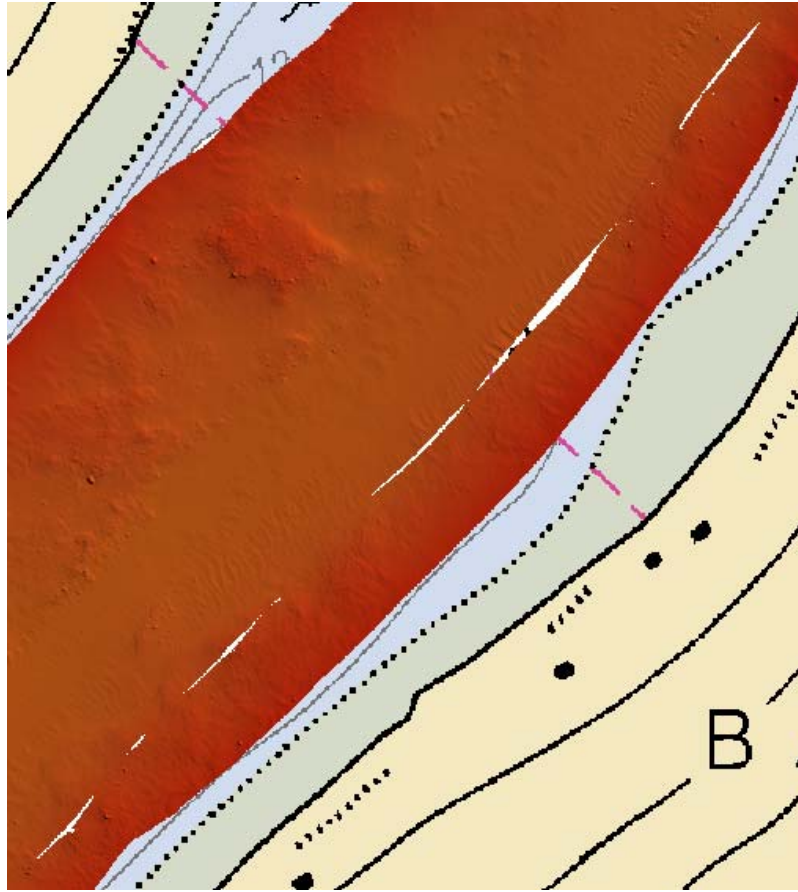


Figure 6: Holiday due to removal of 2806's line 2010\_0902112 (47°42'53"N 122°33'40"W)

#### DENSITY:

Density requirements for H12216 were achieved with an average of 99.96% of nodes containing five or more soundings at the appropriate resolution for depth (see Appendix V).

#### TRUEHEAVE:

To enable the application of TrueHeave some POS/MV true heave files were "fixed" using the *fixTrueHeave.exe* utility from CARIS. Fixed files were assigned an additional \*.fixed suffix. This was performed on files from vessel 2806 on DN 088.

#### SOUND VELOCITY:

Data collected by vessel 2806 on DN 089, in the central area of Port Madison, displays "frowns" characteristic of improper sound speed modelling, shown in figure 7. This was most likely caused by too few casts performed in the area during acquisition. The sound speed errors do not exceed IHO specifications, and the hydrographer retained all data not egregiously in error.<sup>6</sup>

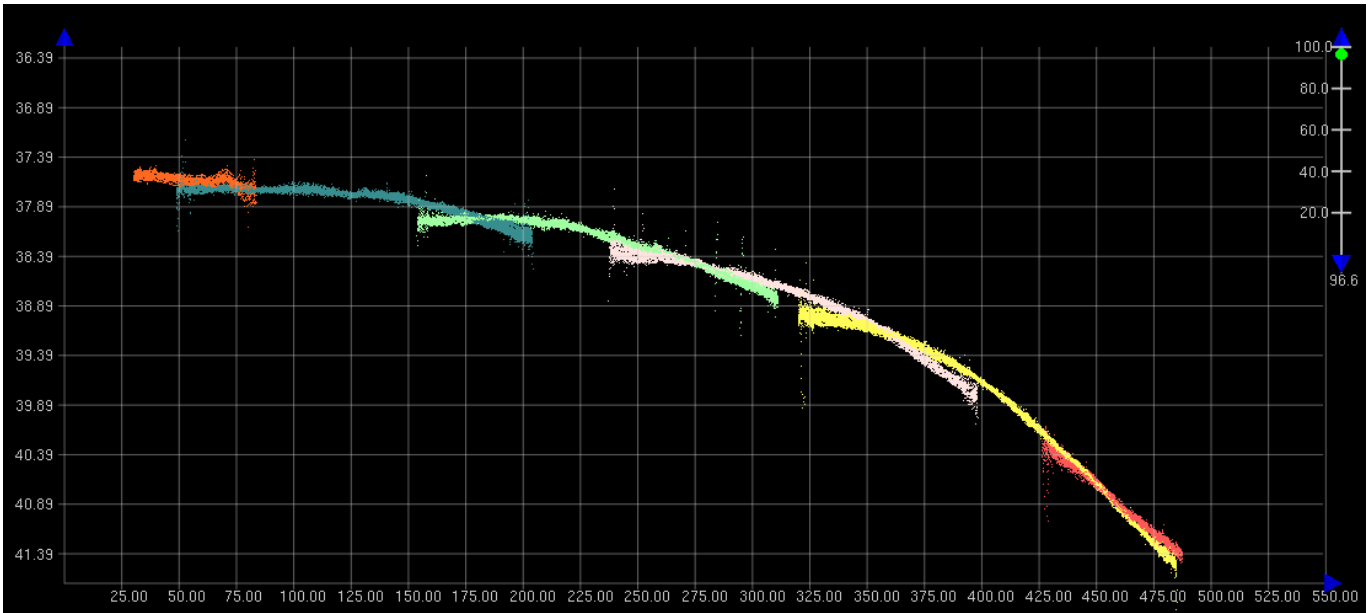


Figure 7: Sound Speed Errors in 2806 Data from DN 089

**TIMING OFFSETS:**

Data acquired by vessel 2805 on DN 096 showed significant horizontal offsets of 7 to 10 meters for all data acquired on that day. It was later discovered that 2805 had a +1 second timing bias for the entire day. The cause of this bias is still unknown, and it was not observed in any previous or subsequent data from vessel 2805. A +1 second offset was entered into the 2805 400kHz HVF (Hips Vessel File) in CARIS HIPS to account for the timing bias, shown in figure 8. The hydrographer verified all data to ensure no new errors were created.<sup>7</sup>

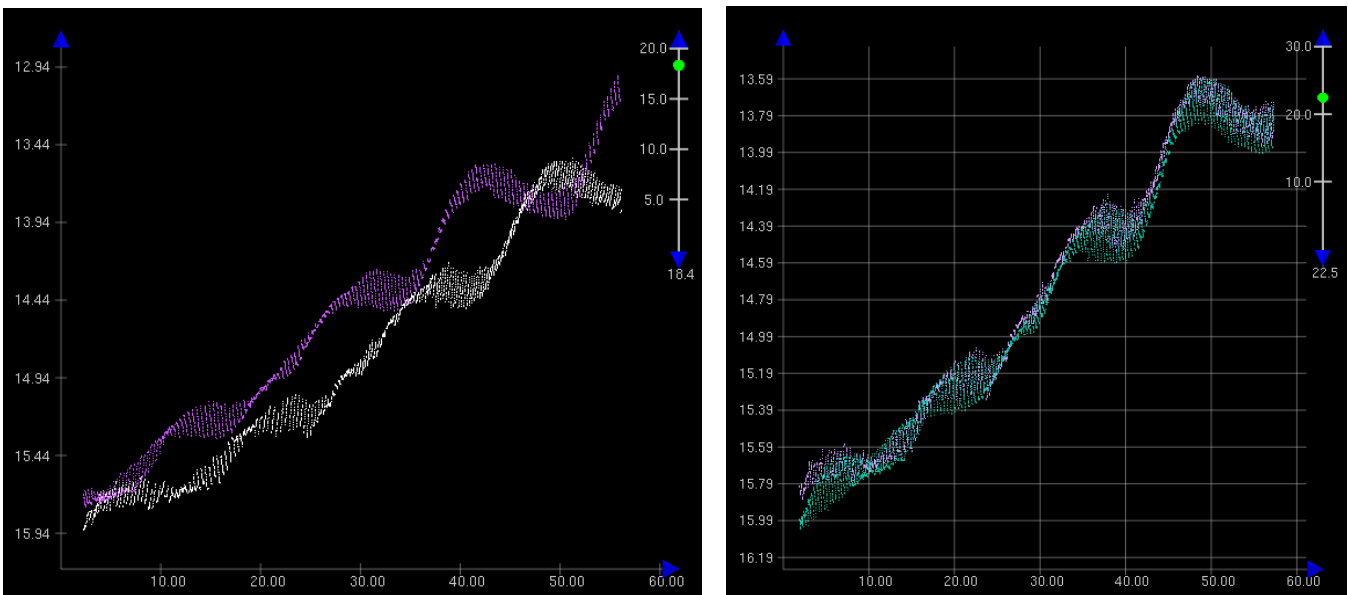


Figure 8: Timing errors before (left) +1 second bias, and after (right)

## MOTION ERRORS:

Data acquired by vessel 2805 on DN 096 also showed heave artifacts with an average of 0.1 meter amplitude, with a maximum of 0.4 meter amplitude, on roughly half the survey lines, as shown in figure 9. In all instances the motion errors occur at the very beginning of the line and die out within one minute. Sensor attitude data for the lines displayed 0.1 meter heave differences and 3 degree rolls for the corresponding time periods. Weather conditions and traffic was analyzed for the day and no waves or excessive wakes were reported. The POS/MV data was analyzed in POSpac and showed no abnormal data from the IMU (Internal Motion Unit) or GPS data. The cause of these artifacts is thought to be aggressive maneuvering to start survey lines, resulting in sensor drift and waking the boat. In all cases the errors were found to be acceptable within IHO Order 1 uncertainty levels.<sup>8</sup>

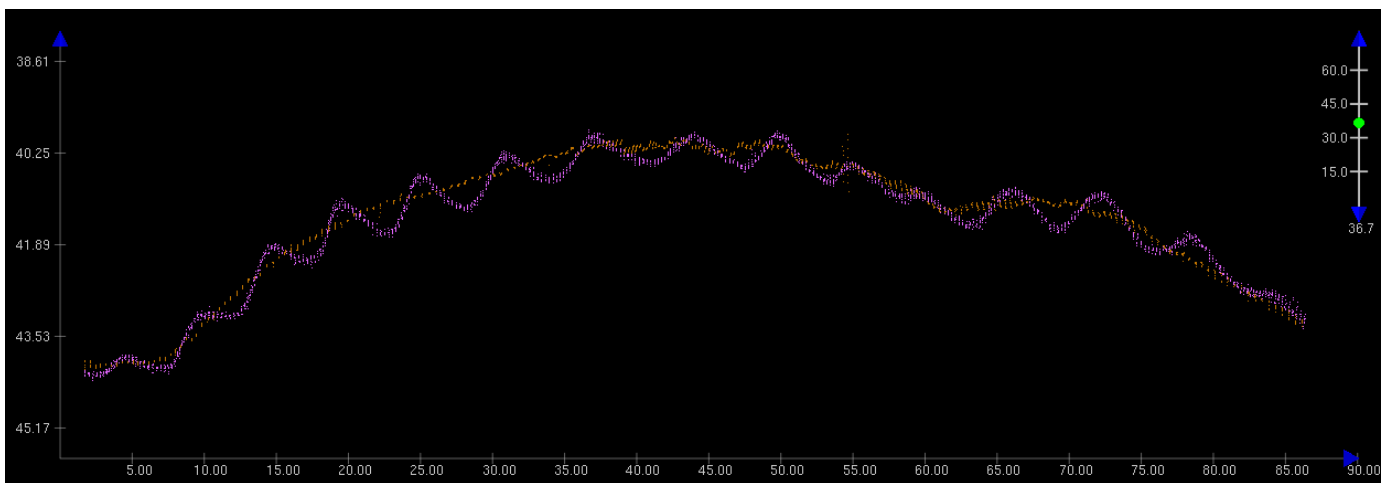


Figure 9: Heave Errors from Vessel 2805 on DN096

## ROLL BIAS:

Data collected by vessel 2805 exhibited a starboard roll bias on a magnitude 0.07 meters. While the bias exists in all data collected by vessel 2805 on H12216, it is most noticeable in shoal areas. Figure 10 shows data in Port Madison Harbor, where the bias is most recognizable due to adjacent lines run in the same direction. The bias was discovered after completion of acquisition, and does not appear to be present in 2805 patch test data. Due to the small magnitude of the bias, it was not addressed further in H12216.<sup>9</sup>

