

H11553

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. N/A

Registry No. H11553

LOCALITY

State Washington

General Locality Approaches to Anacortes and Bellingham

Sublocality Sout Portion of Bellingham Bay

2005-2006

CHIEF OF PARTY

..... Commander Guy T. Noll, NOAA

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DATE

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;">HYDROGRAPHIC TITLE SHEET</p>	<p>REGISTRY No</p> <p style="text-align: center;">H11553</p>
<p>INSTRUCTIONS – 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: RA-10-19-06</p>
<p>State <u>Washington</u></p> <p>General Locality <u>Approaches to Anacortes and Bellingham</u></p> <p>Sub-Locality <u>South Portion of Bellingham Bay</u></p> <p>Scale <u>1:10,000</u> Date of Survey <u>10/26/05 - 11/08/05 & 10/17/06 - 11/01/06</u></p> <p>Instructions dated <u>8/15/2006, Change 8/24/2006</u> Project No. <u>OPR-O112-RA-05</u></p> <p>Vessel <u>RA5 (1006), RA6 (1015), RA2 (1103)</u></p> <hr/> <p>Chief of party <u>Commander Guy T. Noll</u></p> <p>Surveyed by <u>RAINIER Personnel</u></p> <p>Soundings by <u>Reson SeaBat 8101, Seabeam/Elac 1180, Knudsen 320M</u></p> <p>SAR by <u>Matthew Foss</u> Compilation by <u>Annie Raymond</u></p> <p>Soundings compiled in <u>Fathoms</u></p>	
<p>REMARKS: <u>All times are UTC. UTM Projection 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> <hr/> <hr/>	

Descriptive Report to Accompany Hydrographic Survey H11553

Project OPR-N161-RA-06
Approaches to Anacortes and Bellingham, Washington
South Portion of Bellingham Bay
Scale 1:10,000
October 2005 to November 2006
NOAA Ship RAINIER (s221)
Chief of Party: Commander Guy T. Noll, NOAA

A. AREA SURVEYED

This hydrographic survey was completed as specified by Hydrographic Survey Letter Instructions OPR-N161-RA-06 dated August 15, 2006, and all other applicable direction¹, with the exception of deviations noted in this report. The survey area is the Approaches to Anacortes and Bellingham, and the sublocality is the south portion of Bellingham Bay. This survey corresponds to sheet “D” in the sheet layout provided with the Letter Instructions. OPR-N161-RA-06 responds to a request from the Puget Sound Pilots Association to address critical areas and inadequate chart data, and to provide contemporary hydrography with full-bottom coverage in the approaches to Bellingham and Anacortes, including channel anchorage areas that support deep-draft vessel traffic to the ports.

The area seaward of the 8m curve was surveyed with a combination of 100% multi-beam echosounder (MBES) and 200% side scan sonar (SSS) coverage, as described in Section B. In depths less than 8 meters additional MBES coverage was obtained to acquire least depths over significant features or shoals, as appropriate for this survey. Vertical-beam echo sounder (VBES) data were acquired in depths from approximately 1 to 10 meters to define the navigable area limit of Samish Bay and Samish River, aid in the planning of SWMB and SSS data acquisition, and provide inshore bathymetry in navigationally significant areas.

Survey statistics were calculated for each vessel (see Table 1).

Data Acquisition Type	1101	1103	1021	1016	1006	1015	Total
MBES (mainscheme)	-	-	-	33.17	67.65	-	100.82
SSS		-	-	-	-	138.52	138.52
XL (VBES+MBES)	-	-	-	-	6.74		6.74
DEV (VBES+MBES)	-	72.26	-	-	12.28	11.04	95.58
Bottom Sample	-	6	-	-	-	-	6
Number of Feature Investigations	-	7	-	-	-	-	-
Square Nautical Miles	-		-				18.48

Table 1: Statistics for survey H11553.

Limited Shoreline Verification was performed for the survey area.

Data acquisition was conducted from October 26, 2005 through November 8, 2005, and again from October 17, 2006 through November 1, 2006.

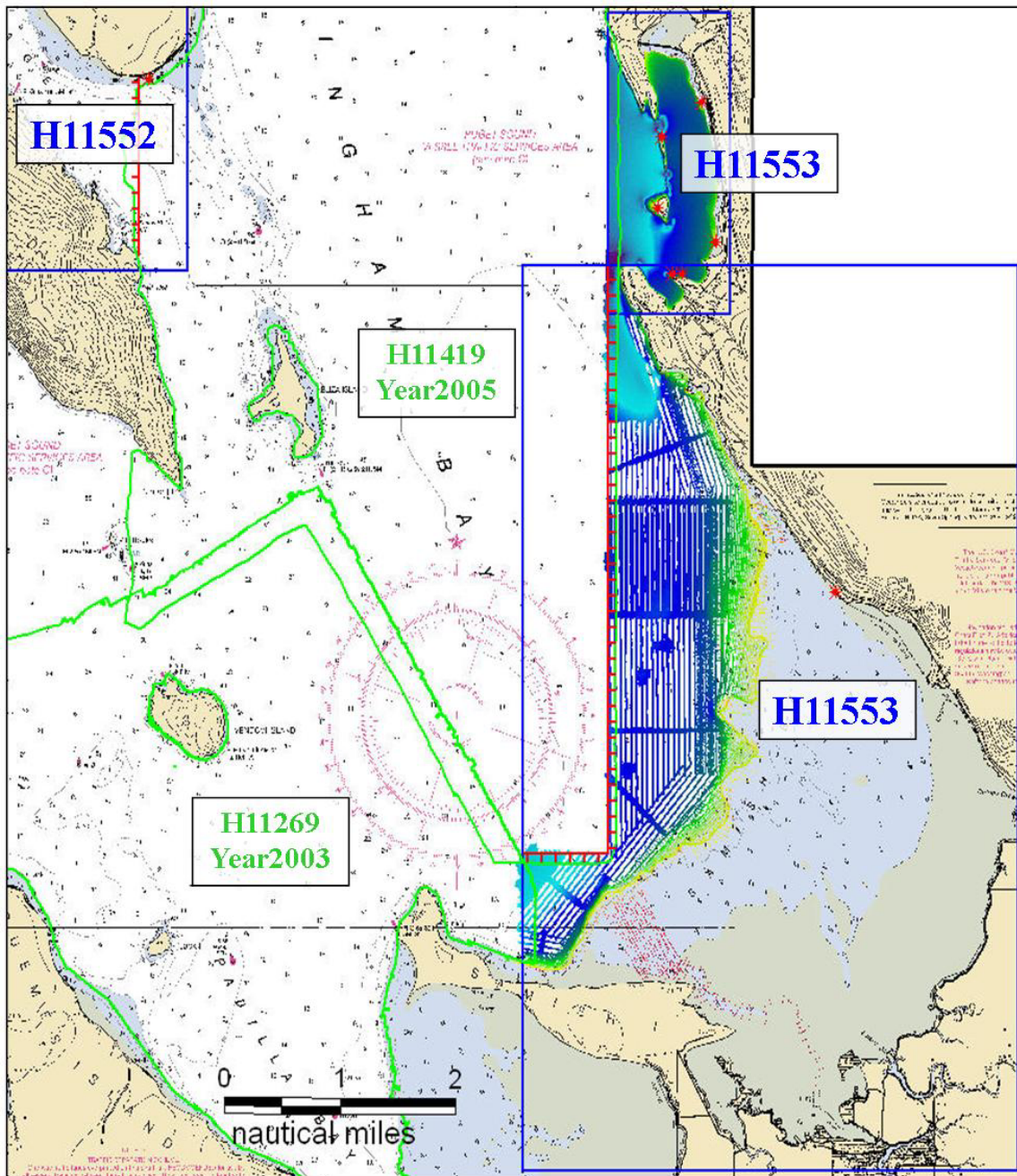


Figure 1: H11553 survey limits and corresponding junction surveys (Chart 18424).

B. DATA ACQUISITION AND PROCESSING

The Chuckanut Bay inset was surveyed with 100% MBES coverage. No inshore VBES coverage was required, as the nearshore bathymetry is steep. This was supplemented with a

SSS buffer along the shoreline to improve object detection in shallow areas where manmade features were observed or may have existed in the past.

In Samish Bay, RAINIER employed a mix of 200% SSS and 100% MBES to most efficiently acquire 100% bottom coverage in depths 4m and greater. Vertical Beam Echo Sounder (VBES) lines at 50m spacing were acquired to define the inshore limit of hydrography in the shallows of the Samish Bay mudflats, and determine the navigable limit of the Samish River Channel. Some areas initially surveyed with 200% SSS required further development due to their rocky or diverse terrain and were therefore covered with 100% SWMB to ensure least depths were acquired on all features hazardous to navigation. The depth regimes in which each technique was used are given in Table 2 and the approximate boundaries of the regions covered with each acquisition system are shown in Figure 2. This change was initiated by the Chief of Party and approved via phone conversation with the Chief, Operations Branch, Hydrographic Surveys Division.

Acquisition System	Depth Regime
200% Side Scan Sonar, with “skunk stripe” MBES bathymetry	Between 18.3m (~10ftm) and 4m
100% Shallow Water Multibeam (SWMB)	Over 18.3m (~10ftm)
Vertical Beam Echo Sounder (VBES)	Between Defining the 4m contour and Samish River Channel

Table 2: H11553 Depth regime for data acquisition in Samish Bay

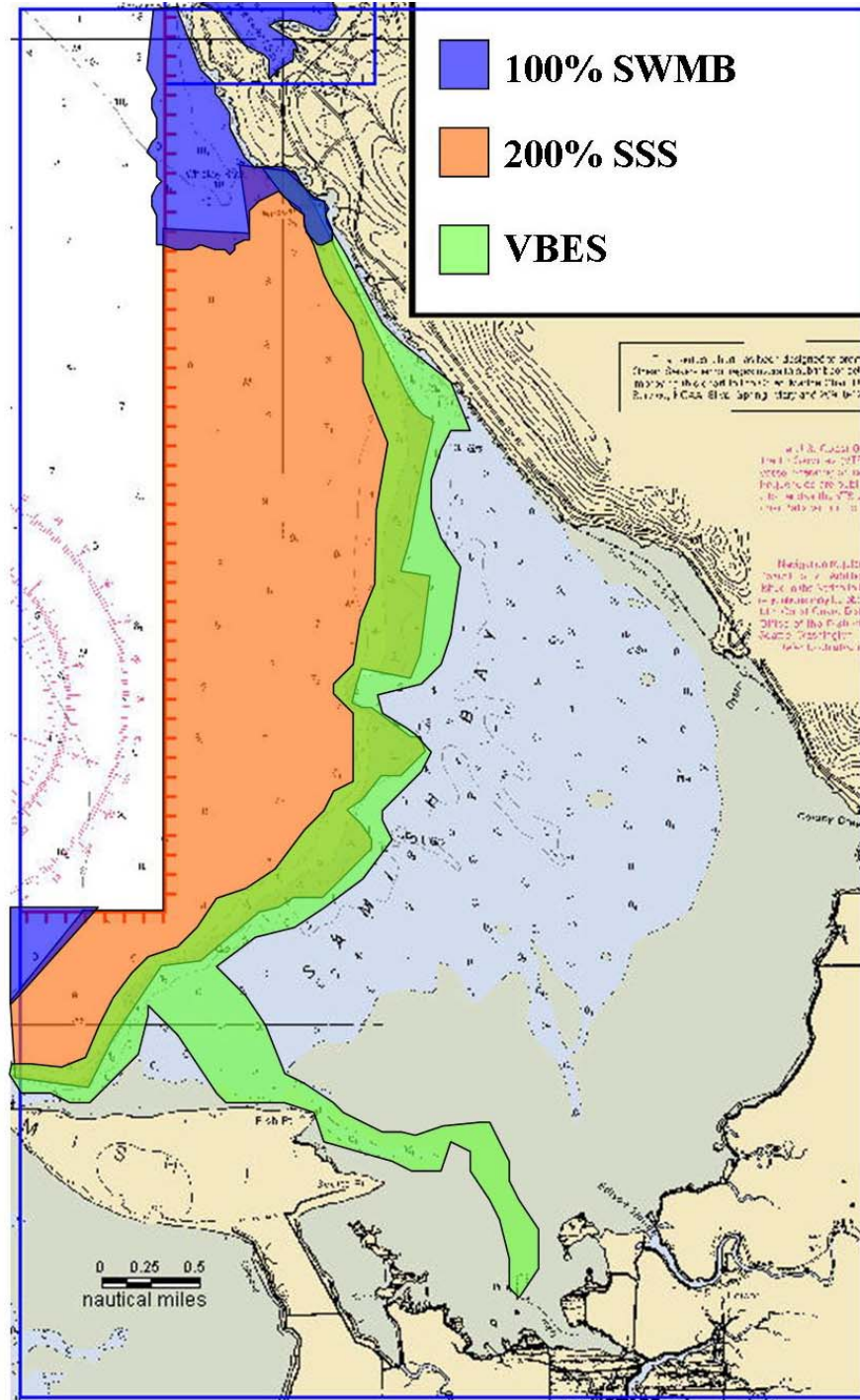


Figure 2: H11553 Acquisition System Boundaries for Samish Bay (Chart 18424).
 Chuckanut Bay was surveyed with 100% SWMB.

A complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods can be found in the *OPR-N161-RA-06 Data Acquisition and Processing Report (DAPR)*², submitted under separate cover. Items specific to this survey, and any deviations from the aforementioned report are discussed in the following sections.

Verified Water Levels with Preliminary Zoning have been applied to this survey. See Section C. for additional information.³

B1. Equipment and Vessels

Data for this survey were acquired by the following vessels:

Hull Number	Name	Acquisition Type
1103	RA-2	Vertical-Beam Echosounder Detached Positions Bottom Samples
1016	RA-4	Multi-Beam Echosounder
1006	RA-5	Multi-Beam Echosounder Detached Positions
1015	RA-6	Multi-Beam Echosounder Side Scan Sonar

Table 3: Data Acquisition Vessels for H11553.

Sound speed profiles were measured with SEACAT SBE-19 and 19+ profilers in accordance with the Specifications and Deliverables.

