

H12369

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: H12369

**LOCALITY**

State: Washington

General Locality: Strait of Georgia, WA

Sub-locality: South of Roberts Bank to Boundary Bay

**2011**

CHIEF OF PARTY  
CAPT Donald W. Haines

**LIBRARY & ARCHIVES**

Date:

NOAA FORM 77-28 (11-72)		U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION		REGISTRY NUMBER:	
<b>HYDROGRAPHIC TITLE SHEET</b>				<b>H12369</b>	
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:		<b>Washington</b>			
General Locality:		<b>Strait of Georgia, WA</b>			
Sub-Locality:		<b>South of Roberts Bank to Boundary Bay</b>			
Scale:		<b>10000</b>			
Dates of Survey:		<b>08/06/2011 to 08/17/2011</b>			
Instructions Dated:		<b>04/07/2011</b>			
Project Number:		<b>OPR-N161-RA-11</b>			
Field Unit:		<b>NOAA Ship <i>Rainier</i></b>			
Chief of Party:		<b>CAPT Donald W. Haines</b>			
Soundings by:		<b>Multibeam Echo Sounder</b>			
Imagery by:					
Verification by:		<b>Pacific Hydrographic Branch</b>			
Soundings Acquired in:		<b>meters at Mean lower low water</b>			
H-Cell Compilation Units:		<b><i>meters at Mean lower low water</i></b>			
Remarks: <i>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 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.</i>					

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## Descriptive Report to Accompany Survey H12369

Project: OPR-N161-RA-11

Locality: Strait of Georgia, WA

Sublocality: South of Roberts Bank to Boundary Bay

Scale: 1:10000

August 2011 - August 2011

**NOAA Ship *Rainier***

Chief of Party: CAPT Donald W. Haines

### A. Area Surveyed

The survey area is south of Roberts Bank to Boundary Bay, at the northern end of the Strait of Georgia in Washington State. The southwest corner of the sheet includes the main shipping channel for the Strait of Georgia. In addition, the international maritime boundary between the United States and Canada border adjoins the northern limit. This survey corresponds to sheet #4 as shown in the modified sheet layout dated August 4, 2011.

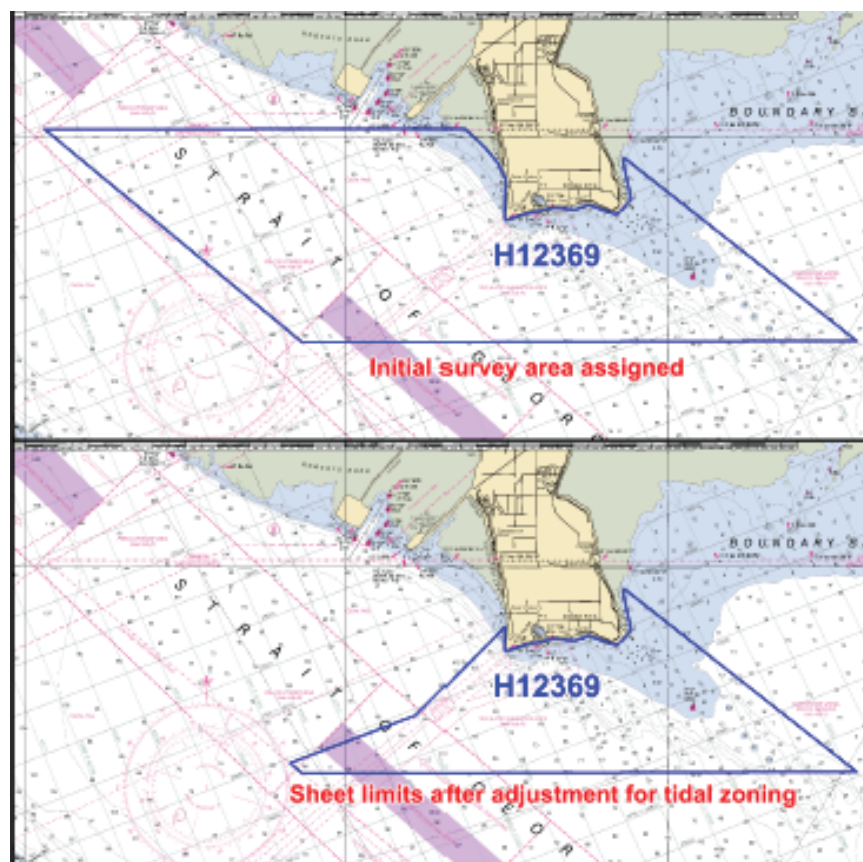
#### A.1 Survey Limits

Data was acquired within the following survey limits:

Northeast Limit	Southwest Limit
49.0022222222 N 122.900555556 W	48.9266666667 N 123.2 W

*Table 1: Survey Limits*

It was determined that the northwest corner of the original survey limits were outside of the ZDF grid for tides that were submitted by COOPS. Therefore, per HSD direction, the survey limits were adjusted to conform to the tide zoning grid.