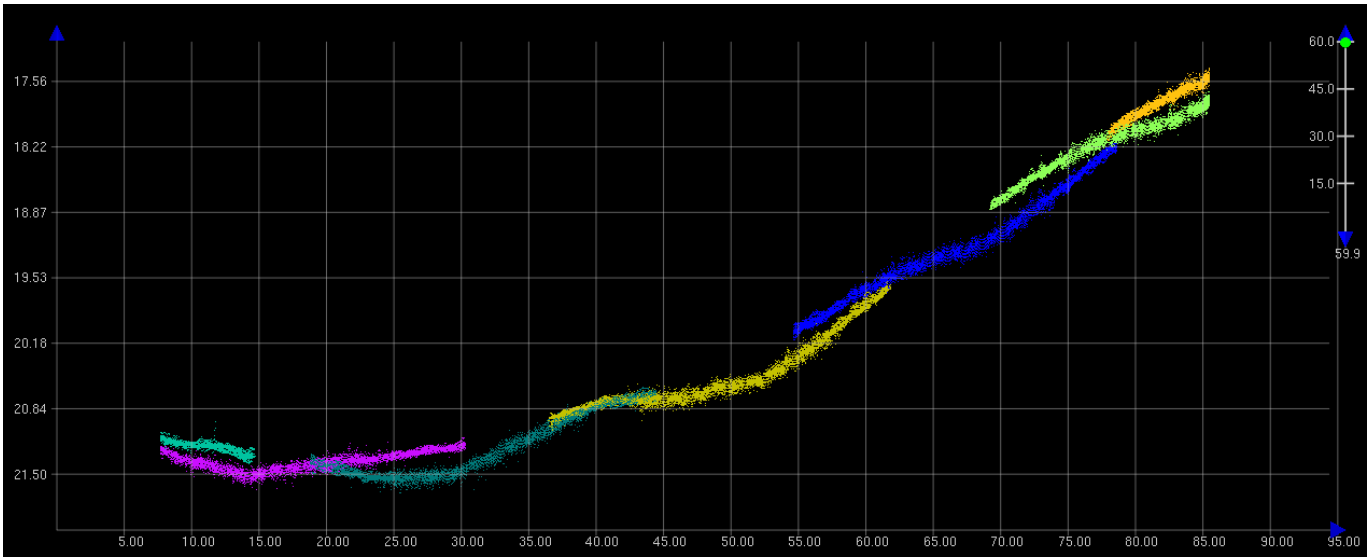


Figure 10: Roll bias in data run by vessel 2805

#### BOTTOM SAMPLES:

Bottom samples were not collected South of Agate Passage in H12216 due to time constraints. Bottom samples were collected in Port Madison within specifications as defined by the Field Procedures Manual (FPM), dated April 2009.

#### DESIGNATED SOUNDINGS:

Designation of soundings followed procedures as outlined in section 5.1.1.3 of the HSSD dated April 2009.

There were eight soundings in H12216 that were designated in CARIS HIPS. In six cases the soundings were designated to force the BASE surface to honor the least depth of a feature. Two of these designated soundings are submitted as dangers to navigation and are further described in section D.3. A further two soundings were flagged as “outstanding” in order to import the feature into CARIS Notebook to be addressed as piles. In the case of these two soundings, an outstanding flag was sufficient to use to import since the BASE surface was honoring the appropriate depth.<sup>10</sup>

#### UNUSUAL CONDITIONS:

Large amounts of kelp were sighted during acquisition and represented in the data along the North shore of Port Madison. In areas where the kelp affected the BASE surface, the hydrographer rejected data.<sup>11</sup>

#### B.2.5. Accuracy Standards

All data meet the accuracy specifications specified by the HSSD. Fledermaus statistics indicate that over 95% of nodes in the combined 8-meter grid meet or exceed IHO Order 1 specifications for all depths of survey H12216. To assess vertical accuracy standards, a child layer titled “IHO\_1” was created for each of the 0.5-meter, 1-meter, 2-meter, 4-meter, and 8-meter finalized surfaces using the equation as stated in the DAPR.<sup>12</sup>

### B.3. Corrections to Echo Soundings

Data reduction procedures for survey H12216 conform to those detailed in the DAPR.

### B.4. Data Processing

Initial data acquisition and processing notes are included in the acquisition and processing logs, additional processing such as final tides and sound velocity applied is most accurately tracked in the survey wide query in the Reviewer\_Qry tab of the H12216\_Data\_Log spreadsheet. All of the logs are included with the digital Separates.

Data processing procedures for survey H12216 conform to those detailed in the DAPR. Data were processed initially using CARIS HIPS & SIPS v7.0, Service Pack 1, and Hotfix 4, Notebook v.3.1 Hotfix 1, and BathyDatabase v.2.3 Hotfix 17 in conjunction with version 1 of the NOAA object catalog support files. During the course of survey processing computer systems processing and finalizing data for submission were updated to CARIS HIPS & SIPS v7.0, Service Pack 1, and Hotfix 5 and Notebook v.3.1 Hotfix 2. Additional processing details regarding Total Propagated Uncertainty (TPU/TPE) and CUBE Surfaces and Parameters utilized, along with any the deviations from the processing procedures outlined in the DAPR are discussed below.

#### TPU VALUES:

The survey specific parameters used to compute TPU in CARIS for H12216 are listed in Table 4. Tide uncertainty values were not applied because the data were reduced via a VDatum ellipsoid-to-MLLW separation model. The RMS error files associated with the PPK SBET files were applied in CARIS HIPS.

<b>Tide values:</b>	Measured	0.0 m	Zoning	0.0 m
<b>Sound Speed Values:</b>	Measured	1.0 m/s	Surface	0.50 m/s

**Table 4: Survey Specific CARIS TPE Parameters**

#### CUBE SURFACES:

The CARIS HIPS BASE surfaces created in fieldsheet H12216\_QC and the associated resolutions are listed below in Table 5.<sup>13</sup> After initial review of the data, it was found that a 1-meter resolution BASE surface was not honoring the large quantity of rocks in nearshore areas. To prevent excessive designated soundings, a half-meter surface was created for depths 0 to 13 feet. An overlap with the 1-meter resolution surface of 10 to 23 meters was found to be the best resolution where no holidays were created due to finer resolution gridding.

The ellipsoid surfaces were created while the soundings were reduced to the ellipsoid and will appear out of date because the soundings have been reduced back to MLLW. See the *H12216 Vdatum Validation Report* for how the GPS Tides were applied in CARIS HIPS.

The CUBE parameters utilized for creating CUBE surfaces are included in Table 5. The CUBE parameters \*.xml file is included with digital data in the vessel configuration folder.

Surface Name	Depth Ranges (m)	Resolution (m)	CUBE Parameters	Vertical Datum
H12216_50cm_MLLW	All	0.5	NOAA_0.5m	MLLW
H12216_1m_MLLW	All	1	NOAA_1m	MLLW
H12216_2m_MLLW	All	2	NOAA_2m	MLLW
H12216_4m_MLLW	All	4	NOAA_4m	MLLW
H12216_8m_MLLW	All	8	NOAA_8m	MLLW
H12216_50cm_MLLW_Final_0to13m	0-13	0.5		MLLW
H12216_1m_MLLW_Final_10to23	10-23	1		MLLW
H12216_2m_MLLW_Final_18to40	18-40	2		MLLW
H12216_4m_MLLW_Final_35to80	35-80	4		MLLW
H12216_8m_MLLW_Final_75to160	75-160	8		MLLW
H12216_8m_MLLW_Combined	All	8		MLLW
H12216_50cm_Ellipsoid	All	0.5	NOAA_0.5m	Ellipsoid
H12216_1m_Ellipsoid	All	1	NOAA_1m	Ellipsoid
H12216_2m_Ellipsoid	All	2	NOAA_2m	Ellipsoid
H12216_4m_Ellipsoid	All	4	NOAA_4m	Ellipsoid
H12216_8m_Ellipsoid	All	8	NOAA_8m	Ellipsoid

Table 5: Depth Ranges, Resolutions, and CUBE Parameters

### C. HORIZONTAL AND VERTICAL CONTROL

A complete description of horizontal and vertical control for survey H12216 can be found in the *OPR-N395-FA-10 Horizontal and Vertical Control Report (HVCR)*, submitted under separate cover. A summary of horizontal and vertical control for this survey follows.

#### C.1. Horizontal Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Differential corrections from the U.S. Coast Guard DGPS beacon at Robinson Pt (323 kHz) were used for positioning during real-time data acquisition.

Vessel position and kinematic data were processed using Post Processing Kinematic (PPK) methods in POSPac to create Single Best Estimated Trajectory (SBETs). Due to the unavailability of a secure site to set up a differential Single Base Station, a POSPac Smart Base virtual network was used as the baseline to calculate SBETs. The SBET files were then applied to the data in CARIS HIPS. See the DAPR and OPR-N395-FA-10 HVCR for detailed information on how the SmartBase network was created and used to post-process the vessel kinematic data.

#### C.2. Vertical Control

The vertical datum for this project is Mean Lower Low Water (MLLW) as specified in the Project Instructions. The operating National Water Level Observation Network (NWLON) primary tide station at Seattle, Puget Sound, WA (944-7130) served as control for datum determination and as the primary source for water level correctors for survey H12216 during the course of the survey and during initial processing and analysis.

A request for delivery of final approved water level correctors for survey H12216 was forwarded to N/OPS1 on April 10, 2010, in accordance with the Field Procedures Manual (FPM), dated April 2009. A copy of the request is included in Appendix V.

Prior to the mirroring of the HDCS data and the VDatum analysis portion of H12216 described in Appendix V, all data were reduced to MLLW using verified tides from the Puget Sound, WA station (945-7130) with the final, approved zone definition file N395FA2010CORP.zdf.<sup>14</sup> Several vertical offsets remained in the data even after final, approved zoned water levels were applied, so water level data from the Seattle, Puget Sound, WA station (945-7130), Tacoma, Commencement Bay, WA station (944-7659), and Port Townsend, Admiralty Inlet, WA station (944-4900) were applied with time and height correctors through the TCARI grid file N395RA2009.tc, which was used in NOAA Ship *Rainier's* 2009 Puget Sound project. The Vdatum analysis was completed using soundings reduced to MLLW via TCARI.