No unusual vessel configurations were used for data acquisition.

B2. Quality Control

Crosslines

Vertical Beam Echo Sounder (VBES) buffer lines totaled 2.67 nautical miles. The remainder of the buffer lines and all crosslines were run using Shallow-Water-Multi-Beam (SWMB).

Shallow-Water Multi-beam (SWMB) crosslines and buffer lines totaled 19.02 nautical miles. Crosslines made up 6.74 nautical miles of the 19.02, comprising 2.8% of SWMB and SSS hydrography. Crosslines were run in all of Samish Bay, as well as the inshore sections of SWMB data acquired in 2006 in Chuckanut Bay. The majority of SWMB data in Chuckanut Bay was acquired in October and November 2005, and did not include crosslines at the time of acquisition. No crosslines were planned or run over the data collected during the 2005 field season due to hydrographer oversight. The mainscheme bathymetry was manually compared to the available XL nadir beams in CARIS subset mode and agreed with differences averaging no more than approximately 0.2 meters.

A statistical Quality Control Report has been conducted on representative data acquired with each system used on this survey. Results of these tests are included in the updated 2006 Hydrographic System Readiness Review package submitted with this survey.

Junctions

The following contemporary surveys junction with H11553:

<u>Registry #</u>	<u>Scale</u>	<u>Date</u>	<u>Junction side</u>
H11419	10,000	2005	West
H11269	10,000	2003	Southwest

The soundings from H11533 were compared in Subset Editor to adjacent surveys H11419 from OPR-N161-RA-05. Agreement was excellent (within 0.2 m) with little discernable offset in the common area.

The data from H11269 was not available to RAINIER at the time of survey and no comparison was made (see Figure 1)

Data Quality Factors

1015 (RA-6) Dynamic Draft

The majority of the side-scan sonar run by RA-6 was acquired at a speed of 12-14 knots. Elac 1180 MBES bathymetry was acquired in addition to side-scan to provide “skunk stripe” bathymetry. This relatively high speed was determined to meet the requirements of this survey, as the Klein 5500 high speed, high resolution side scan sonar provided object detection capability while the Elac 1180 determined bathymetry. As described above, all significant features detected by SSS were further investigated by high resolution shallow water multibeam sonar.

Multibeam sonar data acquisition at these speeds was not anticipated when vessel 1015’s dynamic draft properties were measured and correctors generated in Spring 2006. As a result, the maximum speed in the dynamic draft table in 1015’s the Hydrographic Vessel File (HVF) is approximately 9 knots (4.7 m/s). For the high speed data acquired on survey H11553, CARIS HIPS incorrectly extrapolated dynamic draft correctors from the entered values. The result was a discernable vertical offset (approximately 0.2m) in the data when compared to bathymetry acquired with other vessels (see Figure 3).

The hydrographer addressed this issue by extrapolating an additional corrector data point (-0.38m at 7m/s, or 13.6kts) from the experimental values. This value follows the trend of the measured dynamic draft data, is in line with Jensen survey launch historical measurements, and was empirically shown to reduce the error in H11553 Elac 1180 bathymetric data to less than 0.1m. A new HVF (“1015_Elac1180_HV_ExtendedDraft.hvf”) was created, and **all** Elac lines were re-imported and processed using the new configuration.

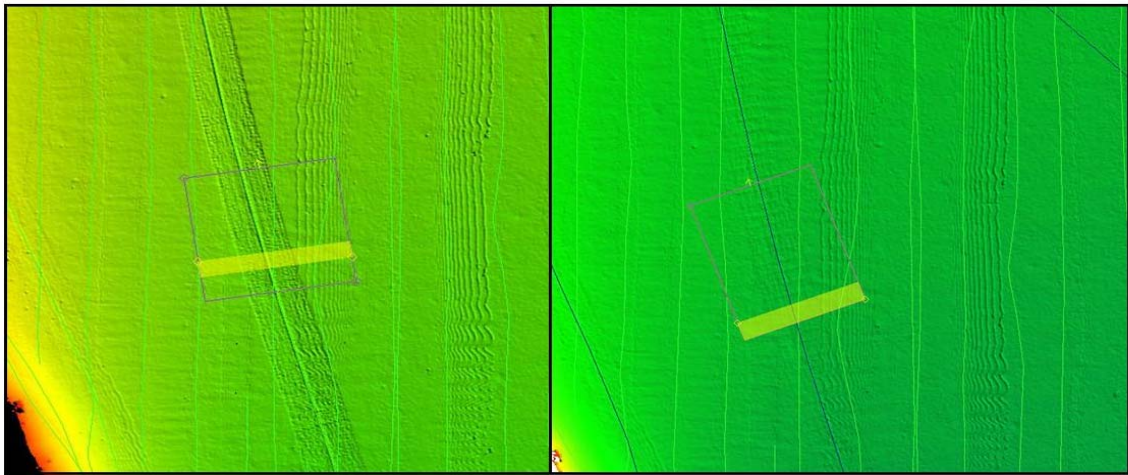


Figure 3: Resulting CUBE surface before (left) and after (right) vessel 1015 (RA-6) configuration file correction for dynamic draft.

“Noisy” Bathymetry

The Elac 1180 is the primary source of bathymetry in the areas of Samish Bay covered by 200% SSS. Due to the resolution limitations of the Elac multibeam system, these areas are generally noisier than in other parts of the survey. CUBE resolves these surfaces fairly well with an error no greater than 0.2m.

Noisy bathymetry was also encountered in the 100% multibeam coverage in an area 600m west of Whiskey Rock (see Figure 4). The noise is attributed to an unusual amount of fishing boats and aquatic life, including fish balls visible on SSS. The data was cleaned extensively and the surfaces resolved to IHO standards of error less than 0.25m.

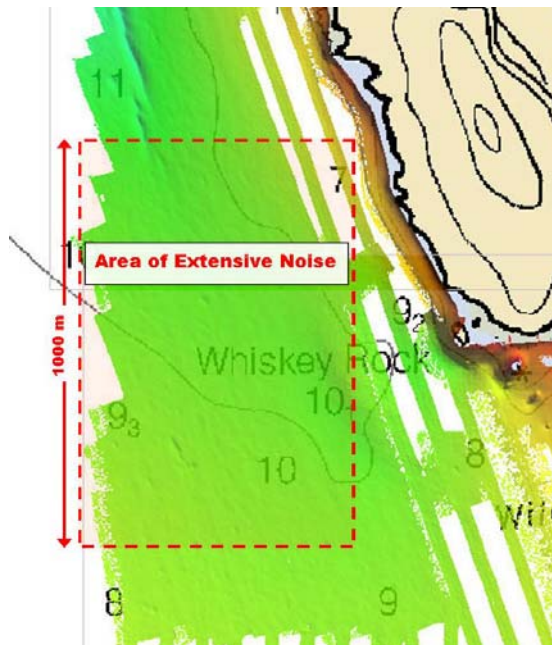


Figure 4: Area of extensive noise around Whiskey Rock

Multibeam Holidays

There are small holidays in the 100% multibeam coverage. Attempts were made to re-accept data to fill in the holidays, but not all could be appropriately filled in. The holidays varied in size, with the largest one approximately 560m². The only holiday occurring over a shoal occurred in SE Chuckanut Bay at approximately 48° 40.4'N 122° 29.5'W (see Figure 5). Analysis of the bathymetry in CARIS HIPS Subset Mode indicates that this gap occurs in the acoustic shadow of the outcrop, and the least depth was accurately surveyed. The hydrographer recommends that survey soundings supersede all prior survey and charted depths in the common area despite these coverage gaps.⁴

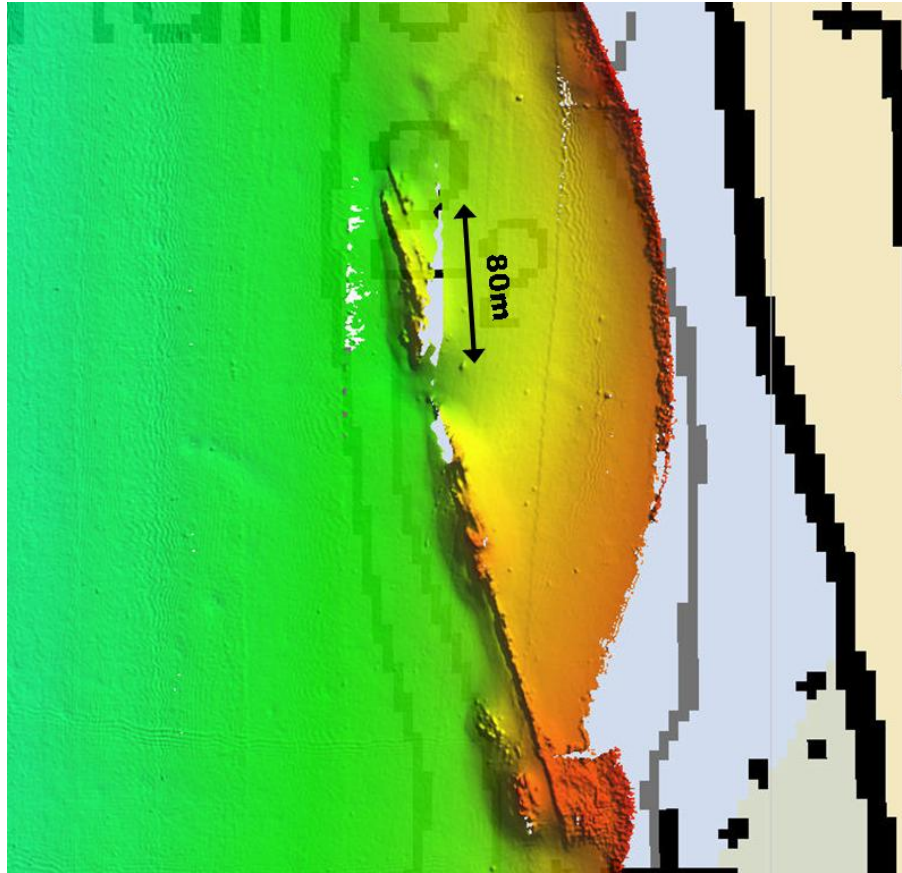


Figure 5: Holidays in the 100% multibeam coverage showing evidence of shoaling

Side-Scan Holidays

There are also holidays in the 100% (Figure 6) and 200% (Figure 7) side-scan coverage. The largest holiday can be seen in the in the 200% side-scan mosaic. Lines were planned for full 200% coverage in this area but were run by the launch crews as continuations of 100% lines to improve acquisition efficiency. As a result, the 100% mosaic has greater than 100% coverage of this area, while the 200% mosaic shows a holiday (see Figure 7). Separating the offending lines into their 100% and 200% SSS components would have required splitting the original raw data files into multiple segments. The hydrographer determined that separating the data would not contribute to a safer product, and is confident that the area is surveyed to the required specification and is free of obstructions.⁵

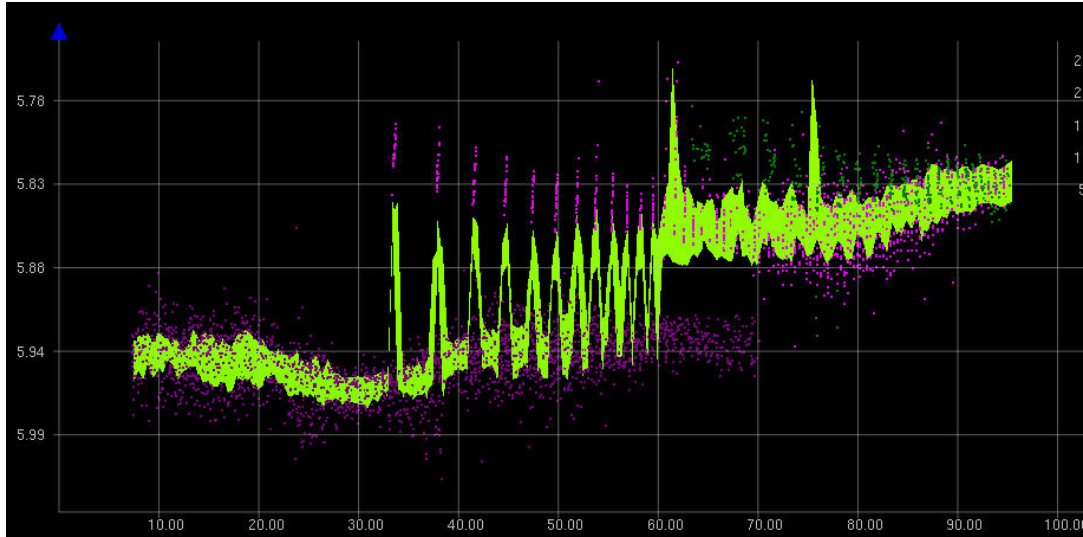


Figure 9: Data offset causing the CUBE surface to bounce back and forth between the two different years of data. The soundings on the lower left are from 2005 and the values in the upper right are from 2006.

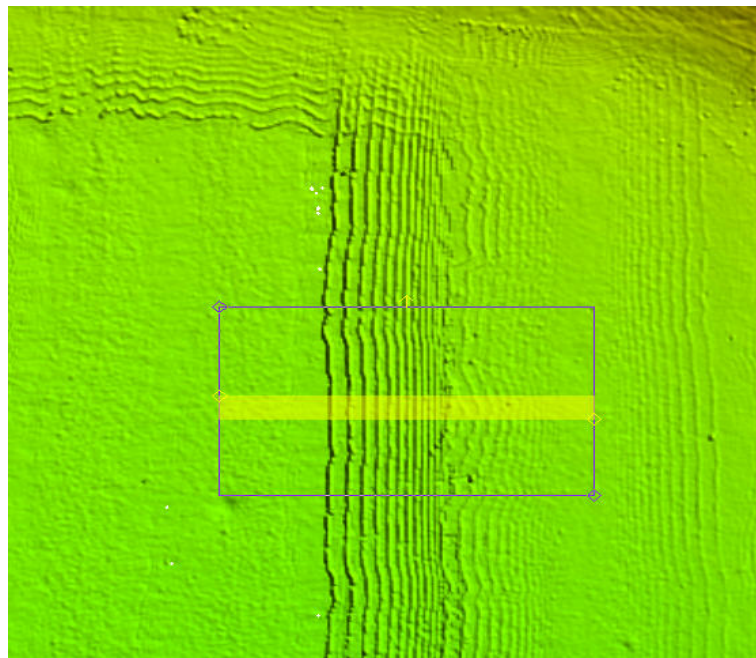


Figure 10: Data offset causing the CUBE surface to bounce back and forth between the two different years of data. This creates a ripple or corduroy effect.

