H12310

NOAA Form 76-35A

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Survey

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12310

LOCALITY

State:	Washington
General Locality:	Southern Puget Sound
Sub-locality:	Southern Carr Inlet

2011

CHIEF OF PARTY
Dan Jacobs (Acting)

LIBRARY & ARCHIVES

Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12310**

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

State:	**Washington**
General Locality:	**Southern Puget Sound**
Sub-Locality:	**Southern Carr Inlet**
Scale:	**10000**
Dates of Survey:	**05/04/2011 to 10/14/2011**
Instructions Dated:	**04/07/2011**
Project Number:	**OPR-N360-NRT3-11**
Field Unit:	**Navigation Response Team 3**
Chief of Party:	**Dan Jacobs (Acting)**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean lower low water**
H-Cell Compilation Units:	***meters at Mean lower low water***

Remarks:

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. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/

Descriptive Report to Accompany Survey H12310

Project: OPR-N360-NRT3-11

Locality: Southern Puget Sound

Sublocality: Southern Carr Inlet

Scale: 1:10000

May 2011 - October 2011

Navigation Response Team 3

Chief of Party: Dan Jacobs (Acting)

A. Area Surveyed

Southern Carr Inlet enters the western shore of the sound about 7½ miles south, south west of Point Defiance. From the entrance, between Fox and McNeil Islands, it extends about 6 miles north west to Green Point and South Head (see Figure 1).

A.1 Survey Limits

Data was acquired within the following survey limits:

Northeast Limit	Southwest Limit
47.1968111111 N 122.600980556 W	47.2815333333 N 122.725819444 W

Table 1: Survey Limits

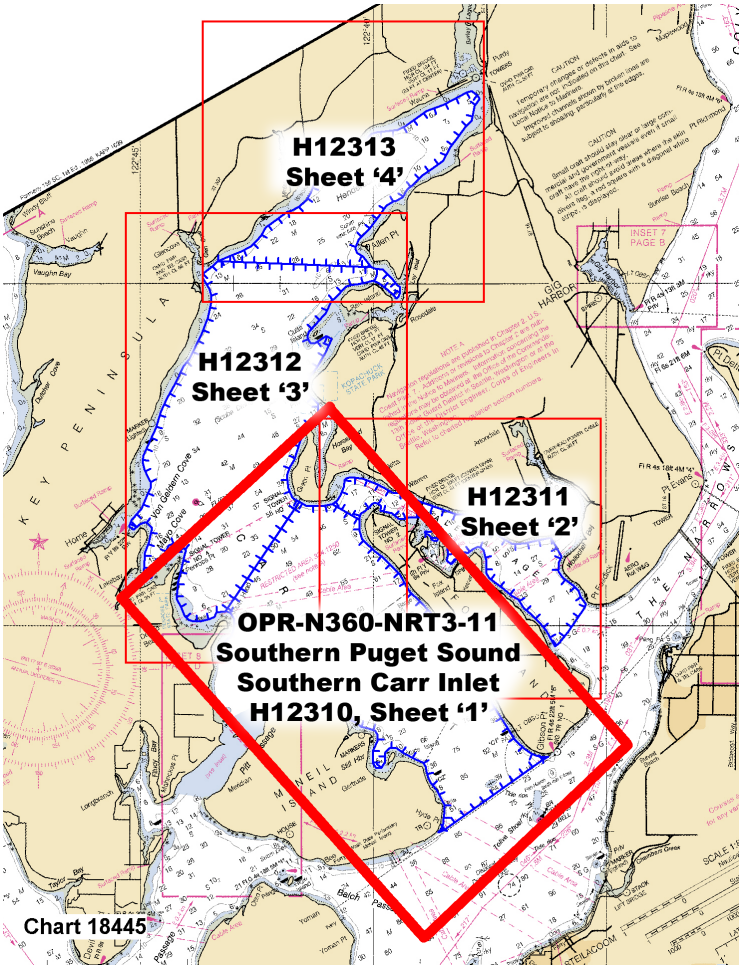


Figure 1: Sheet limits for survey H12310 (red box).

Survey acquisition differed from the branch provided suggested survey limits polygon in two locations, Still Harbor of McNeil island and Wyckoff Shoals / Pitt Passage area.

Still Harbor is a restricted area of the Washington State Penitentiary located on McNeil Island. Survey operations were conducted up to the posted signs restricting navigation (see Figure 2).

Wyckoff Shoals and Pit Passage coverage was extended beyond the suggested survey limits to the sheet limits because the Hydrographers observed commercial and public seafaring traffic transit over Wyckoff Shoals outside of areas marked for safe navigation. The Hydrographers acquired data to the 4 meter curve, verifying safe navigational boundaries of Wyckoff Shoal and Pitt Passage (see Figure 3).

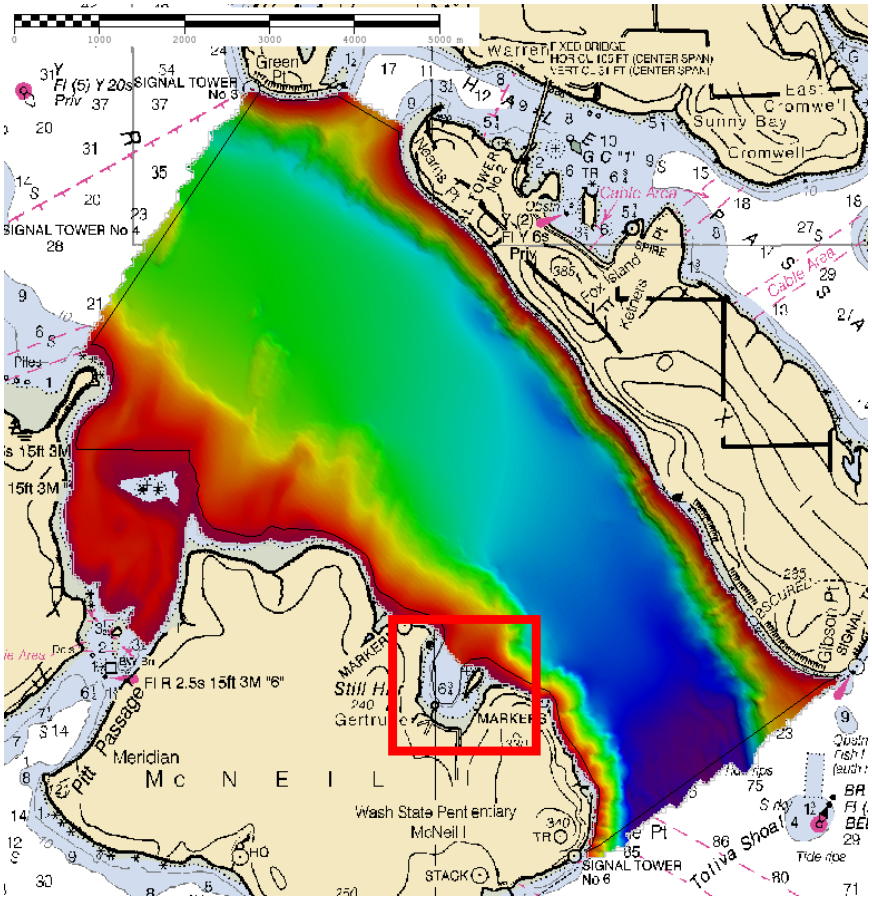


Figure 2: Still Harbor (inside red box) could not be surveyed due to restrictions to navigation posted by the Washington State Penitentiary located on McNeill Island.

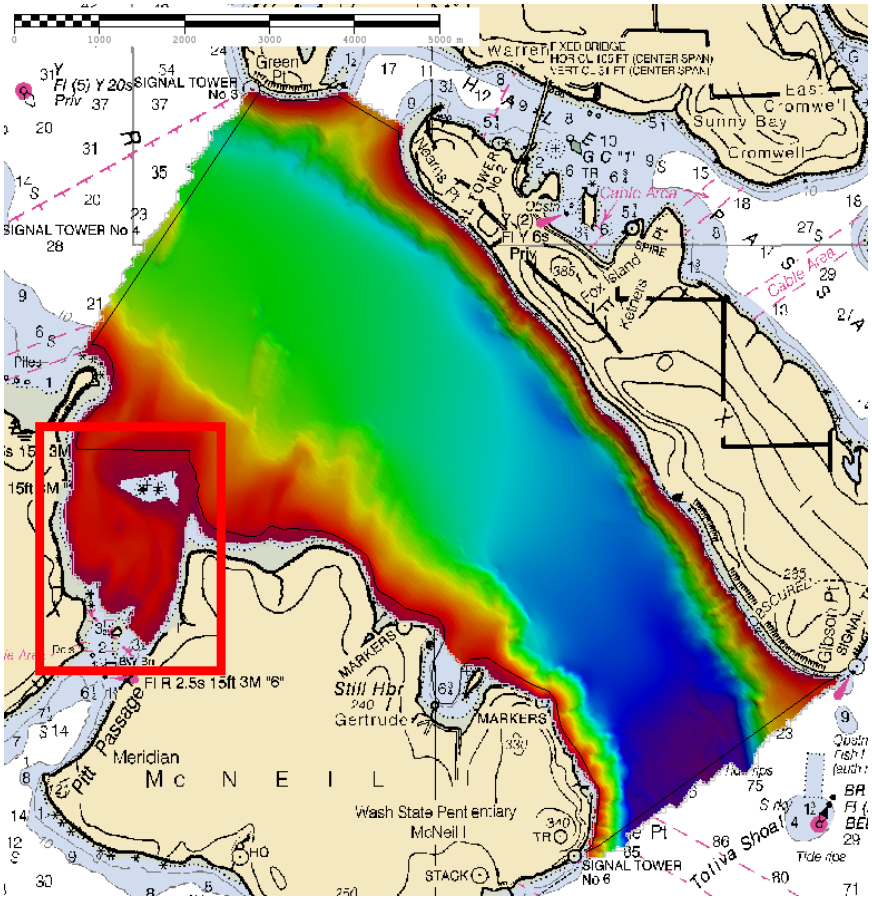


Figure 3: Wyckoff Shoals and Pitt Passage coverage extends beyond suggesed survey limits due to observed traffic outside of areas marked safe for navigation.

A.2 Survey Purpose

The Southern Puget Sound area is in need of bathymetry survey. The prior surveys in this area date back to the 1930s. The intent of this priority survey is to supersede all bathymetry, sea floor features, and bottom characteristics within the survey boundaries. These instructions define how the hydrographic data will be acquired and will be used to update NOAA nautical charts.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey H12310 is complete and required no additional work is required.

A.4 Survey Coverage

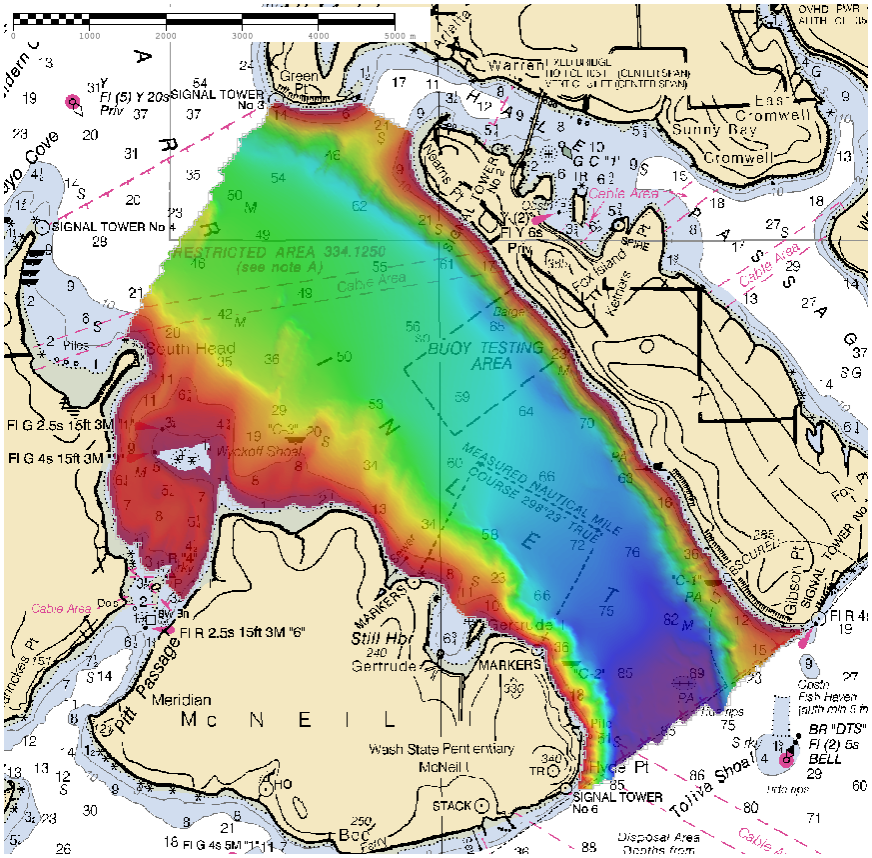


Figure 4: Survey area for survey H12310.