*Figure 1: Sheet limits prior to and after adjusting for tide zoning*

## **A.2 Survey Purpose**

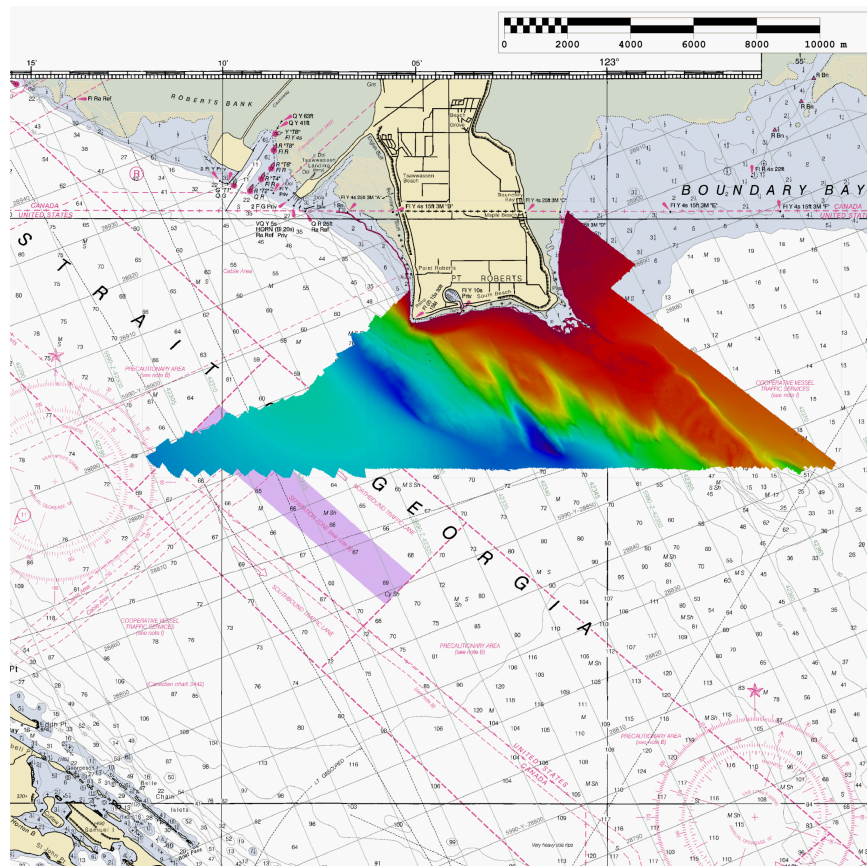
The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. Survey H12369 covers part of the Strait of Georgia traffic Lane, which provides access to Vancouver, B.C. Also Point Roberts has a heavy pleasure boat presence, as well as a large amount of gill net fishing in the area.

## **A.3 Survey Quality**

The entire survey is adequate to supersede previous data.

Data acquired on sheet H12369 met complete multibeam coverage requirements, including the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSD

## **A.4 Survey Coverage**



*Figure 2: Coverage and tracklines run on H12369*

Complete multibeam echo sounder (MBES) coverage was achieved in the survey area 8 meters and deeper. In depths less than 8 meters, MBES coverage was achieved by 25 meter line spacing to identify least depths over significant features or shoals, as appropriate for this survey.

A single reconnaissance line was acquired, beyond the assigned sheet limits, in Point Roberts Marina to spot check charted soundings.

## A.5 Survey Statistics

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

	<b>HULL ID</b>	<b>2801 (RA-4)</b>	<b>2802 (RA-5)</b>	<b>2803 (RA-3)</b>	<b>2804 (RA-6)</b>	<b>Total</b>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	0	0	0
	<b>MBES Mainscheme</b>	156.31	147.42	92.50	119.52	515.75
	<b>Lidar Mainscheme</b>	0	0	0	0	0
	<b>SSS Mainscheme</b>	0	0	0	0	0
	<b>SBES/MBES Combo Mainscheme</b>	0	0	0	0	0
	<b>SBES/SSS Combo Mainscheme</b>	0	0	0	0	0
	<b>MBES/SSS Combo Mainscheme</b>	0	0	0	0	0
	<b>SBES/MBES Combo Crosslines</b>	0.66	15.36	0	5.04	21.06
	<b>Lidar Crosslines</b>	0	0	0	0	0
<b>Number of Bottom Samples</b>						9
<b>Number of DPs</b>						0
<b>Number of Items Items Investigated by Dive Ops</b>						0
<b>Total Number of SNM</b>						23.23

Table 2: Hydrographic Survey Statistics

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

<i>Survey Dates</i>
08/06/2011
08/07/2011
08/08/2011
08/09/2011
08/10/2011
08/11/2011
08/12/2011
08/15/2011
08/16/2011
08/17/2011

*Table 3: Dates of Hydrography*

***Vessel 2802 actually collected 18.76 nautical miles of crosslines. Total mileage for crosslines was 24.46. The percentage of crosslines to mainscheme was recalculated at 5.2%. The percentage of crosslines to set line spacing mainscheme was calculated at 0.7%.***

## **A.6 Shoreline**

Limited shoreline verification was performed for the survey area seaward of the Navigable Area Limit Line (NALL) for H12369, as per section 3.5.5.2 of the Field Procedures Manual May 2011 (FPM). Shoreline features were given NOAA and S-57 attribution and included for submission in the H12369\_Final\_Features\_File.hob file.