Eel Grass

There are substantial areas of eel grass in the eastern Chuckanut Bay area just inshore of the 4m curve (see Figures 11 and 12). In some cases where there was a discernable bottom beneath the vegetation, the eel grass noise was removed and the CUBE surface updated to reflect the actual bottom depth. However, in the majority of eel grass areas, there was no discernable bottom. The noisy soundings were not cleaned and the CUBE surface is shoaler than the actual bottom depth. These areas were all inside the 4m curve.

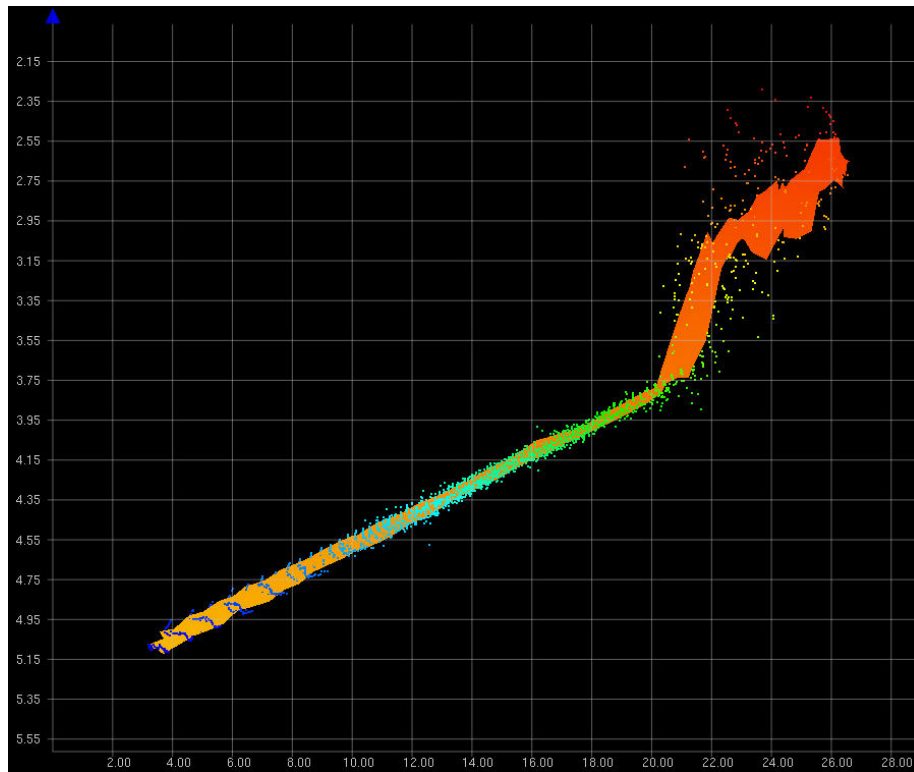


Figure 11: Eel grass soundings causing the surface to be shoaler

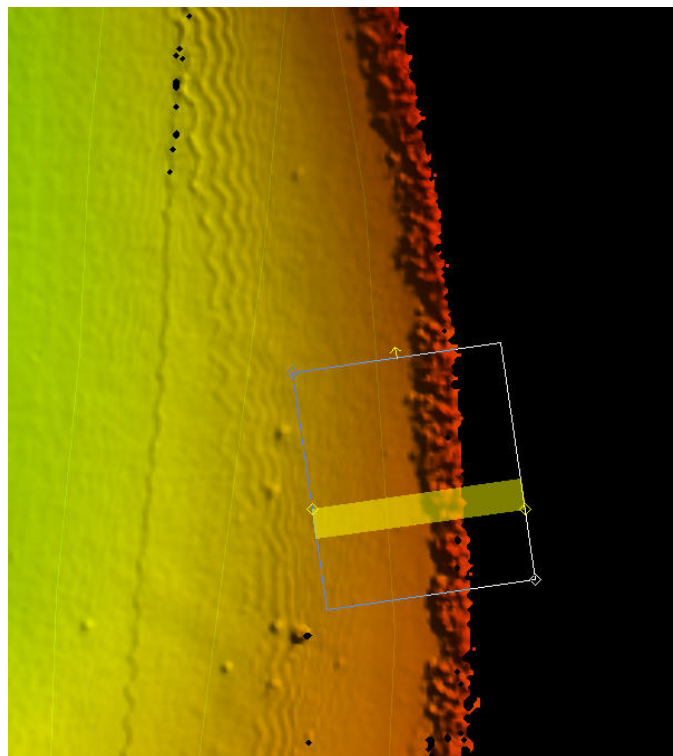


Figure 12: Eel grass affected bottom inshore of the 4m curve

B3. Data Reduction

Data reduction procedures for survey H11553 conforms to those detailed in the *OPR-N161-RA-06 DAPR*.

Note that a finalized CARIS BASE surface cannot include negative soundings. Lines of VBES hydrography were run at high tide through the Samish River channel. After correction for water levels, some soundings were found to have negative depths (i.e., elevations above MLLW). Under the current process, these cannot be portrayed in the finalized BASE surface, so an apparent data gap appears⁹. If these soundings are needed, please see the original HDCS data.

B4. Data Representation

Many BASE surfaces were used in processing H11553. Final CUBE surface resolutions and depth ranges were set in accordance with the Field Procedures, with field sheets smaller than 25×10^6 nodes. The submission Field Sheet structure is shown in Figure 13 and the Field Sheet layout is shown in Figure 14.¹⁰

Side-scan sonar data was split into two complete coverage mosaics to demonstrate areas covered by this technique. These mosaics were created at 2m resolution and named “H11553_SSS_100%” and “H11553_SSS_200%” (see Figure 15).

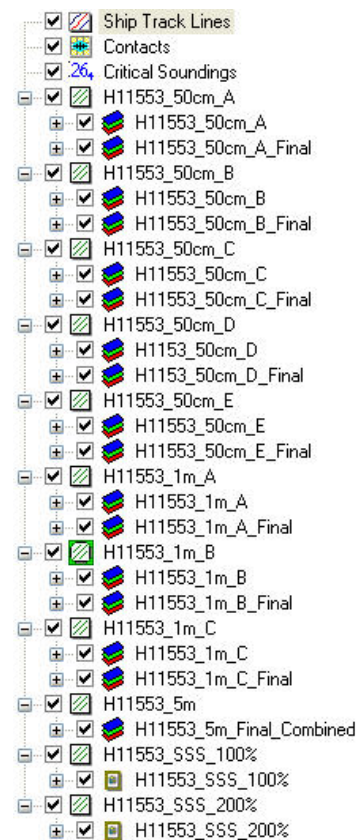


Figure 13: Field sheets, BASE surfaces, and side-scan sonar mosaics submitted with H11553.

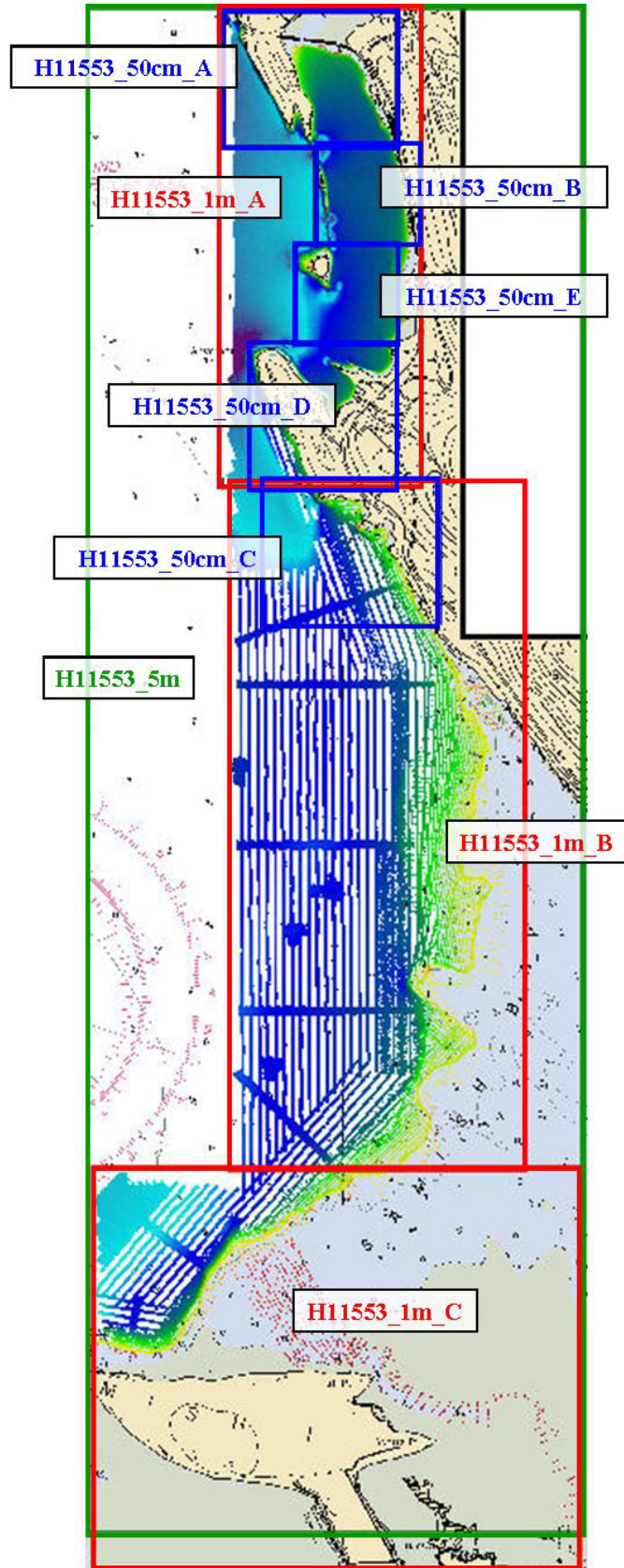


Figure 14: Layout of field sheets and CUBE surfaces for H11553

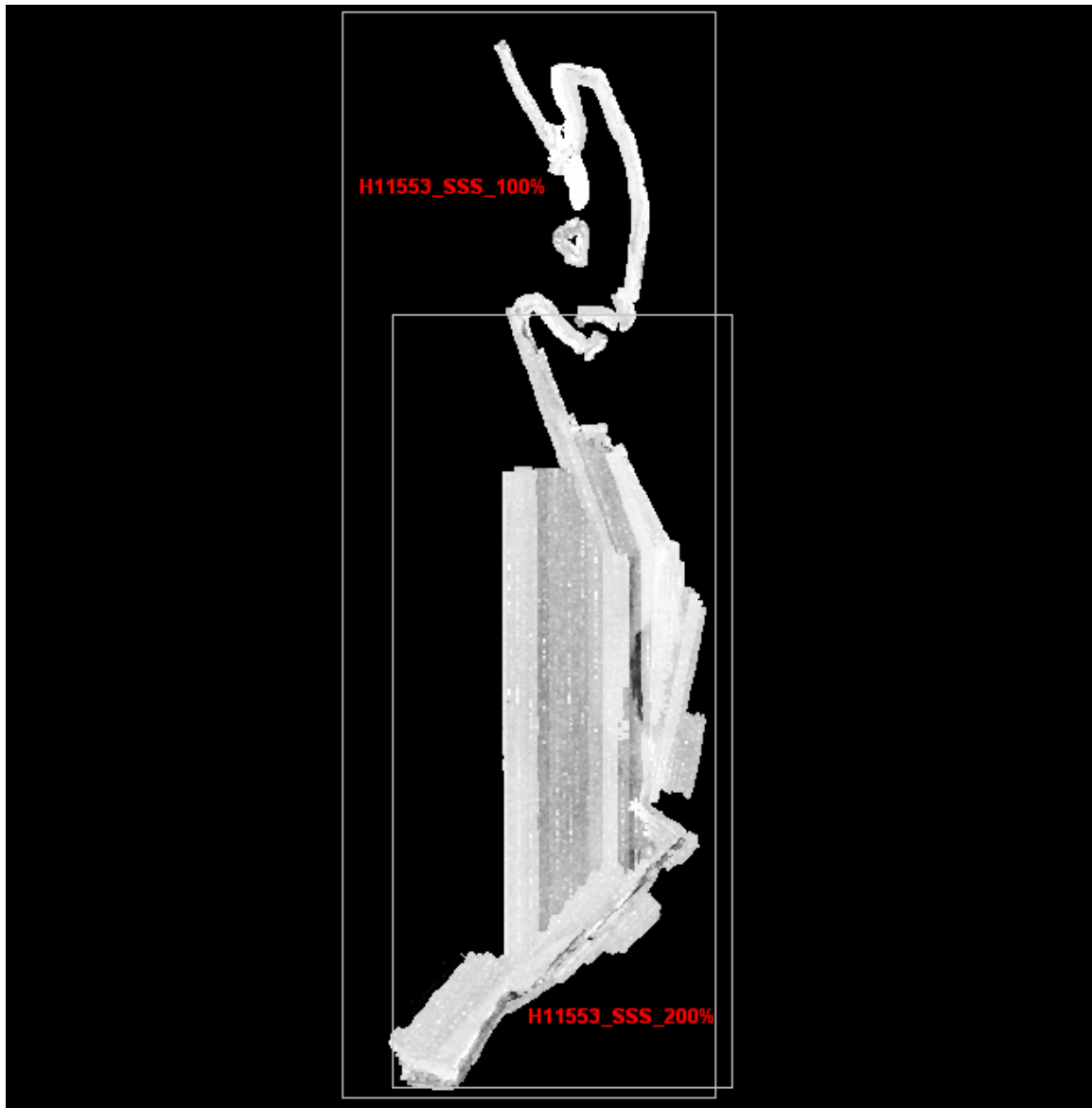


Figure 15: Layout of side-scan sonar mosaics for survey H11553

Soundings and contours were generated in CARIS HIPS from the final combined BASE surface for field unit review purposes. They are included for reference only and are not intended as a deliverable.

