

W00220

NOAA FORM 76-35A

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

## DESCRIPTIVE REPORT

*Type of Survey* ..... Hydrographic Survey  
*Field No.* ..... N/A  
*Registry No.* ..... W00220

### LOCALITY

*State* ..... Washington  
*General Locality* ..... Columbia River  
*Sublocality* ..... Snake River to Hanford Works

2011

CHIEF OF PARTY  
Gunnar E. Forsman, USN-NUWC

### LIBRARY & ARCHIVES

DATE .....

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;"><b>HYDROGRAPHIC TITLE SHEET</b></p>	<p>REGISTRY No</p> <p style="text-align: center;"><b>W00220</b></p>
<p><b>INSTRUCTIONS</b> – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.</p>	<p>FIELD No: N/A</p>
<p>State <u>Washington</u></p> <hr/> <p>General Locality <u>Columbia River</u></p> <hr/> <p>Sub-Locality <u>Snake River to Hanford Works</u></p> <hr/> <p>Scale <u>1:40,000</u> Date of Survey <u>August 11 - August 18, 2011</u></p> <p>Instructions dated <u>N/A</u> Project No. <u>S-N914-KR-12</u></p> <p>Vessel <u>R/V Krivchak Surveyor</u></p> <hr/> <p>Chief of party <u>Gunnar E. Forsman, USN-NUWC</u></p> <p>Surveyed by <u>Steven S. Intelmann, NOAA-AFSC</u></p> <p>Soundings by <u>Simrad EM3002D</u></p> <p>SAR by <u>Grant Froelich</u> Compilation by <u>Kurt Brown</u></p> <p>Soundings compiled in <u>Meters</u></p>	
<p>REMARKS: <u>All times are UTC. UTM Zone 11N</u></p> <hr/> <p><u>The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Revisions and end notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non sequential.</u></p> <hr/> <p><u>All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via <a href="http://www.ngdc.noaa.gov/">http://www.ngdc.noaa.gov/</a>.</u></p>	

# **Descriptive Report**

## **Columbia River Hydrographic Survey**



*Clover Island and Benton-Franklin Intercounty Bridge*

Vessel: *R/V Kvichak Surveyor*

Survey: **Columbia River Hydrographic Survey**

State: **Washington**

General Locality: **Hanford Reach**

Sublocality: **River Miles 325-343**

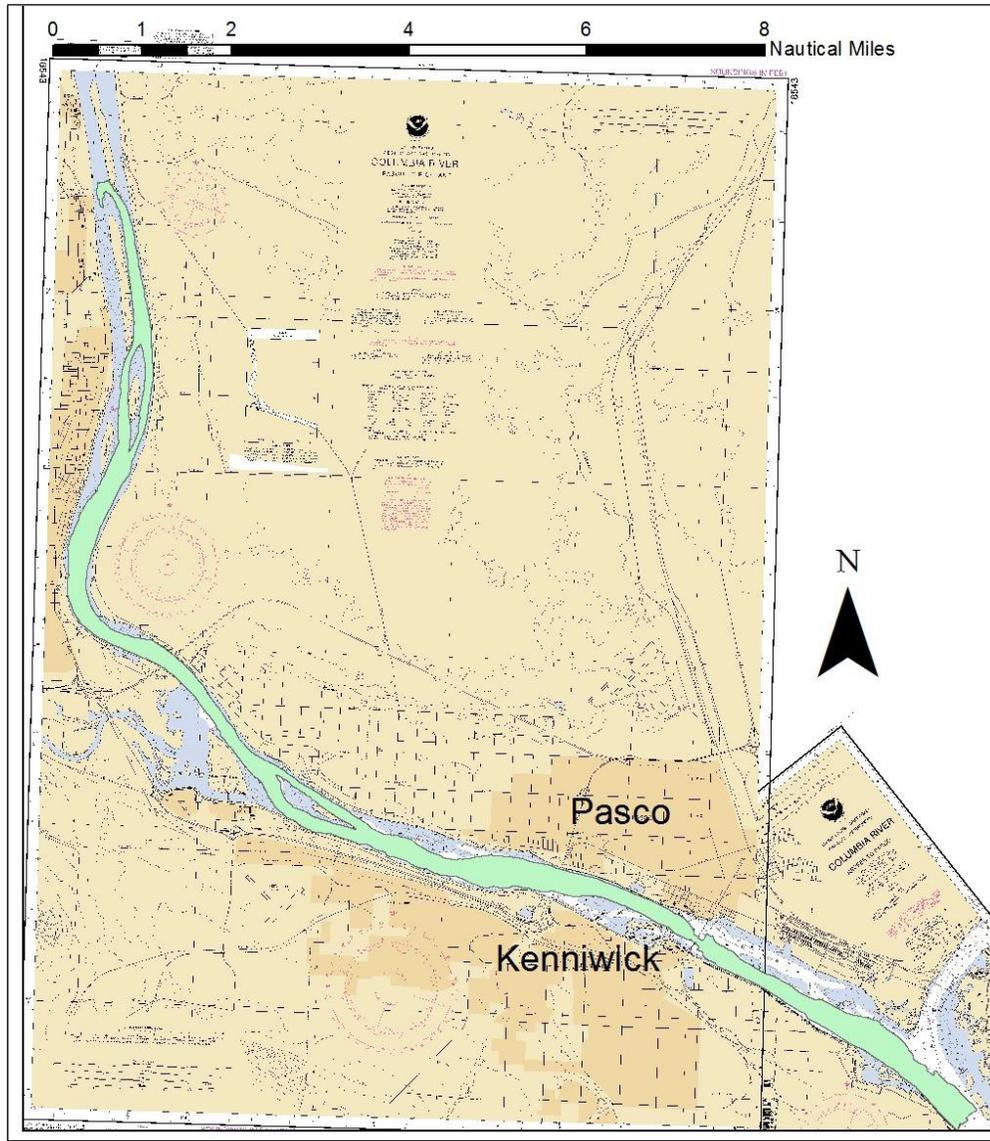
Survey Dates: **August 11, 2011 to August 18, 2011**