## **A.7 Bottom Samples**

No recommended bottom sample locations were provided for H12369. Correspondence with HSD OPS indicated Rainier should plan and acquire bottoms samples as appropriate for this survey. Nine (9) bottom samples were acquired in the shoaler areas of H12369. The south and southwest areas were deemed too deep to collect bottom samples, as shown.

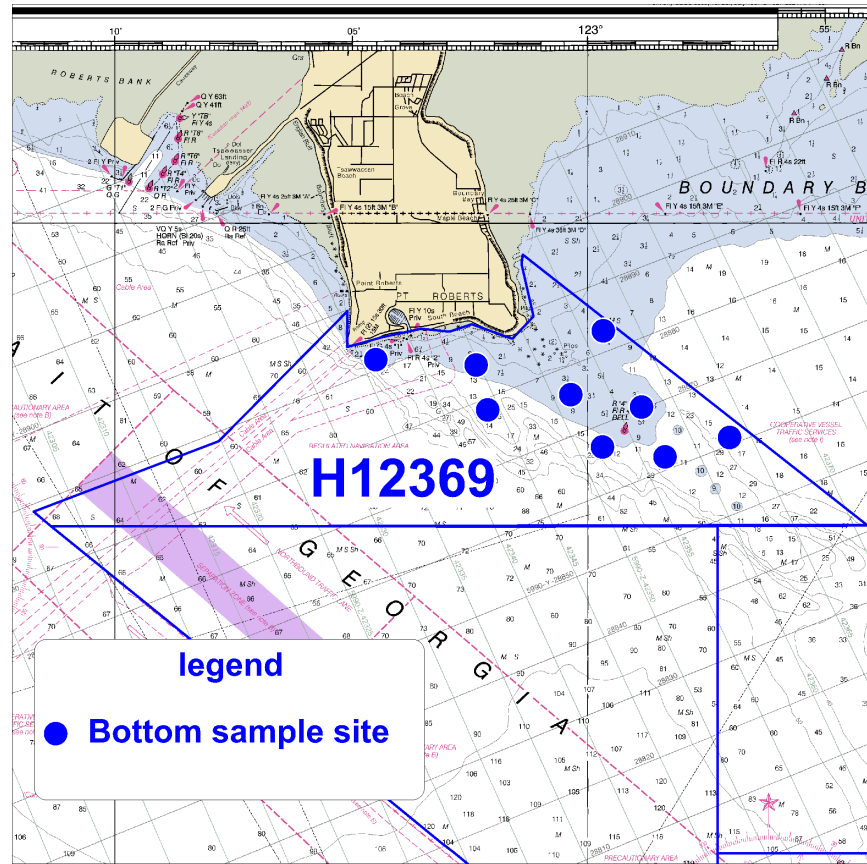


Figure 3: Bottom samples collected for H12369

*All bottom samples were recommended to be added to the chart.*

## 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:

<b>Hull ID</b>	<b>2801 (RA-4)</b>	<b>2802 (RA-5)</b>	<b>2803 (RA-3)</b>	<b>2804 (RA-6)</b>
<b>LOA</b>	29 feet	29 feet	29 feet	29 feet
<b>Draft</b>	3.5 feet	3.5 feet	3.5 feet	3.5 feet

*Table 4: Vessels Used*

### B.1.2 Equipment

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

<b>Manufacturer</b>	<b>Model</b>	<b>Type</b>
Reson	7125	MBES
Trimble/Applanix	POS-MV V4	Positioning and Orientation System
Reson	SV-71	Sound Speed System
Sea-Bird	Seacat 19, 19+	Sound Speed System

*Table 5: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Manually compared all crosslines in CARIS Subset Editor, all crosslines agreed very well at all depths with 0.1m or less difference. The comparison showed an agreement well within the IHO standards.

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0meters	0.075meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
2801 (RA-4)	3.0meters/second		0.15meters/second
2802 (RA-5)	3.0meters/second		0.15meters/second
2803 (RA-3)	3.0meters/second		0.15meters/second
2804	3.0meters/second		0.15meters/second

Table 7: Survey Specific Sound Speed TPU Values

An IHO layer was added to CARIS with the formula  $((0.25 + ((\text{Depth} * 0.013)^2))^{0.5})$  - Uncertainty. All soundings were found to be within IHO Order 1 standards.