The data submitted with H12216 have been reduced to MLLW via the VDatum ellipsoid-to-MLLW grid file: mllw\_2009\_OPR-N395-RA-09\_TCARI\_Nodes\_GPSTide.xyz, submitted with the digital data in the CARIS Tide folder.

**It will not be necessary for the Pacific Hydrographic Branch to reapply the final approved water levels to the survey data during final processing.**

## D. RESULTS AND RECOMMENDATIONS

### D.1. Chart Comparison

Chart comparison procedures were followed as outlined in section 4.5 of the FPM and section 8.1.3-D.1 of the HSSDM, utilizing CARIS HIPS software program.

Survey H12216 was compared with the following charts listed in Table 6.

NOAA Chart Number	Chart Scale	Edition Number	Edition Date	Updated with Notice to Mariners through
18446_1	1:25,000	17 <sup>th</sup> Ed.	September 1, 2005	February 20, 2010 (02/10) <sup>15</sup>
18446_2	1:10,000	17 <sup>th</sup> Ed.	September 1, 2005	February 20, 2010 (02/10) <sup>16</sup>

Table 6: NOAA Charts compared with Survey H12216

#### D.1.1. Chart 18446

##### SOUNDING COMPARISON:

Depths from survey H12216 generally agree within 3 feet with soundings on chart 18446.<sup>17</sup> Some of the shoaler soundings represented on the chart near the shoreline appear to have been pulled off shore for cartographic representation, but remain accurate within the scale of the chart.

Depths from H12216 inside Agate Passage agree with charted soundings within 2 feet.<sup>18</sup> The primary exception was a 16 foot depth on a rock located directly over a 23 foot charted sounding. This depth was submitted as a DTON, as discussed in section D.3.

Depths in the Northwest quarter of Port Madison tend to be shoaler than charted soundings by 5 to 10 feet on average. The largest shoal difference was measured to be 16 feet.<sup>19</sup>

Depths along the South shore of Port Madison tended to be deeper than charted soundings by an average of 5 to 10 feet. The largest difference was found to be 20 feet deeper than the charted sounding.<sup>20</sup>

Section B.2.4 included a paragraph stating the reasons behind the removal of a line and the resulting holiday which was created. This holiday was examined using CARIS Subset Editor and found to agree with the charted sounding within the scale of the chart. Figure 11 below shows the charted sounding and loaded subset; as stated earlier in the document, data in the holiday can be interpolated without consequence.<sup>21</sup>

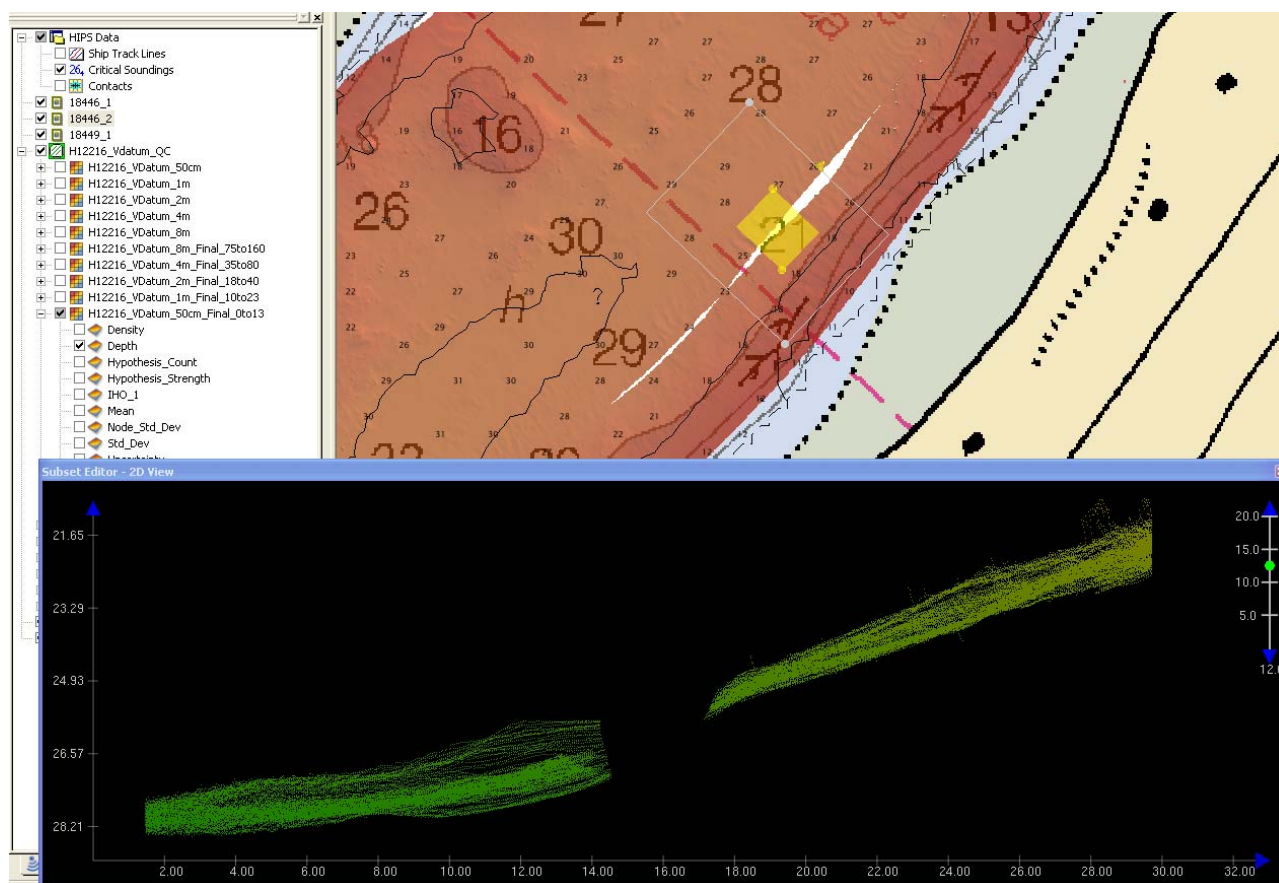


Figure 11: Sounding comparison of holiday in Agate Passage

#### CONTOUR COMPARISON:

Contours drawn on Chart 18446 generally agreed with contours produced by H12216.<sup>22</sup>

Data acquired from H12216 showed that contours on the north shore of Bainbridge Island in Port Madison had migrated significantly shoreward. On average the contours were 50 meters, with a maximum of 130 meters, closer to the shore than charted contours. Figure 12 shows the area of largest difference, just NW of the entrance to Port Madison harbor.

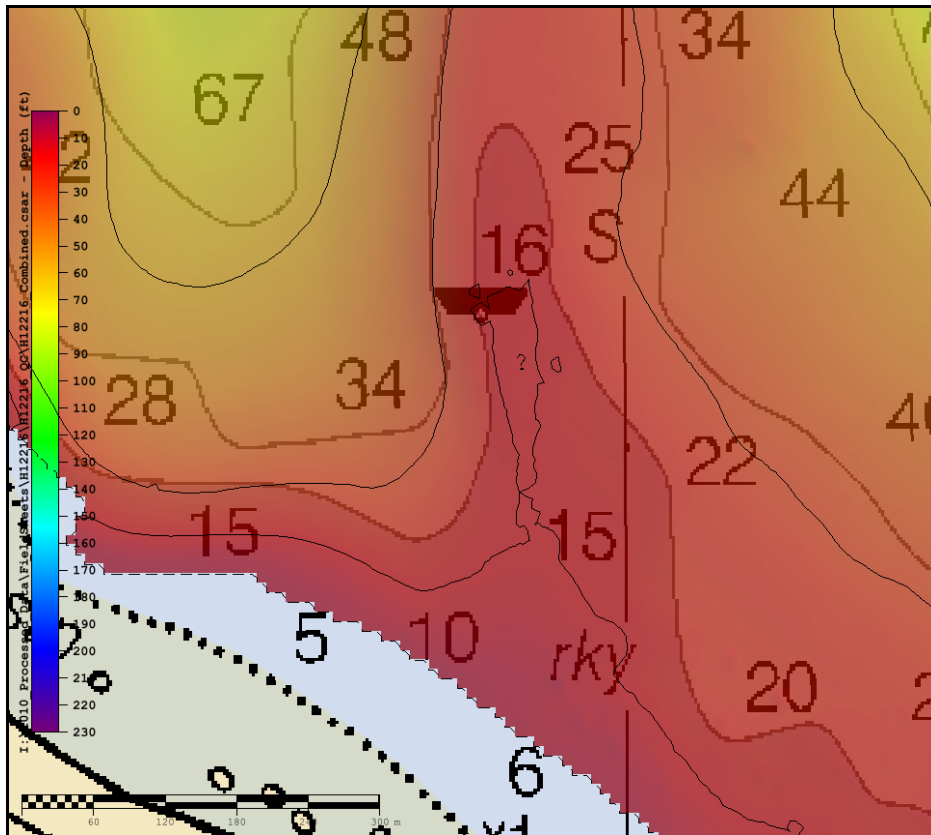


Figure 12: Contour offsets on the North shore of Bainbridge Island in Port Madison

### D.1.2. Chart Comparison Recommendations

The Hydrographer has determined that bottom coverage requirements have been met and data accuracy meets requirements specified by the *HSSDM*. **The surveyed soundings are adequate to supersede prior surveys in their common areas.**<sup>23</sup>

### D.2. Automated Wreck and Obstruction Information System (AWOIS) Investigations

There were five AWOIS items located within the limits of H12216. All AWOIS items were addressed and are included in the H12216\_Tabulated\_Feature\_Listing spreadsheet submitted in Appendix II.<sup>24</sup>

### D.3. Dangers to Navigation

Two dangers to navigation were found and reported to the Marine Chart Division on April 7, 2010. A copy of the preliminary Danger to Navigation Report is included in Appendix I and related correspondence in Appendix V.<sup>25</sup>

### D.4. Shoreline Source

A composite source file (CSF) in .000 format from HSD's Operations Branch was provided with the Project Instructions. The original file was imported into CARIS Notebook, converted to a .hob file,

clipped to the sheet limits, and named H12216\_Orig\_Comp\_Source.hob to be included with the deliverables. This file was copied and named H12216\_Final\_Feature\_File.hob to be utilized during field verification. Additionally features that are to be included in future editions of chart 18446 that were supplemented by Notice to Mariners were included in the Composite Source.

An AWOIS feature hob file separated out from the project reference file (PRF) was used in the field for investigation purposes during shoreline verification. This survey addressed AWOIS items numbers 54001 to 54005.

#### **D.4.1. Shoreline Verification**

*Fairweather* personnel were unable to conduct limited shoreline verification at times below predicted low water, as directed in the Project Instructions and section 3.5.5.3 of the FPM. Detached positions (DPs) were acquired and edits to the daily field H12216\_Feature\_File\_TR1\_Dn099.hob and H12216\_Feature\_File\_TR2\_Dn096.hob were recorded in CARIS Notebook and on paper DP forms and boat sheets. Scanned copies of the DP forms and boat sheets with field annotations are included in the digital Separates I folder.