Project Lead: **Gunnar E. Forsman, USN-NUWC**

Lead Hydrographer: **Steven S. Intelmann, NOAA-AFSC**

## A. AREA SURVEYED

A navigable area hydrographic survey was conducted in the free-flowing Hanford Reach section of the Columbia River near the Tri-Cities region of Washington State. This 8-day survey was designed and conducted to address specific concerns of the Puget Sound Naval Shipyard, and additionally served to deliver accurate hydrographic survey data with which to update the nautical charts of the assigned area.



*Figure 1 – Columbia River Hydrographic Survey extent. Background charts are NOAA BSB 18542 and 18543.*

Survey limits were restricted to the 6m curve and deeper. Full bottom coverage with multibeam data was achieved within the designed limits. One hundred percent backscatter coverage was also acquired, but not submitted. This survey has a maximum depth of 24 meters and a minimum depth of 3 meters below the Chart Datum of 340' above Mean Sea Level (MSL), or NGVD29. The R/V

*Kvichak Surveyor* collected 210 lineal nautical miles of multibeam lines with minimal crosslines between August 11, 2011 and August 18, 2011 over a total of 3.59 square nautical miles of coverage. No bottom samples were collected in the project area.

For complete survey limits, refer to Figure 1 on the preceding page.

## B. DATA ACQUISITION AND PROCESSING

### B.1. Equipment

Bathymetry for this survey was acquired using the hydrographic survey vessel *R/V Kvichak Surveyor*.

#### *R/V Kvichak Surveyor*

The *R/V Kvichak Surveyor* is an approximately 20-meter aluminum catamaran type vessel with a 7 meter beam and minimal draft. The vessel was powered by two 3196 Caterpillar diesel engines with electrical power being supplied by two Northern Lights 32 kW generators. Major systems used on the *R/V Kvichak Surveyor* are listed in Table 1.

VESSEL <i>R/V Kvichak Surveyor</i>	
LOA: 20m, BEAM 7m, DRAFT: minimal	
Equipment	Manufacturer & Model
Multibeam sonar	Kongsberg EM 3002D
Positioning	Applanix POS MV V4
Sound speed	AML Smart SV&P, SBE19
Vessel attitude	Applanix POS MV - IMU 200

*Table 1 - Major systems used aboard the R/V Kvichak Surveyor.*

Equipment performance details are provided in the Data Acquisition and Processing Report (DAPR), Sections *B. Equipment* and *C. Quality Control*.

### B.2. Quality Control

#### B.2.1. Multibeam Bathymetry

No conditions with the potential for adversely affecting data integrity were encountered with the multibeam equipment used during this survey.