4.5 METER GAP IN COVERAGE TO THE 4 METER CURVE

A 4.5 meter gap in data, located near Nearns Point, Fox Island (47/16/25.99 N, 122/40/17.98 W) does not complete coverage to the four meter curve. The Hydrographer recommends charting as per digital data (see Figure 5).

HOLIDAYS

Three holidays greater than three nodes across were located within survey H12310. The corresponding multibeam backscatter side scan was examined and no navigationally significant items were found; additionally, the least depths were represented.

WYCKOFF SHOAL HOLIDAYS

Two of the holidays are within close proximity, located 47/14.34.27 N, 122/42.12.81 W, on chart 18448, Southern Carr Inlet, approximately 700 meters north east of Wyckoff Shoal.

These holidays just meet the minimum requirements of a holiday (greater than three nodes), and occur in depths of 27.4 meters. There is no evidence that a feature is obscured; there is no scouring, nor shoaling trends of surrounding bathymetry.

The Hydrographer recommends that bathymetric data supersede as charted (see Figure 6).

HALE PASSAGE HOLIDAY

A holiday located 47/16/25.65 N, 122/40/18.31 W, on chart 18448, Southern Carr Inlet, near the west end of Fox Island, near the entrance to Hale Passage.

This holiday is nine meters long and six meters wide and occurs in depths of 6.7 meters. There is no evidence that a feature is obscured; there is no scouring, nor shoaling trends of surrounding bathymetry.

The Hydrographer recommends that bathymetric data supersede as charted (see Figure 7).

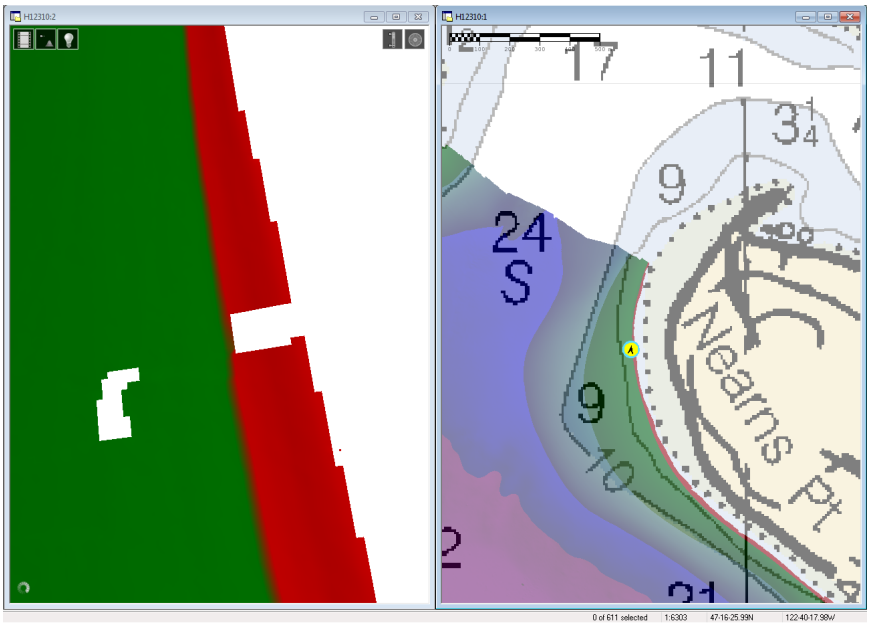


Figure 5: Associated image (left) a gap in data prevents complete coverage to the four meter curve. The location (right) is Nearns Pt, Fox Island.

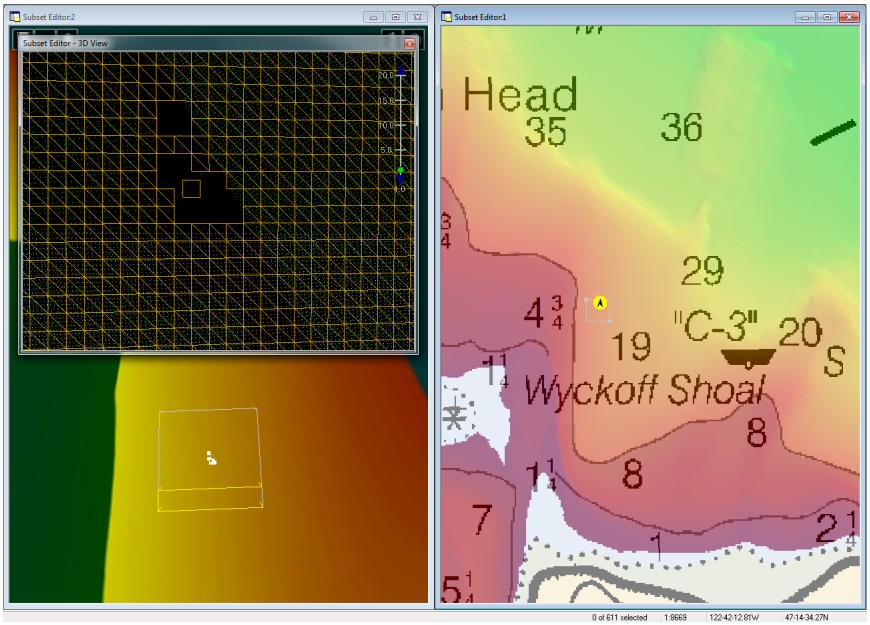


Figure 6: Associated image (left) is a one meter CUBE surface viewed in 3D Display, with a one meter wireframe reference surface viewed in a 3D subset, showing two holidays in close proximity each greater than four nodes . The location (right), is approximately 70 meters north east of Wyckoff Shaol.

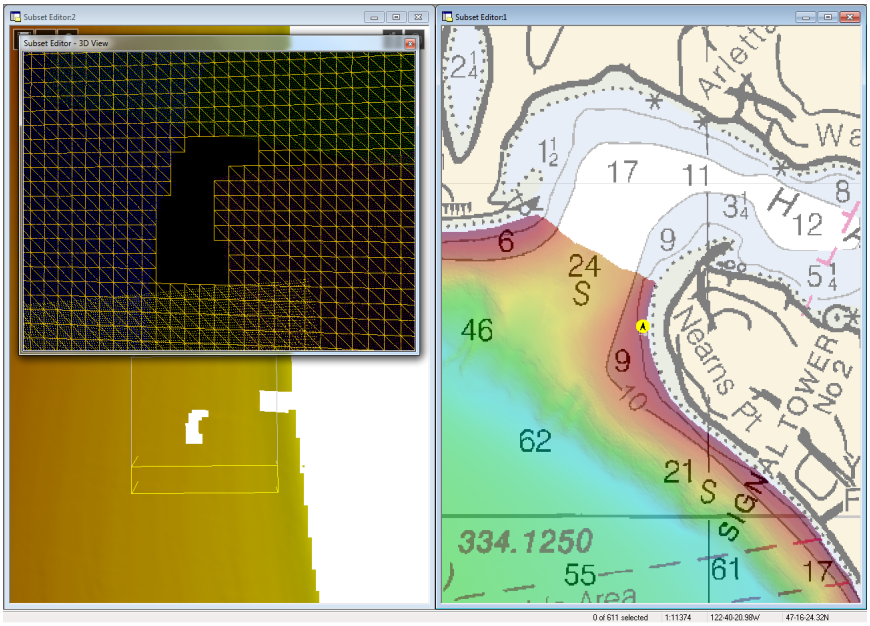


Figure 7: Associated image (let) is a two meter CUBE surface viewed in 3D Display, with a two meter wireframe reference surface viewed in a 3D subset , showing a holiday greater than four nodes. The location (right) is near the west end of Fox Island, near the entrance to Hale Passage (yellow, arrow).

A.5 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	*Total*
LNM	**SBES Mainscheme**	0
	MBES Mainscheme	261.3
	Lidar Mainscheme	0
	SSS Mainscheme	0
	SBES/MBES Combo Mainscheme	0
	SBES/SSS Combo Mainscheme	0
	MBES/SSS Combo Mainscheme	0
	SBES/MBES Combo Crosslines	13.86
	Lidar Crosslines	0
Number of Bottom Samples		4
Number of DPs		0
Number of Items Items Investigated by Dive Ops		0
Total Number of SNM		10.47

Table 2: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates
05/04/2011
05/05/2011
05/09/2011
05/10/2011
05/11/2011
05/12/2011
05/17/2011
05/23/2011
06/16/2011
06/21/2011
06/24/2011
06/27/2011
07/08/2011
07/11/2011
07/18/2011
07/20/2011
07/26/2011
08/18/2011
08/30/2011
09/08/2011
09/15/2011
09/22/2011
10/14/2011

Table 3: Dates of Hydrography

Complete multibeam echosounder (MBES) coverage was achieved in the survey area in waters 4 meters and deeper.

A.6 Shoreline

During survey operations the Hydrographer extended coverage over Wyckoff Shoal and Pitt Passage to the sheet limit, beyond suggested survey limits provided by the branch. The provided composite source file

(0_1AFF01.000) features were edited to the constraints of the suggested survey area. Therefore, shoreline verification was not conducted to the shoreline associated with the extended survey area (see Figure 8).

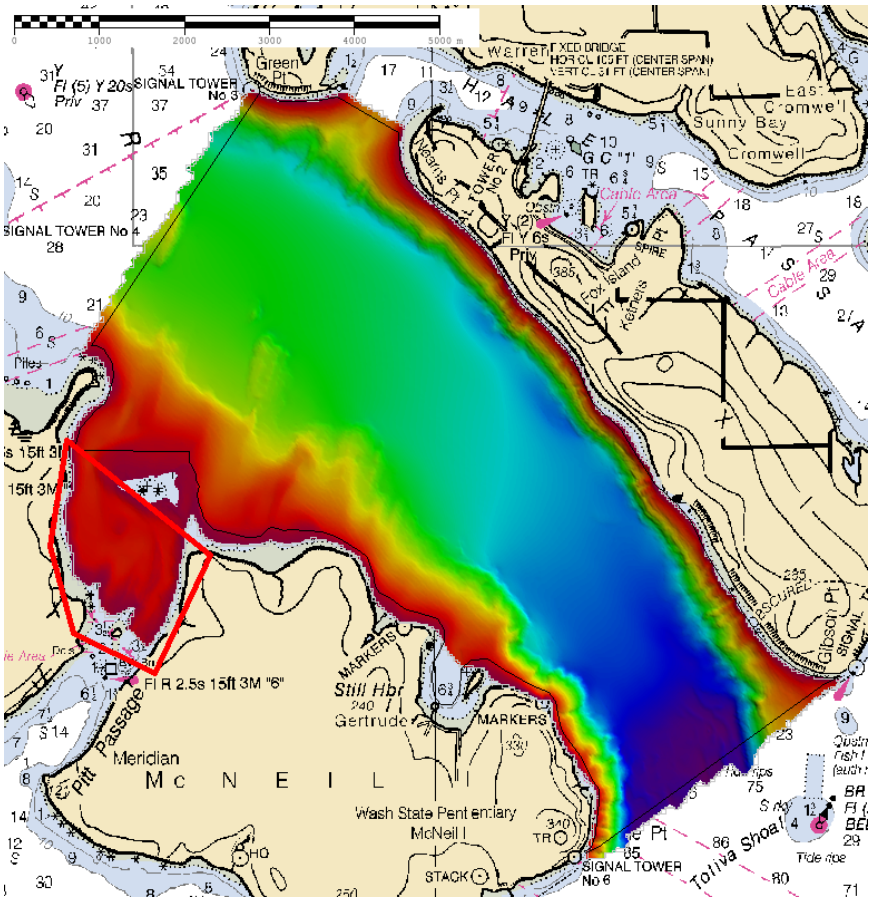


Figure 8: Extended area of survey coverage (red box) where shoreline verification was not conducted.

A.7 Bottom Samples

Bottom Samples were acquired in accordance with the Project Instructions or the HSSD.