The inset (1:10,000) was the largest scale chart for the project area. A Mean High Water (MHW) Buffer line, offset 8 meters (0.8 mm at scale of 1:10,000) from the composite source MHW, was used during shoreline verification to determine the Navigable Area Limit Line (NALL). The NALL, that defines the inshore limit of multibeam acquisition, was determined in the field as the farthest off-shore of either the MHW buffer listed above, the 4-meter depth contour, or the inshore limit of safe navigation.<sup>26</sup>

#### **D.4.2. Shoreline Data Processing**

Acquired and edited positions during shoreline verification operations were processed in CARIS Notebook. There were no features addressed during shoreline that required tide correction, all were buoys and ATONs.

New features and features requiring revision were given S57 attribution. Features were delineated and attributed to correspond with their status (New, Update, Delete, Retain, AWOIS, and Not Addressed).

Source features collected or edited by the field have source indication (SORIND) and source date (SORDAT) attribute fields populated to reflect the survey number (US,US,survey,H12216) and final survey date 20100409. Unmodified source shoreline features were left with their original SORIND and SORDAT values.

#### **D.5. Source Shoreline Changes, New Features and Charted Features**

In accordance with section 4.4.10 of the FPM, field notes made by the Hydrographer were provided in the Remarks field for features and when appropriate and recommendations to the cartographer were included in the Recommendations field.

Items disproved by the Hydrographer and deemed to not be charted are attributed as “Delete” in the descr field and located in the H12216\_Final\_Feature\_File.hob file.

### D.5.1. Shoreline Recommendations

The Hydrographer recommends that the shoreline depicted in the CARIS Notebook files and final sounding files supersede and complement shoreline information compiled on the CSF and charts.<sup>27</sup>

### D.6. Aids to Navigation

Survey H12216 included five (5) aids to navigation (ATONs). Detached positions were taken on each ATON for check purposes only. Four of the ATONs were found to serve their intended purpose.<sup>28</sup>

Agate Passage Light “2” had two positions in the composite source file provided for H12216. The light corresponds with one position, and the other was disproved.<sup>29</sup> Further deconfliction is provided in the H12216\_Final\_Feature\_File.

### D.7. Miscellaneous

Two buoys were investigated during shoreline verification, both buoys are included in the H12216\_Final\_Feature\_File. The buoy near the entrance to Port Madison in the CSF was not visible and is recommended for removal. Charted (18446) mooring buoy northwest of the entrance to Port Madison was found to disagree with the charted position and has been submitted with repositioned values.<sup>30</sup>

Cable areas are located within H12216 in the areas of Port Madison Harbor and Agate Passage. In all cases, no signs of underwater cable were found in the multibeam data. In addition, the charted sewer pipeline located in the North entrance of Agate Passage was also not found in MBES data.<sup>31</sup>

Overhead power cables located to the North and South of the bridge across Agate Passage were visibly verified by survey personnel.

The hydrographer recommends retaining these features as charted.<sup>32</sup>

#### D.7.1. Bottom Samples

Fourteen bottom samples were collected on April 5, 2010 (DN 095) and are included as SBDARE classifications along with the other S57 features, with descrp value of “New,” in the Notebook H12216\_Final\_Feature\_File.hob file.<sup>33</sup>

### D.8. Supplemental Reports

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

<u>Title</u>	<u>Date Sent</u>	<u>Office</u>
Hydrographic Systems Readiness Review 2010	4/9/10	N/CS34
Data Acquisition and Processing Report 2010	8/13/10	N/CS34
Horizontal and Vertical Control Report for OPR-N395-FA-10	8/13/10	N/CS34
H12216 Vdatum Validation Report	7/16/10	N/CS31



**UNITED STATES DEPARTMENT OF COMMERCE**

National Oceanic and Atmospheric Administration  
NOAA Marine and Aviation Operations  
NOAA Ship FAIRWEATHER S-220  
1010 Stedman Street  
Ketchikan, AK 99901

August 10, 2010

MEMORANDUM FOR: Gary Nelson  
Chief, Pacific Hydrographic Branch

FROM: CAPT David O. Neander, NOAA  
Commanding Officer

David O. Neander  
2010.08.12 16:05:48  
-08'00'

TITLE: Approval of Hydrographic Survey H12216,  
OPR-N395-FA-10

As Chief of Party, I have ensured that standard field surveying and processing procedures were adhered to during acquisition and processing of hydrographic survey H12216 in accordance with the Hydrographic Manual, Fourth Edition; Field Procedures Manual, April 2009; and the NOS Hydrographic Surveys Specifications and Deliverables, as updated for April 2009. Additional guidance was provided by applicable Hydrographic Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required. All data and reports are respectfully submitted to N/CS34, Pacific Hydrographic Branch.

I acknowledge that all of the information contained in this report is complete and accurate to the best of my knowledge.

In addition, the following individuals were responsible for oversight of acquisition and processing of this survey:

Briana Welton  
I have reviewed this document  
2010.08.12 22:24:40 Z

Digitally signed by David Moehl  
DN: cn=David Moehl, ou=NOAA, ou=NOAA Ship  
FAIRWEATHER, email=david.moehl@noaa.gov, c=US  
Date: 2010.08.11 20:33:47 Z

ENS Adam Reed  
Survey Manager

AST David Moehl  
Assistant Survey Manager

Briana Welton  
2010.08.11 20:59:55 Z

LT Briana J. Welton  
Field Operations Officer

Digitally signed by  
Lynette Morgan  
Date: 2010.08.12 22:42:44 Z

CST Lynette V. Morgan  
Chief Survey Technician

Attachment



- 
- <sup>1</sup> Concur.
  - <sup>2</sup> Concur.
  - <sup>3</sup> A junction between H12216 and H12024 was made during compilation.
  - <sup>4</sup> Due to relative vintage of H11190 and its data already having been applied to the chart there was no junction made between it and H12216.
  - <sup>5</sup> All holidays are minor, and data still meets object detection requirements. Holidays not preserved in H12216\_CS.000.
  - <sup>6</sup> Concr, data are adequate for charting.
  - <sup>7</sup> Concur, no errors were detected during the Survey Acceptance Review (SAR).
  - <sup>8</sup> Concur.
  - <sup>9</sup> Concur, roll bias has no noticeable effect on data.
  - <sup>10</sup> Concur with clarification, several additional soundings were designated during the SAR process, only those deemed appropriate for representation at the scale of the chart were selected for H12216\_CS.000.
  - <sup>11</sup> All charted kelp notations have been bluenoted to be retained.
  - <sup>12</sup> All data are adequate for charting.
  - <sup>13</sup> An 8 meter combined surface created during the SAR was used as the basis of compilation.
  - <sup>14</sup> Final approved tides memo attached to this report.
  - <sup>15</sup> Compiled to LNM update 3/12/2011.
  - <sup>16</sup> Compiled to LNM update 3/12/2011.
  - <sup>17</sup> Concur.
  - <sup>18</sup> Concur.
  - <sup>19</sup> Concur, chart per H12216\_CS.000.
  - <sup>20</sup> Concur, chart per H12216\_CS.000.
  - <sup>21</sup> Concur, holiday not represented in H12216\_CS.000.
  - <sup>22</sup> Concur, update charted contours based on survey data.
  - <sup>23</sup> Concur.
  - <sup>24</sup> AWOIS report was generated during the SAR and is attached to this report.
  - <sup>25</sup> DTON report is attached to this report. The DTONs have been applied to the chart and are included in the HCell.
  - <sup>26</sup> Chart per H12216\_CS.000.
  - <sup>27</sup> Concur with clarification, field delivered files were used in the compilation of H12216\_CS.000. Chart per H12216\_CS.000.
  - <sup>28</sup> Chart per latest ATONIS publication.
  - <sup>29</sup> Correction to Agate passage light noted and incorporated in the compilation of H12216\_CS.000.
  - <sup>30</sup> Newly surveyed buoy position is included in H12216\_CS.000.
  - <sup>31</sup> Retain cable areas and sewer line per blue notes in H12216\_CS.000.
  - <sup>32</sup> Concur with clarification, with the exception of the repositioned buoy.
  - <sup>33</sup> All surveyed bottom samples have been included in H12216\_CS.000 and are recommended for charting.

# H12216\_DTON1

**Registry Number:** H12216  
**State:** Washington  
**Locality:** Central Puget Sound  
**Sub-locality:** Pt Bolin to Port Madison  
**Project Number:** OPR-N395-FA-10  
**Survey Dates:** 03/29/2010 - 03/31/2010

## Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18446	17th	09/01/2005	1:10,000 (18446_2)	[L]NTM: ?
18445	32nd	08/01/2007	1:80,000 (18445_1) 1:25,000 (18445_3)	[L]NTM: ?
18446	17th	09/01/2005	1:25,000 (18446_1)	USCG LNM: 02/09/2010 (02/09/2010) CHS NTM: None (10/30/2009) NGA NTM: 02/02/2008 (02/20/2010)
18473	8th	09/01/2005	1:40,000 (18473_1)	[L]NTM: ?
18441	46th	12/01/2007	1:80,000 (18441_1)	[L]NTM: ?
18440	29th	09/01/2007	1:150,000 (18440_1)	[L]NTM: ?
18003	20th	11/01/2006	1:736,560 (18003_1)	[L]NTM: ?
18007	33rd	02/01/2009	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

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

## Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Rock	4.76 m	47° 43' 33.4" N	122° 33' 01.2" W	---
1.2	Rock	5.47 m	47° 44' 23.8" N	122° 30' 21.1" W	---

## **1 - Danger To Navigation**

**1.1) Profile/Beam - 2524/390 from h12216 /  
fa\_2805\_400khz\_rsn7125\_512bms\_2010 / 2010-090 / 2010\_\_0902023**

**DANGER TO NAVIGATION**

**Survey Summary**

**Survey Position:** 47° 43' 33.4" N, 122° 33' 01.2" W  
**Least Depth:** 4.76 m (= 15.61 ft = 2.602 fm = 2 fm 3.61 ft)  
**TPU ( $\pm 1.96\sigma$ ):** **THU (TPEh)**  $\pm 0.982$  m ; **TVU (TPEv)**  $\pm 0.148$  m  
**Timestamp:** 2010-090.20:24:41.625 (03/31/2010)  
**Survey Line:** h12216 / fa\_2805\_400khz\_rsn7125\_512bms\_2010 / 2010-090 / 2010\_\_0902023  
**Profile/Beam:** 2524/390  
**Charts Affected:** 18446\_2, 18445\_3, 18446\_1, 18473\_1, 18441\_1, 18445\_1, 18440\_1, 18003\_1, 18007\_1, 501\_1, 530\_1, 50\_1

**Remarks:**

15-foot shoal rock over 23 foot charted depth. These data were reduced using predicted tides.

