Descriptive Report Summary W00311	
Project	M-N908-RA-16 IOCM Olympic Coast NMS Mapping Project
Survey	W00311
State	Washington
Locality	Offshore - Washington Coast
Sub Locality	Western Quinault Canyon
Scale of Survey	1:80000
Sonars Used	Kongsberg EM710 MBES
Horizontal Datum	World Geodetic Survey 1984 (WGS 84_G1674)
Vertical Datum	Mean Lower Low Water
Vertical Datum Correction	TCARI
Projection	UTM Zone 10N
Field Unit	NOAA Ship *Rainier*
Survey Dates	05/09/2016 - 05/12/2016
Chief of Party	Edward J. Van Den Ameele, CAPT/NOAA

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. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold, red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via http://www.ncei.noaa.gov/.)

A. Area Surveyed

This hydrographic survey was acquired in accordance with the requirements defined in the Project Instruction M-N908-RA-16 with the exception of total survey assigned area not being achieved . Total survey area acquired was 124.7 SNM which is 57% of the planned 217 SNM (see Figure 1). Total survey line length was 221.139 LNM. Full survey coverage was not acquired due to delay in ship's arrival in the project area. Due to time constraints, the visiting Chief Scientist requested prioritization for data acquisition in the Eastern section of W00311 and the adjacent sheet W00306 to support project objectives.

Technical and procedural requirements from the Hydrographic Surveys Specifications and Deliverables Manual (HSSD, March 2016) and the Field Procedures Manual for Hydrographic Surveying (FPM, April 2014) were fulfilled.

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
47° 55' 0" N 125° 15' 0" W	47° 6' 0" N 124° 43' 0" W

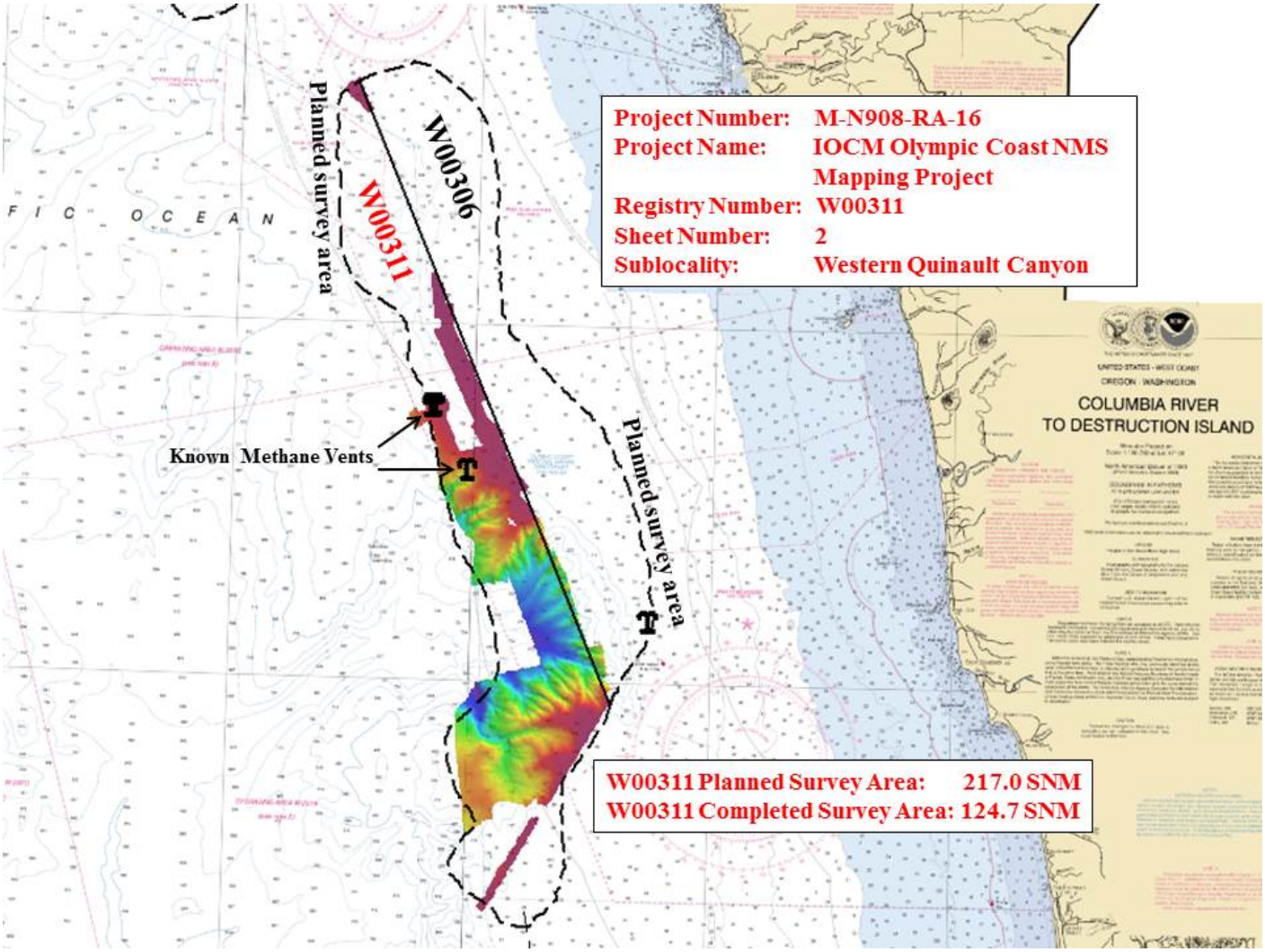


Figure 1: W00311 Survey Area

B. Survey Purpose

This project was conducted in collaboration with the National Ocean Service - Office of Coast Survey (OCS) Integrated Ocean and Coastal Mapping Program (IOCM) and the Olympic Coast National Marine Sanctuary (OCNMS) and their partners in order to collect swath bathymetry, acoustic backscatter data and water column data within high priority areas of the OCNMS. The data from this project provided seafloor habitat information to support fishery and resource protection mandates and will be used to update National Ocean Service nautical charting products within the area. The W00311 project sheet covered a total of 124.7 SNM within the OCNMS. Survey data from this project is intended to supersede all prior survey data in the common area.

C. Intended Use of Survey

The entire survey is adequate to supersede previous data.

This survey is recommended for charting. Acquired survey data is adequate to supersede previous charted information.

D. Data Acquisition and Processing

Please reference NOAA ship Rainier's Data Acquisition and Processing Report 2016 for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods.

