

H11420

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey HYDROGRAPHIC

Field No. RA-10-22-05

Registry No. H11420

LOCALITY

State Washington

General Locality Approaches to Anacortes and Bellingham

Sublocality Port of Bellingham to Portage Bay

2005

CHIEF OF PARTY

..... CDR Guy. T. Noll, NOAA

LIBRARY & ARCHIVES

DATE

HYDROGRAPHIC TITLE SHEET

H11420

INSTRUCTIONS The hydrographic sheet should be accompanied by this form,
filled in as completely as possible, when the sheet is forwarded to the office.

FIELD NO.

RA-10-22-05

State WashingtonGeneral Locality Approaches to Anacortes and BellinghamSublocality Port of Bellingham to Portage BayScale 1:10,000Date of Survey 10/15/2005 - 11/9/2005Instructions Date 3/15/2005Project No. OPR-N161RA-05Vessel NOAA Ship Rainier launches 1006, 1016, 1015, 1021, 1103Chief of Party CDR Guy T. Noll, NOAASurveyed by NOAA Ship Rainier PersonnelSoundings taken by echo sounder Reson 8101 and 8125, Seabeam/Elac 1180, Knudsen 320MGraphic record scaled by NOAA Ship Rainier PersonnelGraphic record checked by NOAA Ship Rainier PersonnelEvaluation by Katie Reser, Russ. Davies Automated plot by _____Verification by Russ DaviesSoundings in Fathoms and feet at MLLWREMARKS: Time in UTC. UTM Projection Zone 10Revisions and annotations appearing as endnotes weregenerated during office processing.All separates are filed with the hydrographic data.As a result, page numbering may be interrupted or non-sequential

Descriptive Report to Accompany Hydrographic Survey H11420

Project OPR-N161-RA-05
Bellingham Bay
Port of Bellingham to Portage Bay
Scale 1:10,000
October – November 2005
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-05 dated March 15, 2005 and all other applicable direction¹, with the exception of deviations noted in this report. The survey area is north Bellingham Bay, and in addition, a portion of Alden Bank in the Strait of Georgia (AWOIS items 53237, 53238, and 53239). This survey corresponds to sheet “B” in the sheet layout provided with the Letter Instructions.

Survey H11420 junctions with surveys H11419 and H11515 assigned to Navigation Response Team 3 (NRT-3) (figure 1). Work on both surveys was accomplished concurrently. By agreement between the respective Chiefs of Party, endorsed by OCS, the work was divided as follows:

- NRT-3 was responsible for surveying all features above MLLW (including Aids to Navigation) within its assigned survey limits.¹
- RAINIER conducted a full hydrographic survey within the assigned survey limits of H11420, with the exception of any features above MLLW within the boundaries of H11515.
- A small portion of the offshore area was surveyed by NRT-3 (see Figure 2 and discussion below), but processed by RAINIER and included with H11420.²

Together surveys H11420 and H11515 form a complete product. The hydrographer recommends that these surveys be reviewed and compiled together.³

¹ Standing Instructions for Hydrographic Surveys (March 2004), NOS Hydrographic Surveys Specifications and Deliverables (March 2003), OCS Field Procedures Manual for Hydrographic Surveying (March 2005), and all Hydrographic Surveys Technical Directives issued through November 2005.

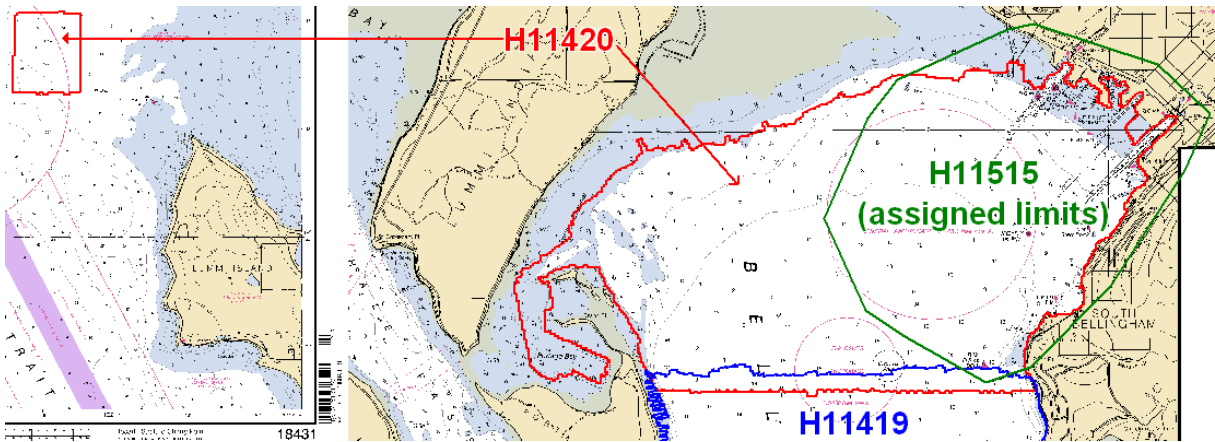


Figure 1. H11420 and H11515 assigned survey limits.

Limited Shoreline Verification was performed for the survey area. As discussed above, features above MHW within the limits of H11515 were addressed by NRT-3.

Data acquisition was conducted from October 15 to November 9, 2005 (DN 288 to 313).

B. DATA ACQUISITION AND PROCESSING

RAINIER and NRT-3 employed a mix of 200% side scan sonar and 100% multi-beam echosounder coverage to most efficiently acquire 100% bottom coverage of the survey area. The approximate boundaries of the regions covered with each acquisition system are shown in Figure 2, and the depth regimes in which each technique was used are given in Table 1. This change was initiated by the Chief of Party and verbally approved by the Chief, Operations Branch, Hydrographic Surveys Division.

Three of the AWOIS items assigned to survey H11420 fall outside of the sheet boundaries shown in figure 1. The separate area of survey performed to complete the “outside” AWOIS item investigations is shown in figure 2 as a small square west of the main survey area. AWOIS items will be further discussed in section D1.

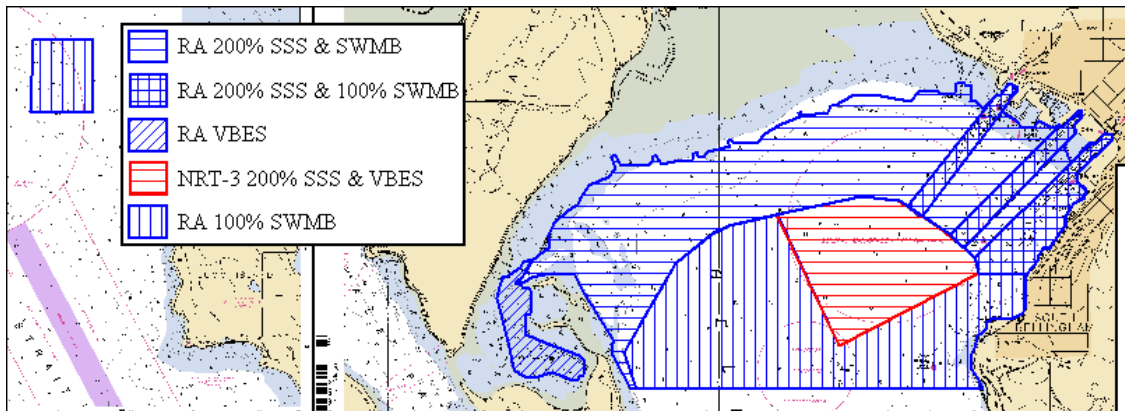


Figure 2. Types of survey coverage

Technique	Depth/Location Regime
100% SWMB	<20M
100% SWMB	Channels & developments
200% SSS & “skunk stripe” SWMB	2 – 20M
200% SSS & VBES	20-30M
VBES	0 – 2M

Table 1. Techniques and depth/location regimes

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-05 Data Acquisition and Processing Report (DAPR)* and *OPR-N161-NRT3-05_DAPR*, submitted under separate cover. ⁴ Items specific to this survey, and any deviations from the aforementioned report are discussed in the following sections.