**Feature Correlation**

Address	Feature	Range	Azimuth	Status
h12216/fa_2805_400khz_rsn7125_512bms_2010/2010-090/2010__0902023	2524/390	0.00	000.0	Primary

**Hydrographer Recommendations**

Add to chart

**Cartographically-Rounded Depth (Affected Charts):**

15ft (18446\_2, 18446\_1)  
 2 ½fm (18441\_1, 18440\_1, 18003\_1, 18007\_1, 530\_1)  
 2fm 3ft (18445\_3, 18473\_1, 18445\_1)  
 4.8m (501\_1, 50\_1)

**S-57 Data**

**Geo object 1:** Underwater rock / awash rock (UWTROC)  
**Attributes:** VALSOU - 4.758 m

Feature Images

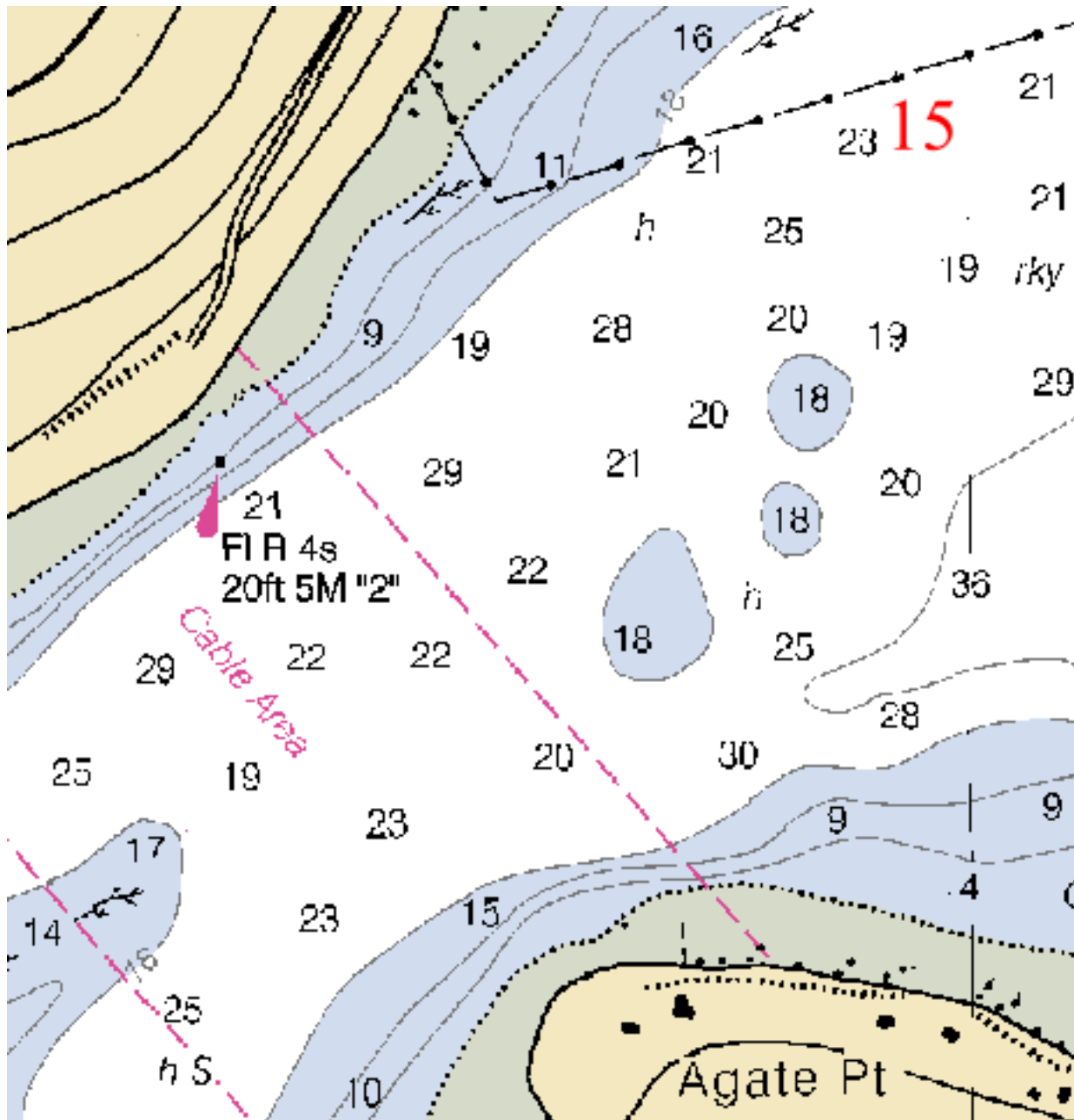


Figure 1.1.1

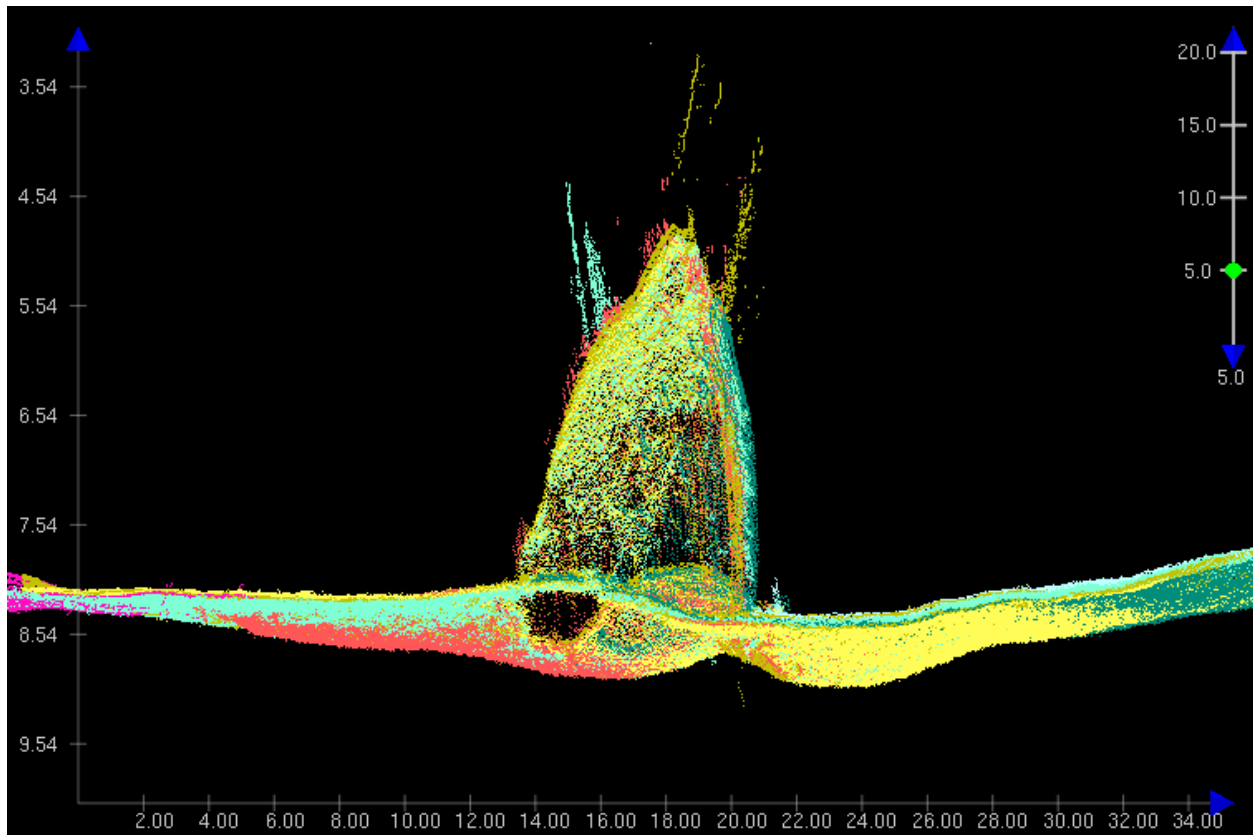


Figure 1.1.2

**1.2) Profile/Beam - 1779/250 from h12216 /  
fa\_2806\_400khz\_rsn7125\_512bms\_2010 / 2010-088 / 2010\_\_0881638**

**DANGER TO NAVIGATION**

**Survey Summary**

**Survey Position:** 47° 44' 23.8" N, 122° 30' 21.1" W  
**Least Depth:** 5.47 m (= 17.94 ft = 2.990 fm = 2 fm 5.94 ft)  
**TPU ( $\pm 1.96\sigma$ ):** **THU (TPEh)**  $\pm 0.983$  m ; **TVU (TPEv)**  $\pm 0.120$  m  
**Timestamp:** 2010-088.16:39:40.780 (03/29/2010)  
**Survey Line:** h12216 / fa\_2806\_400khz\_rsn7125\_512bms\_2010 / 2010-088 / 2010\_\_0881638  
**Profile/Beam:** 1779/250  
**Charts Affected:** 18446\_1, 18473\_1, 18441\_1, 18445\_1, 18440\_1, 18003\_1, 18007\_1, 501\_1, 530\_1, 50\_1

**Remarks:**

18-foot shoal rock in 28 feet of water. These data were reduced using predicted tides.

**Feature Correlation**

Address	Feature	Range	Azimuth	Status
h12216/fa_2806_400khz_rsn7125_512bms_2010/2010-088/2010__0881638	1779/250	0.00	000.0	Primary

**Hydrographer Recommendations**

Add to chart

**Cartographically-Rounded Depth (Affected Charts):**

18ft (18446\_1)  
 3fm (18441\_1, 18440\_1, 18003\_1, 18007\_1, 530\_1)  
 1fm 0ft (18473\_1, 18445\_1)  
 5.5m (501\_1, 50\_1)