Do Not Concur. No bottom samples were submitted by the field. All charted bottom types in the survey area were recommended to be retained.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional

information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	***S1212***
LOA	32 feet
Draft	0.65 meters

Table 4: Vessels Used

Figure 9: NOAA Survey Launch S1212.

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	**Model**	**Type**
Konsberg	EM3002	MBES
Applanix	POS/MV	Vessel Attitude System
Applanix	POS/MV	Positioning System
Odom	Digibar Pro	Sound Speed System

Table 5: Major Systems Used

Konsberg EM 3002 was exclusively used for data acquisition for survey H12310.

B.2 Quality Control

B.2.1 Crosslines

CROSSLINE OVERVIEW

Multibeam Echosounder (MBES) crosslines totaled 13.86 nautical miles, comprising 5.31% of mainscheme MBES hydrography, satisfying field procedure requirements. The mainscheme bathymetry was manually compared to the crossline nadir beams in CARIS subset mode. Additionally the Hydrographer created a one meter swath angle BASE surface showing a standard deviation representing areas 0.3 meters greater than the mean surface. Comparison yielded excellent agreement with no discernible offsets between crosslines and mainscheme bathymetry greater than IHO Order 1 error limits.

CROSSLINE DN192_1635

Crossline DN192_1635, located near Wyckoff Shoals, 47/14/39.43 N, 122/42/47.57 W, exhibited the greatest disagreement, with error 0.2 meters shoaler than mainscheme bathymetry, yet still within IH0 Order 1 error limits (see Figure 10).

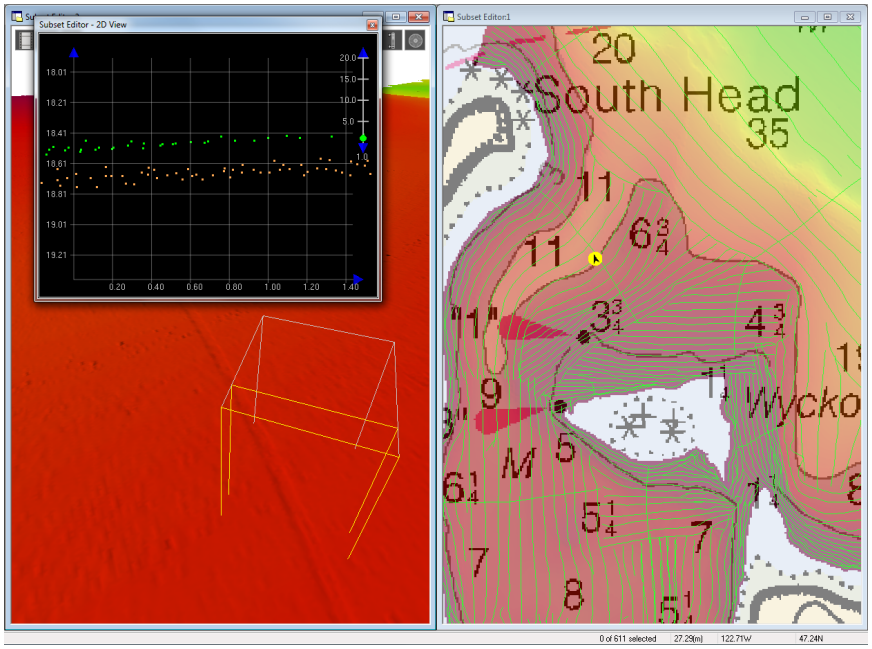


Figure 10: Associated image (left) is a half meter swath angle surface viewed in 3D Display, with a 2D view of a subset showing the 0.2 meter differences between crossline (green) and mainscheme bathymetry data (orange). The location (right) is near Wyckoff Shoals (yellow, arrow).

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0.01meters	0.14meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
S1212	0.5meters/second		0.3meters/second

Table 7: Survey Specific Sound Speed TPU Values

Uncertainty values of submitted, finalized grids are calculated in CARIS HIPS & SIPS using the “Greater of the Two” of total propagated uncertainty and standard deviation (scaled to 95%). An “IHO-ness” attribute layers were created for all H12310 finalized surface in CARIS HIPS & SIPS for analysis. Uncertainty values throughout the survey meet IHO Order 1 specifications with the exception of those areas show in red (see Figure 11).

Note that all designated soundings and minuscule speckling at the edge of bathymetry did not meet IHO Order 1 specifications.

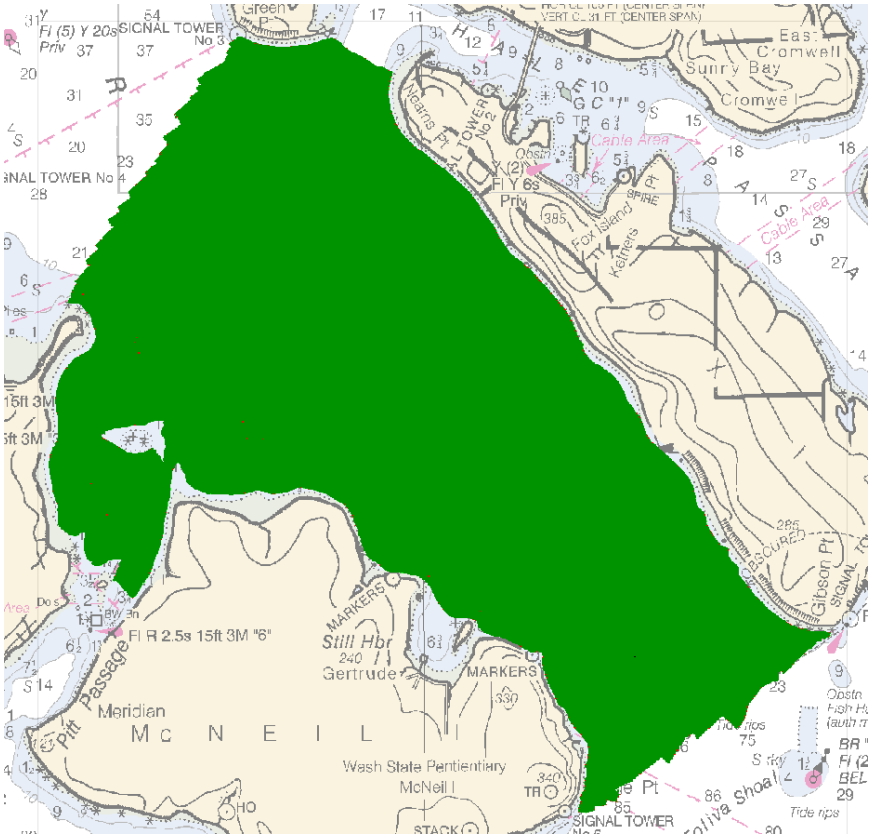


Figure 11: Associated image is all data that is green met IHO Order 1 specifications. Data that is red did not meet IHO Order 1 Specifications.

B.2.3 Junctions

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12311	1:10000	2011	Navigation Response Team 3	NW
H12312	1:10000	2011	Navigation Response Team 3	W

Table 8: Junctioning Surveys

H12311

Survey H12310 junctions with survey H12311. Survey H12311 and H12310 are both part of the same project, OPR-N360-NRT3-11, and data collected during the same time frame and with the same vessel, Survey Launch S1212.

Comparison was made using Caris Hips & Sips subset mode, where the Hydrographer examined both data sets simultaneously. Overlap was generous, averaging over 100 meters. The surveys agreed strongly. No data exceeded IHO Order 1 standards.

A common junction was made with this survey.

H12312

Survey H12310 junctions with survey H12312. Survey H12312 and H12310 are both part of the same project, OPR-N360-NRT3-11, and data collected during the same time frame and with the same vessel, Survey Launch S1212.

Comparison was made using Caris Hips & Sips subset mode, where the Hydrographer examined both data sets simultaneously. Overlap was generous, averaging over 100 meters, with shoaler areas as much as 50 meters overlap. Although some sound velocity error was noted with survey H12312, generous overlap of line spacing prevented the error from being an issue. The surveys agreed strongly. No data exceeded IHO Order 1 standards.

A common junction will be made with this survey during its compilation.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

B.2.5.1Konsberg Simrad EM 3002 Systematic Error, “Devil Horns”

The Konsberg Simrad EM 3002 sonar exhibited a consistent systematic error: two downward along-track spikes were consistently evident near 9-12 degrees either side of nadir. However, the one meter combined CUBE surface negated the error to within 0.1-0.2 meters, within IHO Order 1 specifications (see Figure 12).

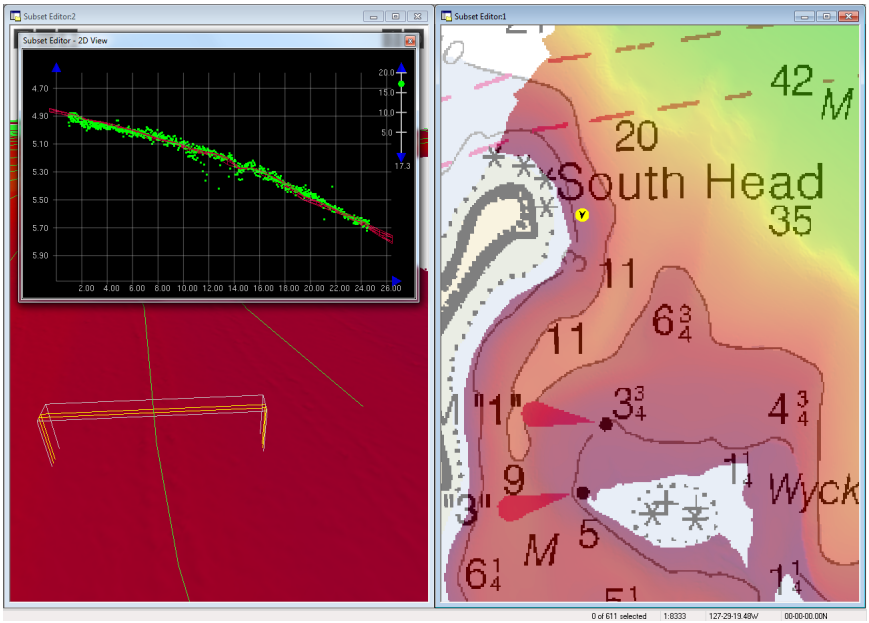


Figure 12: Associated image (left) is a half meter swath angle surface viewed in 3D Display, with a 2D view of a subset showing the "Devil Horns" anomaly. Note how the half meter swath angle surface exhibits the "Devil Horns" at nadir near the tracklines. The location (right) is near Wyckoff Shoals. 47/15/58.8 N, 122/42/57.02 W (yellow, arrow).

B.2.6 Factors Affecting Soundings

B.2.6.1 Submerged Aquatic Vegetation

Underwater vegetation near the four meter curve along the south western extent of Fox Island and the southern tip of Green Point was sporadically prevalent in mainscheme bathymetry. Four major areas of vegetation bloom were encountered and cleaned by the Hydrographer.

Three areas of vegetation bloom are located near the shore of Fox Island, locations: near Gibson Point (47/13/05.2 N, 122/36/27.81 W), near the "wreck showing any portion of hull or superstructure at level of chart datum" symbol (47/14/07.45 N, 122/37/37.30 W), and near the middle western shore of Fox Island (47/14.51 N, 122/38/28.33 W) (see Figure 13).

An area of vegetation bloom is located at the southern tip of Green Point (47/16/45.94 N, 122/41/04.55 W) (see Figure 14).

The Hydrographer recommends bathymetry supersede as charted.