C. VERTICAL AND HORIZONTAL CONTROL

Project OPR-N161-RA-06 did not require static GPS observations or other horizontal control work, and all tide corrections were generated from CO-OPS maintained tide stations. Thus, no Horizontal and Vertical Control Report will be submitted.¹¹

Horizontal Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Differential GPS (DGPS) was the sole method of positioning. The differential corrector beacons utilized for this survey are given in Table 4.

Location	Frequency	Operator	Distance	Priority
Whidbey Island, WA	302kHz	USCG	25nm	Primary
Amphritrite Pt., BC	315kHz	CCG	200nm	Backup

Table 4: Differential Corrector Sources for H11553.

Vertical Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). The operating National Water Level Observation Network (NWLON) tide stations at Friday Harbor, WA (944-9880) and Cherry Point, WA (944-9424) served as controls for datum determination and sources for water level reducers for survey H11553.

No tertiary gauges were required.

The requests for Final Approved Water Levels for H11553 were submitted to CO-OPS on November 02, 2006, and the Final Tide Note was received on November 27, 2006. However, complete **verified observed water levels** were **not** available for Cherry Point, WA (944-9424). Missing from the verified observed water levels was data for November 1-2, 2006.

As a result, all data was reduced to MLLW using **verified observed water levels** from only Friday Harbor, WA (944-9880) using the tide files 9449880.tid. The time and height correctors were applied from the **preliminary** zone corrector file H11553CORP.zdf which uses only water levels from Friday Harbor, WA (944-9880)

The Pacific Hydrographic Branch will apply final approved water levels to the survey data during final processing.¹²

D. RESULTS AND RECOMMENDATIONS

D.1. Chart Comparison

D.1.a. Survey Agreement with Chart

Electronic Navigational Chart Comparison

Survey H11553 was compared with the vector chart US5WA45M with Notice to Mariners applied through 11/01/2006. All charted depths agree well with discrepancies no greater than 0.5 fathoms with the exception of the area west of Wildcat Cove. The western shelf (48° 39.2'N 122° 29.9'W) extends approximately 40m farther to the west than charted (see Figure

16). The hydrographer recommends that survey soundings supersede all charted and prior survey data in the common area.¹³

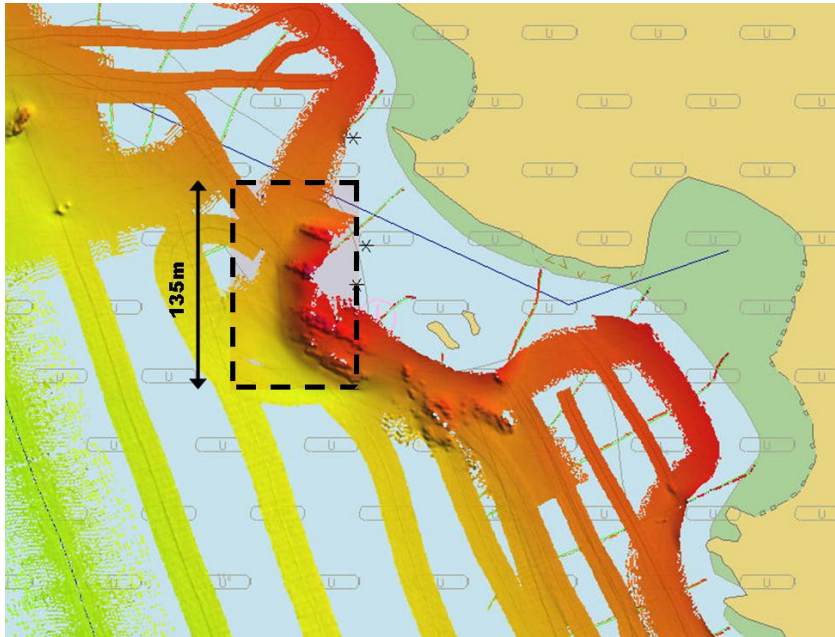


Figure 16: Wildcat Cove extended ledge area not portrayed correctly on chart US5WA45M

Raster Comparison

Survey H11553 was compared with the following raster charts:

Chart	Scale	Edition and Date	Notice to Mariners Applied Through
18424	1:40,000	26/04	11/01/06
18421	1:80,000	46/06	11/01/06
18007	1:200,000	32/05	11/01/06
18400	1:200,000	48/05	11/01/06

Table 5: Charts compared with H11553

Shoreline and features depicted on raster charts were found up to 40m from their charted positions. This is in contrast to the Electronic Navigational Chart (ENC), which agreed well with the survey (as discussed above). Specific examples of raster chart positioning errors are described below:

Chart 18424¹⁴

This is the primary chart (1:40,000) used for navigation of the area. All charted depths agree well with discrepancies no greater than 0.5 fathoms.

There is an apparent datum shift of approximately 20m in the north portion of Pleasant Bay in position 48° 40.1'N 122° 30.0'W (see Figure 17), and approximately 25m at Chuckanut Rock in position 48° 41.1'N 122° 30.1'W (see Figure 18).

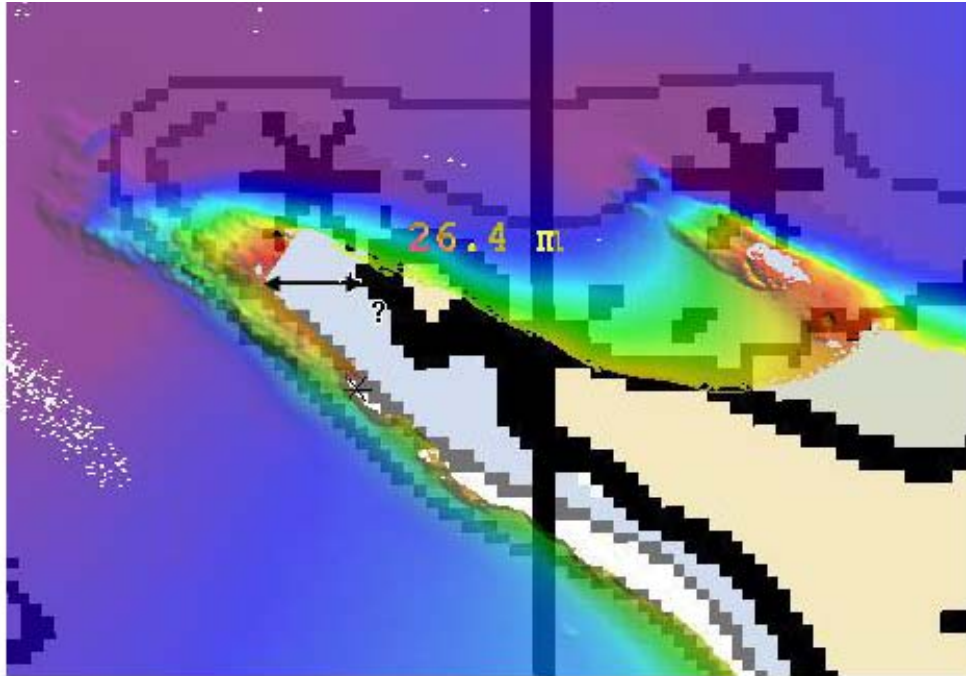


Figure 17: North Point of Pleasant Bay apparent datum shift

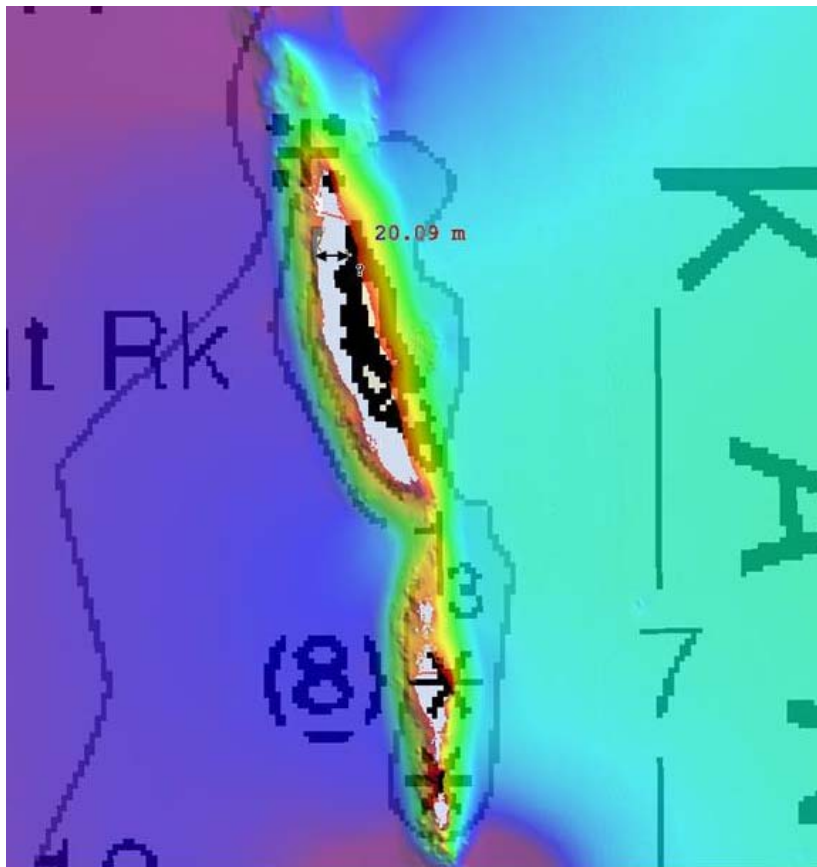


Figure 18: Chuckanut Rock apparent datum shift

Other areas that exhibit chart discrepancies:

1. Whiskey Rock ($48^{\circ} 39.3'N$ $122^{\circ} 30.2'W$), is incorrectly positioned and the surrounding area needs to be updated with bathymetry (see Figure 19)
2. The rock ($48^{\circ} 39.3'N$ $122^{\circ} 30.1'W$) southeast of Whiskey Rock, is charted with a position that is shifted by 20m to the southeast (see Figure 19)
3. In Wildcat Cove ($48^{\circ} 39.2'N$ $122^{\circ} 29.9'W$), the western shelf extends approximately 40m farther to the west than what is charted and needs to be updated with bathymetry (see Figure 20)
4. The point ($48^{\circ} 41.3'N$ $122^{\circ} 30.2'W$) north of Chuckanut Rock, is charted incorrectly and needs to be updated with bathymetry (see Figure 21)