Multibeam confidence checks were conducted on the *R/V Kvichak Surveyor* prior to beginning the survey operations to verify proper operation of the multibeam equipment. The confidence check was performed by comparing nadir beam depths with lead line depths. The results of these comparisons and the line acquisition logs detailing aspects of quality control for each survey line are contained in *Separates I: Acquisition and Processing Logs* of this report.

Moreover, uncertainty surfaces were built in CARIS HIPS, where the uncertainty child layer was analyzed to verify the quality of the data in the surfaces. The majority of the data were found to meet IHO Order 1 specifications.

Sound velocity (SV) profiles were taken for the full water column and were geographically and temporally distributed within the survey area to meet the criteria specified in NOS Hydrographic Surveys Specifications and Deliverables (HSSD) April 2010. Sound speed profiles extended to 100% of the anticipated water depth. No obvious data quality issues related to speed of sound measurements were encountered during the survey.

A detailed discussion of multibeam system calibrations, speed of sound profiling, patch tests, and data acquisition/processing is also provided in the DAPR.

### **B.2.2. Crosslines**

Over 300 mainscheme lines totaling over 200 lineal nautical miles were run during the survey. However, minimal crosslines were attempted due to the nature of being a river survey. Narrow channel and high currents precluded safe transits perpendicular to the flow (and mainscheme lines) in all but one area where 3 crosslines were acquired for Quality Control.

Crossline analysis was conducted by using the CARIS QC Report to perform a beam by beam analysis of the crosslines where their statistics were compared with a BASE surface produced from the mainscheme survey lines. Although limited in scope, over 99% of the data met IHO Order1 specifications. Results of the beam by beam analysis are provided in *Separates IV: Crossline Comparisons* of this report.

### **B.2.3. Contemporary Survey Junctions**

No junction comparison was performed<sup>1</sup>.

### **B.3. Corrections to Echo Soundings**

Change to the corrections of echo soundings are described in detail in the DAPR.

Sounding data were reduced through use of an Ellipsoid-to-Chart-Datum model incorporating Post-Processed Kinematics (PPK). No water level data were used for the survey. Refer to the Vertical and Horizontal Control Report (VHCR) for detailed information.

### **B.4. Data Processing**

Final depth information for this survey was submitted as a collection of CARIS CUBE surfaces which best represented the river elevations at the time of the 2011 survey. All possible measures were taken to ensure data flow integrity and that the data were processed correctly.

High velocity currents and pleasure craft traffic on the river complicated line planning for the survey. Swath width and spacing was adjusted by the operator to provide 100% bottom coverage in targeted areas. Many holidays had to be filled on subsequent passes.

Base Surfaces were named with the following naming convention: Fieldsheet Name\_JDx\_ppk. In general, Field Sheets were created and named by Julian Day, however in a few instances, there were multiple Field Sheets created on a single survey day<sup>2</sup>.

Grids of 1m resolution were used for the BASE surfaces and are listed in Table 2.

<u>Depth Range (m)</u>	<u>BASE Surface Resolution</u>	<u>Surface Name</u>
5-17	1m	JD223_ppk
5-24	1m	JD224_ppk
4-21	1m	JD225a_ppk
4-20	1m	JD225b_ppk
3-19	1m	JD226_ppk
4-21	1m	JD227a_ppk
3-23	1m	JD227b_ppk
3-12	1m	JD228_ppk
3-10	1m	JD229_ppk
4-14	1m	JD230_ppk

*Table 2 –List of CUBE surfaces for Columbia River Hydrographic Survey.*

The DAPR Sections *B.2 Data Collection*; and *C: Quality Control* contain a detailed discussion of the steps followed when acquiring and processing the survey data.

### **C. VERTICAL AND HORIZONTAL CONTROL**

Sounding data were not adjusted by water level data for this survey thus obviously no tidal zoning methodology was applied. Instead, the survey was treated as an Ellipsoid Referenced Survey (ERS) using PPK techniques.

The horizontal control datum used for this survey was the North American Datum of 1983 (NAD 83), in the UTM, Zone 11 North projection.

Sounding position control was initially determined using an Applanix POS M/V 320 with additional RTCM DGPS correctors being supplied from a separate Trimble Ag332 receiver. A summary of DGPS confidence checks is provided in *Separates I: Acquisition and Processing Logs* included with this report. In the end, PPK positioning was applied to the reduced sounding data based on a single Continuously Operated Reference Station (CORS) located in Richland, WA. Processing considerations are described in detail within the project wide VHCR.