**S-57 Data**

**Geo object 1:** Underwater rock / awash rock (UWTROC)  
**Attributes:** VALSOU - 5.469 m

### Feature Images

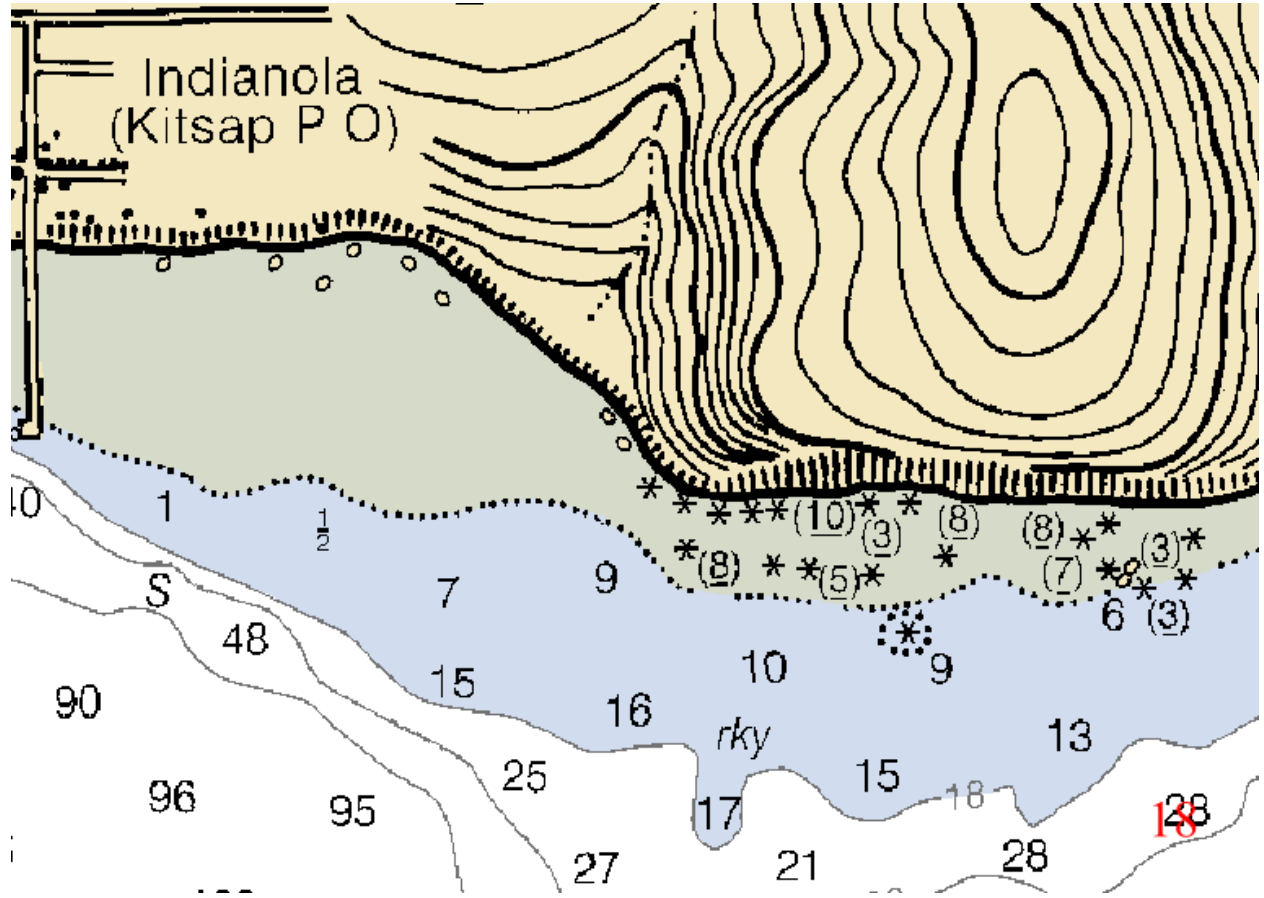


Figure 1.2.1

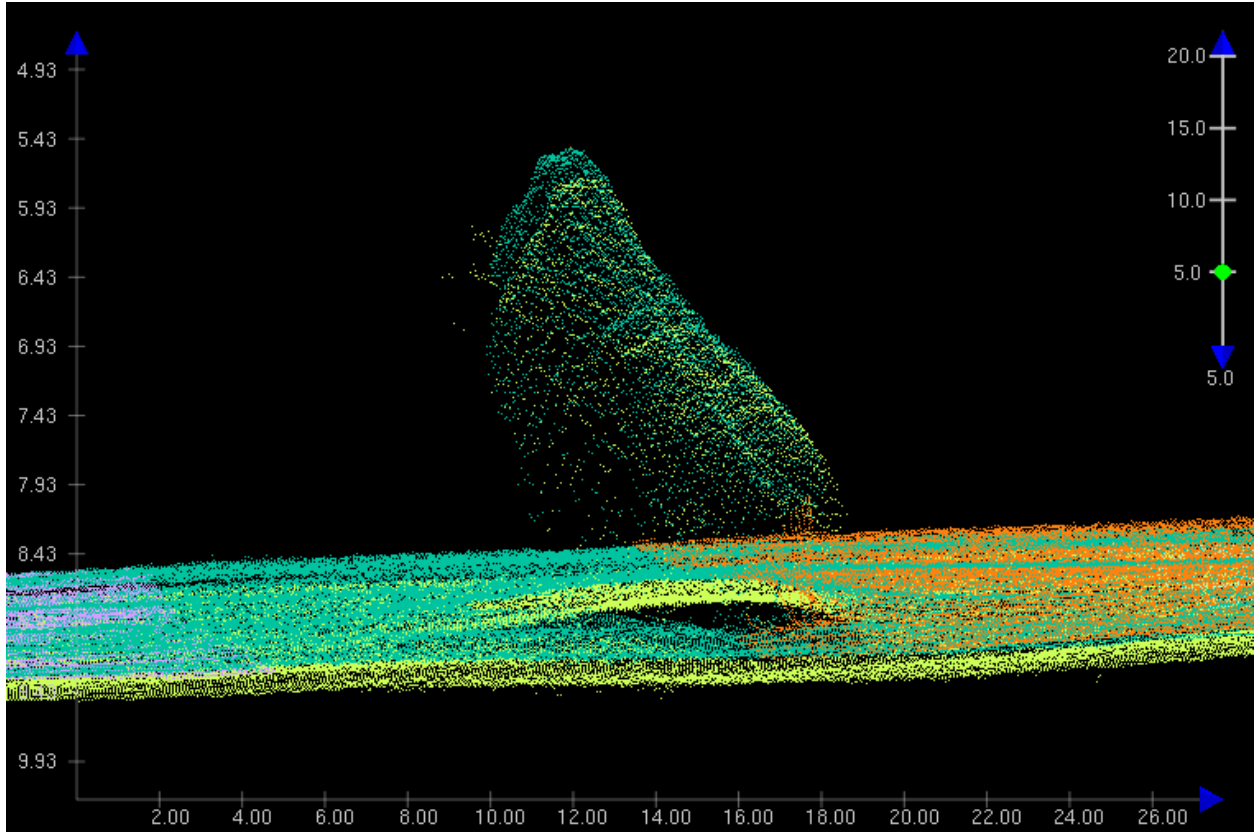


Figure 1.2.2

## AWOIS Report

The purpose of this document is to provide the compiler with additional information in regards to the AWOIS items assigned to this survey. The information delivered by the field was not sufficient for updating the AWOIS database. This document shall be appended to the final DR during HCell compilation.

### **AWOIS Item #53924**

#### *Information assigned to the field:*

History: H11190/2002; NOS -- A new wreck was found during SWMB acquisition, at position (NAD83) 47° 44' 24.42"N, 122° 29' 41.24"W (537875.3E, 5287539.4N). It was visually verified by divers in 8m visibility to be a sailboat lying on its starboard side (LAH 3/16/2010)

Location: 47-44-24.42N, 122-29-41.24W

Item Status: Assigned

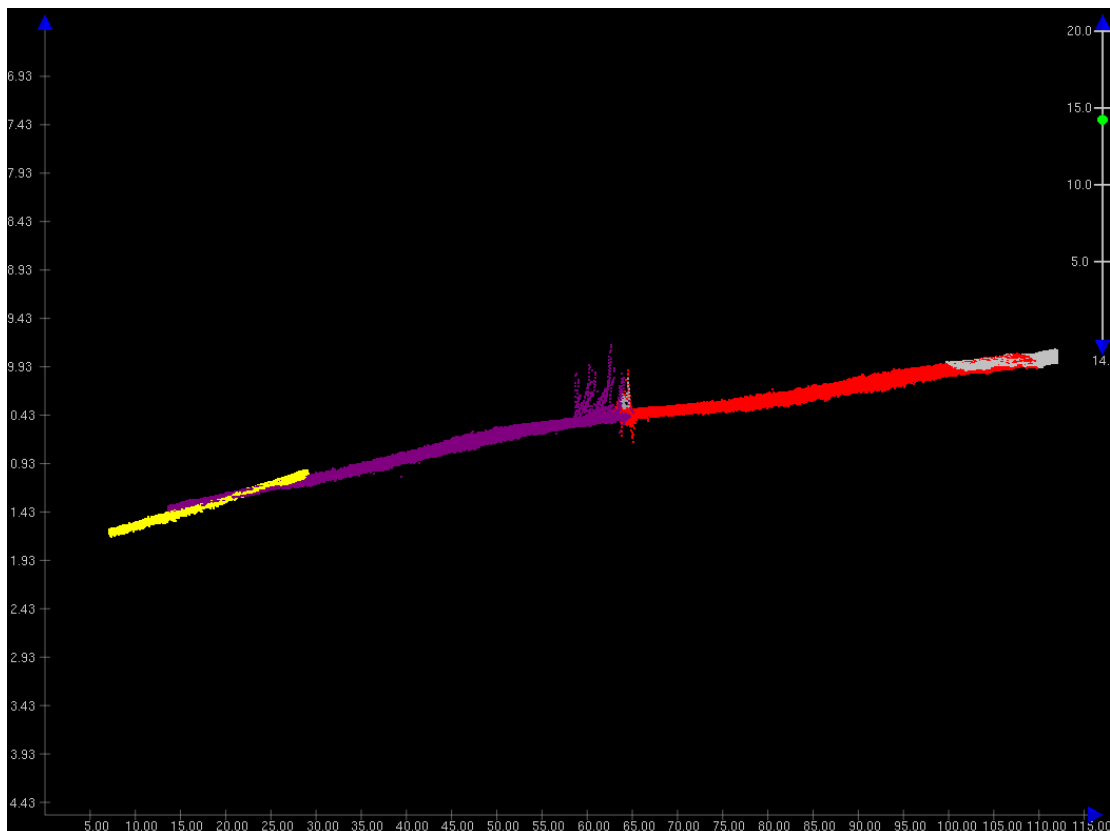
Search Type: Information

Radius: Null

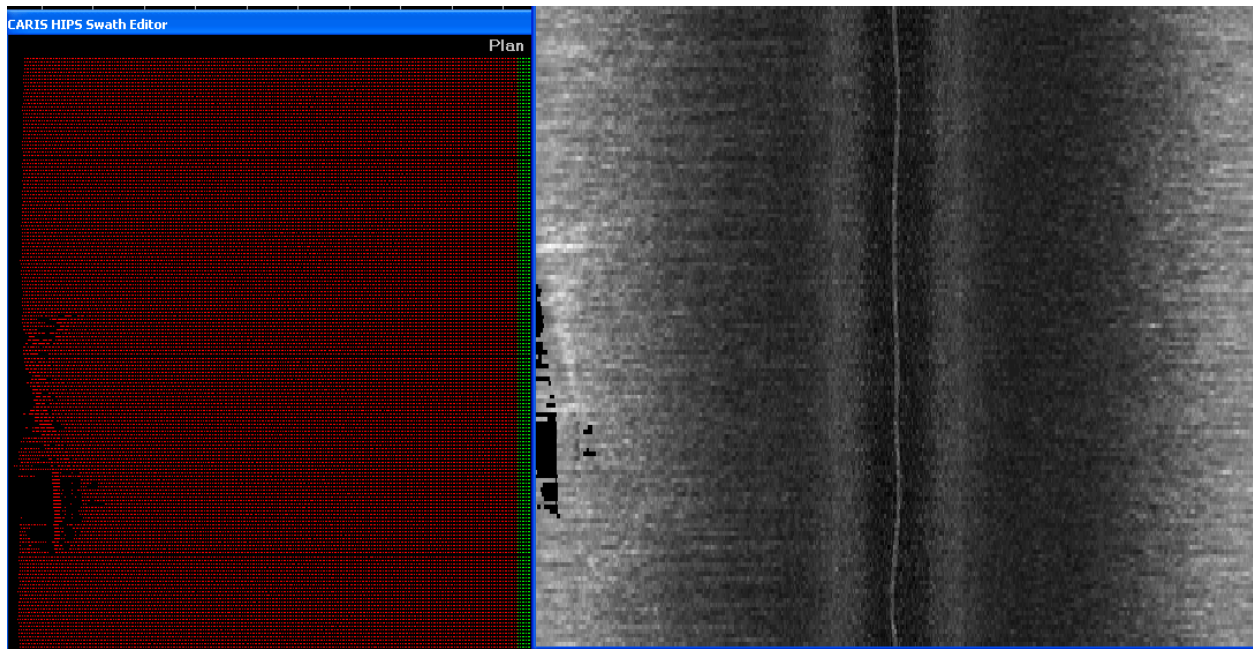
Technique: Null

Technique Note: Verify position of charted submerged rock

*Remarks:* 100% multibeam coverage was obtained in over the wreck. It appears that the wreck is still present. Though there have been 100% SWMB over this wreck, the object was found in the outerbeams.



*Image 1:* Two-dimension imagery of data collected over charted wreck.