Additional information to supplement survey data are provided as follows:

-Survey Coverage:
Three significant data holidays are present in the W00311 surfaces and are depicted in Figure 2.
1) The northern holiday "A" was a result of survey line 190 swath coverage not overlapping while the ship was executing a turn to approach a detected methane gas seep on a perpendicular course to survey lines 188 and 189. No effort was made to re-survey this holiday as time constraints required the ship to prioritize data acquisition elsewhere.
2) The central holiday "B" was also a result of swath coverage limits not achieving overlap and could not be re-surveyed prior to departure of the project area.
3) The eastern holiday "C" was the result of acoustic shadowing of the outer swath of survey line 0123 and is located on the boundary with project area W00306. Data in this area was acquired on survey line 0105 and is incorporated into the W00306 project surface.

There were no signs of significant features in the vicinity of any of the above holidays.

-Equipment Effectiveness:
Yaw Error induced artifacts: GAMS calibration prior to the survey resulted in poor antenna separation results. As a result, horizontal offset disparities of up to 160 meters were observed between some survey lines. The error was evaluated at approximately 3 degrees and a yaw corrector was placed in the S221 HVF for the period of survey data collection. The input of the HVF yaw corrector eliminated the horizontal offsets in the data. Full description of this issue is discussed in the 2016 DAPR.

-Sound Speed Methods:
Sound Velocity Profiles (SVPs) were obtained using the ship's Moving Vessel Profiler (MVP200) for depths up to 500 meters and Expendable Bathythermographs (XBT) for depths up to 700 meters. SVPs were obtained at least once every four hours within or adjacent to the survey area for W00311 as depicted in Figure 3.

A concatenated sound velocity file was created which combined casts for adjacent survey areas W00306 and W00311. A total of twenty-two MVP/XBT SVP files were applied to W00311 using the Caris HIPS profile method "Nearest in Distance Within 4 hours". There were no observed disparities between surface sound speed and SVP casts throughout W00311. Reference the 2016 DAPR for XBT processing.

-Backscatter Data:
Raw backscatter data were collected and sent to NOAA's Pacific Hydrographic Branch. Contact the visiting Chief Scientist to obtain processed backscatter data.