### **D. RESULTS AND RECOMMENDATIONS**

#### **D.1. Chart Comparison**

Only a cursory chart comparison was performed by comparing the contours produced from shoal biased soundings of this survey to the historic contours on the Raster Navigation Charts that intersect the project area and are listed in Table 3.

<b>RNC</b>	<b>Scale</b>	<b>Edition #</b>	<b>Last Update</b>
18542	1:20,000	10	1/8/2000
18543	1:20,000	2	2/12/2003

*Table 3 - Charts used for comparisons.*

The chart comparison was accomplished by generating shoal-biased soundings and contours and overlaying them along with the finalized BASE surfaces on the latest edition NOAA charts. The general agreement between charted soundings and survey soundings was then examined and a more detailed comparison was undertaken.

Agreement between this survey and the charts was good, although there were some slight differences as would be suspected in a riverine environment with inherent sedimentation processes influenced by dams<sup>3</sup>.

The 2011 survey identified no features that are not currently charted within the survey extents.

#### **D.1.1. Charted Features**

There were no charted features within the survey extents.

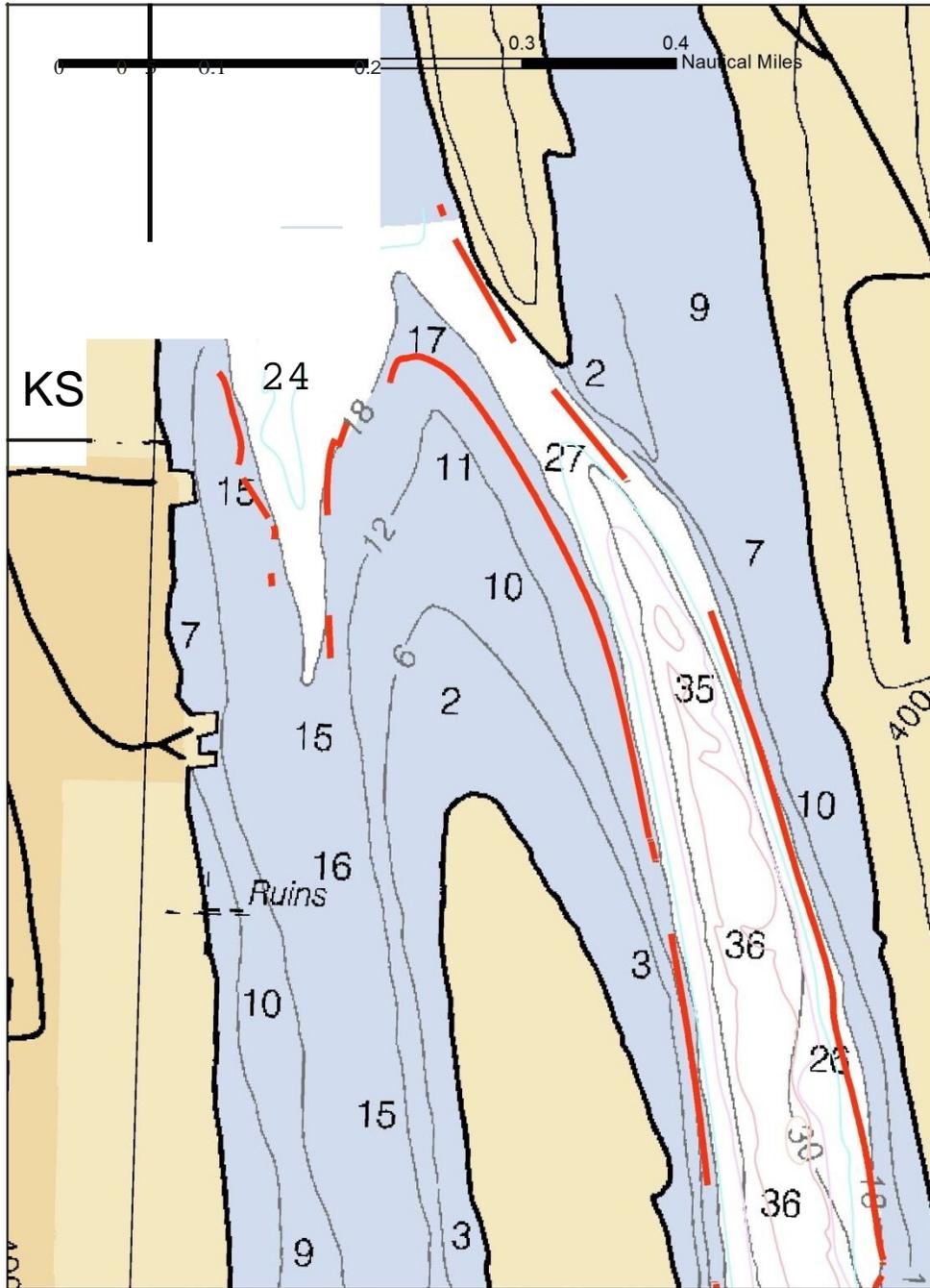
#### **D.1.2. Soundings**

Agreement between charted soundings and surveyed depths was excellent, with most depths in general agreement.

#### **D.1.3. Trends and Changeable Areas**

Contours were created in Caris Bathydatabase 3.2.0 and examined concurrently with the charted contours from chart 18542 and 18543 in ArcMap 10.0.

In general, agreement between old and new contours was excellent although some contours have shifted as would be expected in a riverine environment. Figure 2 provides an example of an area where the 18-foot contour is in general agreement, but has shifted slightly in a few areas around the island near Hanford Works. The bold red lines are contours produced from the 2011 ERS data. The remainder of contours are plotted at 6-foot intervals to show the bathymetry trend.



*Figure 2 – 6 foot contours produced from shoal biased soundings in a select area (near Hanford Works) of the Columbia River Hydrographic Survey (bold red) overlaid on chart 18543 for comparison.*

The hydrographer recommends that the charted contours be updated to reflect the 2011 survey data.

#### **D.1.4. AWOIS Items Summary**

There were no AWOIS items within the survey extents of the Columbia River Hydrographic Survey.

#### **D.1.5. Features Labeled PA, ED, PD, or Rep.**

There are no charted features labeled PA, ED, PD or Rep. within the survey extents.