### B.2.3 Junctions

The following junctions were made with this survey.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12323	1:10000	2011	NOAA Ship RAINIER	S
H12368	1:10000	2011	NOAA Ship RAINIER	SE

Table 8: Junctioning Surveys

#### H12323

Junction survey H12323 was compared with H12369 using subset editor in CARIS HIPS/SIPS. Observed depths agreed very well with differences less than 0.5m at all depths. H12323 data were acquired as part of the same project, OPR-N161-RA-11.

*A difference surface created during office processing was used to compare the junction between the two surveys. Differences of up to 1.5m were noted but in the depth of water in this area, this difference was within IHO tolerance.*



## H12368

Junction survey H12368 was compared with H12369 using subset editor in CARIS HIPS/SIPS. Observed depths agreed very well with differences less than 0.6m at all depths. H12368 data were acquired as part of the same project, OPR-N161-RA-11.

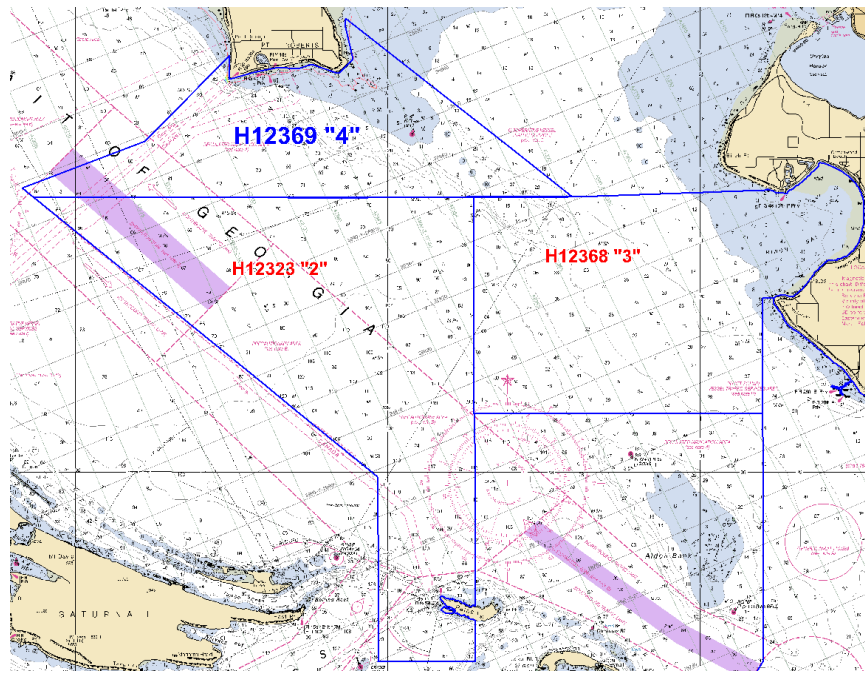


Figure 4: Junction surveys where data acquisition occurred simultaneously as H12369

*A difference surface created during office processing was used to compare the junction between the two surveys. Differences of up to 4m were noted. These large differences occurred in a steep area of the survey. These differences do not meet IHO tolerance but due to the steep topography in the area, it is recommended that the data supersede the previous data. Differences in other areas that did not have steep topography were within IHO tolerance.*

### 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.2.5.1 None Exist

There were no conditions or deficiencies that affected equipment operational effectiveness.

## **B.2.6 Factors Affecting Soundings**

### **B.2.6.1 None Exist**

There were no other factors that affected corrections to soundings.

## **B.2.7 Sound Speed Methods**

Sound Speed Cast Frequency: A sound velocity cast was taken at least every 4 hours. More frequent casts were taken when moving to another area or if there was a large change in surface sound velocity.

CTD casts were taken at approximately 2 m/s difference of sound velocity shown by the SVP-71 in the Reson BITE screen, and at varying depths to ensure adequate sound velocity measurements over the survey area. All CTD casts were concatenated and applied to multibeam data using the "nearest in distance within time" (4 hours) option in Caris HIPS and SIPS.

## **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 reductions procedures conform to those detailed in the DAPR.

### **B.3.2 Calibrations**

The Inertial Measurement Unit (IMU) installed on 2804 (RA-6) which is part of the POS-MV developed a fault prior to beginning acquisition on H12369. The original IMU (serial number 334) was replaced with spare IMU (serial number 355) and a patch test conducted to update the CARIS HVF.

## **B.4 Backscatter**

Backscatter data was acquired, but was not formally processed by Rainier personnel. However, periodic spot checks were performed to ensure backscatter quality. This data was sent to NGDC for archival.