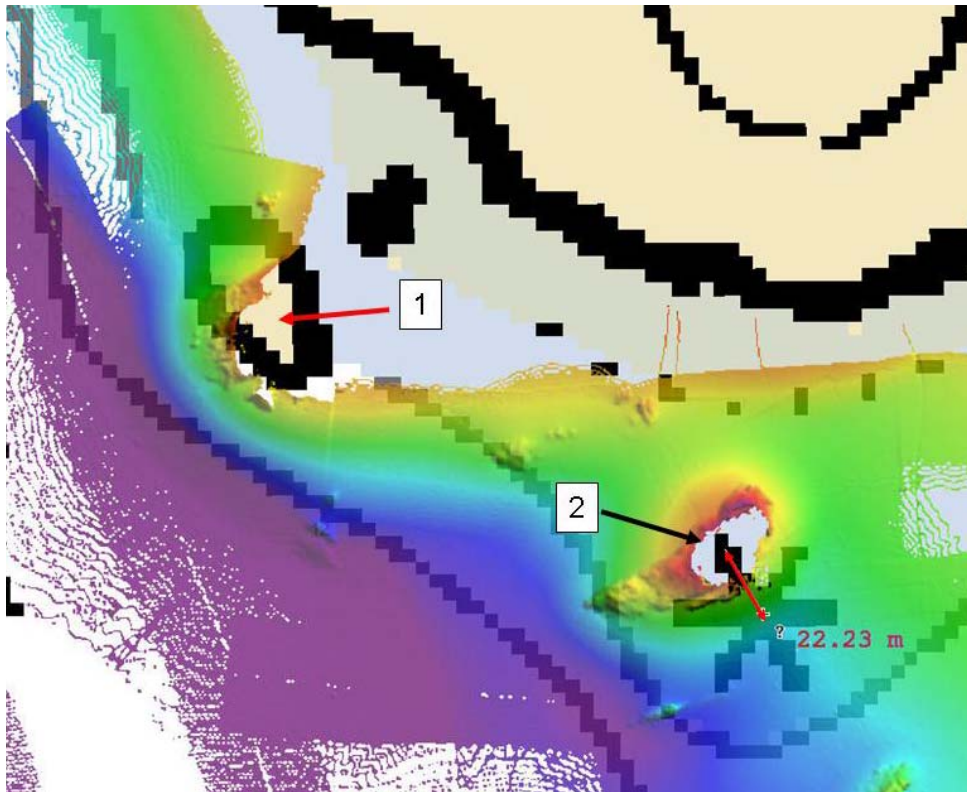


Figure 19: Whiskey Rock area chart discrepancies

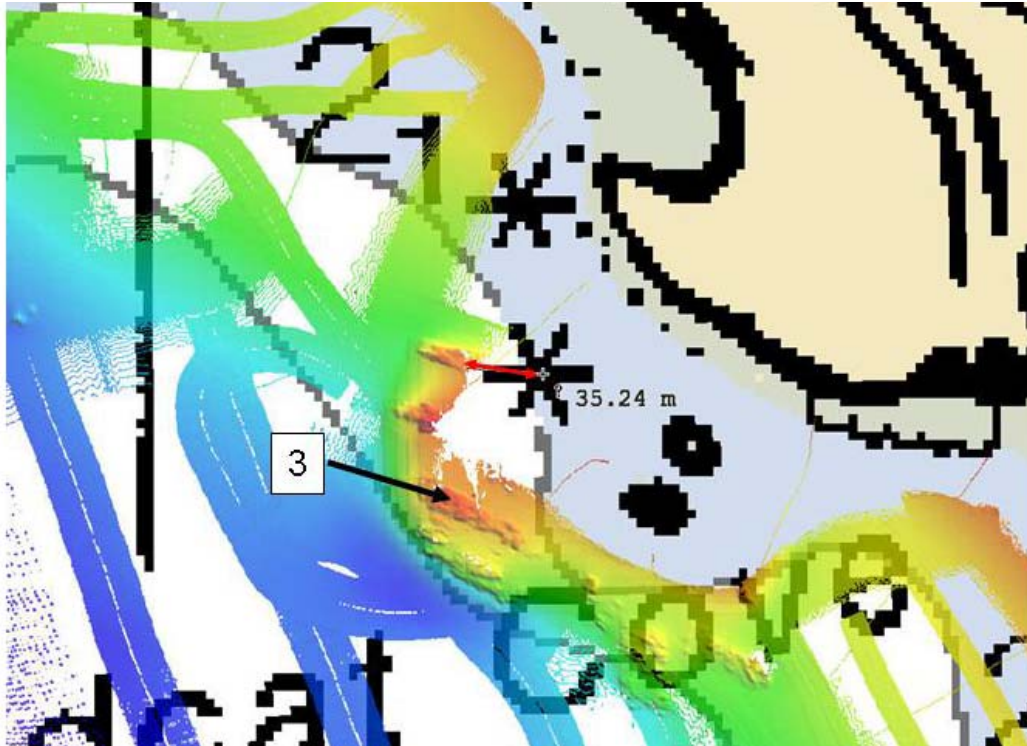


Figure 20: Wildcat Cove extended ledge area¹⁵

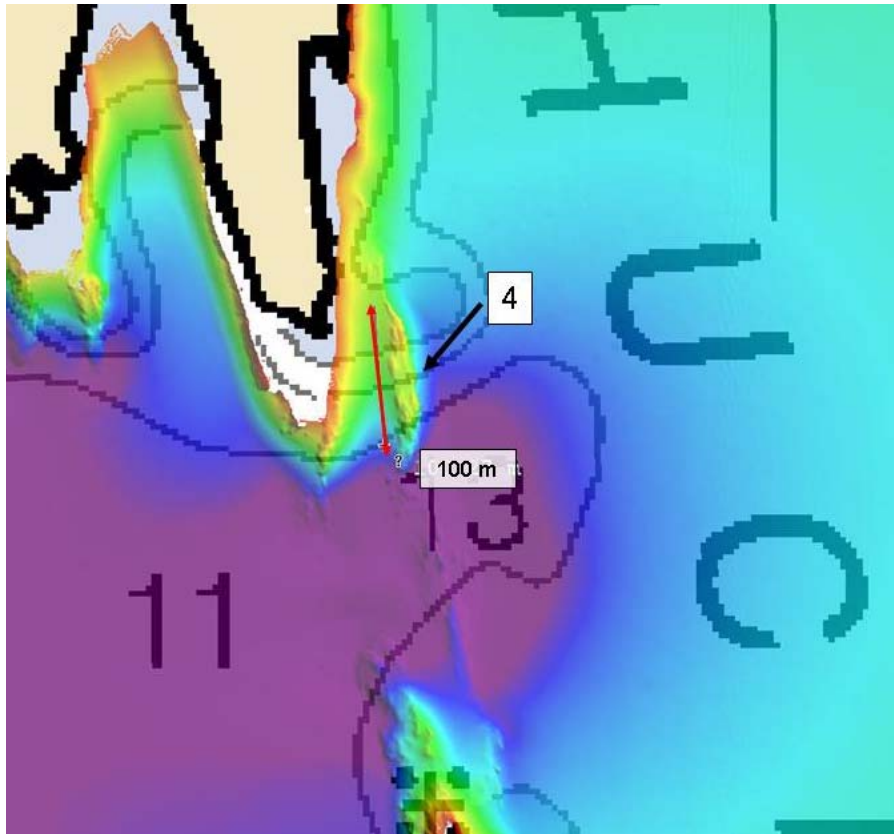


Figure 21: Point north of Chuckanut Rock chart discrepancy

Chart 18421¹⁶

This chart is intended for coastal navigation in Bellingham Bay and surrounding areas. All charted depths agree well with discrepancies no greater than 0.5 fathoms.

There is an apparent datum shift of approximately 20m in the north point of Pleasant Bay (see Figure 22) in the location of $48^{\circ} 40.1'N$ $122^{\circ} 30.0'W$.

Other areas that exhibit chart discrepancies:

1. Whiskey Rock ($48^{\circ} 39.3'N$ $122^{\circ} 30.2'W$) is incorrectly positioned and the surrounding area needs to be updated with bathymetry (see Figure 23)
2. Rock ($48^{\circ} 39.3'N$ $122^{\circ} 30.1'W$) southeast of Whiskey Rock, charted position is shifted by 20m to the southeast (see Figure 23)

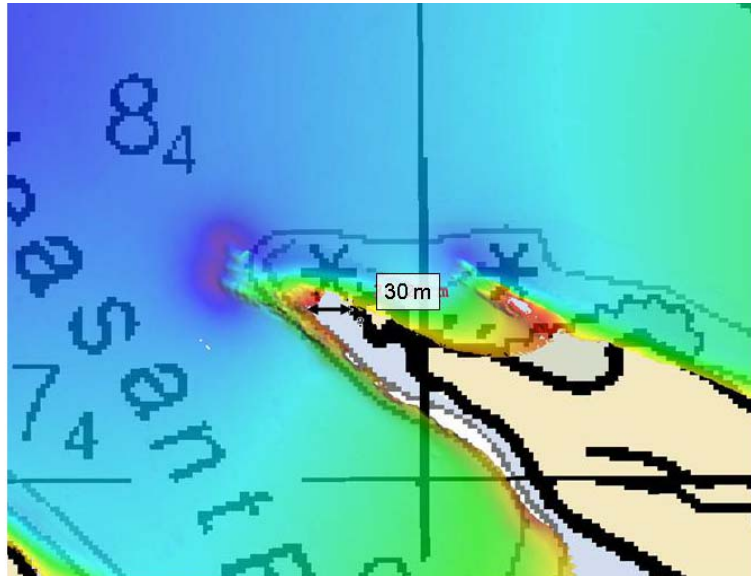


Figure 22: North Point of Pleasant Bay apparent datum shift

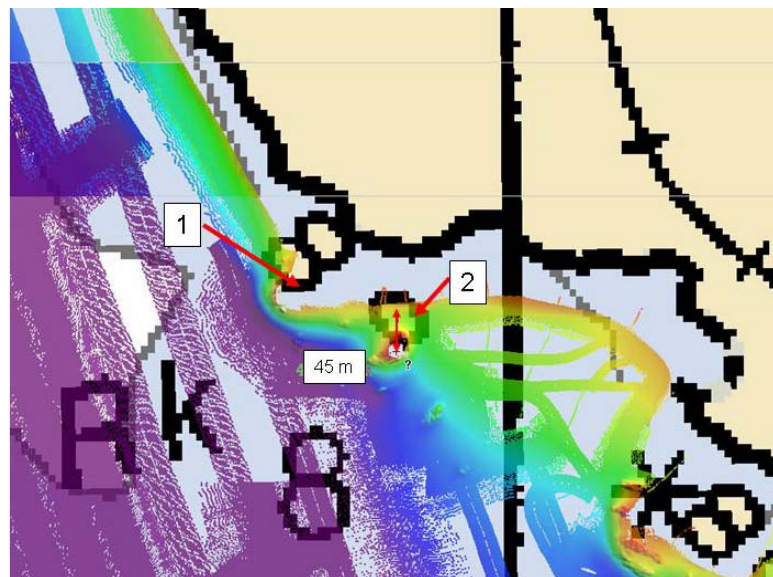


Figure 23: Whiskey Rock area chart discrepancies

Chart 18007, Chart 18400

Charts 18007 and 18400 (1:200,000) are small-scale charts and are not intended for coastal navigation. No chart discrepancies were noted.¹⁷

D.1.b. Dangers to Navigation

No dangers to navigation (DTONs) were found in survey H11553.¹⁸

D.1.c. Other Features

Additional features investigated within the limits of H11553 are described in the Survey Feature Report in Appendix II.¹⁹

Automated Wreck and Obstruction Information System (AWOIS) Investigations²⁰

Seven (7) AWOIS items fall within the survey limits of H11553 and were assigned for full investigation. AWOIS item #53513 was not investigated due to its proximity to shore. Descriptions of each AWOIS item investigation are included in the Survey Feature Report in Appendix II.

Samish River

The Samish River (see Figure 24) is an area used by local fisherman, recreational boaters and oyster farmers. The entrance to the river is clearly marked by several uncharted private channel markers that are included in the Survey Feature Report in Appendix II. Bathymetric profiles of the river channel were acquired with VBES at 100m line spacing. The hydrographer recommends that the chart be updated to include the river channel and the corresponding aids to navigation. However, it should be noted that due to the depth and changing nature of the channel, mariners should use extreme caution and local knowledge.²¹

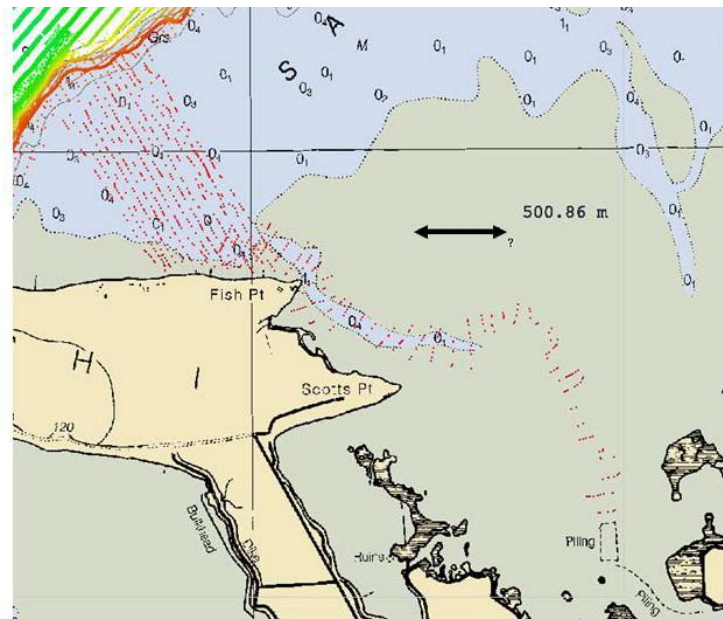


Figure 24: Samish River at the southern end of Samish Bay

Possible wreck south of Wildcat Cove

A small object, possibly a wreck (48° 39.1'N 122° 29.7'W) was found in the area just south of Wildcat Cove. It lies in 5.5m of water with a least depth of 4.5m and a length of 7m (see Figure 25). It is not a danger to navigation due to its proximity to the shoreline.²² It was not discovered until acquisition was completed and no additional investigations were made.

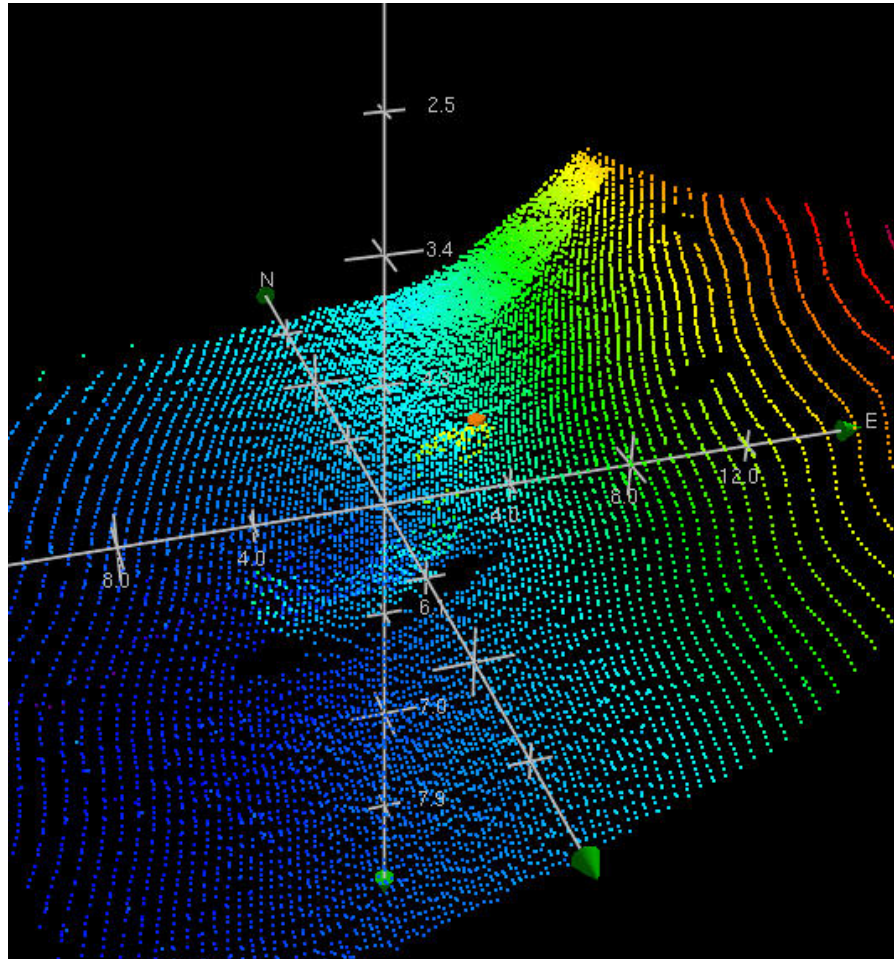


Figure 25: Small wreck near Wildcat Cove

D.2. Additional Results

D.2.a. Prior Survey Comparison

Prior survey comparison with H11553 was not performed.

D.2.b. Shoreline Verification

Shoreline Source

The single source for shoreline was the ENC cell US5WA45M, which was compiled from the most current RSD Digital Cartographic Feature Files (DCFF). Shoreline features contained on the ENC were selected according to the procedure described in the *OPR-N161-RA-06 Data*

Acquisition and Processing Report. This source data was printed on paper “boat sheets” and displayed in Hypack for field verification.