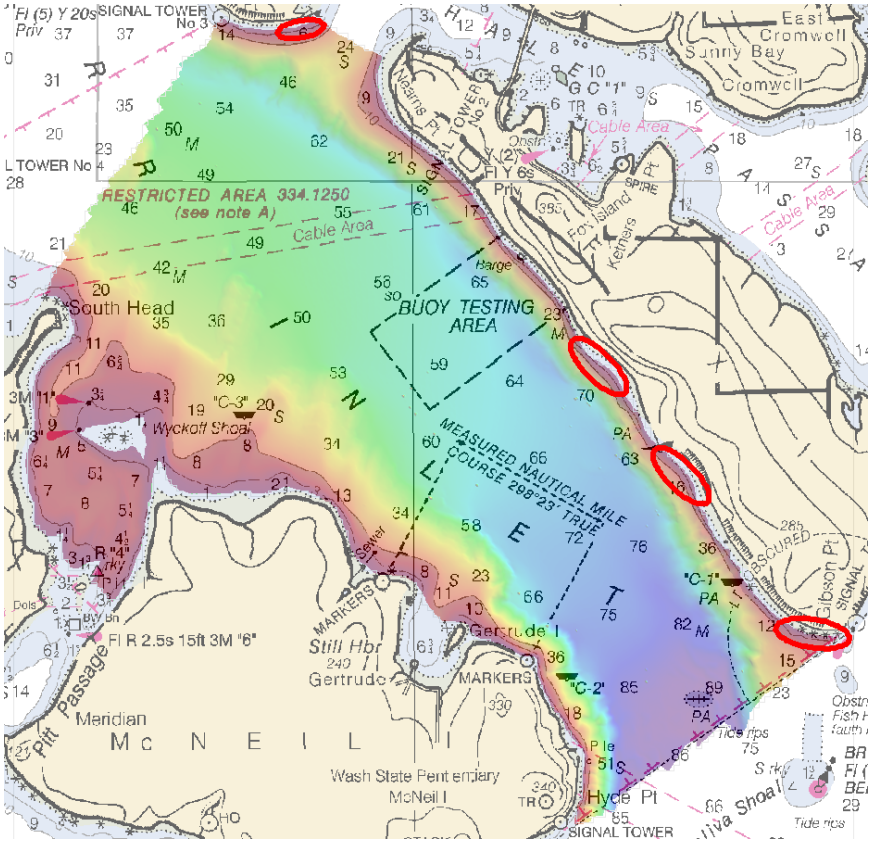


Figure 13: Associated image: Areas of 'vegitation bloom,' circled red, located on sheet H12310, overlaid on chart 18448.

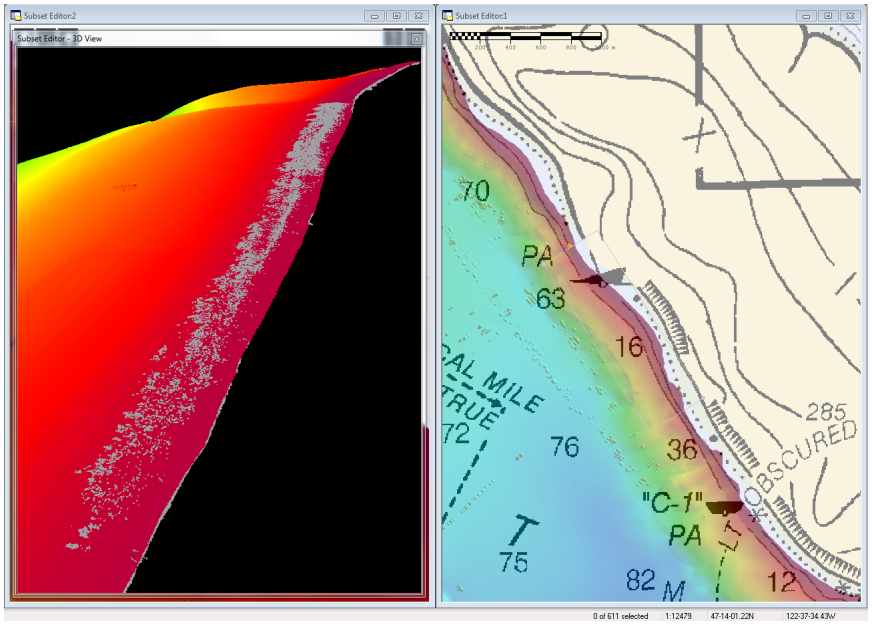


Figure 14: Associated image (left) is a 3D view of 'vegitation bloom' near the four meter curve cleaned by the Hydrographer (grey soundings). The location (right) "wreck showing any portion of hull or superstructure at level of chart datum" symbol, near the western shore of Fox Island.
Seaweed has been recommended for charting at these locations.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: CTD casts were performed and data loaded into th Konsberg EM 3002 multibeam using SIS acquisition software prior to logging data. Additional casts were made at four hour intervals or more frequently when observed surface sound speed values changed significantly (approximately 3 meters per second). CTD data was applied real-time during acquisition; no post application of CTD data was performed. This methodology is unique to the Konsberg EM 3002.

The Hydrographer employed proactive sound speed methodology using a Seacat Profiler CTD SBE 19plus. Over the duration of the survey the Hydrographer studied surface velocity trends throughout the survey area. During acquisition the Hydrographer 'blocked' his daily survey area in accordance to surface sound velocity zones that he had established. Sound velocity casts were taken within four hours, but were only taken in areas that exhibited stable surface velocity within the daily defined survey area. As a result sound velocity error is difficult to measure within survey H12310 and not a single sound velocity error was identified outside of Order 1 specifications.

B.2.8 Coverage Equipment and Methods

All Equipment and survey methods were used as detailed in the DAPR.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter was not collected for this survey.

B.5 Data Processing

B.5.1 Software Updates

The following software updates occurred after the submission of the DAPR:

Manufacturer	Name	Version	Service Pack	Hotfix	Installation Date	Use
Caris	HIPS/SIPS	7.1	2	0	10/04/2011	Processing

Table 9: Software Updates

The following Feature Object Catalog was used: S-57 ENC 3.1

B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
1m_cube	CUBE	1 meters	0.22 meters - 195.26 meters	NOAA_1m	Complete MBES
2m_cube	CUBE	2 meters	0.24 meters - 168.07 meters	NOAA_2m	Complete MBES
4m_cube	CUBE	4 meters	0.28 meters - 167.7 meters	NOAA_4m	Complete MBES
8m_cube	CUBE	8 meters	0.23 meters - 167.63 meters	NOAA_8m	Complete MBES
1m_cube_Final	CUBE	1 meters	0.22 meters - 20 meters	NOAA_1m	Complete MBES
2m_cube_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
4m_cube_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
8m_cube	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES
16_cube_Final	CUBE	16 meters	144 meters - 167.47 meters	NOAA_16m	Complete MBES

Table 10: CARIS Surfaces

One field sheet was created for survey H12310. Various cube resolution surfaces were created for the various depths encountered during survey, and finalized surfaces were created as outlined by the 2011 Field Procedures Manual. Surfaces were cleaned using directed editing methods. Designated soundings were applied to features that the Hydrographer determined to warrant object detection coverage standards.

The 16m combined surface, H12310_16m_Combined, created during office processing was used for compilation.

C. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary tide station at Tacoma, Washington (944-6484) served as control for datum determination and as the primary source for water level reducers for survey H12311. No tertiary gage was required.

All data were reduced to MLLW using the final approved water levels (verified tides) from the Tacoma, WA station (944-6484) by applying tide file 9446484.tid and time and height correctors through the zone corrector file H12310CORF.zdf. It will not be necessary for the Pacific Hydrographic Branch to reapply the final approved water levels (smooth tides) to the survey during branch processing.

C.1 Vertical Control

The vertical datum for this project is Mean lower low water.

Standard Vertical Control Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Tacoma, WA	944-6484

Table 11: NWLON Tide Stations

File Name	Status
9446484.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
H12310CORF.zdf	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 10/17/2011. The final tide note was received on 10/28/2011.

Tides were successfully applied to survey H12310.

The Tide Note is attached.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

No issues were found with DGPS during survey acquisition.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Robinson Point, WA. 323 kHz

Table 14: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 TIDE ERROR

TIDE ERROR, OVERVIEW

Although final tides are applied to survey H12310, there is discernible tide error located throughout the survey. This error is mostly found near the inshore limit of hydrography and was exacerbated by the survey

crew performing data acquisition of the final few lines of the inshore limit at a different date than the rest of the mainscheme data.

The strong majority of the tide error is within IHO Order 1 limits, averaging 0.2 meters of offset. However, there are three areas -- North Fox Island, North McNeil Island, and South Fox Island --that exhibit error as great as 0.5 meters. These areas are discussed in detail below (see Figure 15).

TIDE ERROR, FOX ISLAND

Tide error as great as a half meter is present in mainscheme bathymetry approximately three kilometers south of the north end of Fox Island, 47/15/27.75 M, 122/39/13.99 W. Data collected on days June 23 (DN175) and July 17 (DN199) exhibited a tide error as great 0.5 meters, near the limits of IHO Order 1 specifications. However, due to the severe downhill slope of the glacially cut Carr Inlet the Hydrographer recommends that mainscheme bathymetry supersede as charted (see Figure 16).

TIDE ERROR, NORTH MCNEIL ISLAND

Tide error as great as a half meter was present in mainscheme bathymetry approximately 1.8 kilometers east of Wyckoff shoals, near the northern most extent of McNeil Island, 47/14/00.48 M, 122/41/06.37 W. Data collected on days July 19 (DN201) and July 25 (DN207) exhibited a tide error as great 0.5 meters, near the limits of IHO Order 1 specifications. Despite minor deviations from data meeting IHO specifications, the Hydrographer recommends all data be deemed acceptable and should be used to supersede prior charted data (see Figure 17).

TIDE ERROR, SOUTH FOX ISLAND

Subtle tide issues with error as much as 0.25 meters were present near south shore of Fox Island, 47/13/36.93 N, 122/37/18.02 W. Examination in CARIS Subset mode revealed a subtle downslope tide variance between survey days June 15 (DN167) and July 10 (DN192). None of the error exceeds IHO Order 1 specifications (see Figure 18).

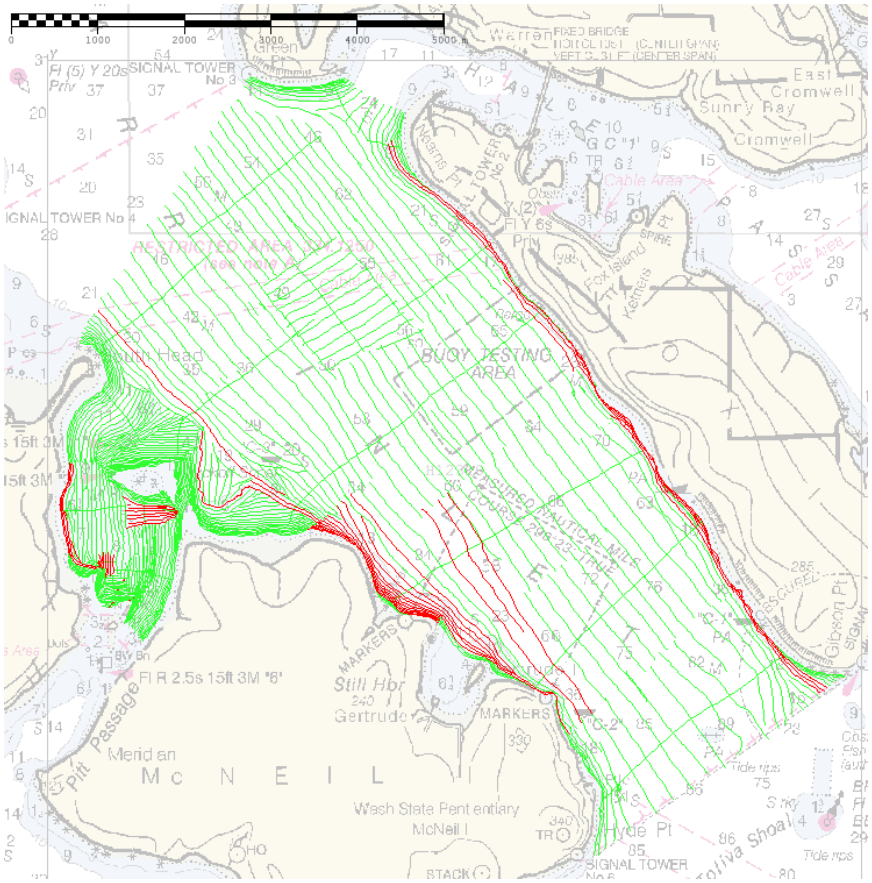


Figure 15: H12310 Survey lines colored red that exhibited discernable tide error.