*Branches are not currently processing the delivered backscatter.*

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAAProfile.xml

### 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	1 meters	0 meters - 94 meters	NOAA_1m	Complete MBES
2m	CUBE	2 meters	0 meters - 94 meters	NOAA_2m	Complete MBES
4m	CUBE	4 meters	0 meters - 94 meters	NOAA_4m	Complete MBES
8m	CUBE	8 meters	0 meters - 94 meters	NOAA_8m	Complete MBES
1m_Final	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
2m_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
4m_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
8m_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES

*Table 9: CARIS Surfaces*

Data Processing procedures for survey H12369 conform to those detailed in the DAPR. Data were processed using CARIS HIPS & SIPS v7.1 hot fix 2.

In areas where multibeam data was acquired on vegetation (Eel grass and kelp), soundings on vegetation were rejected to more accurately represent the seafloor depths. These were all within the 4-meter curve, and not navigationally significant.

*The 8m surface H12369\_Combined\_Office, created during office processing, was used for chart compilation.*

## C. Vertical and Horizontal Control

A complete description of vertical and horizontal control for survey H12369 can be found in the OPR-N161-RA-11 Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

### 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
Cherry Point, WA	944-9424

*Table 10: NWLON Tide Stations*

File Name	Status
9449424.tid	Final Approved

*Table 11: Water Level Files (.tid)*

File Name	Status
H12369CORF.zdf	Final

*Table 12: Tide Correctors (.zdf or .tc)*

A request for final approved tides was sent to N/OPS1 on 08/18/2011. The final tide note was received on 08/31/2011.

*The Tide Note is appended to the DR.*

## C.2 Horizontal Control

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

The following PPK methods were used for horizontal control:

Single Base

Rate: 5Hz

Vessel kinematic data were post-processed using Applanix POSPac processing software, POSGNSS processing software and Single Base processing methods described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all data.

The following user installed stations were used for horizontal control:

<b>HVCR Site ID</b>	<b>Base Station ID</b>
Cherry Point	N/A
Point Roberts	N/A

*Table 13: User Installed Base Stations*

The following DGPS Stations were used for horizontal control:

<b>DGPS Stations</b>
Whidbey Island (302 kHz)
Amphitrite Point (315 kHz)

*Table 14: USCG DGPS Stations*



Soundings from survey H12369 also agreed well overall with charted depths, within 2 ftm at depths deeper than 10 ftm, and within 0.5 ftm shoaler than 10 ftm. Due to the scale of this chart (1:80,000 compared to 1:200,000 on 18400) the contour shifts are shown in more detail, but are still minor with the exception of the northeast corner of this survey, as shown in Figure 6.

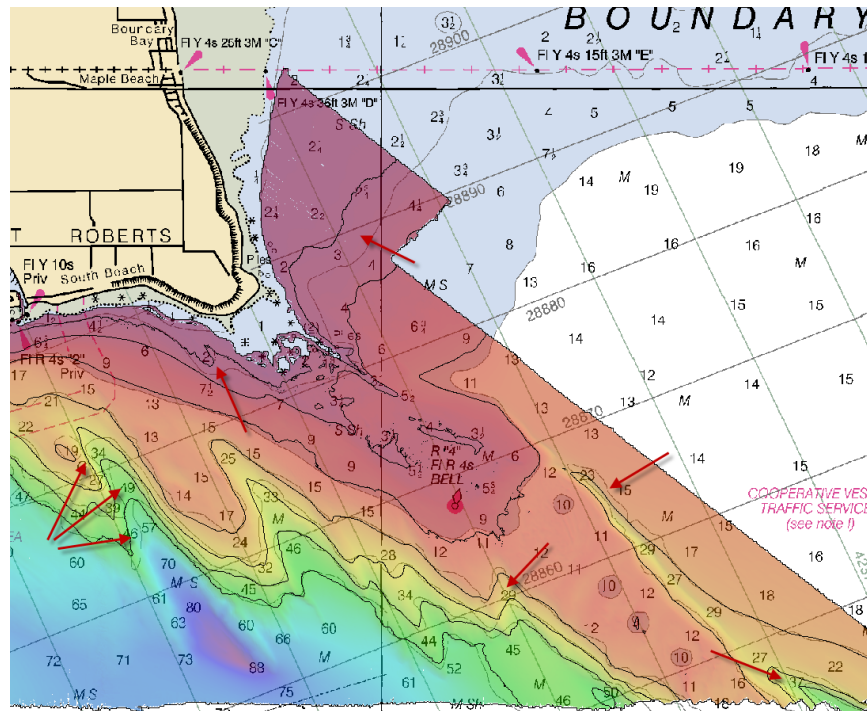


Figure 6: Examples of shifting shoals and contours (Chart 18421)

#### D.1.2 AWOIS Items

There were no AWOIS items assigned to survey H12369.

#### D.1.3 Charted Features

There were no features assigned to survey H12369.

#### D.1.4 Uncharted Features

Four (4) rocks were mischarted, and were digitally relocated in CARIS Notebook during shoreline investigation. 35 new rocks were designated in CARIS HIPS/SIPS from bathymetric data. For more information refer to the H12369\_Final\_Features\_File.hob in Notebook.

### **D.1.5 Dangers to Navigation**

No Danger to Navigation Reports were submitted for this survey.