Shoreline Verification

A zero or negative tide window did not occur during daylight hours throughout the acquisition of this survey. Shoreline verification was performed during the lowest available daylight tides.

Detached positions (DPs) acquired during shoreline verification were recorded in HYPACK and on DP forms, and then processed in Pydro. These indicate revisions to features and features not found on the verified shoreline. In addition, annotations describing shoreline were recorded on hard copy plots of digital shoreline. DP forms are included in the *Separates to be Included with Survey Data*.²³

All shoreline data is submitted in CARIS Notebook .hob files. The session *H11553_Notebook.hsf* contains the following:

HOB File	Purpose and Contents
H11553_Comp_Source.hob	Original Source Data as filtered from ENC cell US5WA45M
H11553_Reference.hob	Survey outline and limit lines, and AWOIS item positions and radii.
H11553_Field_Verified_Comp Source.hob	Field verified source features and shoreline, including edits and updates not requiring DPs.
H11553_Pydro_Updates.hob	New or modified items processed through Pydro.
H11553_Pydro_Disprovals.hob	Deleted items processed through Pydro.

Table 6. List and Description of Notebook HOB files.

The combination of *Pydro_Updates.hob* and *Field_Verified_Comp_Source.hob* layers depict the shoreline as surveyed. *Pydro_Updates.hob* is the combination of *modify*, *add*, and *none* layers exported from Pydro. *Pydro_Disprovals.hob* is the *CartoActionDelete* layer exported from Pydro. The *Field_Verified_Comp_Source.hob* reflects unchanged features that were noted in the field, and also includes a *Marker* layer with hydrographer notes.

Source Shoreline Changes and New Features

Items for survey H11553 that require further discussion and are associated with a detached position have been flagged “Report” in Pydro in *H11553.pss*. Investigation methods and recommendations are listed in the *Remarks and Recommendation* tabs. These features are included in the *Survey Feature Report* in Appendix II.²⁴

Recommendations

The Hydrographer recommends that the shoreline as depicted in the Notebook .HOB files supersede and complement shoreline information compiled on the raster and vector charts as described above.²⁵

D.2.c. Aids to Navigation

There are several private aids to navigation marking the entrance to the Samish River channel. They are previously uncharted (18424). Private aids also mark the river channel through the mudflats. These markers vary in type – including piles, stakes, and hunting blinds. ²⁶ See Survey Feature Report in Appendix II for more details. ²⁷

D.2.d. Overhead Features

A railroad trestle crosses the north end of Chuckanut Bay. The main span is approximately 6m wide, and overhead clearance was estimated to be 1.5m above MHW. Exact dimensions were not surveyed. Although the extreme north end of the bay appears to be navigable by very small craft, none were observed to transit this area while RAINIER and her launches were operating in the area.

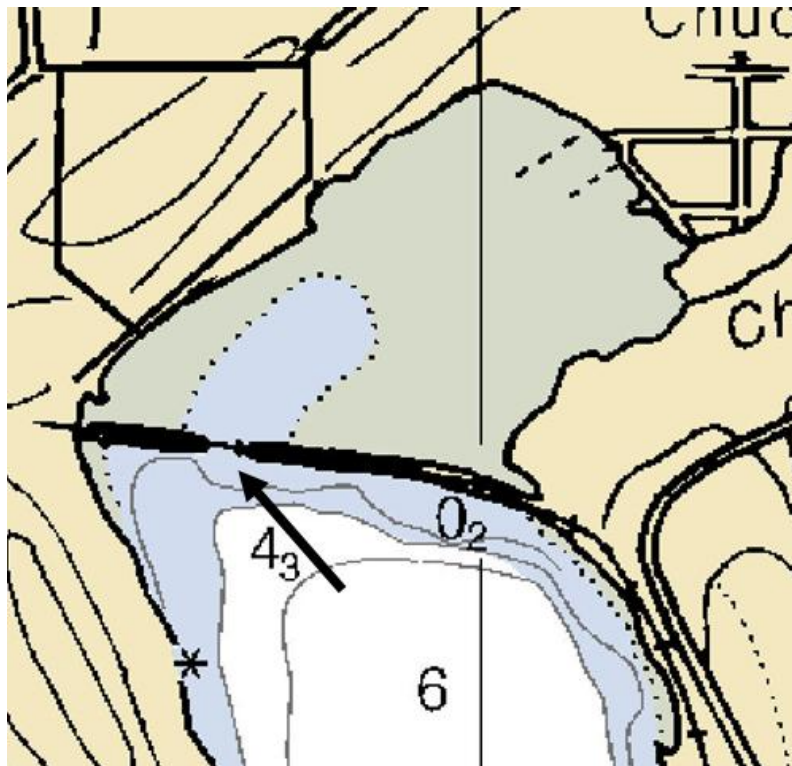


Figure 26: Railroad Bridge at the north end of Chuckanut Bay

D.2.e. Submarine Cables and Pipelines

No submarine cables or pipelines are charted within the limits of H11553, and none were noted during review of survey bathymetry and imagery. ²⁸

D.2.f. Ferry Routes

There are no charted ferry routes within the limits of survey H11553, and no ferries were observed to be operating in the survey area.²⁹

D.2.g. Bottom Samples

Six (6) bottom samples were collected in survey H11553 in accordance with the Field Procedures Manual for depth, spacing, and possible anchorages. Four of the samples were collected from areas with charted bottom characteristics. All samples agreed well with previously charted bottom types. Two additional samples were obtained in Chuckanut Bay in potential anchorage areas that were not previously charted.³⁰ Details of bottom characteristics from obtained samples can be found in the Survey Feature Report in Appendix II.

D.2.h. Other Findings

NOAA Ship RAINIER found good anchorage with sticky mud approximately 0.25nm NW of Governor's Point and W of Chuckanut Island. Prevalent SE 40 knot winds were common in the fall of 2005 and holding ground was good in this weather.

E. ADDITIONAL DOCUMENTATION

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>
Data Acquisition and Processing Report for OPR-N161-RA-06	TBD	N/CS34
Tides and Water Levels Package for OPR- N161-RA-06 ³¹	11/29/2006	N/OPS1
Coast Pilot Report for OPR- N161-RA-06 ³²	12/12/2006	N/CS26



**UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration**

Office of Marine and Aviation Operations
NOAA Ship RAINIER (S221)
1801 Fairview Ave E, Seattle, WA 98102

December 22, 2006

MEMORANDUM FOR: CDR Donald W. Haines, NOAA
Chief, Pacific Hydrographic Branch


FROM: CDR Guy T. Noll, NOAA
Commanding Officer


Guy Noll
Digitally signed by Guy Noll
DN: cn=Guy Noll, c=US, o=Command,
ou=NOAA Ship RAINIER, email=Guy.
Noll@NOAA.GOV
Reason: I am approving this document
Date: 2007.01.30 13:32:51 -08'00'


SUBJECT: Approval of Hydrographic Survey H11553

Field operations for hydrographic survey H11553 were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports. The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, Standing and Letter Instructions, and HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required. All data and reports are respectfully submitted to N/CS34, Pacific Hydrographic Branch.

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

Survey Sheet Manager:  2006.12.22
19:34:53 Z
Nathan Eldridge
Ensign, NOAA

Chief Survey Technician:  James B Jacobson
2007.01.18
17:08:22 Z
James B. Jacobson
Chief Survey Technician, NOAA Ship RAINIER

Field Operations Officer:  LT Benjamin K. Evans,
NOAA
2006.12.22 22:07:10 Z
Benjamin K. Evans
Lieutenant, NOAA



Revisions Compiled During Office Processing and Certification

¹ Standing Instructions for Hydrographic Surveys (January 2006), NOS Hydrographic Surveys Specifications and Deliverables (June 2006), OCS Field Procedures Manual for Hydrographic Surveying (May 2006), and all Hydrographic Surveys Technical Directives issued through November 1, 2006. Filed with the project records.

² Filed with the project records.

³ Final Approved Water Levels applied by office during Survey Acceptance Review.

⁴ Concur

⁵ Concur

⁶ Concur

⁷ Appended to this report.

⁸ With the application of Final Approved Water Levels at PHB the offset remains in the data. The maximum offset of 0.2 meters, when combined with the uncertainty reflected in the final combined surface, does not exceed the allowable IHO order 1 error of 0.5 meters and should be accepted

⁹ New surfaces were created in the office for compilation which includes negative soundings.

¹⁰ A new 2m finalized surface was created during office processing to better represent the data for compilation.

¹¹ Concur

¹² Concur. Final approved zone corrector file H11553CORP.zdf applied during office processing.

¹³ Concur

¹⁴ HCell compiled to current edition of Chart H18424, 27th ed., Dec.06, NM 02/06.

Compilation concurs with chart comparison with the exception of discrepancies 1-2 listed which have been corrected on current edition. Chart should be updated per HCell.

¹⁵ Concur with clarification: feature is submerged rocky outcropping, not a ledge. Chart as depicted in HCell as Rocky Seabed area and adjust contours as appropriate.

¹⁶ Current edition of Chart H18421, 49th ed., Feb. 08, NM 16/08. Compilation concurs with chart comparison.

¹⁷ Concur

¹⁸ Concur

¹⁹ Filed with the hydrographic records.

²⁰ Assigned AWOIS item investigations are included in the AWOIS Report appended. Two assigned AWOIS items were not investigated #53507 and #53513. Two additional items found during office evaluation and the possible wreck south of Wildcat Cove included in the DR are also included in the AWOIS Report. All items have been identified in HCell.

²¹ Concur. Chart as depicted in HCell.

²² Concur. Added to HCell and AWOIS report.

²³ Filed with the hydrographic records.

²⁴ Filed with the hydrographic records

²⁵ Concur. Chart as depicted in HCell.

²⁶ Concur. Chart as depicted in HCell.

²⁷ Filed with the hydrographic records

²⁸ Concur

²⁹ Concur

³⁰ Concur. Chart as depicted in HCell.

³¹ Filed With the project records.

³² Filed With the project records.

AWOIS Features

Registry Number: H11553
State: WA
Locality: Bellingham
Sub-locality: Samish Bay
Project Number: OPR-P183-RA-06
Survey Dates: 10/17/2006 - 11/01/2006

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18424	27th	12/01/2006	1:40,000 (18424_1)	[L]NTM: ?
18423	35th	05/01/2005	1:80,000 (18423_1)	[L]NTM: ?
18421	48th	09/01/2006	1:80,000 (18421_1)	[L]NTM: ?
18400	47th	10/01/2006	1:200,000 (18400_1)	[L]NTM: ?
18003	20th	11/01/2006	1:736,560 (18003_1)	[L]NTM: ?
18007	32nd	07/01/2005	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	31st	06/01/2005	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	Wreck	4.50 m	48° 39' 06.0" N	122° 29' 39.6" W	---
1.2	AWOIS	[no data]	[no data]	[no data]	---
1.3	AWOIS	[no data]	[no data]	[no data]	---
1.4	AWOIS	-1.15 m	48° 40' 04.8" N	122° 30' 03.5" W	---
1.5	AWOIS	-0.37 m	48° 40' 04.9" N	122° 29' 55.7" W	---
1.6	AWOIS	0.43 m	48° 41' 25.4" N	122° 29' 40.4" W	---
1.7	AWOIS	0.01 m	48° 40' 19.3" N	122° 29' 29.2" W	---
1.8	AWOIS	[no data]	[no data]	[no data]	---
1.9	SSS	[None]	48° 37' 41.4" N	122° 29' 16.1" W	---

1.10	Wreck	11.80 m	48° 36' 33.1" N	122° 29' 32.9" W	---
------	-------	---------	-----------------	------------------	-----

1 - Tree

1.1) Profile/Beam - 21972/66 from h11553 / 1006_reson8101_hvf / 2006-290 / 301_1627

Survey Summary

Survey Position: 48° 39' 06.0" N, 122° 29' 39.6" W
Least Depth: 4.50 m (= 14.76 ft = 2.460 fm = 2 fm 2.76 ft)
TPU ($\pm 1.96\sigma$): **THU (TPEh)** ± 1.377 m ; **TVU (TPEv)** ± 0.210 m
Timestamp: 2006-290.16:47:27.529 (10/17/2006)
Survey Line: h11553 / 1006_reson8101_hvf / 2006-290 / 301_1627
Profile/Beam: 21972/66
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Submerged Wreck, covered with MBES. Not investigated by divers.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_reson8101_hvf/2006-290/301_1627	21972/66	0.00	000.0	Primary

Hydrographer Recommendations

Chart submerged wreck with designated sounding least depth.

Cartographically-Rounded Depth (Affected Charts):

2 ½fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

2fm 3ft (18424_1, 18423_1)

4.5m (501_1, 50_1)

S-57 Data

Geo object 1: Wreck (WRECKS)
Attributes: CATWRK - 1:non-dangerous wreck
 VALSOU - 4.498 m
 WATLEV - 3:always under water/submerged

Office Notes

Concur. Add to AWOIS.