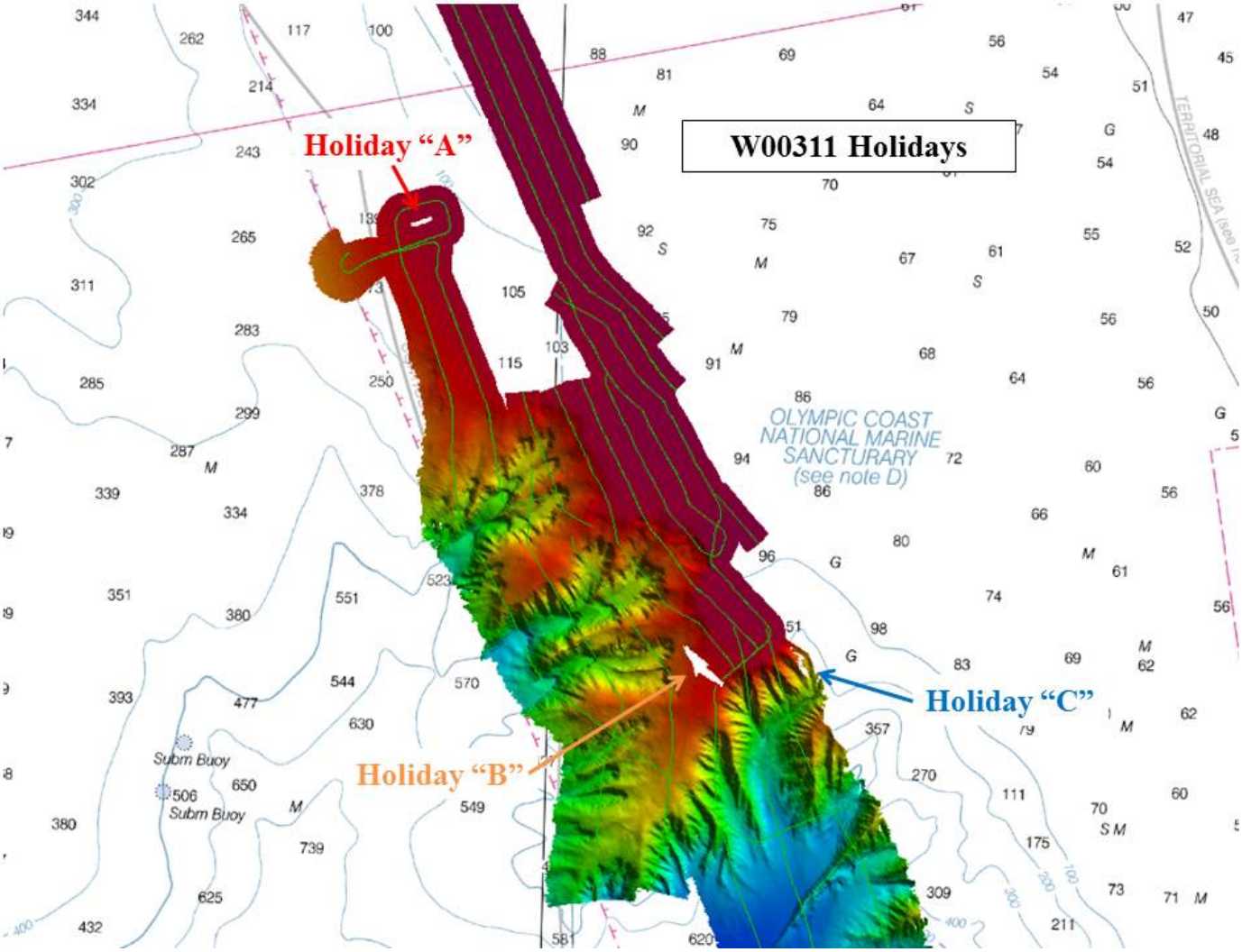


Figure 2: W00311 Holidays

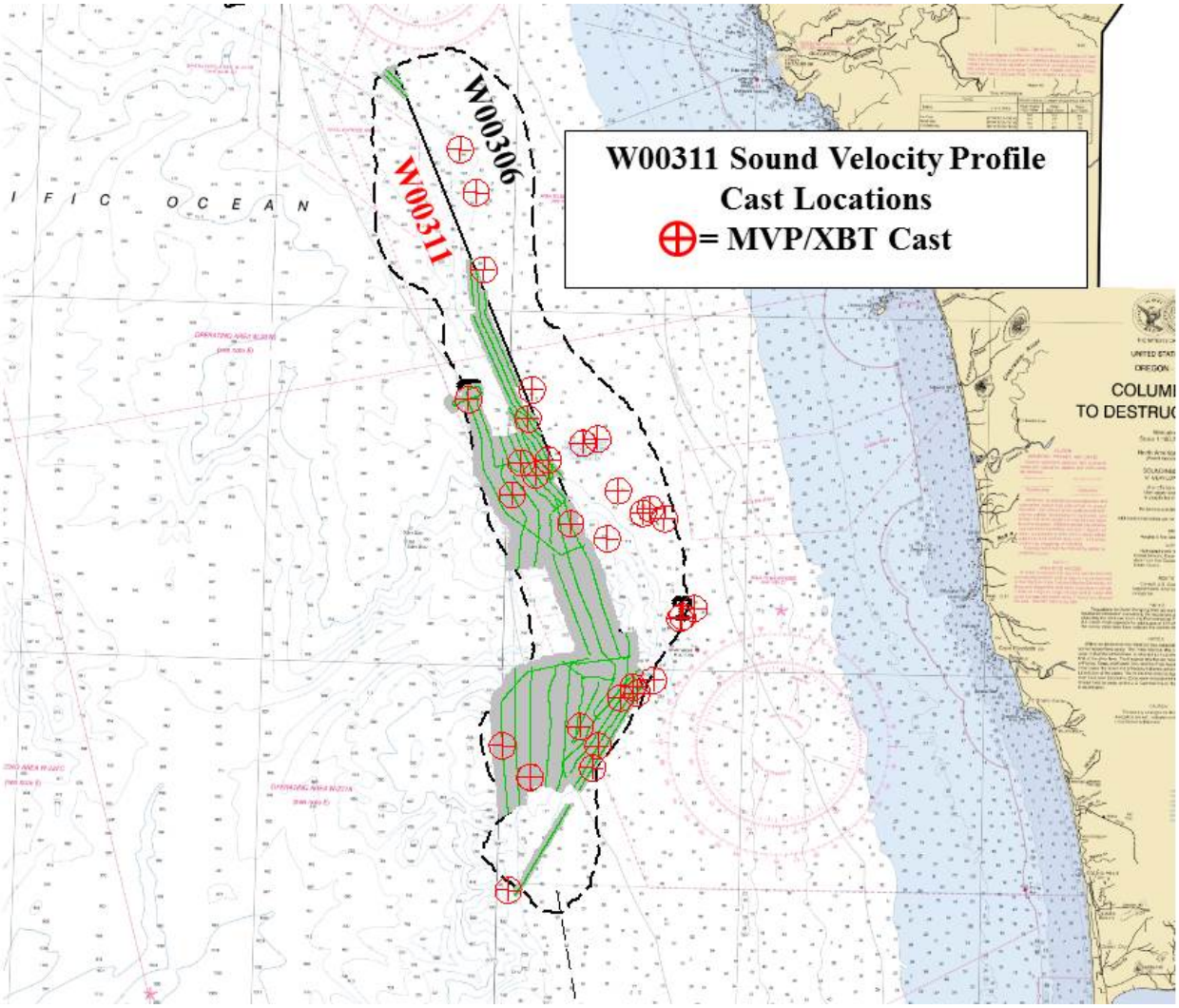


Figure 3: W00311 Sound Velocity Profile Cast Locations

E. Uncertainty

Uncertainty values were measured and applied in accordance with Section B.4 of the DAPR.

Total Propagated Uncertainty (TPU) values for survey W00311 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. Tidal uncertainties were provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), and were applied to depth soundings using a Tidal Constituent and Residual Interpolation (TCARI) grid. TCARI automatically calculates the uncertainty associated with water level interpolation which is then written into the Caris HDCS files. No tidal uncertainty values were entered into the tide value section of the Caris compute TPU function related to TCARI.

Uncertainty values of submitted finalized grids were calculated in Caris using the "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). The Finalized CSAR QA tool within Pydro was used to analyze W00311 MBES data with results as follows:

1) 16-meter surface Uncertainty Standards had >99.9% of nodes pass and meet HSSD requirements (See Figure 4).
2) 32-meter surface Uncertainty Standards had >99.9% of nodes pass and meet HSSD requirements (See Figure 5).