### **D.1.6 Shoal and Hazardous Features**

*No shoals or hazardous features were discovered during office processing.*

### **D.1.7 Channels**

## **D.2 Additional Results**

### **D.2.1 Shoreline**

Limited shoreline verification was accomplished using the composite source file (CSF) provided with the project instructions. The CSF has been created using the latest ENC's, most recent aerial photogrammetry, and prior hydrographic surveys. Prior survey features within the CSF are for reference. This composite source was printed on paper "boat sheets" and displayed in CARIS Notebook and/or Hypack for field verification.

Limited shoreline verification was conducted near predicted low water in accordance with the Specifications and Deliverables and FPM section 3.5. Detached Positions (DPs) acquired during shoreline verification were recorded and S-57 attributed in CARIS notebook. These indicate revisions to features not found in the provided CSF. All shoreline data is submitted in CARIS Notebook HOB file "H12369\_Final\_Feature\_File.hob".

The Hydrographer recommends that the shoreline as depicted in the notebook HOB file supersede and compliment shoreline information compiled on the composite source file and charts as described above.

*The feature file H12369\_Final\_Features\_File\_Office, edited during office processing was used for compilation. Features delivered from the field were edited according to chart scale and navigational significance during compilation.*

### **D.2.2 Prior Surveys**

H08478 was the only prior survey that coincides with H12369. No data for comparison was included with this project, and no comparison was performed.



### D.2.3 Aids to Navigation

No ATONs were assigned to this sheet. Two ATONs were visually checked in the field against the digital raster chart. The Point Roberts Lighted Bell Buoy 4 was noted. Point Roberts Light was also noted. Pictures of these ATONs are in Figures 7 and 8.

Additionally, five private lights and daymarks are located at the entrance of Point Roberts marina. Private aids were noted for characteristics but not positioned.



*Figure 7: Point Roberts Lighted Bell Buoy 4*



*Figure 8: Point Roberts Light*

*The five private aids were recommended to be retained as charted.*

#### **D.2.4 Overhead Features**

Overhead features do not exist for this survey.

#### **D.2.5 Submarine Features**

There are charted submarine cable areas within limits of H12369. None were seen visually or by bathymetry during acquisition. Recommend retaining the cable areas as charted.

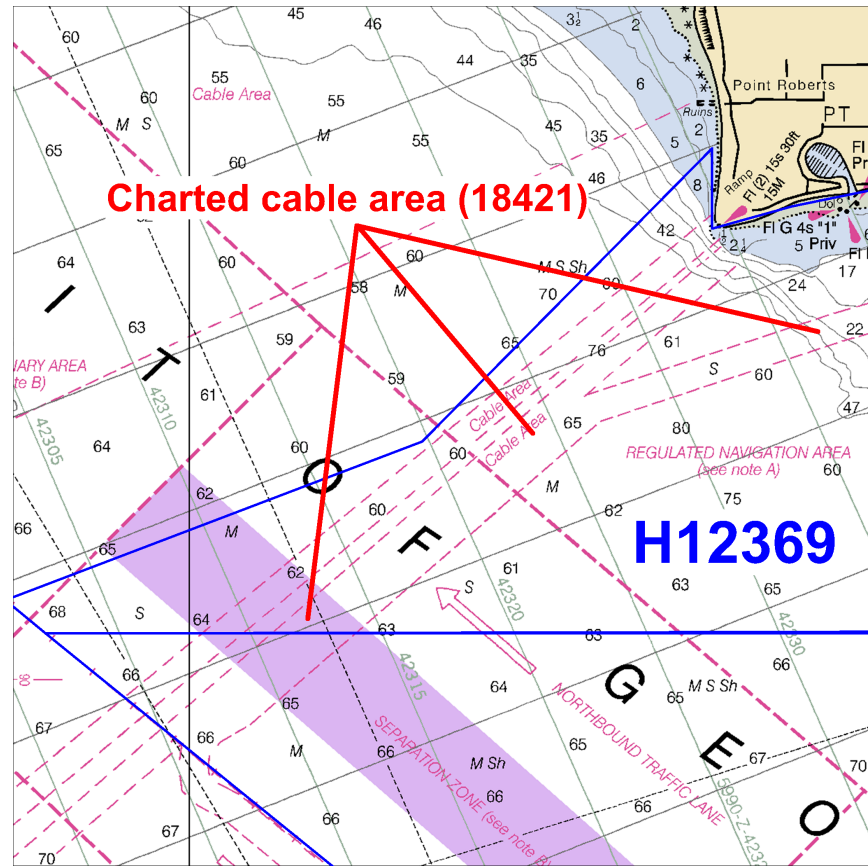


Figure 9: Charted cable areas (Chart 18421)