Feature Images

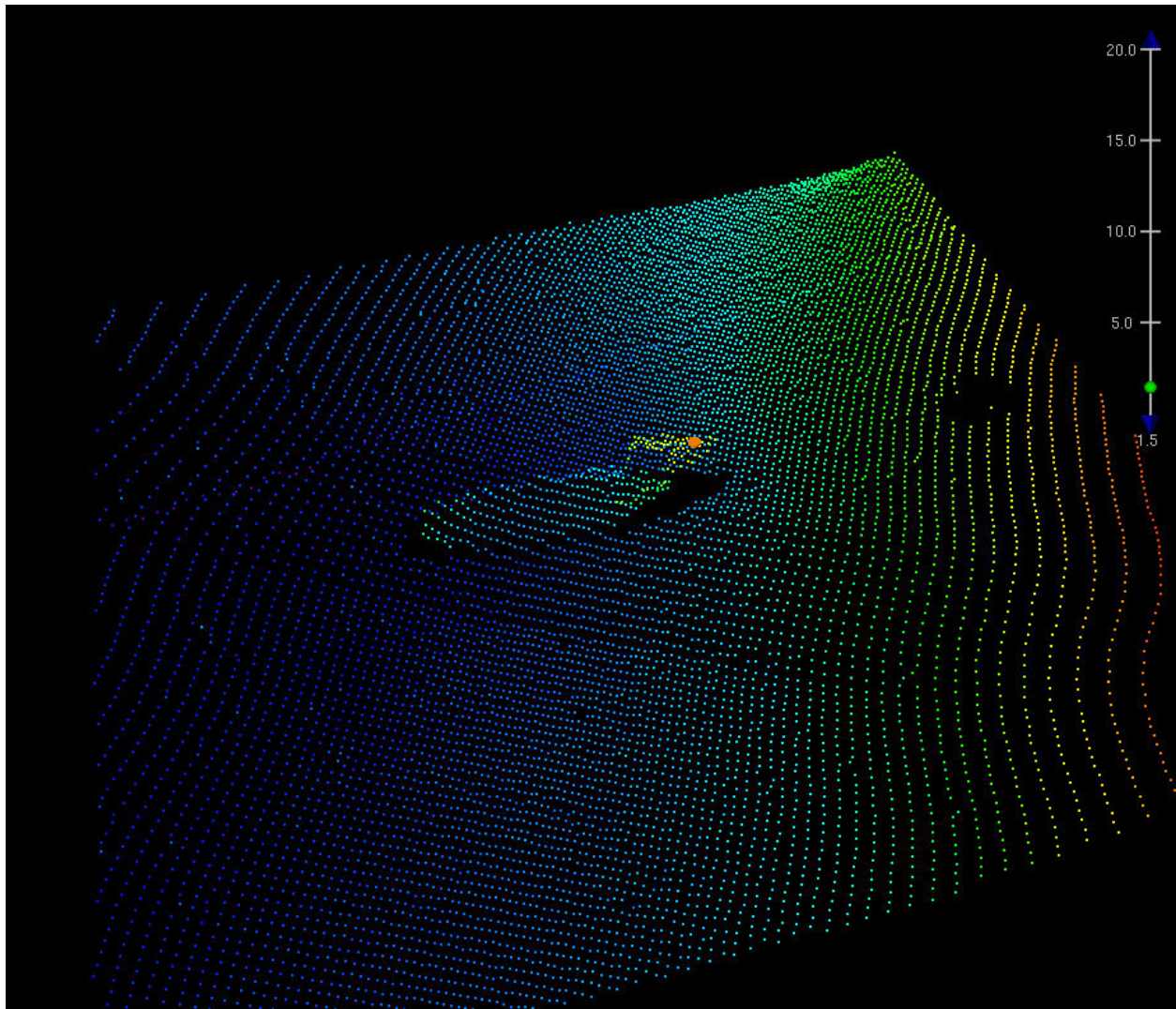


Figure 1.1.1

1.2) AWOIS #53507 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 40' 36.3" N, 122° 30' 15.3" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/40/36.34 N LONG. 122/30/15.34 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS item not seen. Inside the inshore limit.

Feature Correlation

Address	Feature	Range	Azimuth	Status
OPR-N161-RA-06	AWOIS # 53507	0.00	000.0	Primary

Hydrographer Recommendations

Retain CHD (18424) rk.

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: WATLEV - 1:partly submerged at high water

Office Notes

Concur

1.3) AWOIS #53508 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 41' 09.8" N, 122° 30' 12.1" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/41/09.83 N LONG. 122/30/12.11 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS 53508 disproved with full MBES coverage. No rock detected.

Feature Correlation

Address	Feature	Range	Azimuth	Status
OPR-N161-RA-06	AWOIS # 53508	0.00	000.0	Primary

Hydrographer Recommendations

Delete CHD (18424) rk at 48.68606389 , -122.50336389.

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)
Attributes: WATLEV - 4:covers and uncovers

Office Notes

Concur

1.4) AWOIS #53509 - OBSTRUCTION

Primary Survey Feature is Profile/Beam - 6/1 from h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290

Search Position: 48° 40' 05.7" N, 122° 30' 03.9" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/40/05.70 N LONG. 122/30/03.95 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Survey Position: 48° 40' 04.8" N, 122° 30' 03.5" W
Least Depth: -1.15 m (= -3.78 ft = -0.630 fm = 0 fm 2.22 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2006-290.17:52:26.000 (10/17/2006)
DP Dataset: h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290
Profile/Beam: 6/1
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS (53509) rock at end of point, covered at high tide, found by visual search.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_nonechosounder_dp/2006-290/dp_1006_290	6/1	0.00	000.0	Primary
OPR-N161-RA-06	AWOIS # 53509	28.97	162.1	Secondary

Hydrographer Recommendations

Delete CHD (18424) rk at 48°40'05.676" , -122°30'03.724". Add rk at DP location 20m SE.

Cartographically-Rounded Depth (Affected Charts):

0 ½fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

0fm 4ft (18424_1, 18423_1)

-1.2m (501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: VALSOU - -1.152 m

WATLEV - 4:covers and uncovers

Office Notes

Concur

Feature Images



Figure 1.4.1 Facing East

1.5) AWOIS #53510 - OBSTRUCTION

Primary Survey Feature is Profile/Beam - 7/1 from h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290

Search Position: 48° 40' 05.8" N, 122° 29' 56.6" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/40/05.75 N LONG. 122/29/56.56 W (NAD83) of rock is offset from source postion. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Survey Position: 48° 40' 04.9" N, 122° 29' 55.7" W
Least Depth: -0.37 m (= -1.22 ft = -0.203 fm = 0 fm 4.78 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2006-290.17:55:40.000 (10/17/2006)
DP Dataset: h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290
Profile/Beam: 7/1
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS Item 53510. Submerged Rk found by visual search.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_nonechosounder_dp/2006-290/dp_1006_290	7/1	0.00	000.0	Primary
OPR-N161-RA-06	AWOIS # 53510	31.18	143.7	Secondary (grouped)

Hydrographer Recommendations

Delete CHD (18424) rk at 48°40'05.706" , -122°29'56.279". Add rk at DP location 20m SE.

Cartographically-Rounded Depth (Affected Charts):

0 ¼fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

0fm 1ft (18424_1, 18423_1)

-.4m (501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: VALSOU - -0.372 m

WATLEV - 3:always under water/submerged

Office Notes

Concur

1.6) AWOIS #53511 - OBSTRUCTION

Primary Survey Feature is Profile/Beam - 10/1 from h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290

Search Position: 48° 41' 26.1" N, 122° 29' 40.7" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/41/26.11 N LONG. 122/29/40.68 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Survey Position: 48° 41' 25.4" N, 122° 29' 40.4" W
Least Depth: 0.43 m (= 1.40 ft = 0.233 fm = 0 fm 1.40 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2006-290.18:27:14.000 (10/17/2006)
DP Dataset: h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290
Profile/Beam: 10/1
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS Item 53511. Submerged Rk found by visual search, depth from sounding pole.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_nonechosounder_dp/2006-290/dp_1006_290	10/1	0.00	000.0	Primary
OPR-N161-RA-06	AWOIS # 53511	23.33	165.0	Secondary

Hydrographer Recommendations

Delete CHD (18424) rk at 48°41'26.170" , -122°29'40.494". Add rk at location at dp location.

Cartographically-Rounded Depth (Affected Charts):

0 ¼fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

0fm 1ft (18424_1, 18423_1)

.4m (501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: VALSOU - 0.426 m

WATLEV - 3:always under water/submerged

Office Notes

Concur

1.7) AWOIS #53512 - OBSTRUCTION

Primary Survey Feature is Profile/Beam - 9/1 from h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290

Search Position: 48° 40' 20.5" N, 122° 29' 29.8" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/40/20.48 N LONG. 122/29/29.82 W (NAD83) of rock is offset from source postion. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Survey Position: 48° 40' 19.3" N, 122° 29' 29.2" W
Least Depth: 0.01 m (= 0.04 ft = 0.007 fm = 0 fm 0.04 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2006-290.18:13:48.000 (10/17/2006)
DP Dataset: h11553 / 1006_nonechosounder_dp / 2006-290 / dp_1006_290
Profile/Beam: 9/1
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Rock verified. Depth from visual approximation.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_nonechosounder_dp/2006-290/dp_1006_290	9/1	0.00	000.0	Primary
OPR-N161-RA-06	AWOIS # 53512	37.78	162.0	Secondary (grouped)

Hydrographer Recommendations

Delete CHD (18424) rk at 48°40'20.569" , -122°29'29.496". Add rk at location at DP location.

Cartographically-Rounded Depth (Affected Charts):

0fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

0fm 0ft (18424_1, 18423_1)

.0m (501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: VALSOU - 0.013 m

WATLEV - 3:always under water/submerged

Office Notes

Concur

1.8) AWOIS #53513 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 37' 36.7" N, 122° 27' 56.4" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/37/36.74 N LONG. 122/27/56.39 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Charts Affected: 18424_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS item located in mudflats, did not investigate

Feature Correlation

Address	Feature	Range	Azimuth	Status
OPR-N161-RA-06	AWOIS # 53513	0.00	000.0	Primary

Hydrographer Recommendations

Retain CHD (18424) rk

S-57 Data

Geo object 1: Cartographic symbol (\$CSYMB)

Office Notes

Concur

1.9) Contact/Point - 0001/1 from h11553 / 1015_k5k_200_hvf / 2006-304 / sonar_data061031181500

Survey Summary

Survey Position: 48° 37' 41.4" N, 122° 29' 16.1" W
Least Depth: [None]
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2006-305.02:39:45 (11/01/2006)
Survey Line: h11553 / 1015_k5k_200_hvf / 2006-304 / sonar_data061031181500
Contact/Point: 0001/1
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Possible 1.5m pile in 8m of water. Is not visable in any other SSS lines. Is not visable in MB bathymetry.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1015_k5k_200_hvf/2006-304/sonar_data061031181500	0001	0.00	000.0	Primary

Hydrographer Recommendations

Chart appropriately. Add to AWOIS database for future investigation.

S-57 Data

Geo object 1: Pile (PILPNT)

Office Notes

Not charted,unverified by mutlibeam. Add to AWOIS database for future investigation.

Feature Images



Figure 1.9.1

1.10) Profile/Beam - 532/95 from h11553 / 1006_reson8101_hvf / 2006-305 / 206_1746

Survey Summary

Survey Position: 48° 36' 33.1" N, 122° 29' 32.9" W
Least Depth: 11.80 m (= 38.72 ft = 6.453 fm = 6 fm 2.72 ft)
TPU ($\pm 1.96\sigma$): **THU (TPEh)** ± 1.377 m ; **TVU (TPEv)** ± 0.213 m
Timestamp: 2006-305.17:46:05.388 (11/01/2006)
Survey Line: h11553 / 1006_reson8101_hvf / 2006-305 / 206_1746
Profile/Beam: 532/95
Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Submerged 1.6m high by 5.4m long contact in 12m of water discovered in office review. Object visible in Elac MB but has a questionable least depth designated sounding. MDF

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11553/1006_reson8101_hvf/2006-305/206_1746	532/95	0.00	000.0	Primary
h11553/1015_k5k_200_hvf/2006-298/sonar_data061025184100	0001	3.18	017.4	Secondary

Hydrographer Recommendations

Chart least depth. Add to AWOIS database for future investigation.

S-57 Data

Geo object 1: Wreck (WRECKS)
Attributes: VALSOU - 11.801 m

Office Notes

Concur.Chart as new non-dangerous submerged Wreck

Subject: Re: Chuckanut Bay, WA
From: "FOO Rainier" <foo.rainier@noaa.gov>
Date: Thu, 07 Dec 2006 22:07:17 +0000
To: Monica.Cisternelli@noaa.gov
CC: Nathan Eldridge <nathan.eldridge@noaa.gov>

Monica,

We received the final zoning- thanks. Verified tides for Cherry Point for November 1-2 are not yet posted, however. Do you know when they will be ready? We were surprised to see Cherry Point included, because we had been told that that gauge was down for maintenance.

Thanks,

Ben

Monica Cisternelli wrote:

I just sent final zoning for N161RA2006. I spent alot of time with the Chuckanut Bay area, trying to get rid of that stripe, but no matter what we did, it was still there. We built a TCARI grid, including data from a historic station at Bellingham - applied it to your data, but the stripe was still there. For the final zoning for H11553, I referenced the zone covering Chuckanut Bay to Cherry Point. I doubt that will fix it, but that is all I can think to do. So, if you could let me know when you receive the final zoning. Thanks

Monica

--
LT Ben Evans, NOAA
Field Operations Officer
NOAA Ship RAINIER (s221)
NOAA Marine Operations Center, Pacific
1801 Fairview Ave. E
Seattle, WA 98102



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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : November 29, 2007

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N161-RA-2006
HYDROGRAPHIC SHEET: H11553

LOCALITY: South Portion of Bellingham Bay, WA
TIME PERIOD: October 26 - November 1, 2006

TIDE STATION USED: 944-9880 Friday Harbor, WA
Lat. 48° 32.8' N Long. 123° 0.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.167 meters

TIDE STATION USED: 944-9424 Cherry Point, WA
Lat. 48° 51.8' N Long. 122° 45.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.535 meters

REMARKS: RECOMMENDED ZONING

Use zone(s) identified as: PS243, PS244 & PS245

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).

Note 2: Use tide data from the appropriate station with applicable zoning correctors for each zone according to the order in which they are listed in the Tidezone corrector file (*.ZDF). For example, tide station one (TS1) would be the first choice for an applicable zone followed by TS2, etc. when data are not available.