Final Approved Water Levels have been applied to this survey. See Section C. for additional information. ⁵

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
1021	RA-3	Multi-Beam Echosounder
1016	RA-4	Multi-Beam Echosounder
1006	RA-5	Multi-Beam Echosounder
1015	RA-6	Multi-Beam Echosounder Side Scan Sonar
1212	NRT-3	Vertical-Beam Echosounder Side Scan Sonar

Table 2. Data Acquisition Vessels for H11420.

Sound speed profiles were measured with SEACAT SBE-19 and 19+ (RAINIER launches), and Digibar Pro (NRT-3) profilers in accordance with the Specifications and Deliverables.

B2. Quality Control

Crosslines

Shallow-Water Multibeam (SWMB) crosslines totaled 55.42 nautical miles, comprising 8.8% of SWMB main scheme hydrography. The main scheme bathymetry (including VBES from NRT-3) was manually compared to the crossline nadir beams in CARIS subset mode and agreed well with differences averaging approximately 0.5 meters or less.

A statistical Quality Control Report was generated for SWMB data acquired on this project to validate launch offsets and sonar biases. A copy of this report is included in the *OPR-N161-RA-05 DAPR*.

Junctions

The following contemporary survey junctions with H11420 (See Figure 1):

<u>Registry #</u>	<u>Scale</u>	<u>Date</u>	<u>Junction side</u>
H11419	1:10,000	2005	South

Surveys were compared manually in subset mode. Differences between the surveys are minimal and do not exceed 0.25 meters. ⁶

Data Quality Factors

Data for survey H11420 exhibits sound velocity errors, and misalignments between different survey vessels. With the exception of some small areas of disagreement between RA launches and NRT-3 all data meets IHO order 1 specifications. ⁷

Sound Speed Artifacts:

Some portions of the H11420 survey area exhibited refraction artifacts inducing depth errors of up to approximately 0.5m in less than 20m of water. This problem was particularly prevalent at the head of Bellingham Bay. The hydrographer suggests that these refraction errors may have been caused by inadequate CTD profile density in the areas of large fresh water influx from the Nooksack River at the head of the bay and Squalicum and Whatcom creeks on the east side of the bay. The characteristic “smiles” and “frowns” indicative of sound velocity errors are especially pronounced in the SWMB data acquired by launches RA4 (1016), and RA6 (1015), presumably due to their flat faced transducers (figure 2). This problem cannot be fixed without using the CARIS refraction editor. To prevent the frowns and smiles from affecting the base surfaces the overlapping sections were rejected during data processing.

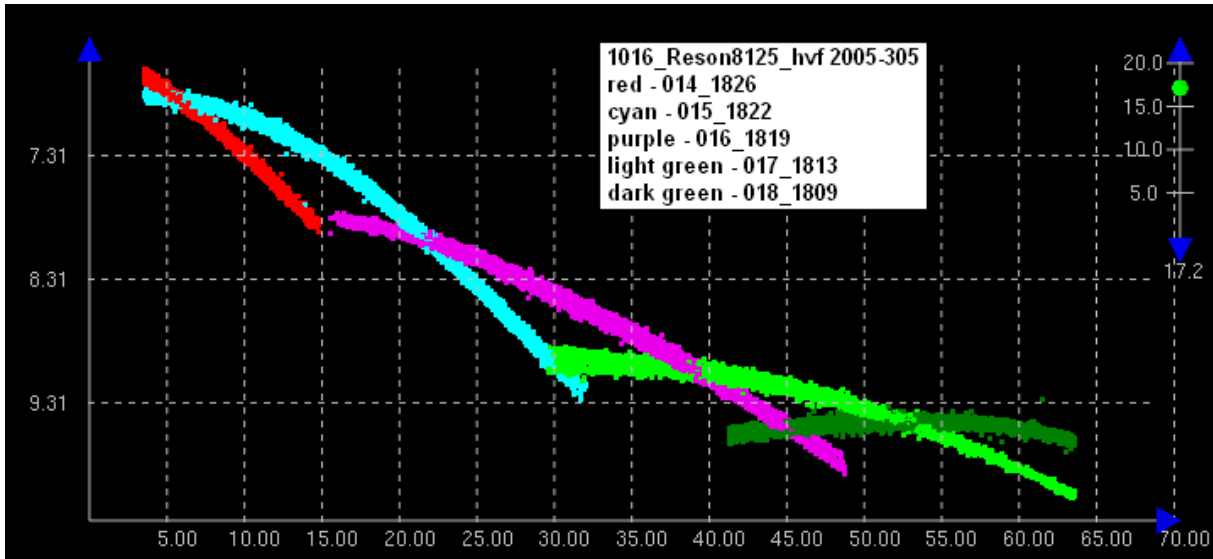


Figure 3. Sound velocity errors prior to data cleaning

B3. Data Reduction

Data reduction procedures for survey H11420 conform to those detailed in the *OPR-N161-RA-05 DAPR*.

B4. Data Representation

Many BASE surfaces were used in processing H11420. Final BASE surface resolutions and depth ranges were set in accordance with the Field Procedures Manual, with field sheets smaller than 25×10^6 nodes. The submission Field Sheet and BASE Surface structure are shown in Figures 4 and 5.

Due to the shoal nature of the H11420 survey area, the coarsest resolution acceptable for a BASE surface is one meter, with many inshore areas requiring a half meter. Even with a half meter surface some features are still not accurately represented. Thus, a number of small rocks have been designated to ensure the least depths of these features are preserved.

Side Scan Sonar data was split into two complete coverage mosaics to demonstrate areas covered by this technique. These mosaics were created at 1m resolution and named "100_SSS" and "200_SSS".