### D.2.6 Ferry Routes and Terminals

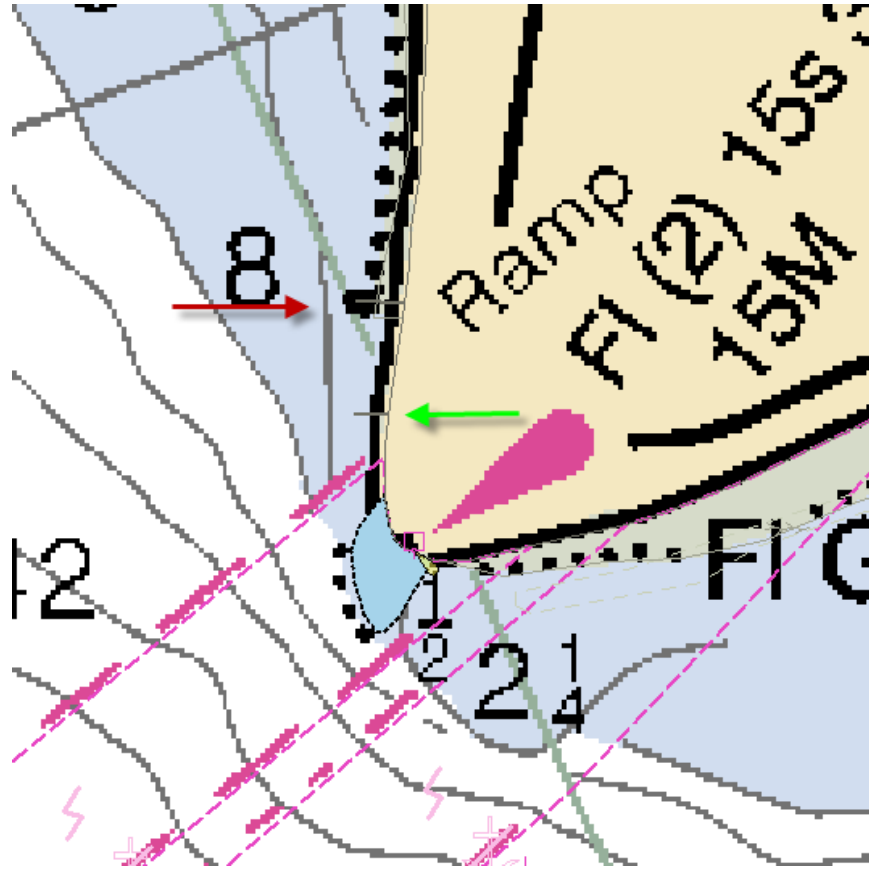
There are no ferry terminals within the limits of H12369. To the northwest of Pt Roberts, B.C. Ferries were noted in operation in and around Tsawwassen, B.C., however none of their routes intersected this survey.

### D.2.7 Platforms

No platforms exist for this survey.

### D.2.8 Significant Features

A boat ramp on the western side of Point Roberts was mischarted in both raster charts 18400 and 18421 as shown in Figure 10. The ramp was digitally relocated in CARIS Notebook during shoreline investigation. For more information refer to the H12369\_Final\_Features\_File.hob in Notebook.



*Figure 10: The red arrow depicts the ramp as charted (Chart 18421), the green arrow shows the correct placement of the boat ramp*

## D.2 Construction and Dredging

There was no construction or dredging during acquisition of survey H12369, and no plans for construction or dredging were received by Rainier personnel.


## 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, Project 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.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2011-12-16
Horizontal and Vertical Control Report	2011-12-16
Tides and Water Levels Package	2011-07-01
Coast Pilot Report	2011-12-16

Approver Name	Approver Title	Approval Date	Signature
Donald W. Haines, CAPT/NOAA	Commanding Officer	12/16/2011	 Donald W. Haines, CAPT/NOAA 2011.12.16 11:12:47 -08'00'
Olivia A. Hauser, LT/NOAA	Field Operations Officer	12/16/2011	 2011.12.16 10:20:07 -08'00'
James Jacobson	Hydrographic Chief Survey Technician	12/16/2011	 Digitally signed by James B Jacobson Reason: I have reviewed this document Date: 2011.12.16 10:35:35 -08'00'
Shawn Gendron	Sheet Manager	12/16/2011	 Shawn Gendron 2011.12.16 10:47:01 -08'00'

## F. Table of Acronyms

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

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

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





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

**TIDE NOTE FOR HYDROGRAPHIC SURVEY**

**DATE :** August 30, 2011

**HYDROGRAPHIC BRANCH:** Pacific  
**HYDROGRAPHIC PROJECT:** OPR-N161-RA-2011  
**HYDROGRAPHIC SHEET:** H12369

**LOCALITY:** South of Roberts Bank to Boundary Bay, Strait of Georgia, WA  
**TIME PERIOD:** August 6 - 17, 2011

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

**REMARKS: RECOMMENDED ZONING**

Use Zone(s) identified as: PS304, PS305, PS306 & PS307

**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).

**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: 2011.08.31 16:12:30 -04'00'

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CHIEF, PRODUCTS AND SERVICES BRANCHES