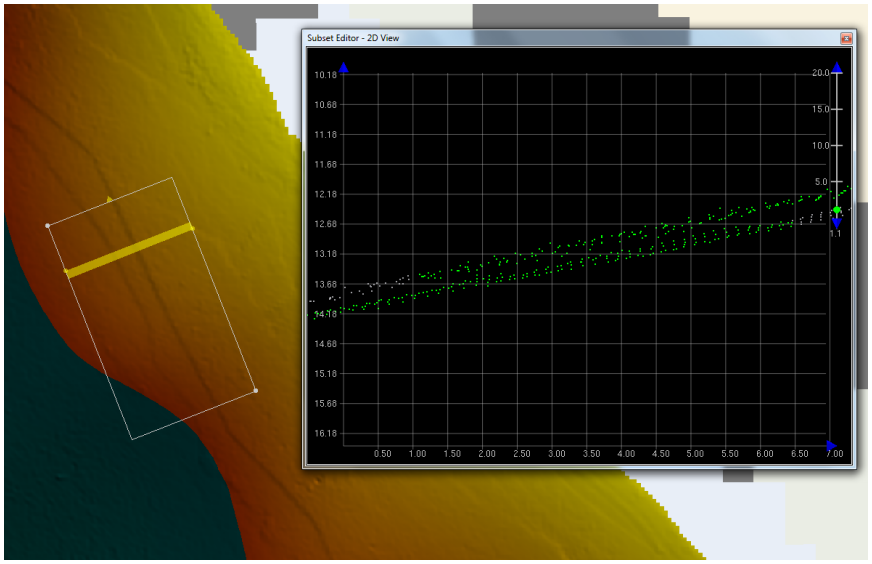


Figure 16: Associated image (left) is a 2D view of a subset showing subtle tide error between survey days June 23 (DN175) and July 17 (DN199). The error is within IHO Order 1 specifications.

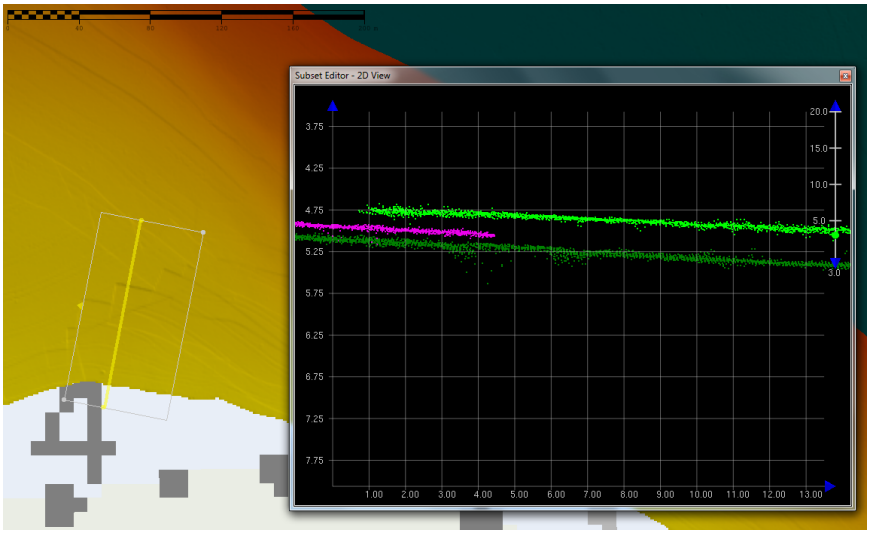


Figure 17: Associated image (left) is a 2D view of a subset showing subtle tide error between survey days July 19 (DN201) and July 25 (DN207). The error is within IHO Order 1 specifications.

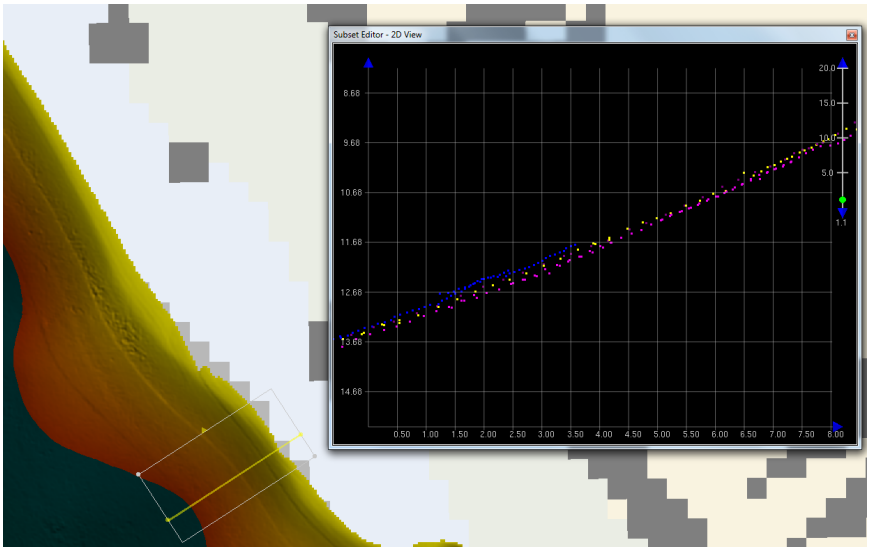


Figure 18: Associated image (left) is a 2D view of a subset showing subtle tide error between survey days June 15 (DN167) and July 10 (DN192). The error is within IHO Order 1 specifications.

The data is adequate for charting despite the tide errors.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Raster Charts

The following are the largest scale raster charts, which cover the survey area:

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
18448	1:80000	34	07/2006	12/20/2011	12/31/2011

Table 15: Largest Scale Raster Charts

18448

CHART COMPARISON, DEPTHS AND SOUNDINGS

Bathymetric depths exhibited strong general agreement with charted soundings on chart 18448. Eleven depth to sounding comparisons exceeded at least a half-fathom difference either shoaler or deeper as charted. No discernible environmental trends, such as migrating sedimentation, were evident (see Figure 19).

Of all differences between bathymetry and charted soundings, the greatest difference was located over the 70 fathom sounding near the middle shore of Fox Island (47-14-32.82N, 122-38-24.14W). Bathymetry was 17.6 fathoms shoaler than the 70 fathom sounding, with a least depth 52.46 fathoms. All the the depths in question are well within safe navigable limits. The Hydrographer recommends bathymetry supersede as charted (see Figure 20).

CHART COMPARISON, ISOPLETHIC

Isoplethic comparison between bathymetry and chart 18448 contours showed general agreement with broad variations as great as 120 meters offset. No isoplethic trends exhibited dramatic difference with charted contours. There does appear to be general trends of scouring deepening the entrance to Hale Passage. The Hydrographer recommends bathymetry supersede as charted.

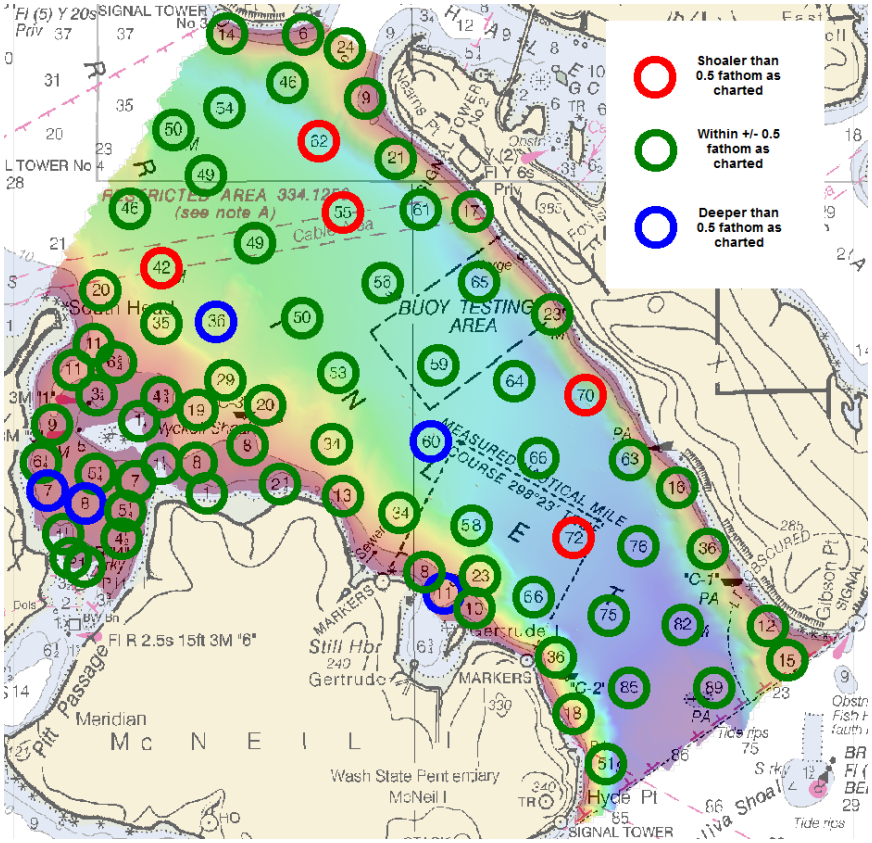


Figure 19: Depth and sounding comparison within half fathom.

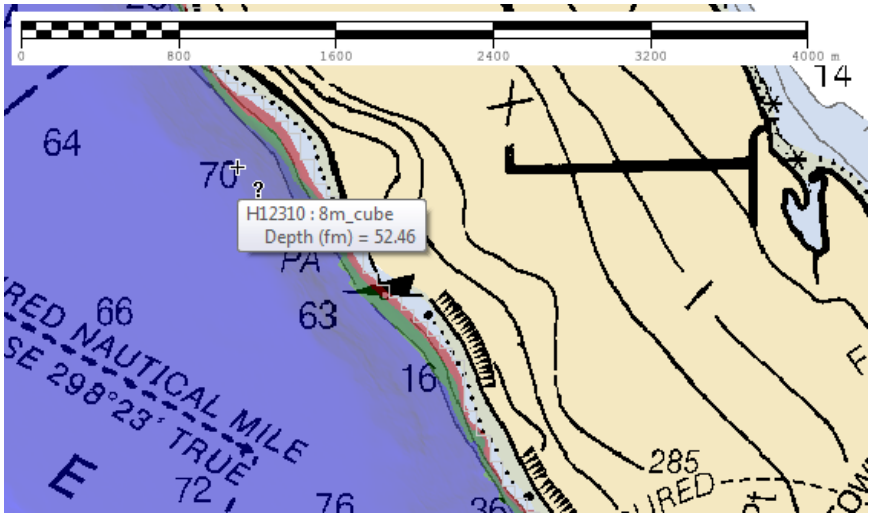


Figure 20: The greatest difference between depth and sounding occured over this 70 fathom sounding.

The 1:20,000 scale inset to Chart 18445 covers the southwestern portion of the survey. Survey depths generally agree within a half fathom of charted depths.

D.1.2 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4WA10M	1:80000	18	03/11/2011	03/11/2011	NO

Table 16: Largest Scale ENCs

US4WA10M

CHART COMPARISON, ISOPLETHIC

Isoplethic comparison between bathymetry and ENC US4WA10M contours showed general agreement with broad variations as great as 120 meters offset. No isoplethic trends exhibited dramatic difference with charted contours. There does appear to be general trends of current scouring deepening the entrance to Hale Passage. A more thorough comparison of shoreline features can be found in the shoreline comparison section. The Hydrographer recommends bathymetry supersede as charted.

D.1.3 AWOIS Items

Number of AWOIS Items Addressed: 2
Number of AWOIS Items Not Addressed: 0

AWOIS OVERVIEW

Two AWOIS items were assigned for investigation within survey H12310, AWOIS items 54002 and 54003. Both AWOIS items are charted wrecks (see Figure 21).

AWOIS ITEM 54002, THE BIG CHARTED WRECK

A large charted wreck located 47/12.27 N, 122/37.26 W, on chart 18448, Southern Carr Inlet, near the entrance of Tacoma Narrows, was verified by bathymetry.

Shoalest depth of wreck is 160.31 meters; length overall is approximately 62.5 meters, beam is approximately 20 meters.

The Hydrographer recommends changing the "dangerous wreck, depth unknown" symbol to "foul ground, non-dangerous to navigation but to be avoided by vessels anchoring, trawling, etc." symbol, and place symbol to encompass wreck appropriately (see Figure 22).

AWOIS ITEM 54003, THE LITTLE CHARTED WRECK

A small charted wreck located 47/14/09.34 N, 122/37/49.66 W, on chart 18448, Southern Carr Inlet, located 2.9 kilometers from the entrance of Tacoma Narrows on Fox Island, was verified by bathymetry.

Shoalest depth of wreck is 16.98 meters; length overall is approximately 14.7 meters, beam is approximately 3 meters.

The Hydrographer recommends changing the "wreck showing any portion of hull or superstructure at level of chart datum" symbol to "submerged wreck, depth known" symbol, and placing the symbol at the location of the wreck appropriately (see Figure 23).