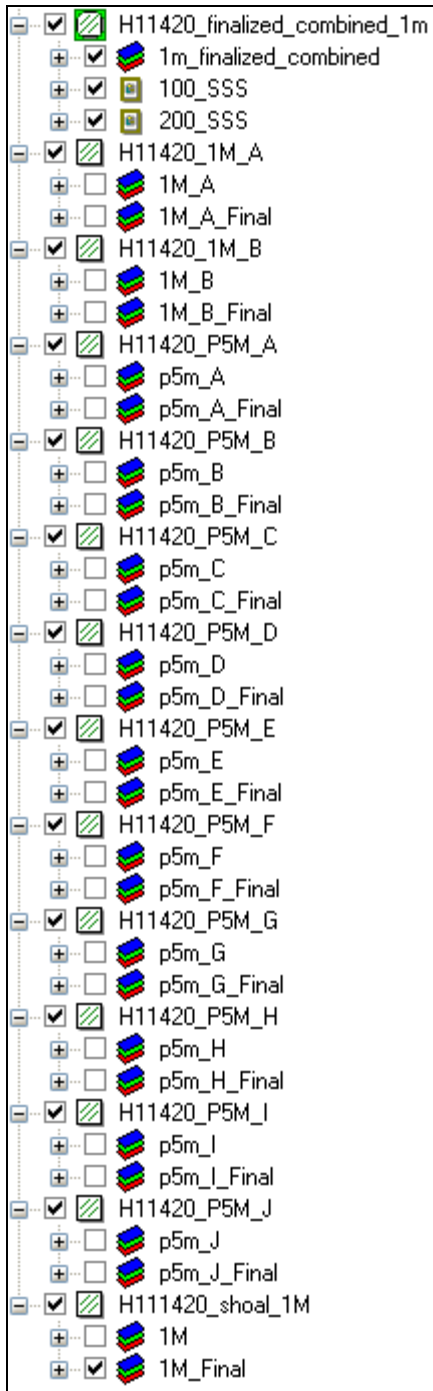


Figure 4: Field sheets and BASE surfaces submitted with H11420

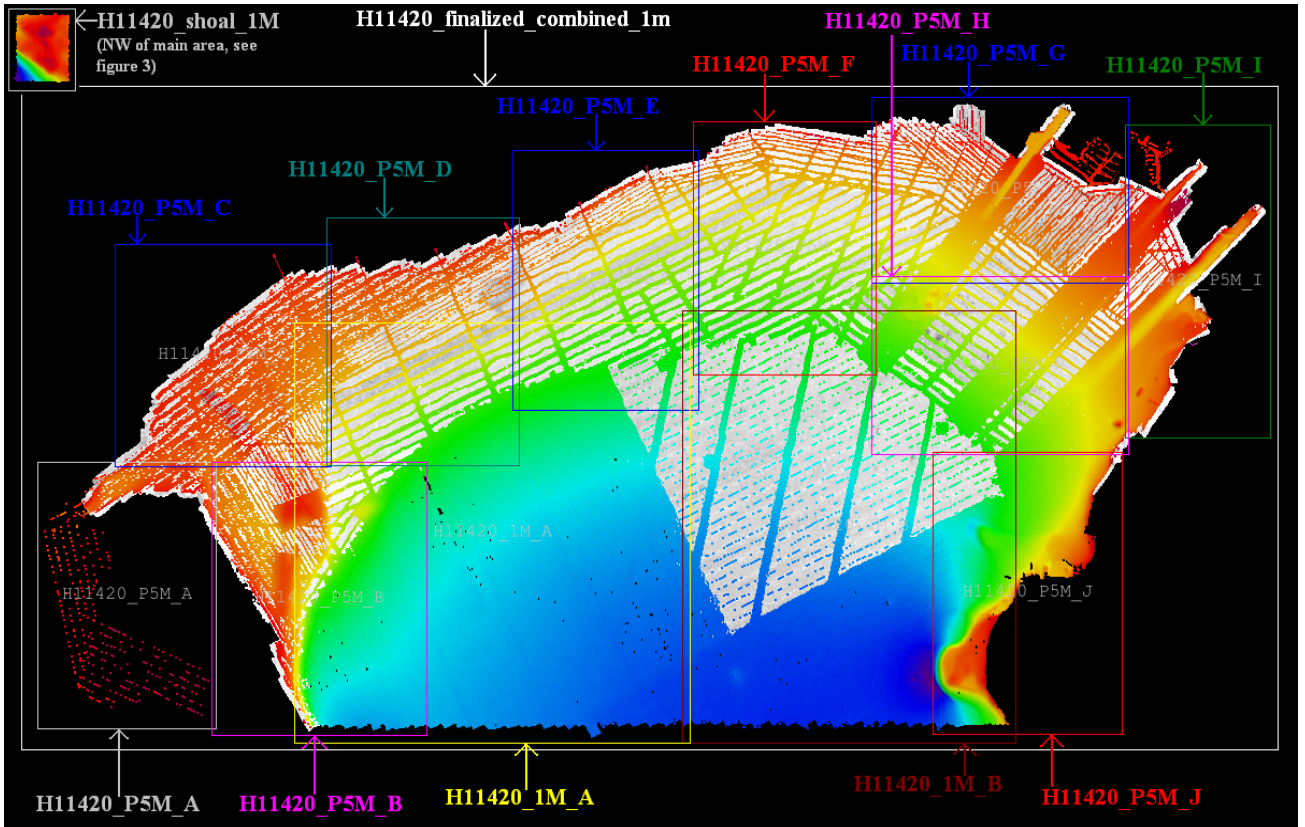


Figure 5: Layout of field sheets, BASE surfaces for H11420

C. VERTICAL AND HORIZONTAL CONTROL

Project OPR-N161-RA-05 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.

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 beacon utilized for this survey is given in Table 3.

Location	Frequency	Operator	Distance	Priority
Whidbey Island	302 kHz	USCG	25nm	Primary

Table 3: Differential Corrector Sources for H11420.

Vertical Control

The operating National Water Level Observation Network (NWLON) stations at Cherry Point, WA (944-9424) and Friday Harbor, WA (944-9880) served as the sources for water level reducers for survey H11420.

All data were reduced to MLLW with final approved water levels from stations Cherry Point, WA (944-9424) and Friday Harbor, WA (944-9880), using the tide files 9449424.tid and 9449880.tid, and final time and height correctors using the zone corrector file N161RA2005CORP.zdf.

The request for Final Approved Water Levels for H11420 was submitted to CO-OPS on November 15, 2005, and the Final Tide Note was received on January 6, 2006. This documentation is included in this report.

D. RESULTS AND RECOMMENDATIONS

D.1. Chart Comparison

D.1 a. Survey Agreement with Chart

Survey H11420 was compared with the following charts:

Chart	Scale	Edition and Date	Latest Notice to Mariners Applied
18424	1:40,000	26 th Ed, Aug 2004	7/21/2005 ⁸
18431	1:25,000	6 th Ed; Dec 2002	7/23/2005 ⁹

Table 4: Charts compared with H11420

Charted depths were compared to survey soundings exported from the Pydro PSS to Mapinfo using the “Draw PSS” tool.

Chart 18424

Soundings from survey H11420 generally agreed within one to three fathoms of the depths on chart 18424. Differences greater than one fathom occurred along the head of the bay from the five-fathom curve towards shore, where the current survey found depths significantly shoaler than charted. This shoaling appears to be outwash from the Nooksack River. The shoaling redefines the one, three, and five fathom curves. ¹⁰

H11420 survey soundings were generally consistent with depths tabulated on chart 18424 for federal project channels in the Port of Bellingham. Results of this comparison are summarized in Table 5 below, with H11420 survey soundings in blue italics, and all depths given in feet.

Name of Channel	Left Outside of Quarter	Middle Half of Channel	Right Outside of Quarter
Whatcom Waterway			
Outer Reach	23.1 26	30.3 32	31.1 29
Middle Reach	9.3 14	22.1 23	16.7 21
Inner Reach	2.1 4	1.7 3	8.7 11
I & J Street Waterway	16.5 14	16.3 15	12.9 13
Squalicum Creek Waterway			
Entrance Channel	28.0 27	28.4 27	28.4 26
Southwest Portion of Basin	28.8 27	29.5 27	29.0 16
Northeast Portion of Basin	A25.7 24	A28.5 27	A27.7 28

Table 5: Tabulated depths and survey soundings for channels on chart 18424 (depths in ft)

Several designated anchorages are depicted on chart 18424.¹¹ H11420 survey soundings agreed with charted depths to within one fathom in these areas.¹²

Chart 18431

Bathymetry acquired as part of the investigation of AWOIS items 53237, 53238, and 53239 (Alden Bank) falls on chart 18431. Survey soundings and charted depths were found to agree to within one half fathom, with the exception of the vicinity of AWOIS items 53237 and 53238, where survey soundings were approximately 1 fathom deeper than charted. For additional information, see the AWOIS section of the “H11420 Survey Feature Report”, filed in this report.¹³

The hydrographer recommends that survey soundings supersede depths depicted on charts 18424 and 18431 in the common area.¹⁴

D.1.b. Dangers to Navigation

No dangers to navigation (DTONs) were found within the limits of H11420.¹⁵

D.1.c. Other Features

Automated Wreck and Obstruction Information System (AWOIS) Investigations

Thirteen (13) AWOIS items fall within the limits of H11420 and were assigned for full investigation. All items were addressed, with results included in this report.¹⁶

Additional Items

Additional features investigated within the limits of H11420 are described in the Survey Feature Report in Appendix II.¹⁷

D.2. Additional Results

D.2.b. Shoreline Verification

Shoreline verification was accomplished on survey H11420 only outside the limits of survey H11515, as discussed in Section A and depicted in Figure 1.