Final Tidal Zoning for  
OPR-N161-RA-2011, H12369  
Strait of Georgia, WA

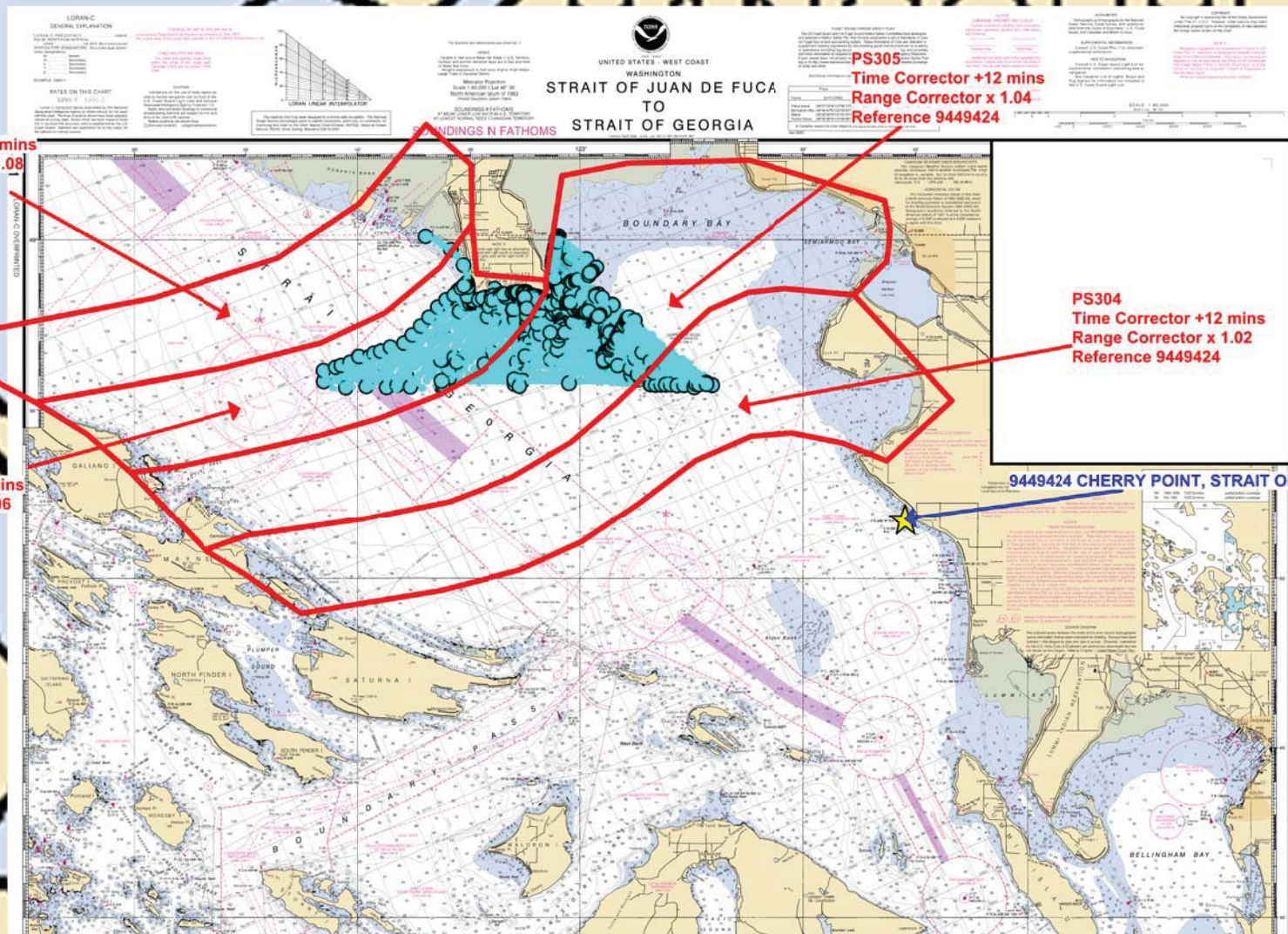
PS307  
Time Corrector +18 mins  
Range Corrector x 1.08  
Reference 9449424

PS306  
Time Corrector +18 mins  
Range Corrector x 1.06  
Reference 9449424

PS305  
Time Corrector +12 mins  
Range Corrector x 1.04  
Reference 9449424

PS304  
Time Corrector +12 mins  
Range Corrector x 1.02  
Reference 9449424

9449424 CHERRY POINT, STRAIT OF GEORGIA



APPROVAL PAGE

J 3458;

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

- ~~WPFGH~~ J\_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- ~~WPFGH~~ J\_GeoImage.pdf

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

Approved: \_\_\_\_\_

**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: \_\_\_\_\_

**Captain David O. Neander, NOAA**

Acting Chief, Pacific Hydrographic Branch