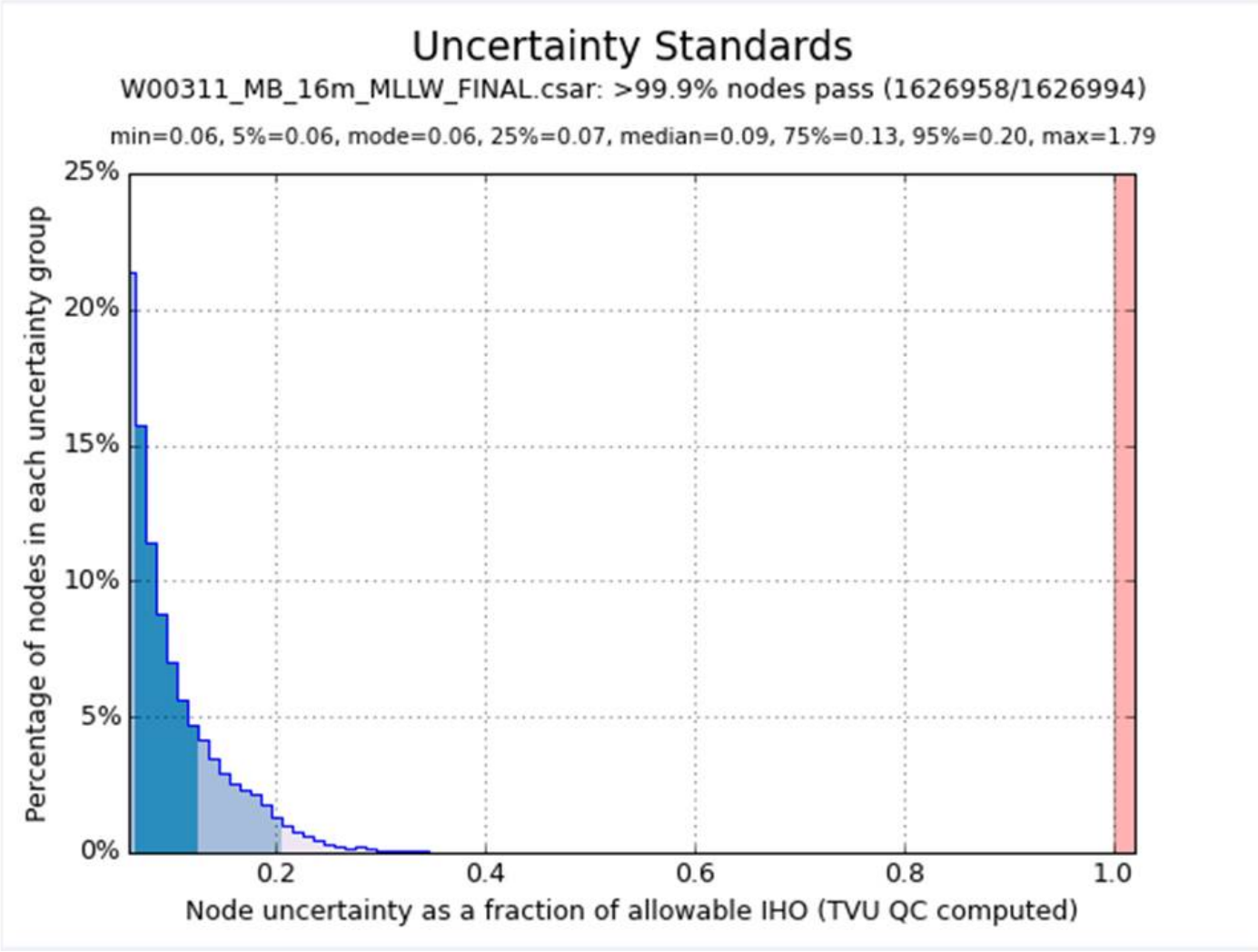


Figure 4: W00311 16-meter Uncertainty Standards

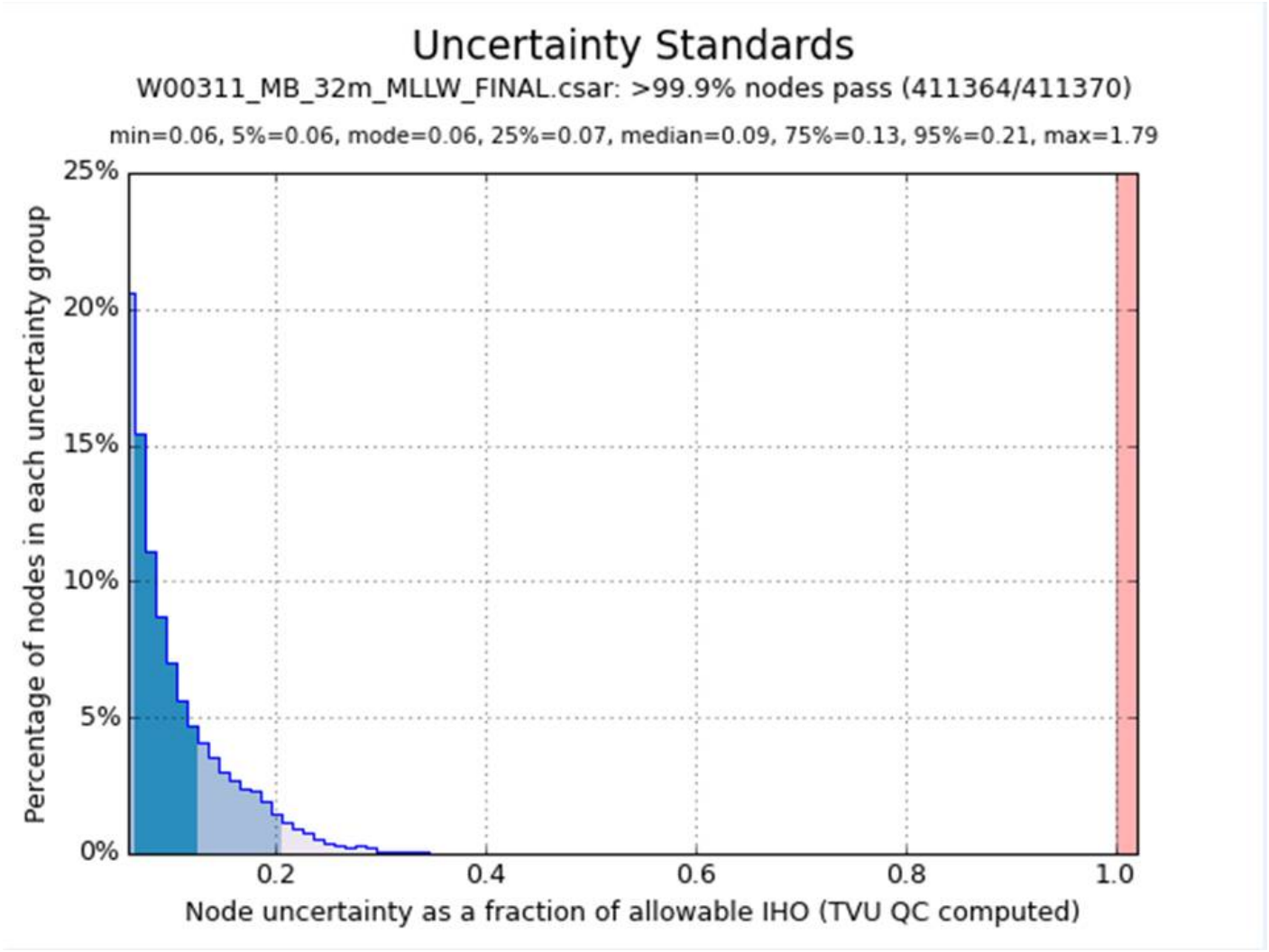


Figure 5: W00311 32-meter Uncertainty Standards

F. Results and Recommendations

The following are the largest scale RNC and ENC, which cover the survey area:

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
18480	1:176253	32	01/2013	01/19/2016	02/19/2016
18500	1:180789	30	05/2008	01/19/2016	02/19/2016

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US3WA03M	1:180789	18	11/18/2015	11/18/2015	NO
US3WA01M	1:176253	18	07/08/2013	06/03/2015	NO

Raster Nautical Charts (RNC) 18480 and 18500 as well as Electronic Nautical Charts (ENC) US3WA01M and US3WA03M were compared to W00311 survey data using a 32 meter resolution combined CUBE surface. Figures 6-11 apply. In general, previously charted soundings and depth contours conform to the new data but some areas show horizontal divergence in contour position up to 0.87 nautical mile (1628 meters), particularly in depths 500 fathoms (914.6 meters) or greater.

RNC Chart 18480:
-Outlier Coverage Area: Soundings and depth contours show general agreement but a 366 meter difference exists between one portion of the charted and new 100 fathom curve. (See Figure 7.)

RNC Chart 18500:
-North Coverage Area: Soundings and depth contours show general agreement. (See Figure 8.)
-Central Coverage Area: Soundings show general agreement but depth contours along the 500-600 fathom range show divergence in charted and new data horizontal position. Most of these differences are observed on the Western facing slope of Quinault Canyon and diverge by up to 1628 meters in points. (See Figure 9.)
-Southern Coverage Area: Soundings and depth contours show general agreement with some divergences noted along the 100 and 200 fathom curves with differences up to 740 meters. (See Figure 10.)

ENC Chart US3WA01M:
-Soundings appear to be in general agreement. Plotted depth contours are parallel but consistently 300-400 meters offset with the ENC contours positioned southwest of W00311 computed contours.

ENC Chart US3WA03M:
-Soundings appear to be in general agreement. Plotted depth contours on the ENC seem to follow similar positioning as on RNC 18500 and thus show similar divergence with W00311 computed contours, particularly along the 500 and 600 fathom contours in the Western facing slope of Quinault Canyon/Central Coverage Area. (See Figure 11.)