Shoreline Source

Vector photogrammetric project WA0402 was supplied by N/NGS3 in the form of a cartographic feature file (CFF). Features shown on the current edition of chart 18424 which differed dramatically or were not included in the CFF (including the mean high water and mean low water lines) were digitized manually in Mapinfo by RAINIER personnel, and compiled with the CFF into a composite shoreline source workspace. This composite source was printed on paper “boat sheets” and displayed in Hypack for field verification.

Shoreline Verification

Limited shoreline verification was conducted near predicted low water in accordance with the Standing Project Instructions and FPM sections 6.1 and 6.2. Detached positions (DPs) acquired during shoreline verification were recorded in HYPACK and on DP forms, and 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*.¹⁸

All shoreline data is submitted in Caris Notebook .hob files. The session H11420_B_Notebook contains the following:

H11420_cff_shoreline.HOB (cff shoreline for reference)
H11420_chd_shoreline.HOB (digitized charted shoreline not seen in CFF)
H11420_B_Add_Notebook.HOB (new features digitized in Notebook using DPs or VBES)
H11420_Modify_Notebook.HOB (features modified in Notebook using DPs or VBES)
H11420_Delete_Notebook.HOB (original source or charted features that have been modified and disprovals not needing Pydro DPs, e.g. 100% SWMB)
H11420_ADD_PYDRO.HOB (new bottom samples and features processed in Pydro)
H11420_None_PYDRO.HOB (verified charted or CFF source features processed in Pydro)
H11420_survey_limits.HOB (survey limits)

The combination of *modify*, *add*, and *none* layers depict the shoreline as surveyed. The *delete* tables contain all disproved or modified features. The CFF and charted shoreline files reflect unchanged features that were noted in the field.

Source Shoreline Changes and New Features

- The majority of the shoreline features within the H11420 limits are located too far inland in very shoal waters and/or on mud flats for investigation by RAINIER launches. As a result only one DP (on a charted ATON) was acquired during shoreline acquisition. However, many objects were visually confirmed.
- A series of charted small nondescript specks are littered on the raster chart just off shore, north of Portage Channel ranging from $48^{\circ} 45' 23.3''$, $122^{\circ} 36' 37.2''$ to $48^{\circ} 44' 53.1''$, $122^{\circ} 37' 17.9''$. These features have been translated to the ENC as Land Areas (LNDARE). No islets, rocks, or other features seaward of the MHW line were observed in this area during shoreline verification. Some portions of this shoreline were observed to be armored with rip rap. The hydrographer recommends these specks and the corresponding LNDARE objects be removed from the chart.¹⁹

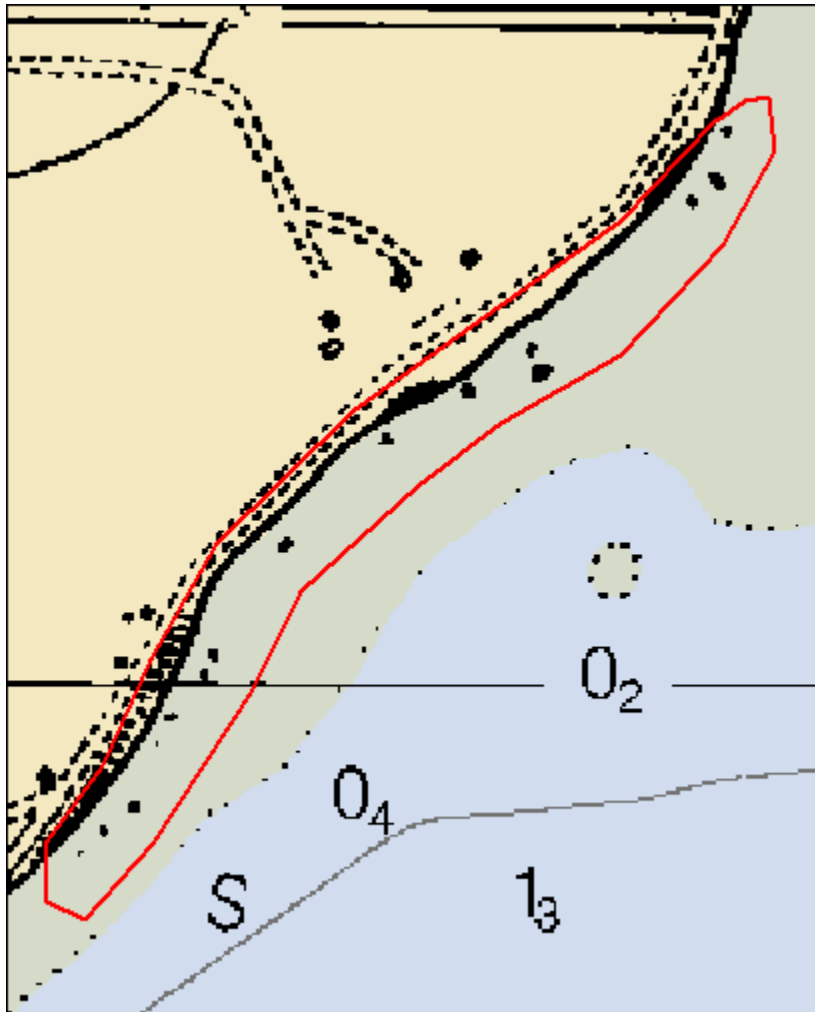


Figure 6. Non-descript specks.

- One exception to the division of work between H11420 and H11515 (section A.) is a single uncharted piling located at 48°44'30.794", 122°29'33.805". The uncharted piling is within the area assigned to NRT-3 to acquire shoreline. However, survey H11515 did not acquire a detached position on the piling. The piling is visible in SSS and SWMB from H11420. Additionally the piling is visible in a photograph taken by NRT-3 (photograph copied to H11420 PSS).²⁰
- The charted log storage area was the only feature addressed inside Portage Bay, as this portion of the survey area is extremely shallow. No logs appeared to be stored in Portage Bay and no pilings were observed above the water's surface. Verbal communication with local fishermen on Lummi peninsula indicated that the log storage was never officially removed but has slowly fallen apart. Thus there is most likely debris below the water surface.²¹

Recommendations

The Hydrographer recommends that the shoreline as depicted in the Notebook HOB files supersede and complement shoreline information compiled on the CFF and charts as noted.

D.2.c. Aids to Navigation

One (1) aid to navigation (ATON) is located within the limits of H11420, and outside the limits of H11515. A detached position was taken of the one charted buoy, which was found to be serving its intended purpose. The position is depicted in the H11420_None_PYDRO.HOB" file.²²

D.2.d. Overhead Features

There are no overhead features within the limits of survey H11420.

D.2.e. Submarine Cables and Pipelines

Charted sewer pipes extending from 48° 44' 54.5", 122° 29' 41.9" to 48° 44' 7.0", 122° 31' 5.2" and 48° 43' 7.2", 122° 31' 4.7" to 48° 43' 9.9", 122° 31' 26.1" were confirmed to be positioned correctly with 100% SWMB and 200% SSS.²³

D.2.f. Ferry Routes

There are no charted ferry routes within the limits of survey H11420. The Alaska Marine Highway System operates ferry service between Bellingham and ports in southeast Alaska from its terminal in South Bellingham, in the southeast corner of the H11420 survey area.