### **D.2. Additional Results**

#### **D.2.1. Aids to Navigation**

There were no charted or uncharted Aids to Navigation within the survey extents<sup>4</sup>.

#### **D.2.2. Drilling Structures**

An investigation of drilling structures was not undertaken and no charted or uncharted drilling structures exist within the survey extents.

#### **D.2.3. Comparison with Prior Surveys**

A comparison with prior surveys was not undertaken. See Section *D.1* for a comparison to the nautical charts.

#### **D.2.4. Bottom Samples**

Collection of bottom samples was not undertaken<sup>5</sup>.

#### **D.2.5. Bridges and Overhead Cables**

There were several bridges and overhead cables in the area<sup>6</sup>.

#### **D.2.6. Submarine Cables and Pipelines**

There was at least one submarine cable or pipeline within the survey extents, and was clearly visible in the survey data<sup>7</sup>.

# LETTER OF APPROVAL

W00220 - COLUMBIA RIVER HYDROGRAPHIC SURVEY

This report and the accompanying digital data are respectfully submitted.

Field operations contributing to the accomplishment of the Columbia River Hydrographic survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report, digital data and accompanying records have been closely reviewed and are considered complete and adequate. Other reports submitted with this survey include the Data Acquisition and Processing Report and the Spatial Components Survey Report, and the Vertical and Horizontal Control Report.

I believe this survey is complete and adequate for its intended purpose.



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**Steven S. Intelmann, Physical Scientist**

NOAA

9 December 2011

**Date** \_\_\_\_\_

## **Revisions Compiled During Office Processing and Certification**

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<sup>1</sup> No contemporary surveys exist to date.

<sup>2</sup> The 1m finalized surface, W00220\_1m\_Final created during office processing was use for compilation.

<sup>3</sup> The general trends of the survey agreed well with the chart. Surveyed soundings however were generally shoaler that the charted soundings.

<sup>4</sup> Several ATONs were located in the survey but were not addressed by the survey.

<sup>5</sup> Two charted bottom samples at the edge of the survey area were retained.

<sup>6</sup> All bridges and overhead cables in the survey area were retained. Clearance heights were not observed.

<sup>7</sup> The cable area was retained.

APPROVAL PAGE

W00220

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

- W00220\_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- W00220\_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