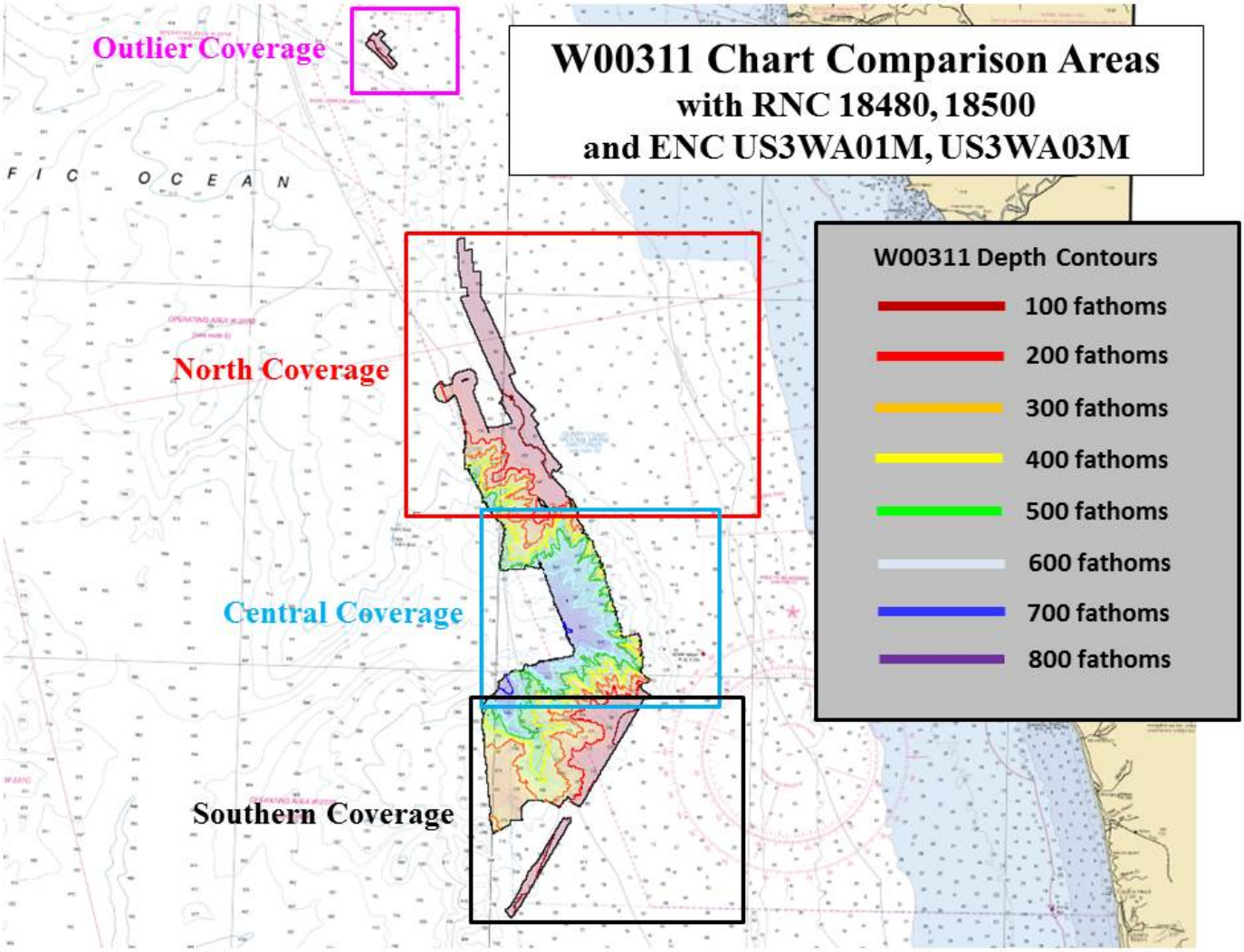


Figure 6: W00311 Chart Comparison Areas with RNC/ENC

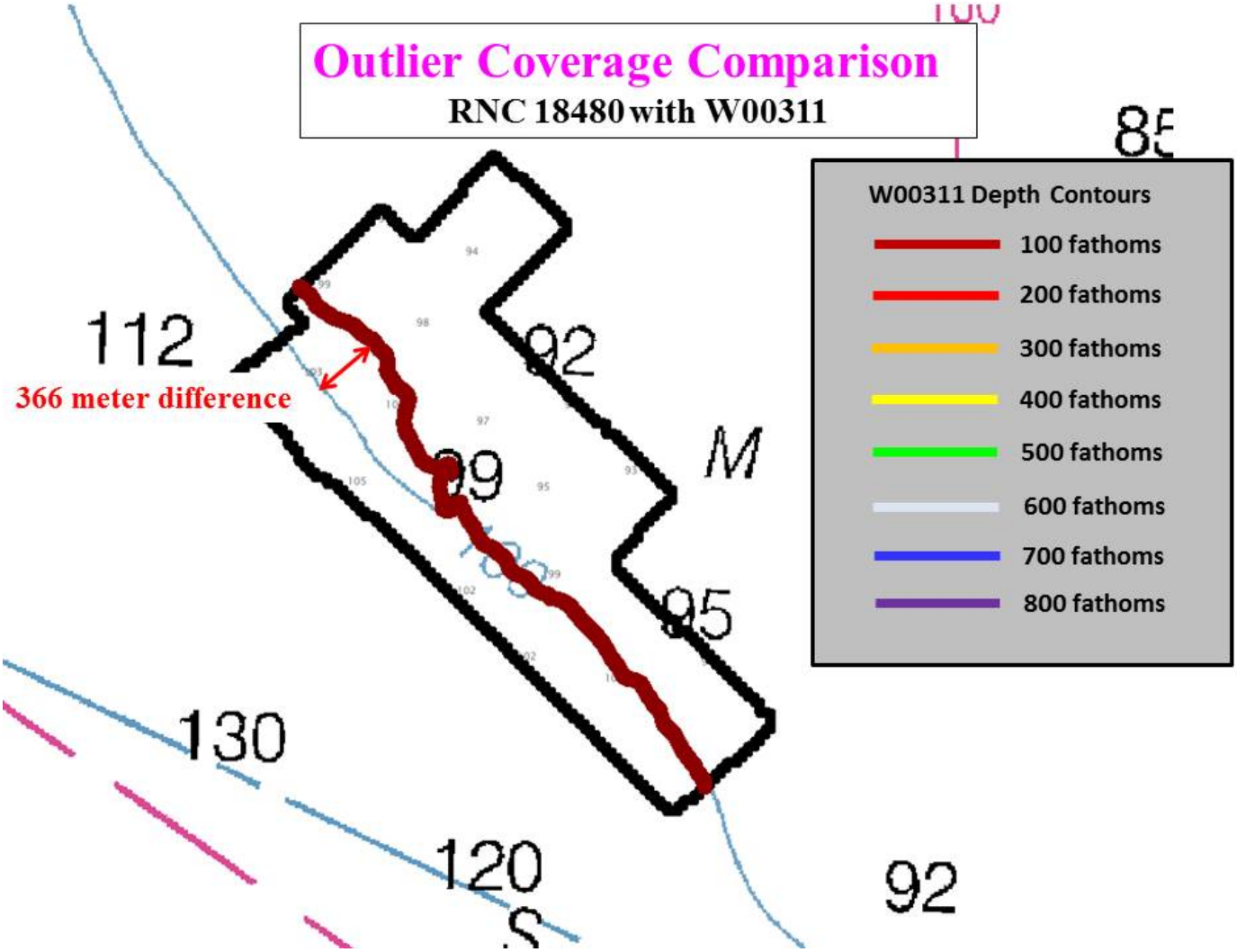


Figure 7: W00311 Outlier Coverage Comparison RNC

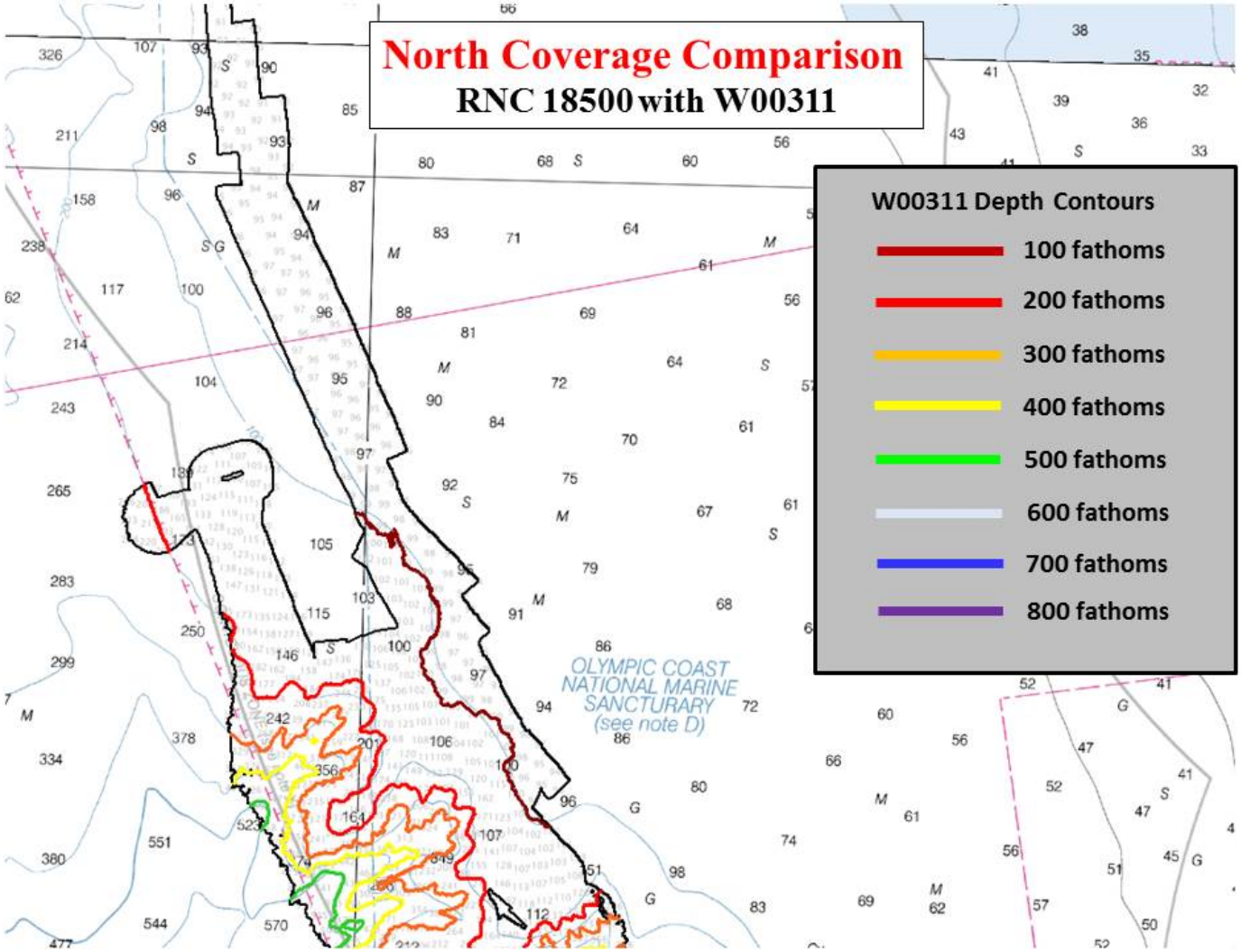


Figure 8: W00311 North Coverage Comparison RNC

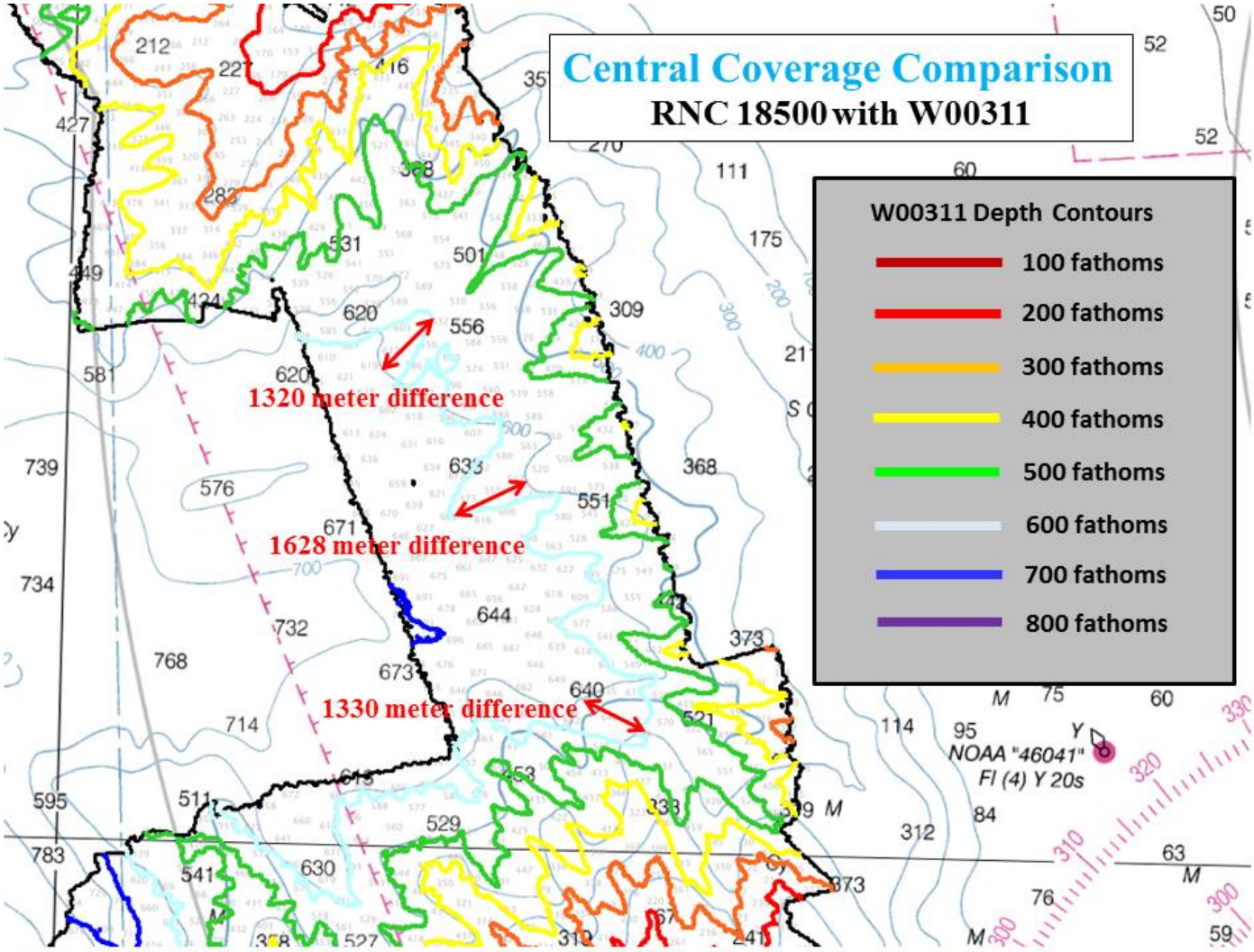


Figure 9: W00311 Central Coverage Comparison RNC

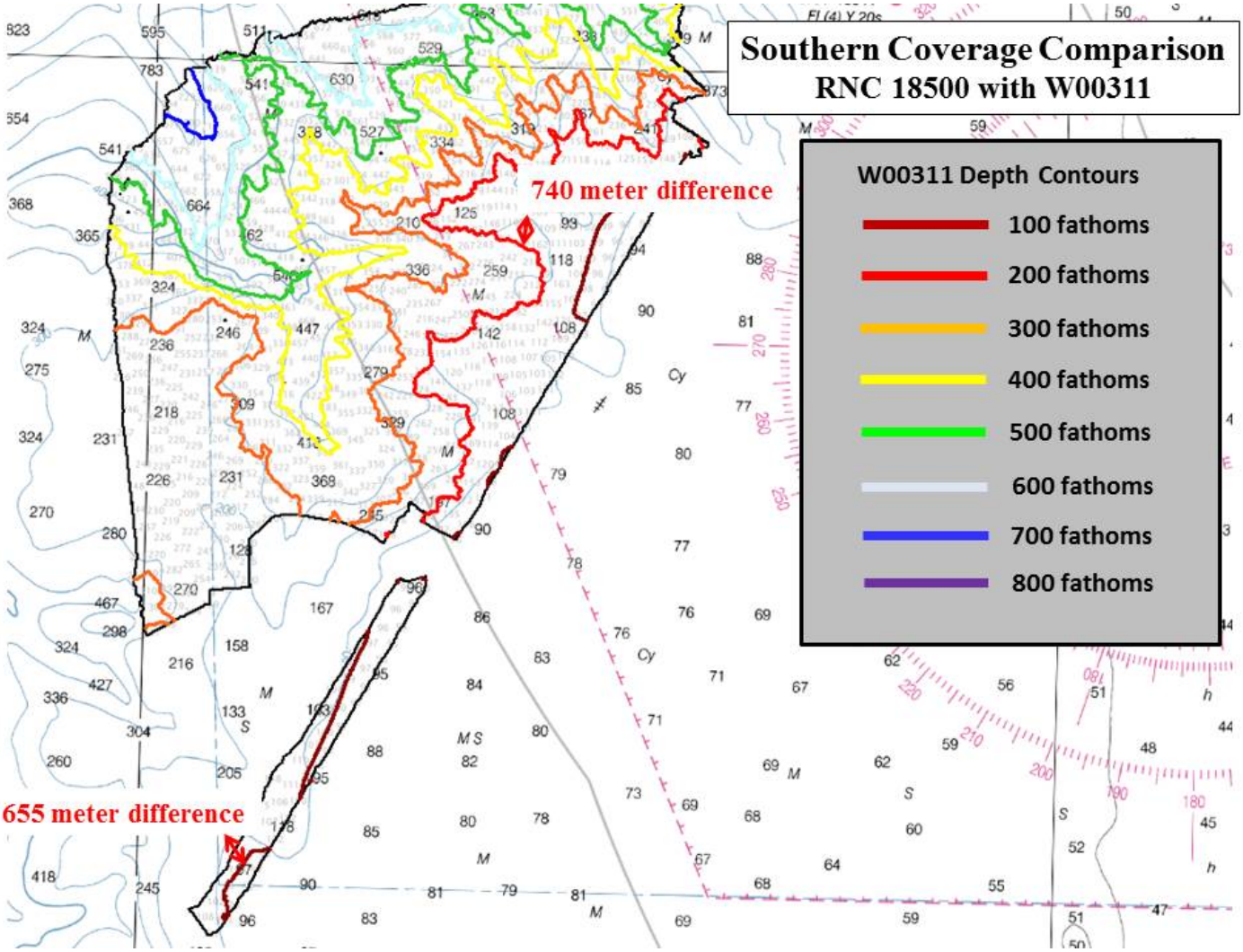


Figure 10: W00311 Southern Coverage Comparison RNC

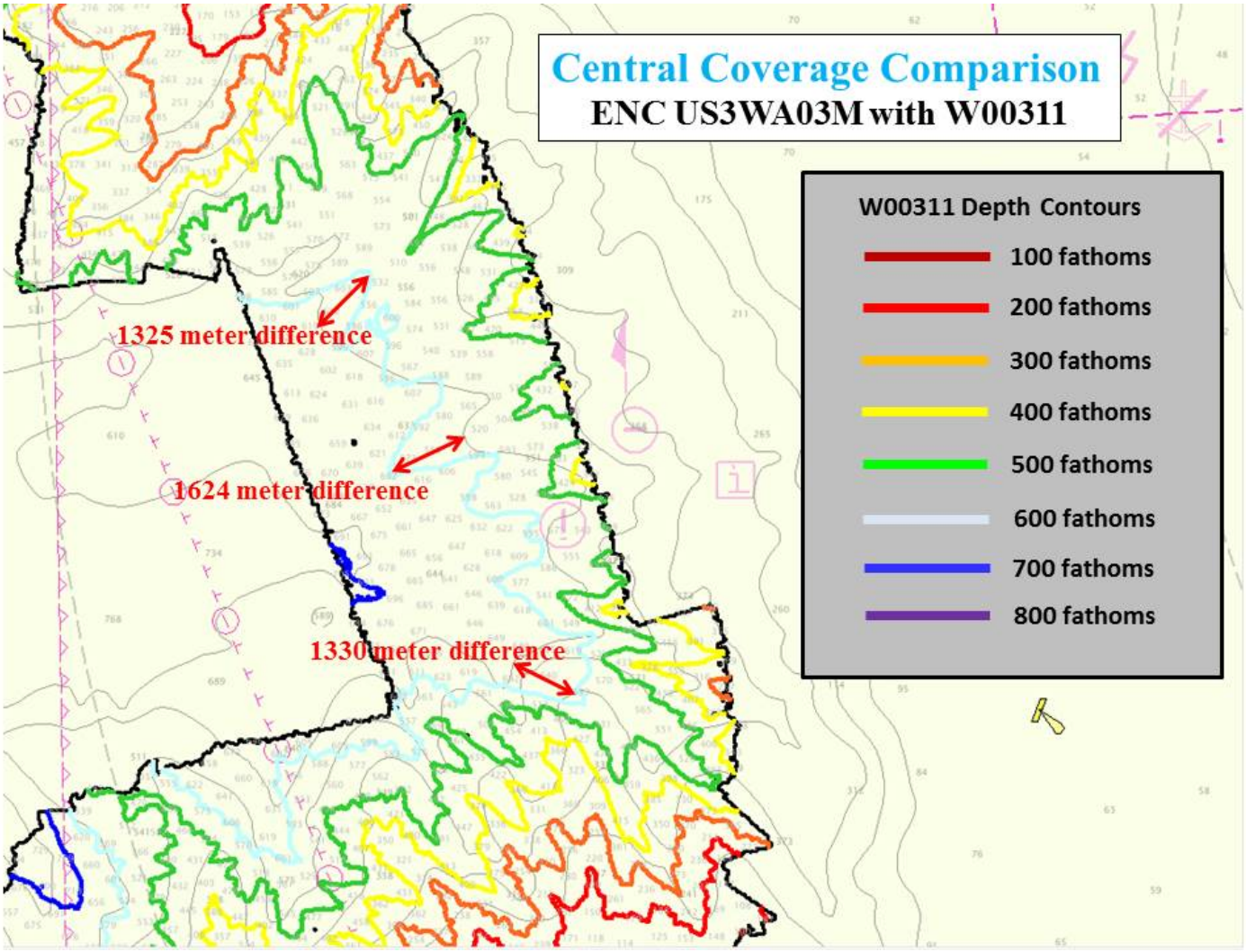


Figure 11: W00311 Central Coverage Comparison ENC

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
W00311_MB_16m_MLLW	CUBE	16 m	164.5 m - 1385.3 m	NOAA_16m	Complete MBES
W00311_MB_32m_MLLW	CUBE	32 m	164.52 m - 1376.88 m	NOAA_32m	Complete MBES
W00311_MB_16m_MLLW_FINAL	CUBE	16 m	164.50 m - 320.0 m	NOAA_16m	Complete MBES
W00311_MB_32m_MLLW_FINAL	CUBE	32 m	288.0 m - 1376.88 m	NOAA_32m	Complete MBES

G. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water.

The vertical control method used for this survey was TCARI.