D.2.g. Bottom Samples

Bottom samples were collected and are depicted in Pydro. Samples in new locations are included in the "H11420_ADD_PYDRO.HOB" file. All samples collected at the positions of currently charted bottom types matched the chart, and are included in the

“H11420_None_PYDRO.hob” file. Due to time constraints and relative high density of charted bottom types (particularly in Portage Bay), not all historic bottom type locations were reoccupied.

The original DP form for two bottom samples collected on DN 306 is missing, however the samples are included in the survey.

Bottom samples correlated well with charted bottom types.

D.2.h. Other Findings

Debris and several submerged pilings and dolphins were found along the eastern edge of the survey ranging from Squalicum Creek Waterway to the piers at South Bellingham. These features are remnants of formerly industrialized areas of Bellingham. All navigationally significant features recognized in the survey data are included in the PSS and HOB files. Additional hazards may exist inshore of the limits of this survey. The hydrographer recommends a note for the chart indicating that mariners shall navigate with caution in the formerly industrialized areas of the Bellingham waterfront where commercial operations exist or may have existed in the past. ²⁴

Three separate boulder fields were found east of Brant Point. The hydrographer recommends against charting individual rocks in these areas, and instead recommends charting survey soundings with the addition of “rky” annotation. These features depicted in the PSS and HOB files, and are fully discussed in the Survey Features Report (Appendix II). ²⁵

Three separate areas of charted pier ruins were disproved in South Bellingham with 100% SWMB (figure 7). The hydrographer recommends that these ruins be removed from the chart. ²⁶

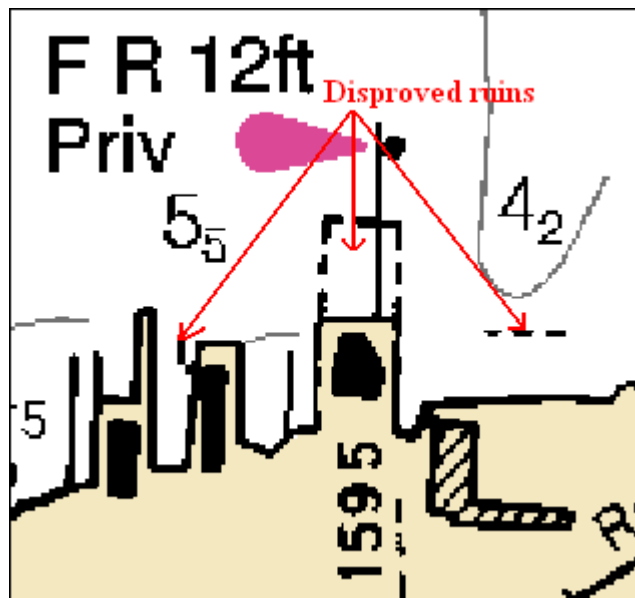


Figure 7. Disproved pier ruins.

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-05	Nov. 14, 2006	N/CS34
Coast Pilot Report for OPR-N161-RA-05	Feb. 15, 2006	N/CS26

Revisions Compiled During Office Processing and Certification

- ¹ All high water features and Aids to Navigation were forwarded (fast tracked) to MCD.
- ² Concur
- ³ Survey H11515 was cancelled. All of survey H11515 data, except for high water features and ATONs, were merged with survey H11420 data.
- ⁴ Filed with the project records
- ⁵ See attached Tide Note dated December 22,2005
- ⁶ Concur
- ⁷ Concur
- ⁸ Survey H11420 was compared to chart 18424, 27th Edition, scale 1:40,000, inset 1:20,000, dated December 2006, updated through Notice to Mariners dated 12/2/2006
- ⁹ This chart was not compared to, it is outside survey area.
- ¹⁰ Concur
- ¹¹ Retain these anchorage areas as charted.
- ¹² Concur
- ¹³ No data was submitted for AWOIS items 53237 – 53239. Retain area as charted
- ¹⁴ Concur
- ¹⁵ Concur
- ¹⁶ Do not concur, AWOIS items 53237, 53238, and 53239 were outside the survey area, retain area as charted.
- ¹⁷ Because the hydrographer submitted all features in .hob files, the Pydro features report was not attached to this report. This features report is filed with the hydrographic records.
- ¹⁸ Filed with the hydrographic records
- ¹⁹ Concur
- ²⁰ Chart High Water pile at the survey position
- ²¹ Chart area as shown on HCell
- ²² Use latest ATONIS information for charting.
- ²³ Do not concur, see HCell for depiction of the sewer lines
- ²⁴ Concur
- ²⁵ These areas are depicted on the Hcell as rocky seabed areas
- ²⁶ Concur



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

13 November 2006

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

FROM: CDR Guy T. Noll, NOAA
Commanding Officer

SUBJECT: Approval of Hydrographic Survey H11420

Field operations for hydrographic survey H11420 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:

Peter S. Holmberg
Physical Scientist, Pacific Hydrographic Branch

Chief Survey Technician:

James B. Jacobson
Chief Survey Technician, NOAA Ship RAINIER

Field Operations Officer:

for Benjamin K. Evans
Lieutenant, NOAA



H11420 AWOIS Items

Registry Number: H11420
State: Washington
Locality: Puget Sound
Sub-locality: Northern Bellingham Bay
Project Number: OPR-N161-RA-05
Survey Dates: 10/15/2005 - 11/9/2005

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18424	27th	12/01/2006	1:20,000 (18424_2)	USCG LNM: 07/11/2006 (02/06/2007) CHS NTM: None (01/26/2007) NGA NTM: None (02/10/2007)
18431	6th	12/01/2002	1:25,000 (18431_1)	[L]NTM: ?
18423	34th	12/01/2003	1:80,000 (18423_1) 1:40,000 (18423_5)	[L]NTM: ?
18424	26th	07/01/2004	1:40,000 (18424_1)	[L]NTM: ?
18421	46th	10/01/2003	1:80,000 (18421_1)	[L]NTM: ?
18400	45th	12/01/2004	1:200,000 (18400_1)	[L]NTM: ?
18003	19th	03/01/2003	1:736,560 (18003_1)	[L]NTM: ?
18007	31st	03/31/2001	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	30th	03/23/2002	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

Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
Rock	2.54 m	48° 44' 03.2" N	122° 30' 12.0" W	53185
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---

AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---
AWOIS	[no data]	[no data]	[no data]	---

1.1) Profile/Beam - 2994/81 from h11420 / 1016_reson8125_hvf / 2005-304 / 025_2124

Primary Feature for AWOIS Item #53185

Search Position: 48° 44' 03.6" N, 122° 30' 11.8" W
Historical Depth: [None]
Search Radius: 50
Search Technique: MB, DI
Technique Notes: [None]

History Notes:

H08320, 1956; THE DR FOR THIS SURVEY UPDATED THE POSITION OF STARR ROCK TO LAT. 48/44/04.2 N, LON. 122/30/07.2 W(NAD27). STARR ROCK IS COVERED BY 1.1 FATHOMS AT MLLW.

Survey Summary

Survey Position: 48° 44' 03.2" N, 122° 30' 12.0" W
Least Depth: 2.54 m (= 8.34 ft = 1.390 fm = 1 fm 2.34 ft)
TPU ($\pm 1.96\sigma$): THU (TPEh) [None] ; TVU (TPEv) [None]
Timestamp: 2005-304.21:27:25.808 (10/31/2005)
Survey Line: h11420 / 1016_reson8125_hvf / 2005-304 / 025_2124
Profile/Beam: 2994/81
Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

AWOIS 53185, Starr Rk

INVESTIGATION SUMMARY: Acquired 200% SWMB and 100% SWMB over the charted "Starr Rock" and verified least depth.

Hydrographer Recommendations

Supersede charted depths with survey soundings.