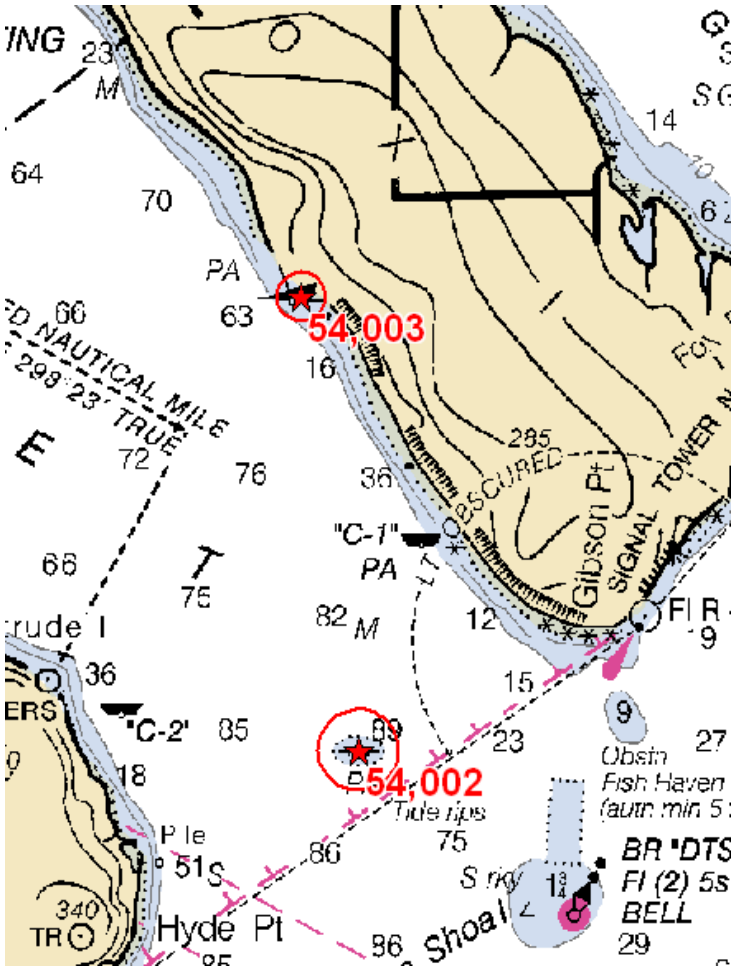


Figure 21: Two AWOIS items assigned for survey H12310.

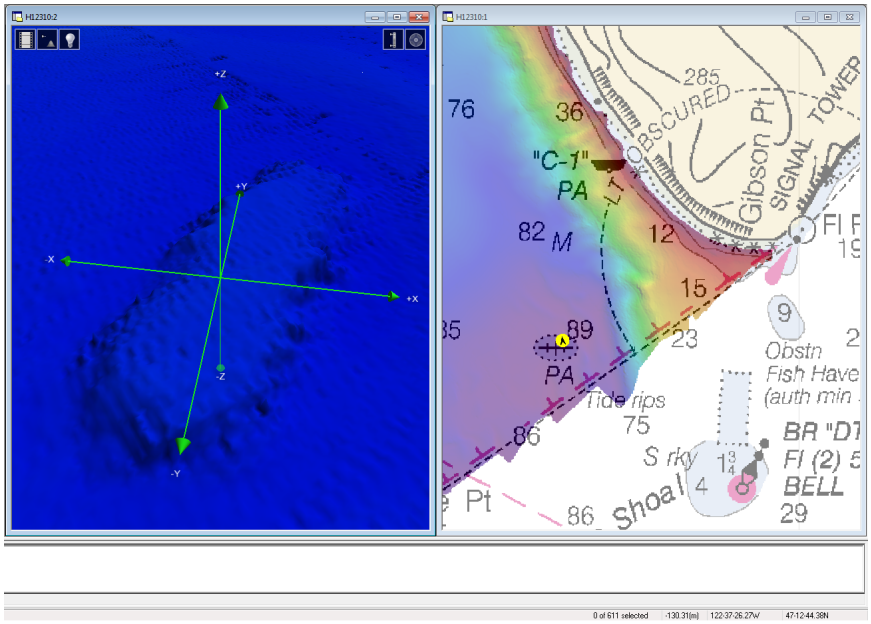


Figure 22: AWOIS item 54002. Associated image (left) is a half meter swath angle surface, viewed in 3D Display. The location (right) is near the eastern entrance to Tacoma Narrows (yellow, arrow).

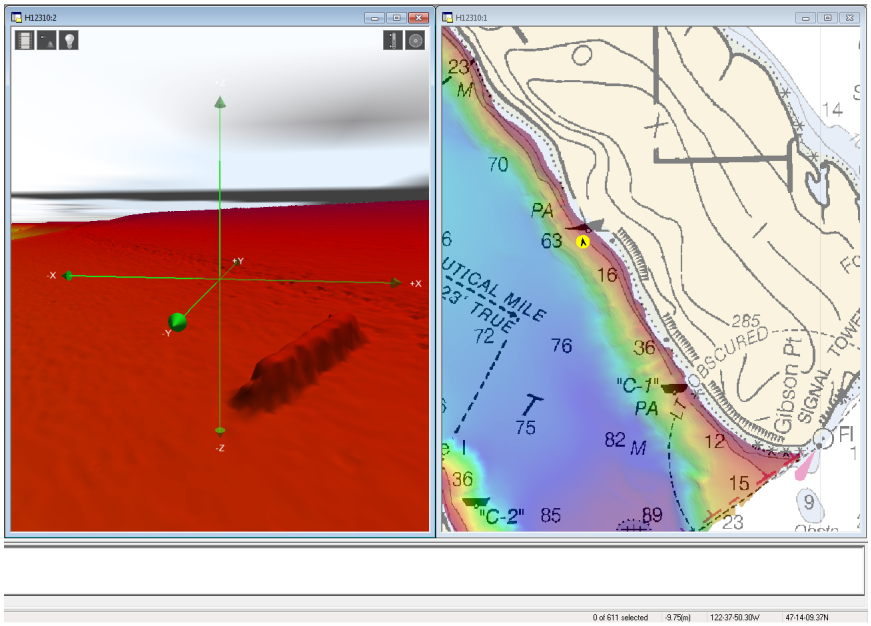


Figure 23: AWOIS item 54003. Associated image (left) is a half meter swath angle surface, viewed in 3D Display. The location (right) is 2.9 kilometers form the entrance of Tacoma Narrows on Fox Island.
Both wrecks were recommended to be charted as point objects at the location of their least depths. See attached AWOIS report.

D.1.4 Charted Features

Survey H12310 assigned AWOIS items, 54002 and 54003, are charted with 'PA' attribution on chart 18448. These items are addressed AWOIS items section of this report.

The AWOIS report is attached.

D.1.5 Uncharted Features

Notable feature, rock, located 47/13/09.12 N, 122/39/29.63 W (yellow, arrow), on chart 18448, Southern Carr Inlet, located near Gertrude Island.

Shoalest depth of rock is 1.29 meters.

The location of the rock is near the entrance to a small boat dock operated and maintained by the Washington State Department of Corrections, McNeil Island Corrections Center. The rock falls within a posted restricted zone. The issue was raised if this feature posed a navigational risk, however, after corresponding with the Pacific Hydrographic Branch, the rock was not considered a danger to navigation (the correspondence, Gertrude_Rock_correspondence.txt, is located in the Supplemental Survey Records and Correspondence folder).

The Hydrographer recommends bathymetry supersede as charted (see Figure 24).

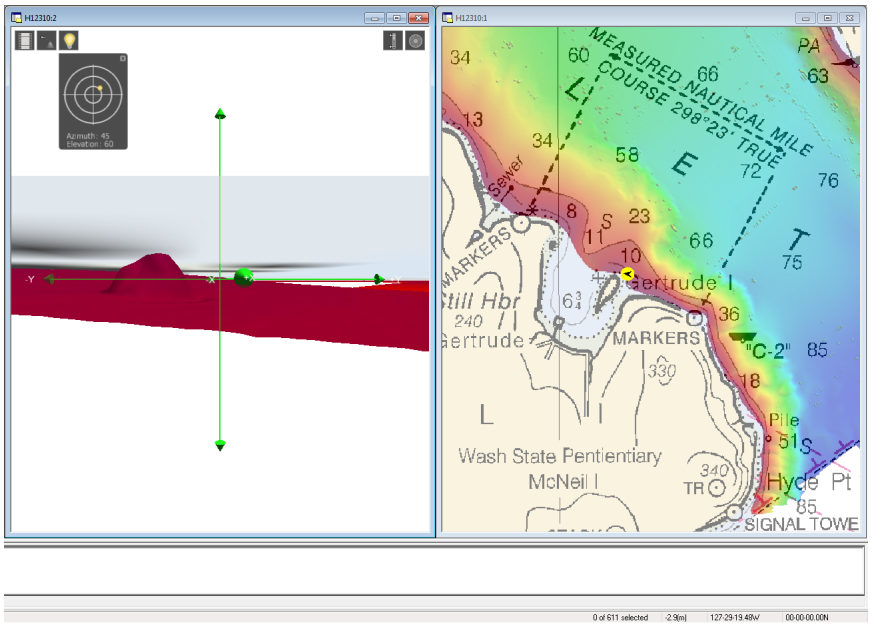


Figure 24: Notable feature, rock, located 47/13/09.12 N, 122/39/29.63 W (yellow, arrow), on chart 18448, Southern Carr Inlet, located near Gertrude Island.

The rock was recommended for charting.

D.1.6 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.7 Shoal and Hazardous Features

WYCKOFF SHOAL

Wyckoff Shoal, located at the entrance to Pitt passage (47-14-17.72N, 122-42-37.87W), was completely surveyed with 100% multibeam coverage to the 4 meter curve. During survey operations crew observed consistent traffic ‘cutting the corner’ to Pitt Passage, bypassing the aids to navigation marking safe passage around Wyckoff Shoals on the western side.

Bathymetry verified there is a small channel approximately 50 meters wide maintaining depths greater than 4 meters separating Wyckoff Shoal from McNeil Island on the eastern side.

Although locals exhibit great knowledge of Wyckoff Shoal, the Hydrographer recommends retaining Wyckoff Shoal as charted, hopefully encouraging mariners to use safe passage on the navigationally marked western side (see Figure 25).

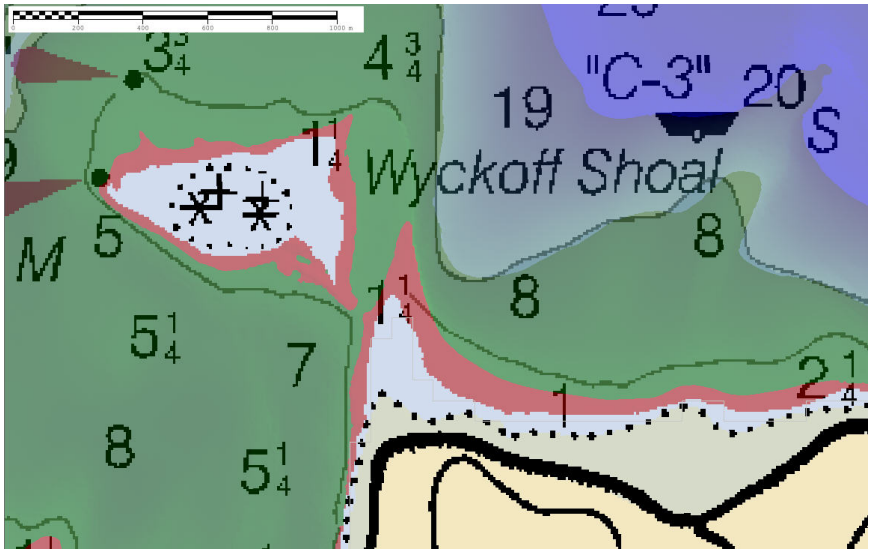


Figure 25: Wyckoff Shoal and vicinity surveyed to the 4 meter curve (red bathymetry).

D.1.8 Channels

There are no maintained channels within the area surveyed.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was accomplished using the Project Reference File (PRF) and the Assigned Feature File (AFF) provided with the project instructions. The PRF contains the survey sheet limits as well as the Automated Wreck and Obstruction Information Service (AWOIS) features and search radii. The AFF is a subset of the Composite Source File (CSF) which includes those features specifically assigned for investigation by the survey. Both PRF and AFF are S-57 attributed datasets in .000 file format.

Limited shoreline verification was conducted near predicted low water in accordance with the pertinent sections of the 2011 NOS Hydrographic Surveys Specifications and Deliverables and Field Procedures Manual. Assigned features seaward of the Navigation Area Limit Line (NALL) were addressed as required, S-57 attributed and recorded in the appropriate CARIS Notebook (v3.0, SP1, HF1) .hob files indicated in figure 14 and submitted with this survey. Also see H12310_Feature_Report.pdf in Appendix II and H12311.pss submitted with this project (see Figure 26).