*Image 2:* Swath editor view of charted wreck. The left hand side is the plan view of swath editor and the right hand side is the back scatter view. It is apparent in these images that there is something being seen in the data.

*Recommendations:* Though 100% SWMB was obtained the least depth of this wreck is unreliable because it appears that least depth was not determined. The reviewer recommends retaining the wreck as charted and as reported in the AWOIS database because it is a more conservative depth.

**AWOIS Item #53925***Information assigned to the field:*

History: LNM49/07--13th CGD; Mariners and divers are requested not to disturb the bottom sediments in the vicinity of approximate position 47-43.127N 122-31.950W, due to unexploded ammunition. For additional information, contact the US Navy at (360) 315-5301 (LAH 3/16/2010)

Location: 47-43-07.6N, 122-31-57W

Item Status: Assigned

Search Type: Full

Radius: 100m

Technique: SWMB

Technique Note: Verify position of charted obstruction

*Remarks:* Underwater charge was not found with 100% MBES. The AWOIS item was fully investigated within the search radius.

*Recommendations:* Due to the sensitive nature of this feature it is recommended to retain the charted underwater charge.

**AWOIS Item #53926***Information assigned to the field:*

History: CL 806/73 13th CGD -- A SUBM RK IN PORT MADISON BAY ABOUT 200 FT S OF THE BEACON ON THE SOUTH SHORE OF TREASURE ISLAND WAS REPORTED. IT WAS EXAMINED BY A SKIN DIVER AND REPORTED TO BE ABOUT 10 FT LONG, 4 FT WIDE, AND 4 FT HIGH OR IRREGULAR SHAPE AND ABOUT 6 FT BELOW THE SURFACE AT LOW TIDE OR ABOUT 3 FT OF WATER DURING A -3 FT TIDE. (LAH 3/16/2010)

Location: 47-41-50.34N, 122-32-11.48W

Item Status: Assigned

Search Type: Full

Radius: 75m

Technique: Null

Technique Note: Verify existence and position of charted subm rk.

*Remarks:* The search radius was not fully fulfilled but two rocks were found (see Image 3). These were found with 100% SWMB. One rock is located at 47-41-50.71N, 122-32-11.89W and has a depth of 2.3m. The second rock is located at 47-41-49.83N, 122-32-08.55W and has a depth of 2.1m.



*Image 3:* The item in the red is AWOIS item #53926. The line permeating from the center of the red feature is 75 meters search radius.

*Recommendations:* Remove charted rock and replace with the two new rocks discovered during survey data collection.

#### **AWOIS Item #53927**

*Information assigned to the field:*

History: CL 1916/78 -- A VISITOR TO THE PACIFIC MARINE CENTER REPORTED AN UNCHARTED SUBMERGED RK NEAR AGATE PASS AND MARKED THE LOCATION ON A CHART SECTION. (LAH 3/16/2010)

Location: 47-42-02.54N, 122-34-38.86W

Item Status: Assigned

Search Type: Full

Radius: 150m

Technique: SWMB

Technique Note: Verify existence and position of charted subm rk.

*Remarks:* 100% SWMB was obtained over charted rock. Search radius was not fully obtained inside of the NALL (see Image 4). The data does not reflect a rock present at this location.

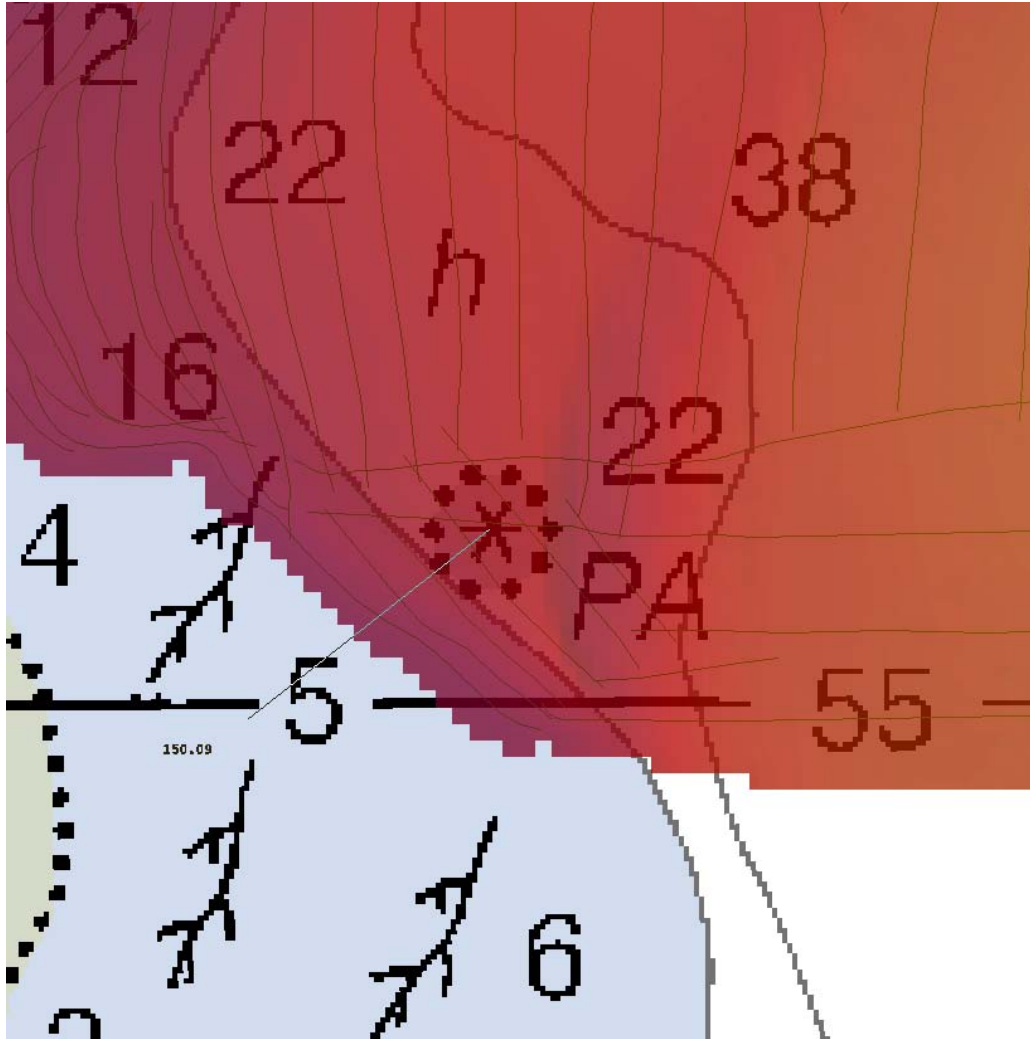


Image 4: Multibeam data overlaid on the chart—the search radius was not obtained within the NALL.

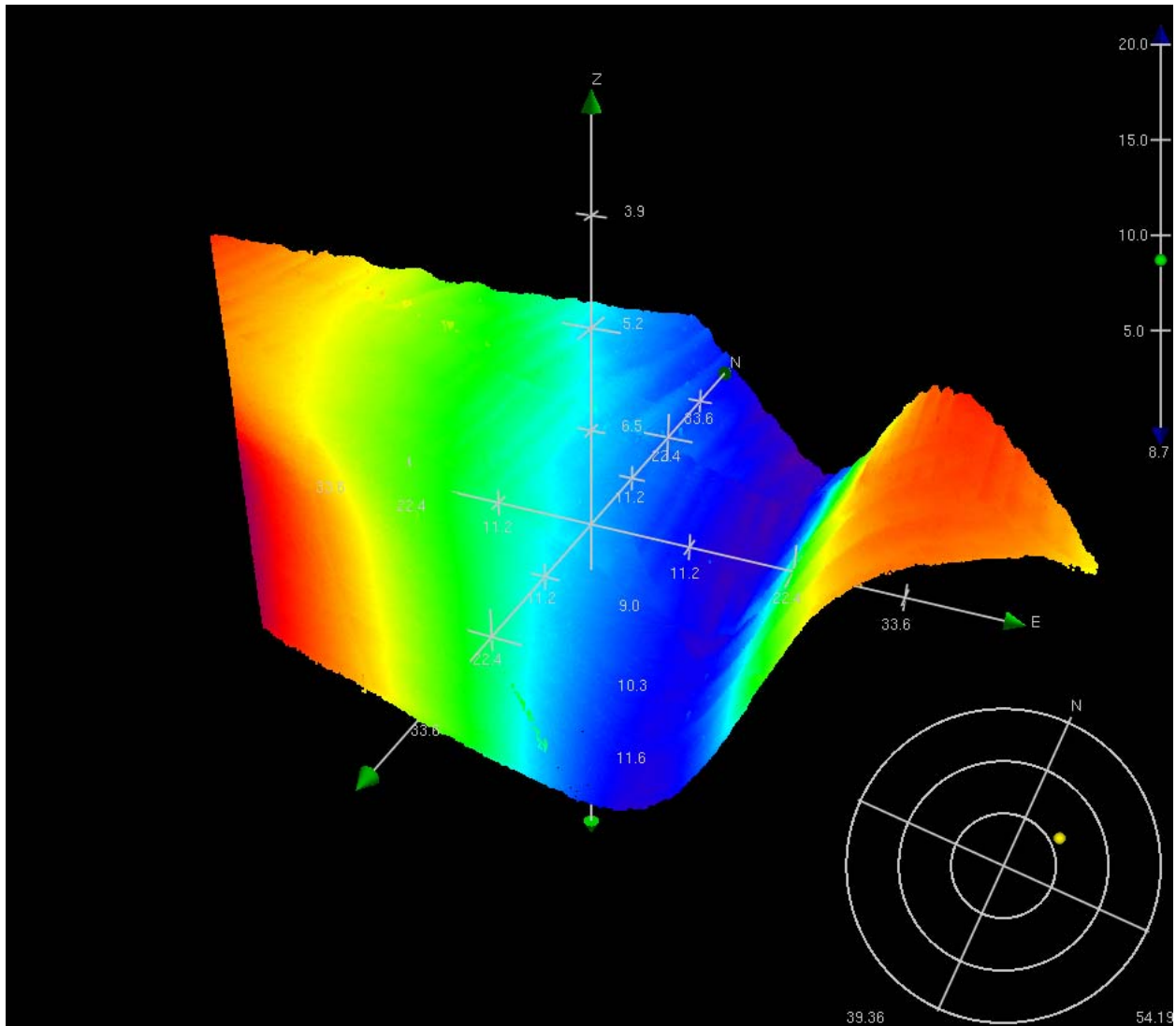


Image 5: Three-dimensional representation of the hydrographic data around the charted rock.

*Recommendations:* Remove charted rock.

**AWOIS Item #53943**

*Information assigned to the field:*

History: CL 507/86; CGD 13 -- AGATE PASS SALMON PEN LIGHT (L.L. #2439) SHOWING QUICK FLASHING WHITE LIGHT HAS BEEN ESTABLISHED IN APPROXIMATE POSITION 47/42/17N, 122/34/37W. LIGHT MARKS A 70 FT BY 70 FT FLOATING WOODEN SALMON PEN. (LAH 3/17/2010)

Location: 47-42-16.41N, 122-34-41.25W

Item Status: Assigned

Search Type: Full

Radius: 125m

Technique: VS

Technique Note: Verify position of charted float and light.

*Remarks:* Charted light repositioned at new location at 47-42-12.40N, 122-34-29.72W. Light is associated with a fish pen. Please chart per Final Feature File.