Cartographically-Rounded Depth (Affected Charts):

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

1fm 2ft (18424_2, 18423_5, 18424_1, 18423_1)

2.5m (501_1, 50_1)

Office Notes

Concur

1.2) AWOIS #53224 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 12.6" N, 122° 30' 08.3" W
Historical Depth: [None]
Search Radius: 20
Search Technique: MB, VS, S2, DI
Technique Notes: [None]

History Notes:

H08320, 1956; The smooth sheet for this survey plots a snag in LAT. 48/45/13.26 N, LON. 122/30/03.71 W (NAD27).

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53224

AWOIS item corresponds to charted snag.

INVESTIGATION SUMMARY: Visual search and 200% SSS coverage show no evidence of a snag or other feature standing vertically off the seabed. Imagery does indicate a large area of debris (logs, etc.) consistent with the area's former timber processing. This debris is lying flat on the seabed and is not a hazard to navigation.

Hydrographer Recommendations

Remove charted snag. Add notation to chart indicating prevalence of debris on seabed in the formerly industrialized areas of Bellingham's waterfront. The notation should inform the mariner that these debris are not hazardous to surface navigation, but render these areas unsuitable for anchoring.

Office Notes

Concur

1.3) AWOIS #53237 - Obstruction

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 34.5" N, 122° 44' 52.2" W
Historical Depth: 20.30 m
Search Radius: 350
Search Technique: MB
Technique Notes: Develop with MB insure least depths have been obtained.

History Notes:

H10621, 1995; The smooth sheet for this single beam survey has located an 11 fathom shoal in Lat.48/45/34.52 N., Lon. 122/44/52.19 W.(NAD83) The navigation manager has requested this shoal be developed with multibeam to insure the least depths have been obtained.

Survey Summary

Charts Affected: 18431_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53237

AWOIS item corresponds to a shoal sounding on Alden Bank.

INVESTIGATION SUMMARY: The 11 fathom shoal sounding was investigated with 100% SWMB. After tide correctors were applied the investigation revealed depths no shoaler than 12 fathoms.

Hydrographer Recommendations

Supersede charted depths with survey soundings in the common area.

Office Notes

Outside survey area, retain as charted

1.4) AWOIS #53238 - Obstruction

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 37.0" N, 122° 45' 04.4" W
Historical Depth: 20.12 m
Search Radius: 350
Search Technique: MB
Technique Notes: Develop with MB insure least depths have been obtained.

History Notes:

H10621, 1995; The smooth sheet for this single beam survey has located an 11 fathom shoal in Lat. 48/45/37.03 N., Lon. 122/45/04.38 W.(NAD83) The navigation manager has requested this shoal be developed with multibeam to insure the least depths have been obtained.

Survey Summary

Charts Affected: 18431_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53238

AWOIS item corresponds to a shoal sounding on Alden Bank.

INVESTIGATION SUMMARY: The 11 fathom shoal sounding was investigated with 100% SWMB. After tide correctors were applied the investigation revealed depths no shoaler than 12 fathoms.

Hydrographer Recommendations

Supersede charted depths with survey soundings in the common area.

Office Notes

Outside survey area, retain as charted

1.5) AWOIS #53239 - Obstruction

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 51.5" N, 122° 44' 59.0" W
Historical Depth: 20.85 m
Search Radius: 350
Search Technique: MB
Technique Notes: Develop with MB insure least depths have been obtained.

History Notes:

H10621, 1995; The smooth sheet for this single beam survey has located an 11 fathom shoal in Lat. 48/45/51.52 N., Lon. 122/44/59.03 W.(NAD83) The navigation manager has requested this shoal be developed with multibeam to insure the least depths have been obtained.

Survey Summary

Charts Affected: 18431_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53239

AWOIS item corresponds to a shoal sounding on Alden Bank.

INVESTIGATION SUMMARY: The 11 fathom shoal sounding was investigated with 100% SWMB. After tide correctors were applied the investigation revealed depths no shoaler than 11.75 fathoms.

Hydrographer Recommendations

Supersede charted depths with survey soundings in the common area.

Office Notes

Outside survey area, retain as charted

1.6) AWOIS #53177 - UNKNOWN

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 46' 22.0" N, 122° 32' 55.0" W
Historical Depth: [None]
Search Radius: 50
Search Technique: VS, DI, MB
Technique Notes: [None]

History Notes:

T5584, 1956; INDICATES A PILE IN LAT. 48/46/22 N, LON. 122/32/55 W(NAD83). POSITION WAS TAKEN FROM NOS CHART 18424. TWO MORE PILES ARE LOCATED INSHORE IN LAT. 48/46/24 N, LON. 122/33/08 W AND LAT. 48/46/30 N, LON. 122/33/11 W.

Survey Summary

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

Remarks:

UNKNOWN, AWOIS# 53177

AWOIS item corresponds to charted piling.

INVESTIGATION SUMMARY: Piles were observed in this area but due to their extremely shoal location RAINIER was unable to verify positions.

Hydrographer Recommendations

Retain as charted.

Office Notes

Concur

1.7) AWOIS #53178 - UNKNOWN

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 24.6" N, 122° 32' 50.8" W
Historical Depth: [None]
Search Radius: 75
Search Technique: MB,VS,DI,SD
Technique Notes: [None]

History Notes:

CL 629, 1956: REPORTS THE LOCATION OF THE WRECK IN NORTH BELLINGHAM BAY LISTED IN NOTICE TO MARINERS DATED 12-5-55 IS INCORRECT. THE CORRECT POSITION IS LAT. 48/45/25.2 N, LON. 122/32/46.2 W(NAD27) A SINGLE MAST PROJECTS ABOUT 11 FEET ABOVE MEAN HIGH WATER. (KRW 11/9/04)

Survey Summary

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

Remarks:

UNKNOWN, AWOIS# 53178

AWOIS item corresponds to charted wreck.

INVESTIGATION SUMMARY: Visual search and 200% SSS showed now evidence of a wreck or other features in this vicinity.

Hydrographer Recommendations

Remove charted wreck and "Masts" notation.

Office Notes

Concur

1.8) AWOIS #53179 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 30.0" N, 122° 31' 20.2" W
Historical Depth: [None]
Search Radius: 25
Search Technique: VS, MB, DI, S2
Technique Notes: Conduct Search in area for possible submerged dolphins.

History Notes:

Topographic Survey WA0402 02/20/2004; The Digital Cartographic Feature Files for this survey indicate a pipeline extending to Lat. 48/45/30.05 N., Lon. 122/31/20.22 W(NAD83)■■■CL 555, 1955; REPORTS THE PROPOSED CONSTRUCTION OF MOORING DOLPHINS IN LAT. 48/45/30 N, LON. 122/31/21 W(NAD83). MULTIPLE DOLPHINS HAVE REPORTEDLY BEEN CONSTRUCTED NORTH OF THIS POSITION.

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53178

AWOIS item corresponds to charted dolphin.

INVESTIGATION SUMMARY: Observed that the structure does exist, but did not acquire DPs on any of the charted construction. NRT-3 has addressed this item as part of survey H11515.

Hydrographer Recommendations

refer to H11515.

Office Notes

Features were fast track to MCD and is currently charted. Retain features as charted.

1.9) AWOIS #53180 - UNKNOWN

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 08.0" N, 122° 29' 59.0" W
Historical Depth: [None]
Search Radius: 125
Search Technique: DI,MB,SD
Technique Notes: [None]

History Notes:

CL 731, 1984; USPS REPORTS THE SUNKEN WRECKS IN LAT. 48/45/08 N, LON. 122/29/59 W(NAD27) HAVE BEEN REFLOATED AND TOWED TO ANOTHER LOCATION.■■■CL 1419, 1965; REPORTS PERMIT FROM THE U.S ARMY CORPS OF ENGINEERS TO SINK TWO HULLS AND MOOR BOOMSTICKS IN THE WATERS ADJACENT TO I J STREET WATERWAY. THE DRAWING INDICATES THE TWO BARDGES 100 AND 200 FT RESPECTIVELY WILL BE ATTACHED BY 1.25 INCH CHAIN AND MOORED TO AN EXISTING 365 FT BARDGE.