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: 2010.03.22 16:49:14 -04'00'

CHIEF, PRODUCTS AND SERVICES DIVISION



Final Tidal Zoning for OPR-N161-RA-2006, H11553 South Portion of Bellingham Bay, WA

944-9424 CHERRY POINT

944-9880 FRIDAY HARBOR

PS245
Time Corrector -12 mins
Range Corrector x0.91
Reference 944-9424

PS243
Time Corrector +6 mins
Range Corrector x1.06
Reference 944-9880

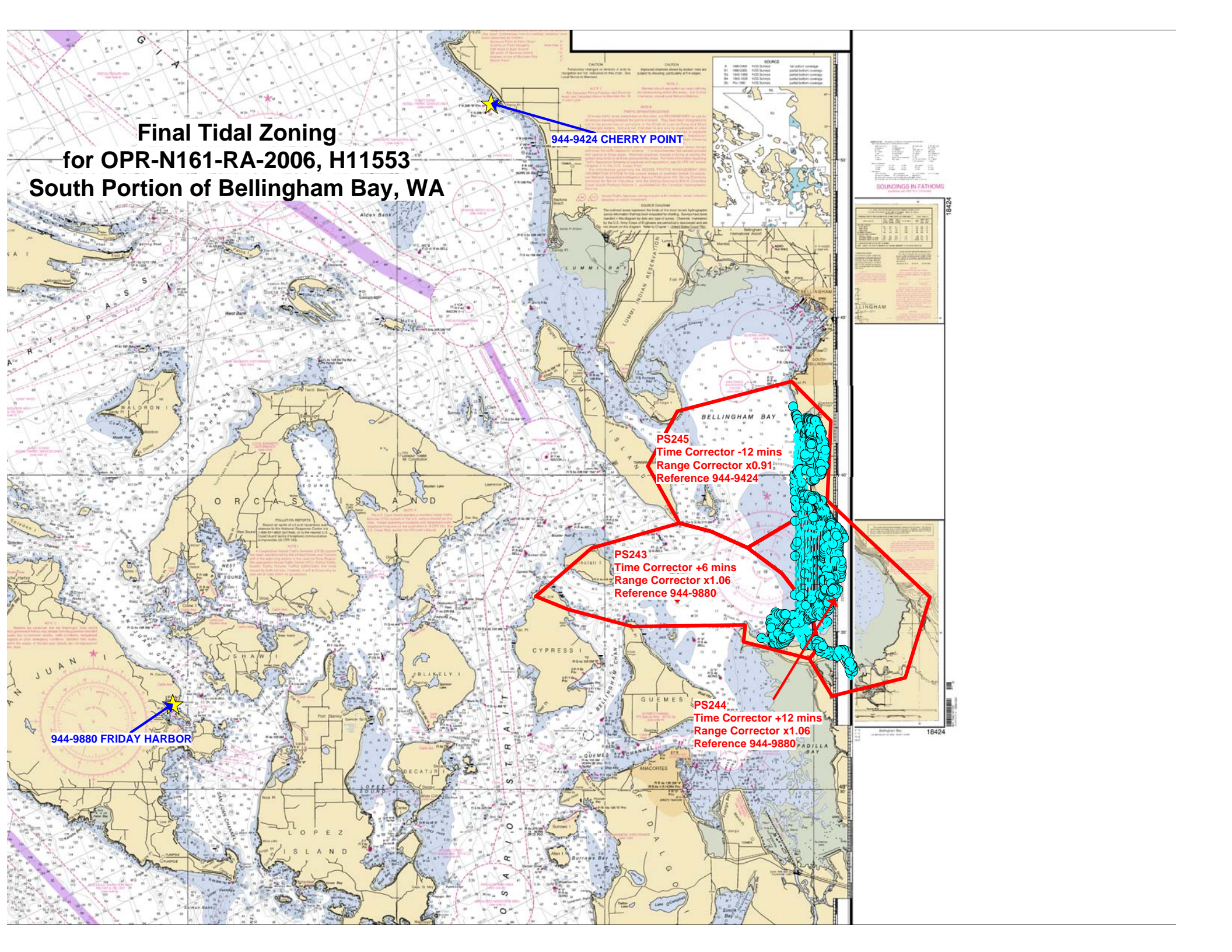
PS244
Time Corrector +12 mins
Range Corrector x1.06
Reference 944-9880

SOUNDINGS IN FATHOMS

Color	Depth (Fathoms)
White	0-1
Light Blue	2-3
Blue	4-5
Dark Blue	6-7
Very Dark Blue	8-9
Black	10-11
Red	12-13
Orange	14-15
Yellow	16-17
Light Green	18-19
Green	20-21
Dark Green	22-23
Black	24-25
White	26-27
Light Blue	28-29
Blue	30-31
Dark Blue	32-33
Very Dark Blue	34-35
Black	36-37
Red	38-39
Orange	40-41
Yellow	42-43
Light Green	44-45
Green	46-47
Dark Green	48-49
Black	50-51
White	52-53
Light Blue	54-55
Blue	56-57
Dark Blue	58-59
Very Dark Blue	60-61
Black	62-63
Red	64-65
Orange	66-67
Yellow	68-69
Light Green	70-71
Green	72-73
Dark Green	74-75
Black	76-77
White	78-79
Light Blue	80-81
Blue	82-83
Dark Blue	84-85
Very Dark Blue	86-87
Black	88-89
Red	90-91
Orange	92-93
Yellow	94-95
Light Green	96-97
Green	98-99
Dark Green	100-101
Black	102-103
White	104-105
Light Blue	106-107
Blue	108-109
Dark Blue	110-111
Very Dark Blue	112-113
Black	114-115
Red	116-117
Orange	118-119
Yellow	120-121
Light Green	122-123
Green	124-125
Dark Green	126-127
Black	128-129
White	130-131
Light Blue	132-133
Blue	134-135
Dark Blue	136-137
Very Dark Blue	138-139
Black	140-141
Red	142-143
Orange	144-145
Yellow	146-147
Light Green	148-149
Green	150-151
Dark Green	152-153
Black	154-155
White	156-157
Light Blue	158-159
Blue	160-161
Dark Blue	162-163
Very Dark Blue	164-165
Black	166-167
Red	168-169
Orange	170-171
Yellow	172-173
Light Green	174-175
Green	176-177
Dark Green	178-179
Black	180-181
White	182-183
Light Blue	184-185
Blue	186-187
Dark Blue	188-189
Very Dark Blue	190-191
Black	192-193
Red	194-195
Orange	196-197
Yellow	198-199
Light Green	200-201
Green	202-203
Dark Green	204-205
Black	206-207
White	208-209
Light Blue	210-211
Blue	212-213
Dark Blue	214-215
Very Dark Blue	216-217
Black	218-219
Red	220-221
Orange	222-223
Yellow	224-225
Light Green	226-227
Green	228-229
Dark Green	230-231
Black	232-233
White	234-235
Light Blue	236-237
Blue	238-239
Dark Blue	240-241
Very Dark Blue	242-243
Black	244-245
Red	246-247
Orange	248-249
Yellow	250-251
Light Green	252-253
Green	254-255
Dark Green	256-257
Black	258-259
White	260-261
Light Blue	262-263
Blue	264-265
Dark Blue	266-267
Very Dark Blue	268-269
Black	270-271
Red	272-273
Orange	274-275
Yellow	276-277
Light Green	278-279
Green	280-281
Dark Green	282-283
Black	284-285
White	286-287
Light Blue	288-289
Blue	290-291
Dark Blue	292-293
Very Dark Blue	294-295
Black	296-297
Red	298-299
Orange	300-301

18424

18424



H11553 HCell Report
Annie Raymond, Physical Scientist
Pacific Hydrographic Branch

Introduction

The primary purpose of the HCell is to provide new survey information in International Hydrographic Organization (IHO) format S-57 to update the largest scale ENC's and RNC's in the region: NOAA RNCs, 18424(1:40,000), 18421(1:80,000), 18423(1:80,000) and corresponding NOAA ENC's, US5WA45M

HCell compilation of survey H11553 utilized Office of Coast Survey DRAFT HCell Specifications Version 4.0. For additional information on the standards and protocols used for HCell Compilation, see the DRAFT A/PHB HCell Reference Guide, version 2.0, 22 February, 2010.

1. Compilation Scale

Depths and features for HCell H11553 were compiled to the largest scale chart in the region, 18424, 1:40,000.

2. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 2-meter Combined Surface in CARIS BASE Editor. A shoal-biased selection was made at 1:10,000 survey scale using a Radius Table file with values shown in the table, below. The resultant sounding layer contains 13,147 depths ranging from -0.914 to 32.918 meters.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
-4.7	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 and imported into a new layer created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

3. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the H11553_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and fathom equivalent contour values are shown in the table below.

Chart Contour Intervals in Fathoms from Chart 18424	Metric Equivalent to Chart Fathoms, Arithmetically Rounded	Metric Equivalent of Chart Fathoms, with NOAA Rounding Applied	Fathoms with NOAA Rounding Applied	Fathoms with NOAA Rounding Removed for Display on H11553_SS.000
0	0	0.000	0.000	0
1	1.8288	2.0574	1.125	1
2	3.6576	3.8862	2.125	2
3	5.4864	5.715	3.125	3
5	9.144	9.3726	5.125	5
10	18.288	18.517	10.125	10

With the exception of the zero contours included in the H11553_CS file, contours have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the H11553_CS file and soundings in the H11553_SS have been. This may result in conflicts between the H11553_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, SBDARE objects, and with DEPCNT objects representing MLLW, should be expected. HCell features should be honored over H11553_SS.000 file contours in all cases where conflicts are found.

Contours in the H11553_SS file for the portions of H11553 surveyed with multibeam and single beam in a skunk-stripe pattern were generated from a TIN surface created in Base Editor. The zero contours included in the H11553_CS file in vicinity of the Samish River were generated by hand using the soundings in the H11553_SS file as guidance and differ from the zero contours included in the H11553_SS file.

4. Meta Areas

The following Meta object areas are included in HCell H11553:

M_QUAL

Meta area objects were constructed on the basis of the limits of the hydrography.

5. Features

5.1 Generalization of Features to Chart Scale

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 is modified to emulate chart scale.

Feature generalization to emulate chart scale is accomplished primarily through reduction in the number of features included in the HCell, and in some cases generalizing area features to point objects. Some instances of reduction of area features to point objects is entrusted to the RNC division, for example rocky seabed areas that will display as point features on the RNC. Where line and area objects are included in the HCell, complexity of the lines and edges comprising the features have been smoothed to commensurate with chart scale.

5.2 Compilation of Features to the HCell

Shoreline features for H11553 were delivered from the field in five different hob files defining new features, modification to GC or charted features, and disprovals. These were deconflicted against GC shoreline, the chart and hydrography during office processing.

During office processing ledges and numerous rocky seabeds were digitized from the high resolution BASE Surfaces.

The source of all features included in the H11553 HCell can be determined by the SORIND field.

5.2 Mean High Water Used for HCells

For the purposes of determining the height at which a rock becomes an islet, the CO-OPS “*Tide Note for Hydrographic Survey*”, “*Height of High Water Above the Plane of Reference*” is used.

6.S-57 Objects and Attributes

The H11553_CS HCell contains the following Objects:

\$CSYMB	Blue Notes
BCNLAT	Private Aids to Navigation
BUISGL	Building
DEPCNT	Modified MLLW
M_QUAL	Data quality Meta object
OFSPFL	Offshore platform
SBDARE	Modified GC ledges, bottom samples, and rocky seabed areas
SLCONS	Boat Ramp
SOUNDG	Soundings at the chart scale density
UWTROC	Rock features
WEDKLP	New and retained kelp areas
WRECKS	A wreck area

The H11553_SS HCell contains the following Objects:

DEPCNT	Generalized contours at chart scale intervals
SOUNDG	Soundings at the survey scale density

All S-57 Feature Objects in the H11553_CS HCell have been attributed as fully as possible based on information provided by the Hydrographer and in accordance with current guidance and the OCS HCell Specifications.

7. Blue Notes

Notes to the RNC and ENC chart compilers are included in the HCell as \$CSYMB features. By agreement with MCD, the NINFOM field is populated with an abbreviated version of the Blue Note (30 characters or less), describing the chart disposition, to be used by MCD in generating their Chart History spreadsheet.

8. Spatial Framework

8.1 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.

8.2 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):	Fathoms and 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

Conversion to charting units and application of NOAA rounding is completed in the same step, at the end of the HCell compilation process.

Conversion to fathoms and feet charting units with NOAA rounding ensures that:

- All depths deeper or equal to 11 fathoms display as whole fathoms.
- All depth units between 0 fathoms (MLLW) and 11 fathoms display as fathoms and whole feet.
- All depth units above 0 fathoms (MLLW) to 2.0 feet above MHW display in feet for values that round to 5 feet or less, and in fathoms and feet above that. (This is a deviation from the traditional 'fathoms and feet' charting rule that requires that all depths above MLLW will be shown in feet. The display in fathoms and feet for depths between MLLW and 2 feet above MHW accommodates S-57 rules that require the same charting units to be used for all depth units (DUNI) in an ENC.)
- All height units (HUNI) which have been converted to charting units, and that are 2.00 feet above MHW and greater, are shown in feet.

In an ENC viewer fathoms and feet depth units (DUNI) display in the format X.YZZZ, where X is fathoms, Y is feet, and ZZZ is decimals of the foot. In an ENC viewer, heights (HUNI) display as whole feet.

9. Data Processing Notes

9.1 Junction with H11553

H11553 junctions with H11419, from 2005 and H11269 from 2003. A common junction was made with H11419 during compilation. H11269 has previously been applied to the chart and data is in a no longer supported format so no junction was made.

10. QA/QC and ENC Validation Checks

H11553 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.

11. Products

11.1 HSD, MCD and CGTP Deliverables

H11553_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:40,000
H11553_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
H11553_DR.doc	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H11553_outline.gml	Survey outline to populate SURDEX
H11553_outline.xsd	Survey outline to populate SURDEX

11.3 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	Creation of soundings and bathy-derived features, creation of the depth area, meta area objects, and Blue Notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.1	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
CARIS GIS 4.4a	Setting the sounding rounding variable for conversion of the metric HCell to NOAA charting units with NOAA rounding.
CARIS HOM Ver. 3.3	Perform conversion of the metric HCell to NOAA charting units with NOAA rounding.
HydroService AS, dKart Inspector Ver. 5.1	Validation of the base cell file.
Newport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

12. Contacts

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

Annie Raymond
Physical Scientist
Pacific Hydrographic Branch
Seattle, WA
206-526-6849
annemieke.raymond@noaa.gov

APPROVAL SHEET
H11553

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.