Shoreline File	Description
H12310_Original_AFF.hob	Original source data (0_1AFF01.000) as provided for project OPR-N360-NRT3-11 and clipped to the limits of survey H12310 and converted to .hob format.
H12310_Field_Verified_AFF.hob	An exact copy of H12310_Original_AFF.hob modified by the field unit to best represent shoreline features at survey scale. This includes addition of new features and modification of source features. This file retains all features neither verified nor disproved by this survey.
H12310_Disprovals.hob	Features deleted from H12310_Field_Verified.hob based on survey findings.
0_4PRF01.000	Project Reference File with survey limits and AWOIS item positions and search radii.

Figure 26: List and description of H12310 shoreline files.

D.2.2 Prior Surveys

D.2.3 Aids to Navigation

A complete ATON report for survey H12310 can be found in section V Supplemental Survey Records and Correspondence / ATONS / OPR-360_atons.pdf submited with this descriptive report.

Chart ATONs according to latest ATONIS information.

D.2.4 Overhead Features

D.2.5 Submarine Features

Two submerged cable area runs through survey H12310.

The first runs from South Head (47-15-16.05N, 122-43-09.49W) to the northern area of Fox Island, just south of Nearns Point (47-15-40.89N, 122-39-29.53W) (see Figure 27).

The second runs into the southern most extent of survey H12310, 47-12-11.33N, 122-38-18.50W (see Figure 28).

No evidence of cabling was found in bathymetry. The Hydrographer recommends Cable Area remain as charted.

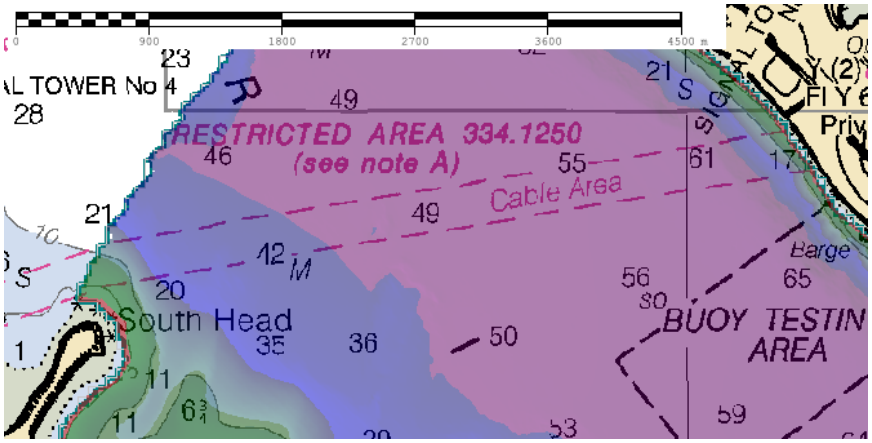


Figure 27: A cable area runs through the northern ara of survey H12310.

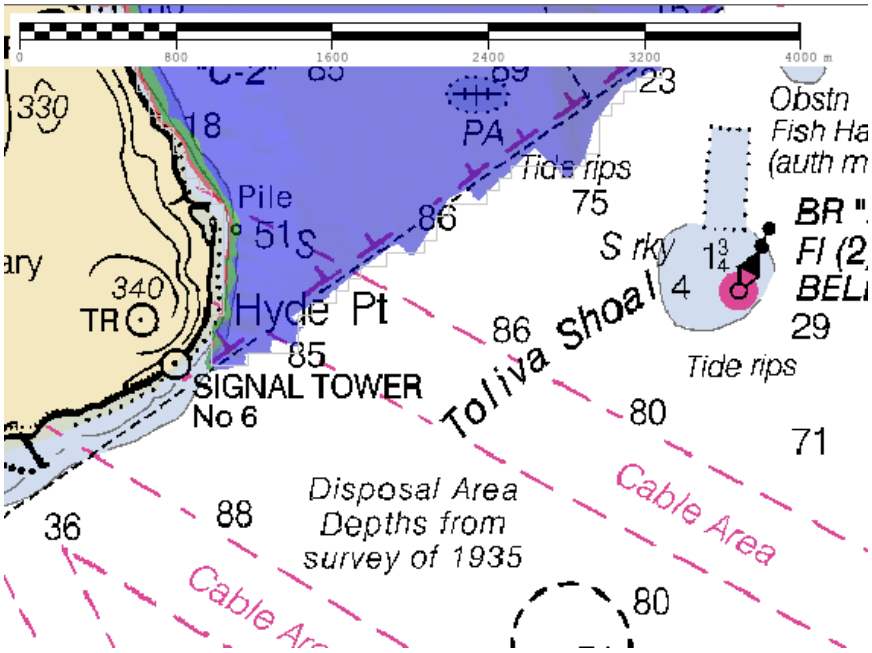


Figure 28: A cable area runs into the southern extent of survey H12310.

D.2.6 Ferry Routes and Terminals

There are no ferry routes charted within survey H12310 and none were observed to be operating within southern Carr Inlet.

D.2.7 Platforms

No existing platforms were observed in the survey area.

D.2.8 Significant Features

No new significant features were observed in the survey area.

D.2 Construction and Dredging

No present or planned construction or dredging was observed in the survey area.

E. Approval Sheet

As Chief of Party, Field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

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 all 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 with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Dan Jacobs	Chief of Party	12/27/2011	Dan Jacobs I am approving this document 2012.02.02 12:26:05 -08'00'
Ian Colvert	Sheet Manager	12/27/2011	Ian Colvert

F. Table of Acronyms

Acronym	Definition
AFF	Assigned Features File
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continually Operating Reference Staiton
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Discrete Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERZT	Ellipsoidally Referenced Zoned Tides
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division
HSSDM	Hydrographic Survey Specifications and Deliverables Manual

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Local Notice to Mariners
LNM	Linear Nautical Miles
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Porpagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Exectutive Officer
ZDA	Global Positiong System timing message
ZDF	Zone Definition File

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : October 28, 2011

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N360-NRT3-2011
HYDROGRAPHIC SHEET: H12310

LOCALITY: Southern Carr Inlet, Southern Puget Sound, WA
TIME PERIOD: May 04 - October 14, 2011

TIDE STATION USED: 944-6484 Tacoma, WA
Lat. 47° 16.0'N Long. 122° 24.8' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.331 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: PS191, PS192, PS193, and PS194

Refer to attachments for zoning information.

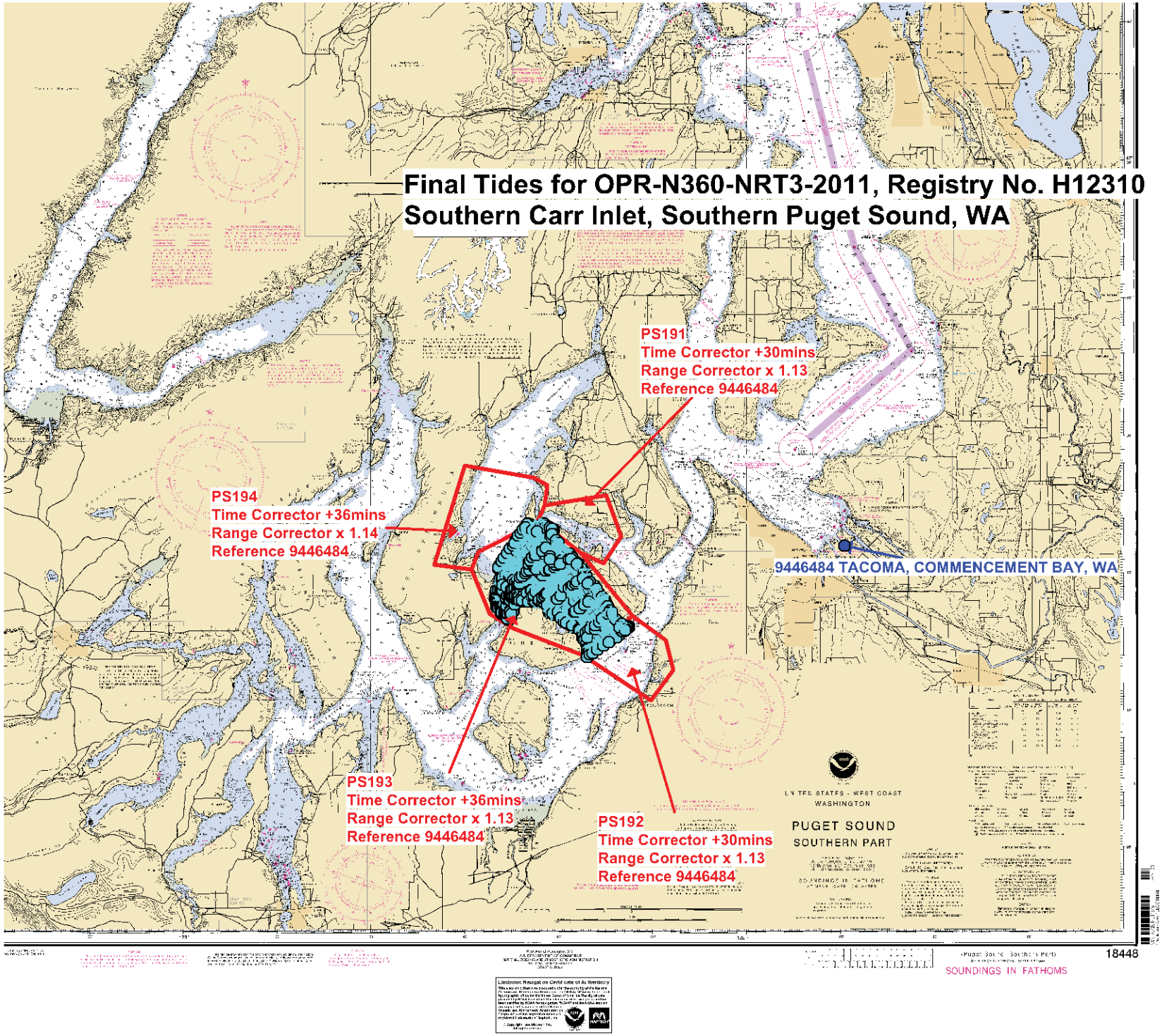
Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: This sheet would be Preliminary as Final but a single point from line dn207000_1934 fell outside of the preliminary zoning. The zone was extended roughly 114 feet to include the point.

Gerald Hovis

Digitally signed by Gerald Hovis
DN: cn=Gerald Hovis, o=Center for Operational Oceanographic Products and Services, ou=NOAA/NOS/CO-OPS/OD/PSB, email=gerald.hovis@noaa.gov, c=US
Date: 2011.10.28 11:44:17 -04'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Final Tides for OPR-N360-NRT3-2011, Registry No. H12310
Southern Carr Inlet, Southern Puget Sound, WA
PS191
Time Corrector +30mins
Range Corrector x 1.13
Reference 9446484
PS194
Time Corrector +36mins
Range Corrector x 1.14
Reference 9446484
9446484 TACOMA, COMMENCEMENT BAY, WA
PS193
Time Corrector +36mins
Range Corrector x 1.13
Reference 9446484
PS192
Time Corrector +30mins
Range Corrector x 1.13
Reference 9446484
PUGET SOUND
SOUTHERN PART
18448
SOUNDINGS IN FATHOMS

H12310 AWOIS Report

Registry Number: H12310
State: Washington
Locality: Southern Puget Sound
Sub-locality: Southern Carr Inlet
Project Number: OPR-N360-NRT3-11
Survey Dates: 05/12/2011 - 06/16/2011

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18445	32nd	08/01/2007	1:80,000 (18445_8)	[L]NTM: ?
18448	34th	07/01/2006	1:80,000 (18448_1)	USCG LNM: 2/8/2011 (2/8/2011) CHS NTM: None (1/28/2011) NGA NTM: 9/30/2006 (2/19/2011)
18440	29th	09/01/2007	1:150,000 (18440_1)	[L]NTM: ?
18003	20th	11/01/2006	1:736,560 (18003_1)	[L]NTM: ?
18007	33rd	02/01/2009	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

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

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Wreck	160.31 m	47° 12' 44.6" N	122° 37' 26.4" W	54002
1.2	Wreck	16.98 m	47° 14' 09.3" N	122° 37' 49.7" W	54003

1 - AWOIS Features

1.1) 2336/179

Primary Feature for AWOIS Item #54002

Search Position:	47° 12' 41.7" N, 122° 37' 28.5" W
Historical Depth:	[None]
Search Radius:	250
Search Technique:	S2, MB, ES
Technique Notes:	[None]

History Notes:

LNM 22/09, USCG; A submerged wreck was added to chart with label of "PA" at 47°12'41.70" - 122°37'28.48". (Entered CEH 3/2011)

Survey Summary

Survey Position:	47° 12' 44.6" N, 122° 37' 26.4" W
Least Depth:	160.31 m (= 525.96 ft = 87.661 fm = 87 fm 3.96 ft)
TPU (±1.96σ):	**THU (TPEh)** ±2.302 m ; **TVU (TPEv)** ±0.535 m
Timestamp:	2011-132.19:25:44.137 (05/12/2011)
Survey Line:	h12310 / nrt3_2011_em3002 / 2011-132 / dn132_1910
Profile/Beam:	2336/179
Charts Affected:	18445_8, 18448_1, 18440_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

A large charted wreck located 47/12.27 N, 122/37.26 W, on chart 18448, Southern Carr Inlet, near the entrance of Tacoma Narrows, was verified by bathymetry.