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

UNKNOWN, AWOIS# 53180

AWOIS item corresponds to charted wreck.

INVESTIGATION SUMMARY: 200% SSS and 100% MBES coverage show no evidence of a wreck or other feature standing vertically off the seabed. Imagery does indicate a large area of debris (logs, etc.) consistent with the area's former timber processing. This debris is lying flat on the seabed and is not a hazard to navigation.

Hydrographer Recommendations

Remove charted wreck. Add notation to chart indicating prevalence of debris on seabed in the formerly industrialized areas of Bellingham's waterfront. The notation should inform the mariner that these debris are not hazardous to surface navigation, but render these areas unsuitable for anchoring.

Office Notes

Concur, remove wreck and add note as recommended on AWOIS item 53224.

1.10) AWOIS #53181 - UNKNOWN

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 09.4" N, 122° 30' 04.6" W
Historical Depth: [None]
Search Radius: 125
Search Technique: DI,MB,SD
Technique Notes: [None]

History Notes:

CL 731, 1984; USPS REPORTS THE SUNKEN WRECKS IN LAT. 48/45/10 N, LON. 122/30/00 W(NAD27) HAVE BEEN REFLOATED AND TOWED TO ANOTHER LOCATION. ■■■CL 1419, 1965; REPORTS PERMIT FROM THE U.S ARMY CORPS OF ENGINEERS TO SINK TWO HULLS AND MOOR BOOMSTICKS IN THE WATERS ADJACENT TO I J STREET WATERWAY. THE DRAWING INDICATES THE TWO BARDGES 100 AND 200 FT RESPECTIVELY WILL BE ATTACHED BY 1.25 INCH CHAIN AND MOORED TO AN EXISTING 365 FT BARDGE.

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

UNKNOWN, AWOIS# 53181

AWOIS item corresponds to charted wreck.

INVESTIGATION SUMMARY: 200% SSS and 100% MBES coverage show no evidence of a wreck or other feature standing vertically off the seabed. Imagery does indicate a large area of debris (logs, etc.) consistent with the area's former timber processing. This debris is lying flat on the seabed and is not a hazard to navigation.

Hydrographer Recommendations

Remove charted wreck. Add notation to chart indicating prevalence of debris on seabed in the formerly industrialized areas of Bellingham's waterfront. The notation should inform the mariner that these debris are not hazardous to surface navigation, but render these areas unsuitable for anchoring.

Office Notes

Concur, remove wreck and ED note. Add note as recommended on AWOIS item 53224 and add to this note that this area is unsuitable for anchoring.

1.11) AWOIS #53182 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 45' 07.3" N, 122° 30' 00.6" W
Historical Depth: [None]
Search Radius: 30
Search Technique: MB, DI, VS
Technique Notes: [None]

History Notes:

H08320, 1956; The smooth sheet for this survey plots a snag in LAT. 48/45/08 N, LON. 122/29/56 W (NAD27).

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53182

AWOIS item corresponds to charted snag.

INVESTIGATION SUMMARY: Visual search and 200% SSS coverage show no evidence of a snag or other feature standing vertically off the seabed. Imagery does indicate a large area of debris (logs, etc.) consistent with the area's former timber processing. This debris is lying flat on the seabed and is not a hazard to navigation.

Hydrographer Recommendations

Remove charted snag. Add notation to chart indicating prevalence of debris on seabed in the formerly industrialized areas of Bellingham's waterfront. The notation should inform the mariner that these debris are not hazardous to surface navigation, but render these areas unsuitable for anchoring.

Office Notes

Concur

1.12) AWOIS #53183 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 44' 20.0" N, 122° 29' 57.6" W
Historical Depth: [None]
Search Radius: 75
Search Technique: MB, DI, VS
Technique Notes: [None]

History Notes:

H08320, 1956; THE SMOOTH SHEET FOR THIS SURVEY INDICATES A DOLPHIN IN LAT. 48/44/20.66 N, LON. 122/29/53 W(NAD27).

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53183

AWOIS item corresponds to charted dolphin.

INVESTIGATION SUMMARY: RAINIER personnel observed a dolphin above the surface in this general vicinity. This item was addressed in full by NRT-3 as part of H11515.

Note: Several scattered submerged dolphins and piles are present in the bathymetry and imagery in the vicinity of the former log processing and industrial areas between South Bellingham and the Whatcomb Creek Waterway.

Hydrographer Recommendations

Refer to H11515 for features above MHW. The hydrographer recommends a note for the chart indicating that submerged debris exists in the waters along the formerly industrialized areas of northeast Bellingham Bay between South Bellingham and the Sqaulicum Creek Waterway.

Office Notes

Chart obstruction area as shown on the HCell. Retain charted ruins. Remove charted line of piles at lat. 48/44/11.958N, long 122/29/52.7676W.

1.13) AWOIS #53184 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 44' 14.4" N, 122° 30' 15.1" W
Historical Depth: [None]
Search Radius: 30
Search Technique: DI, MB, S2, VS
Technique Notes: [None]

History Notes:

H08320, 1956; THE SMOOTH SHEET FOR THIS SURVEY CHARTS A SNAG IN LAT. 48/44/30.6 N, LON. 122/30/10.5 W(NAD27)

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53184

AWOIS item corresponds to charted snag.

INVESTIGATION SUMMARY: Visually observed no snag above the water surface. Acquired 200% SSS and 100% SWMB and found no snag below the surface.

Hydrographer Recommendations

Remove charted snag.

Office Notes

No charted snag appears on the current edition of the chart 18424. Retain as charted

1.14) AWOIS #53186 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 43' 46.4" N, 122° 30' 27.6" W
Historical Depth: [None]
Search Radius: 75
Search Technique: MB, DI, VS
Technique Notes: [None]

History Notes:

BP 54448, 01/25/68; INDICATES A DOLPHIN IN LAT.48/43/47 N, LON. 122/30/41.7 W(NAD27).
NUMEROUS DOLPHINS EXIST IN THE AREA, THE ABOVE LOCATION MARKS THE SEAWARD MOST DOLPHIN.

Survey Summary

Charts Affected: 18424_2, 18423_5, 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

OBSTRUCTION, AWOIS# 53186

AWOIS item corresponds to charted dolphin and log booming platforms.

INVESTIGATION SUMMARY: NRT-3 has been assigned this item as part of survey H11515. RAINIER personnel did not observe a dolphin or other structures above the surface in this vicinity. 200% SSS and 100% SWMB show no signs of a submerged dolphin within the assigned radius.

Hydrographer Recommendations

Refer to H11515.

Office Notes

Remove line of piles and dolphin



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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : December 22, 2005

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N161-RA-2005
HYDROGRAPHIC SHEET: H11420

LOCALITY: Northern Bellingham Bay, WA
TIME PERIOD: October 15 - November 9, 2005

TIDE STATION USED: 944-9880 Friday Harbor, WA
Lat. 48° 32.7' N Long. 123° 00.7' 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 45.4' 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

Preliminary zoning is accepted as the final zoning for project OPR-N161-RA-2005, H11420, during the time period between October 15 and November 9, 2005.

Please use the zoning file "N161RA2005CORP" submitted with the project instructions for OPR-N161-RA-2005. Zones PS245, PS246, PS247, PS258, & PS259 are the applicable zones for H11420.

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).