*Image 6:* Charted light to be repositioned.

*Recommendations:* Reposition charted light.



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
National Ocean Service  
Silver Spring, Maryland 20910

**TIDE NOTE FOR HYDROGRAPHIC SURVEY**

**DATE :** May 5, 2010

**HYDROGRAPHIC BRANCH:** Pacific  
**HYDROGRAPHIC PROJECT:** OPR-N395-FA-2010  
**HYDROGRAPHIC SHEET:** H12216

**LOCALITY:** Central Puget Sound, WA  
**TIME PERIOD:** March 25 - April 6, 2010

**TIDE STATION USED:** 944-7130 Seattle, Puget Sound, WA  
Lat.47° 36.16'N Long. 122° 20.36' **+**

**PLANE OF REFERENCE (MEAN LOWER LOW WATER):** 0.000 meters  
**HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE:** 3.199 meters

**REMARKS: RECOMMENDED ZONING**

Preliminary zoning is accepted as the final zoning for project OPR-N395-FA-2010, H12216, during the time period between March 25 to April 6, 2010.

Please use the zoning file "N395FA2010CORP" submitted with the project instructions for OPR-N395-FA-2010. Zones PS161, PS162, and PS171 are the applicable zones for H12216.

**Refer to attachments for zoning information.**

**Note 1:** Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

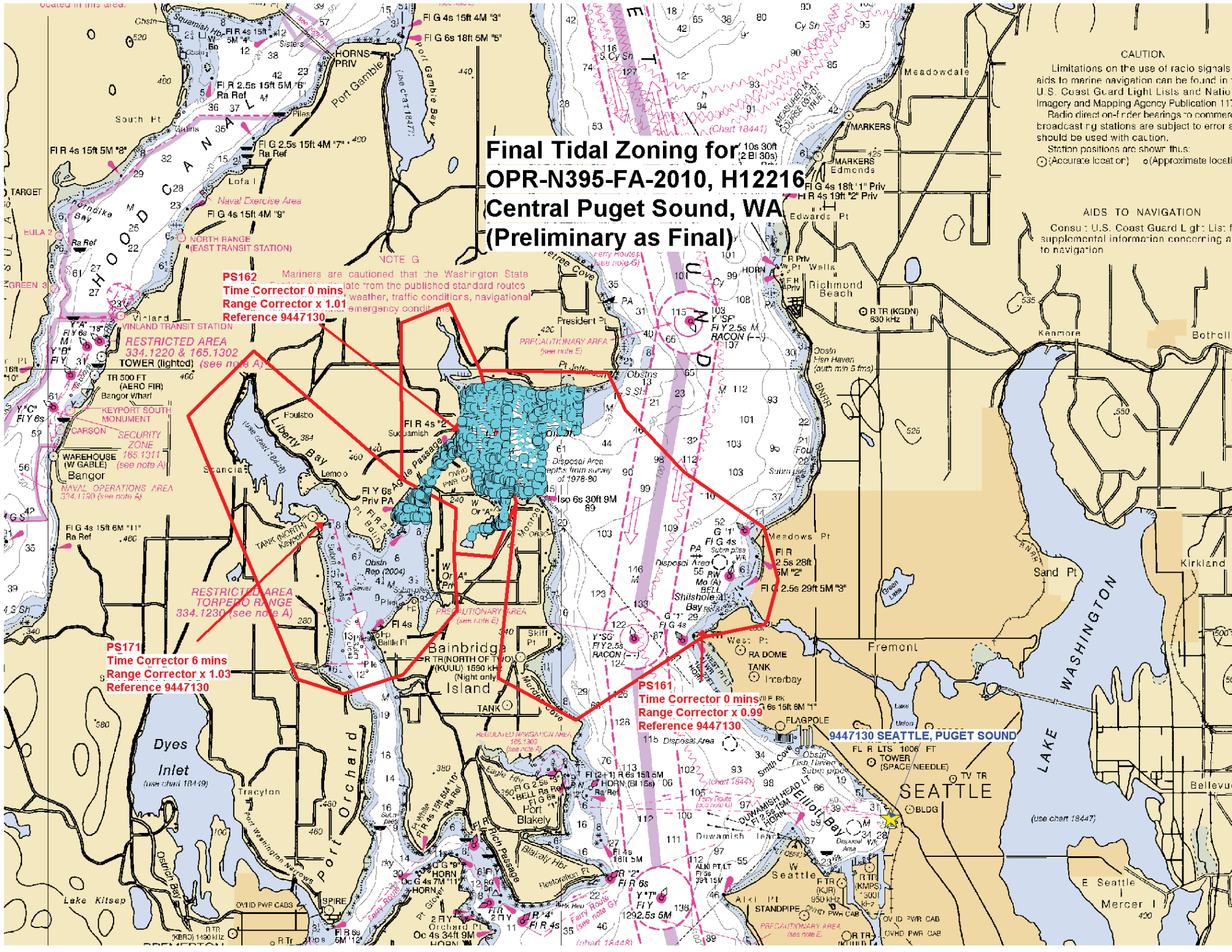
**Peter J. Stone**

Digitally signed by Peter J. Stone  
DN: cn=Peter J. Stone, o=CO-OPS, ou=NOAA/  
NOS, email=peter.stone@noaa.gov, c=US  
Date: 2010.05.06 17:10:43 -04'00'

---

CHIEF, OCEANOGRAPHIC DIVISION





# Final Tidal Zoning for OPR-N395-FA-2010, H12216 Central Puget Sound, WA (Preliminary as Final)

**PS162** Mariners are cautioned that the Washington State tide data is from the published standard routes. Weather, traffic conditions, navigational emergency conditions may vary from the published standard routes.

**Time Corrector 0 mins**  
**Range Corrector x 1.01**  
**Reference 9447130**

**RESTRICTED AREA**  
 334.1220 & 165.1302  
**TOWER (lighted)** (see note A)

**RESTRICTED AREA**  
**TORPEDO RANGE**  
 334.1230 (see note A)

**PS171**  
**Time Corrector 6 mins**  
**Range Corrector x 1.03**  
**Reference 9447130**

**PS161**  
**Time Corrector 0 mins**  
**Range Corrector x 0.99**  
**Reference 9447130**

**9447130 SEATTLE, PUGET SOUND**

**CAUTION**  
 Limitations on the use of radio signals aids to marine navigation can be found in U.S. Coast Guard Light Lists and National Imagery and Mapping Agency Publication 117. Radio direction-finder bearings to commercial broadcast radio stations are subject to error and should be used with caution. Station positions are shown thus:  
 (●) (Accurate location) (○) (Approximate location)

**AIDS TO NAVIGATION**  
 Consult U.S. Coast Guard Light Lists for supplemental information concerning aids to navigation.

**H12216 HCell Report**  
Peter Holmberg, Physical Scientist  
Pacific Hydrographic Branch

**1. Specifications, Standards and Guidance Used in HCell Compilation**

HCell compilation of survey H12216 used:

Office of Coast Survey HCell Specifications: Version: 4.0, 2 June, 2010.  
HCell Reference Guide: Version 2.0, 2 June, 2010.

**2. Compilation Scale**

Depths and features for HCell H12216 were compiled to the largest scale raster chart and inset shown below:

Chart	Scale	Edition	Edition Date	NTM Date
18446	1:25,000	17 <sup>th</sup>	09/01/2005	03/01/2011
18446 inset	1:10,000	17 <sup>th</sup>	09/01/2005	03/01/2011

The following ENC was also used during compilation:

Chart	Scale
US5WA12M	1:25,000/1:10,000

**3. Soundings**

A survey-scale sounding (SOUNDG) feature object layer was built from the 8-meter Combined Surface in CARIS BASE Editor. A shoal-biased selection was made at 1:10,000 survey scale and at 1:5,000 survey scale for the inset portion using a Radius Table file with values shown in the table, below.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
-3	10	3
10	20	4
20	50	4.5
50	200	5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers (SS) and imported into a new layer (CS) created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

#### 4. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the \*\_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and feet equivalent contour values are shown in the table below.

Chart Contour Intervals in Feet from Chart 18446	Metric Equivalent to Chart Feet, Arithmetically Rounded	Metric Equivalent of Chart Feet, with NOAA Rounding Applied	Fathoms with NOAA Rounding Applied	Feet with NOAA Rounding Removed for Display on H12216_SS.000
6	1.8288	2.0574	6.75	6
12	3.6576	3.8862	12.75	12
18	5.4864	5.715	18.75	18
30	9.144	9.3726	30.75	30
60	18.288	18.5166	60.75	60

#### 5. Meta Areas

The following Meta object area is included in HCell H12216:

M\_QUAL  
M\_CSCL

The Meta area object was constructed on the basis of the limits of the surveyed area.

#### 6. Features

Features addressed by the field units are delivered to PHB where they are deconflicted against the hydrography and the largest scale chart. These features, as well as features to be retained from the chart and features digitized from the Base Surface, are included in the HCell. The geometry of these features may be modified to emulate chart scale per the HCell Reference Guide on compiling features to the chart scale HCell.

## **7. Spatial Framework**

### **7.1 Coordinate System**

All spatial map and base cell file deliverables are in an LLDG geographic coordinate system, with WGS84 horizontal, MHW vertical, and MLLW (1983-2001 NTDE) sounding datums.

### **7.2 Horizontal and Vertical Units**

DUNI, HUNI and PUNI are used to define units for depth, height and horizontal position in the chart units HCell, as shown below.

Chart Unit Base Cell Units:

Depth Units (DUNI):	Feet
Height Units (HUNI):	Feet
Positional Units (PUNI):	Meters

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for soundings measured with sonar maintain millimeter precision. Depths on rocks above MLLW and heights on islets above MHW are typically measured with range finder, so precision is less. Units and precision are shown below.

BASE Editor and S-57 Composer Units:

Sounding Units:	Meters rounded to the nearest millimeter
Spot Height Units:	Meters rounded to the nearest decimeter

See the HCell Reference Guide for details of conversion from metric to charting units, and application of NOAA rounding.

## **8. Data Processing Notes**

There were no significant deviations from the standards and protocols given in the HCell Specification and HCell Reference Guide.

## **9. QA/QC and ENC Validation Checks**

H12216 was subjected to QA checks in S-57 Composer prior to exporting to the metric HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to chart units and NOAA rounding applied. dKart Inspector was then used to further check the data set for conformity with the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and warnings and errors investigated and corrected unless they are MCD approved as inherent to and acceptable for HCells.

## 10. Products

### 10.1 HSD, MCD and CGTP Deliverables

H12216_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:25,000 and 5,000.
H12216_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000 and 1:5,000.
H12216_DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H12216_outline.gml	Survey outline
H12216_outline.xsd	Survey outline

### 10.2 Software

CARIS HIPS Ver. 7.0	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 3.0	Creation of soundings and bathy-derived features, creation of the meta area objects, and Blue Notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.2	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
HydroService AS, dKart Inspector Ver. 5.1, SP 1	Validation of the base cell file.
Northport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

## 11. Contacts

Inquiries regarding this HCell content or construction should be directed to:

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APPROVAL SHEET  
H12216

Initial Approvals:

The survey evaluation and verification has been conducted according to branch processing procedures and the HCell compiled per the latest OCS HCell Specifications.

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, S-57 classification and attribution of soundings and features, cartographic characterization, and verification or disproof of charted data within the survey limits. The survey records and digital data comply with OCS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.