Shoalest depth of wreck is 160.31 meters; length overall is approximately 62.5 meters, beam is approximately 20 meters.

Feature Correlation

Source	Feature	Range	Azimuth	Status
dn132_1910	2336/179	0.00	000.0	Primary
AWOIS_EXPORT	AWOIS # 54002	101.15	025.6	Secondary

Hydrographer Recommendations

The Hydrographer recommends changing the "dangerous wreck, depth unknown" symbol to "foul ground, non-dangerous to navigation but to be avoided by vessels anchoring, trawling, etc." symbol, and place symbol to encompass wreck appropriately.

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 5:wreck showing any portion of hull or superstructure
	QUASOU - 1:depth known
	SORDAT - 20111014
	SORIND - US, US, graph, H12310
	TECSOU - 3:found by multi-beam
	VALSOU - 160.314 m
	WATLEV - 3:always under water/submerged

Office Notes

Do not concur. Relative to chart scale the wreck is best represented as a point wreck at the postion of the surveyed least depth shown above. Remove charted wreck and PA.

Feature Images

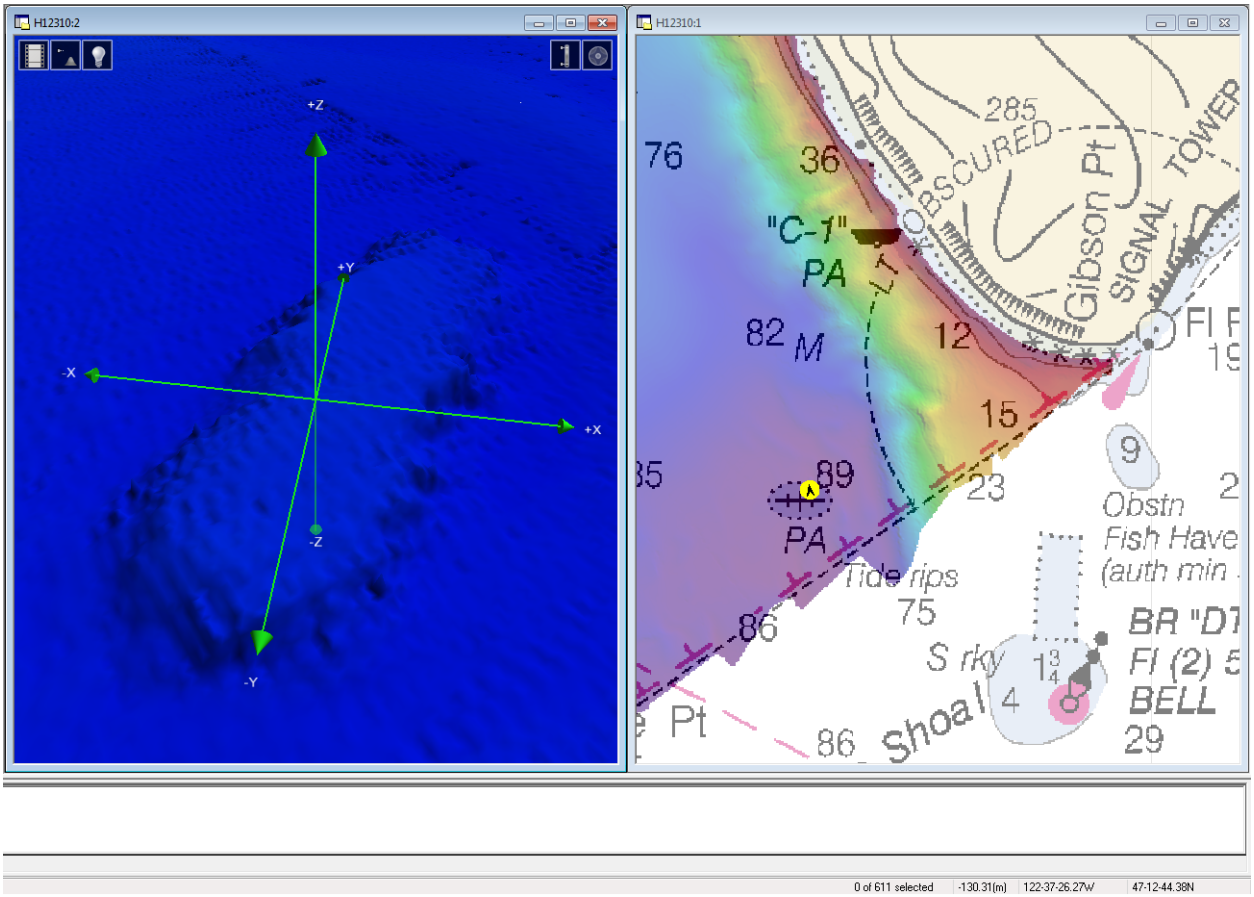


Figure 1.1.1

1.2) 5061/161

Primary Feature for AWOIS Item #54003

Search Position:	47° 14' 12.4" N, 122° 37' 45.3" W
Historical Depth:	[None]
Search Radius:	150
Search Technique:	VS, S2, ES, MB
Technique Notes:	Visible Search for Visible Wreck. If wreck is not visible, use 200% SSS and get least depth on item, with search radius of 200 meters except to the northeast were it may get to shallow to do the 200 meters.

History Notes:

**Unknown Source-- Between 1986 - 1989, a visible wreck was charted at 47/14/12.36 - 122/37/45.28. (Entered CEH 3/2001)

Survey Summary

Survey Position:	47° 14' 09.3" N, 122° 37' 49.7" W
Least Depth:	16.98 m (= 55.71 ft = 9.285 fm = 9 fm 1.71 ft)
TPU (±1.96σ):	**THU (TPEh)** ±1.381 m ; **TVU (TPEv)** ±0.299 m
Timestamp:	2011-167.19:57:16.016 (06/16/2011)
Survey Line:	h12310 / nrt3_2011_em3002 / 2011-167 / dn167_1949
Profile/Beam:	5061/161
Charts Affected:	18445_8, 18448_1, 18440_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

A small charted wreck located 47/14/09.34 N, 122/37/49.66 W, on chart 18448, Southern Carr Inlet, located 2.9 kilometers from the entrance of Tacoma Narrows on Fox Island, was verified by bathymetry.

Shoalest depth of wreck is 16.98 meters; length overall is approximately 14.7 meters, beam is approximately 3 meters.

Feature Correlation

Source	Feature	Range	Azimuth	Status
dn167_1949	5061/161	0.00	000.0	Primary
AWOIS_EXPORT	AWOIS # 54003	131.26	224.7	Secondary

Hydrographer Recommendations

The Hydrographer recommends changing the "wreck showing any portion of hull or superstructure at level of chart datum" symbol to "submerged wreck, depth known" symbol, and placing the symbol at the location of the wreck appropriately.

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 5:wreck showing any portion of hull or superstructure
	QUASOU - 1:depth known
	SORDAT - 20111014
	SORIND - US, US, graph, H12310
	TECSOU - 3:found by multi-beam
	VALSOU - 16.980 m
	WATLEV - 3:always under water/submerged

Office Notes

Concur. Remove charted wreck and PA. Chart new wreck at surveyed postion.

Feature Images

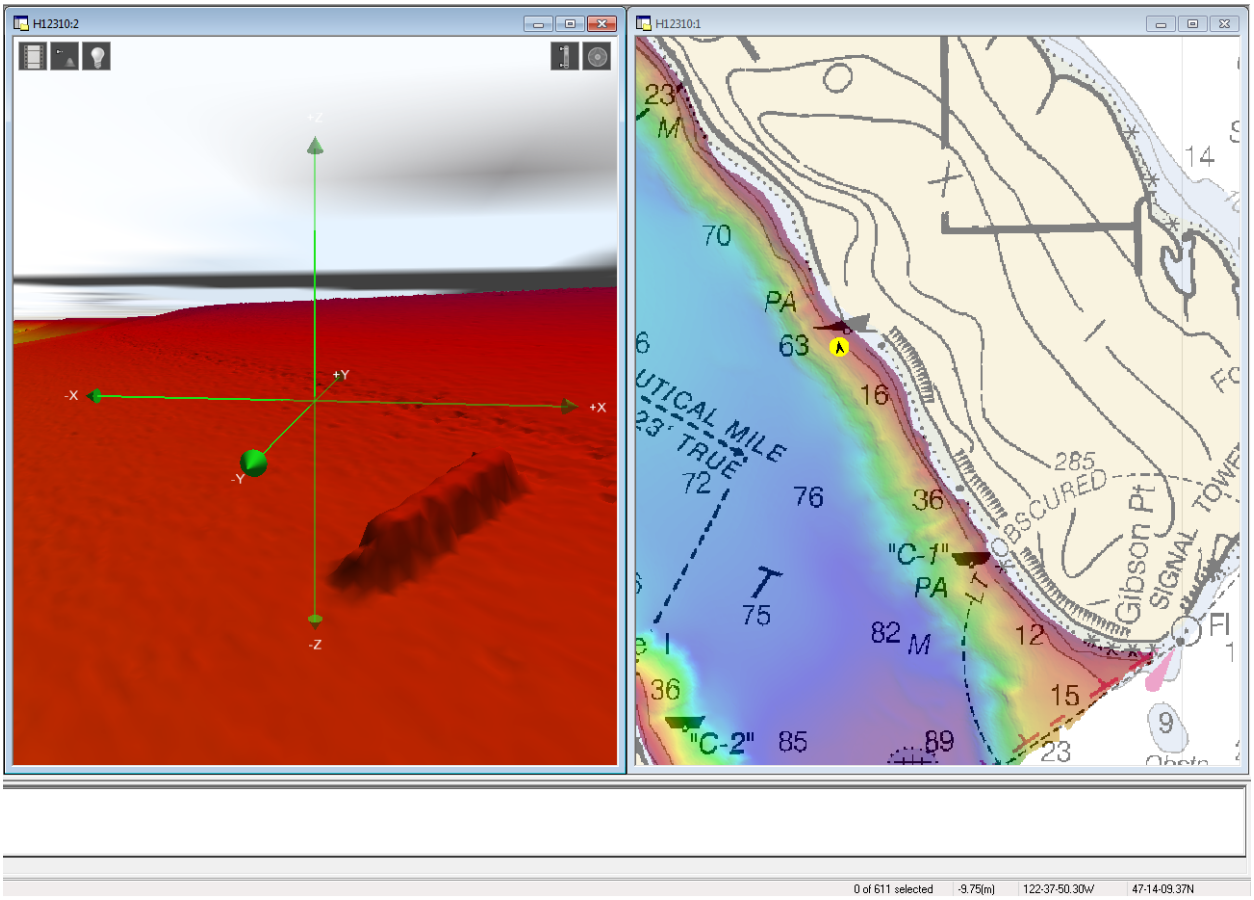


Figure 1.2.1

APPROVAL PAGE

H12310

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NGDC for archive

- H12310_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12310_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.

Approved: Digitally signed by Peter S. Holmberg
DN: cn=Peter S. Holmberg, o, ou, email=peter.holmberg@noaa.gov, c=US
Date: 2012.08.28 11:09:08 -07'00'

Peter Holmberg
Physical Scientist, Pacific Hydrographic Branch

The survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: David Zezula 2012.08.28 11:20:29 -07'00'

LCDR David Zezula, NOAA
Chief, Pacific Hydrographic Branch