For 

CHIEF, PRODUCTS AND SERVICES DIVISION



Final tide zone node point locations for OPR-N161-RA-2005, H11420

Format: Tide Station (in recommended order of use)
 Average Time Correction (in minutes)
 Range Correction
 Longitude in decimal degrees (negative value denotes Longitude West),
 Latitude in decimal degrees

	Tide Station Order	AVG Time Correction	Range Correction
PS245	944-9880	+12	x1.08
-122.489376 48.653514			
-122.486617 48.695651			
-122.518053 48.716593			
-122.609231 48.700738			
-122.632858 48.671748			
-122.607529 48.641504			
-122.58199 48.637064			
-122.553165 48.628482			
-122.489376 48.653514			
PS246	944-9880	+18	x1.10
-122.518053 48.716593			
-122.491299 48.724836			
-122.481112 48.750386			
-122.514203 48.776164			
-122.570979 48.782785			
-122.615489 48.765001			
-122.630736 48.743966			
-122.613594 48.714308			
-122.609231 48.700738			
-122.518053 48.716593			
PS247	944-9880	+18	x1.10
-122.609231 48.700738			
-122.613594 48.714308			
-122.630736 48.743966			
-122.653521 48.727603			
-122.651934 48.716457			
-122.647411 48.710129			
-122.63994 48.7072			
-122.609231 48.700738			
PS258	944-9424	0	x0.95
-122.765442 48.783545			
-122.823959 48.772938			
-122.877482 48.763254			
-122.848095 48.747102			

-122.828206 48.746494
-122.80878 48.744615
-122.791013 48.739914
-122.773482 48.733177
-122.759804 48.727837
-122.73548 48.719766
-122.718133 48.716853
-122.715807 48.727989
-122.718404 48.741353
-122.734954 48.756852
-122.748502 48.769539
-122.765442 48.783545
PS259
-122.660278 48.753753
-122.702117 48.786853
-122.70916 48.786558
-122.710626 48.790122
-122.709904 48.792798
-122.736643 48.789258
-122.765442 48.783545
-122.748502 48.769539
-122.734954 48.756852
-122.718404 48.741353
-122.660278 48.753753

944-9424

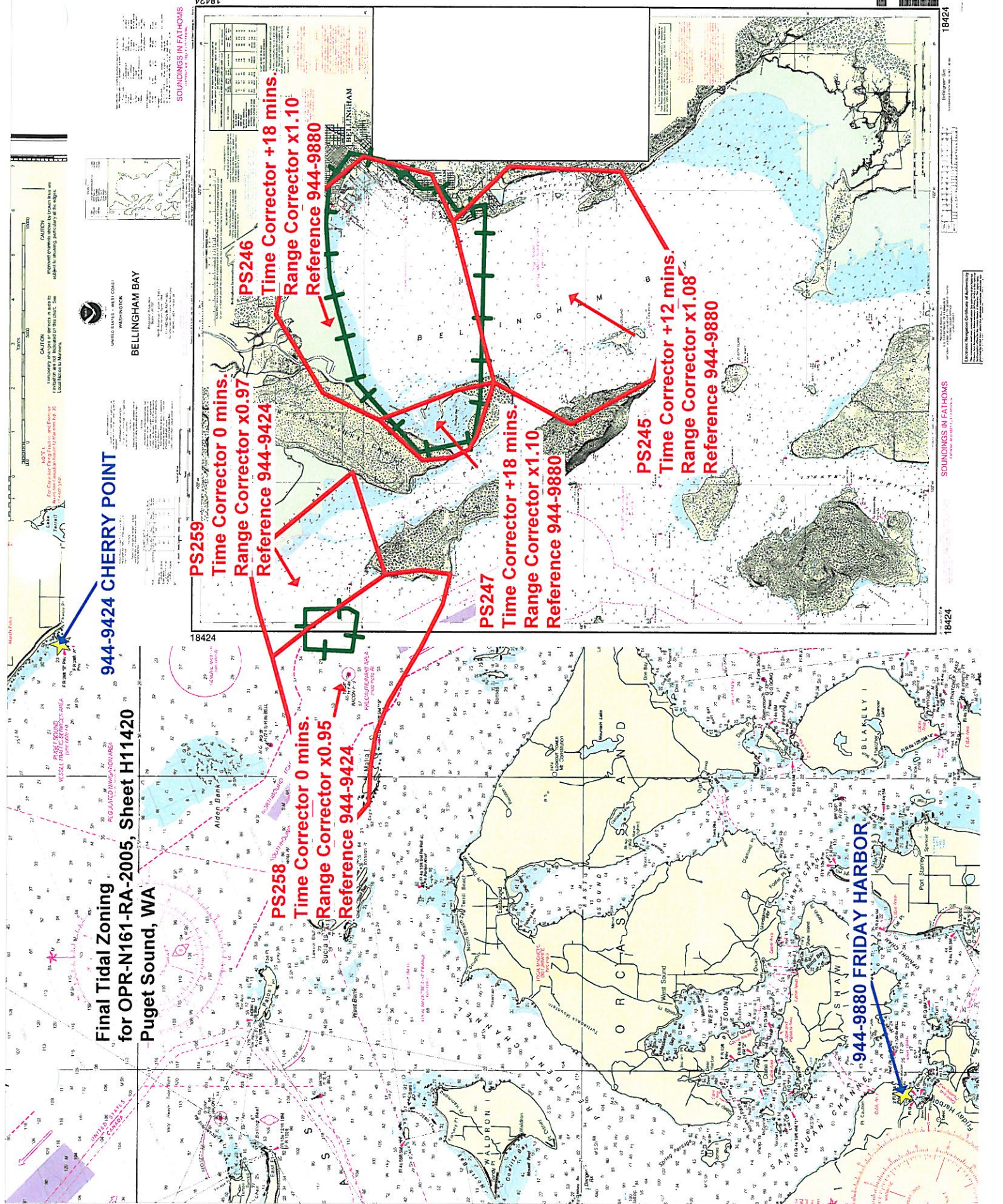
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x0.97

944-9424 CHERRY POINT

**Final Tidal Zoning
for OPR-N161-RA-2005, Sheet H11420
Puget Sound, WA**

944-9880 FRIDAY HARBOR



PS259
Time Corrector 0 mins.
Range Corrector x0.97
Reference 944-9424

PS246
Time Corrector +18 mins.
Range Corrector x1.10
Reference 944-9880

PS247
Time Corrector +18 mins.
Range Corrector x1.10
Reference 944-9880

PS245
Time Corrector +12 mins.
Range Corrector x1.08
Reference 944-9880

PS258
Time Corrector 0 mins.
Range Corrector x0.95
Reference 944-9424

CAUTION
UNDESIRABLE EFFECTS OF POLLUTION ON MARINE LIFE AND PLANTS
UNDESIRABLE EFFECTS OF POLLUTION ON MARINE LIFE AND PLANTS
UNDESIRABLE EFFECTS OF POLLUTION ON MARINE LIFE AND PLANTS

NOTE
This chart is a reproduction of the original chart and is not to be used as a substitute for the original chart.

UNITED STATES COAST AND GEODETIC SURVEY
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DEPARTMENT OF COMMERCE

BELLINGHAM BAY

SOUNDINGS IN FATHOMS

Color	Meaning
Blue	Depth
Green	Shoals
Yellow	Reefs
Red	Breakers
Black	Obstructions
White	Clear

Scale
0 1 2 3 4 5 6 7 8 9 10

Compass Rose
Magnetic Variation: 11° 30' W (2005)
True Variation: 11° 30' W (2005)

Legend
Blue: Depth
Green: Shoals
Yellow: Reefs
Red: Breakers
Black: Obstructions
White: Clear

18424

18424

18424

**APPROVAL SHEET
H11420**

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.