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

Station Name	Station ID
Westport, WA	9441102
La Push, WA	9442396
Neah Bay, WA	9443090
Port Angeles, WA	9444090

Final approved tides was received from NOAA Center for Operational Oceanographic Products and Services (CO-OPS) in a letter dated 26 May 2016. The letter designates Preliminary TCARI file "RA1601IOCM.tc" as the final grid for project M-N908-RA-2016, W00311.

See attached Tide Note dated May 26, 2016.

The horizontal datum for this project is World Geodetic Survey 1984 (WGS 84_G1674). The projection used for this survey is UTM Zone 10N.

The following DGPS Stations were used for horizontal control:

DGPS Stations
None

Horizontal positioning control was through Wide Area Augmentation System (WAAS) enabled GPS. The horizontal datum for this project is World Geodetic System (WGS 84-G1674). The projection used for this survey is UTM Zone 10N.

H. Additional Results

AWOIS Items:
No AWOIS items were assigned for this survey.

Maritime Boundary Points:
No Maritime Boundary Points were assigned for this survey.

Charted Features:
No charted features exist for this survey.

Uncharted Features:
No uncharted features exist for this survey.

Dangers to Navigation:
No Danger to Navigation Reports were submitted for this survey.

Shoal and Hazardous Features:
No shoals or potentially hazardous features exist for this survey.

Channels:
No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

Bottom Samples:
There were no bottom samples assigned for this survey.

Shoreline:
Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

Prior Surveys:
No prior survey comparison exists for the survey.

Aids to Navigation:
No Aids to Navigation (ATONs) exist for this survey.

Overhead Features:
No overhead features exist for this survey.

Submarine Features:
No submarine features exist for this survey.

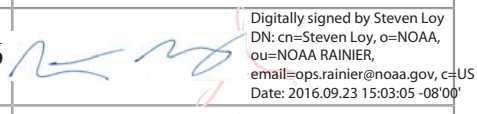
Ferry Routes and Terminals:
No ferry routes or terminals exist for this survey.

I. Approval

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 Survey Summary 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 Survey Summary Report.

Approver Name	Title	Date	Signature
Edward J. Van Den Ameele, CAPT/NOAA	Commanding Officer, NOAA Ship *Rainier*	09/21/2016	
Steven Loy, LT/NOAA	Field Operations Officer, NOAA Ship *Rainier*	09/21/2016	 Digitally signed by Steven Loy DN: cn=Steven Loy, o=NOAA, ou=NOAA RAINIER, email=ops.rainier@noaa.gov, c=US Date: 2016.09.23 15:03:05 -08'00'
James B. Jacobson	Chief Survey Technician, NOAA Ship *Rainier*	09/21/2016	 I am signing for CST Jacobson
Gregory J. Gahlinger	Hydrographic Assistant Survey Technician, NOAA Ship *Rainier*	09/21/2016	

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

PROVISIONAL TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : May 26, 2016

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: M-N908-RA-2016
HYDROGRAPHIC SHEET: W00311

LOCALITY: Western Quinault Canyon, Olympic Coast NMS, WA
TIME PERIOD: May 09 - May 12, 2016

TIDE STATION USED: Port Angeles, WA 944-4090
Lat.48° 07.5′ N Long. 123° 26.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.987 meters

TIDE STATION USED: La Push, WA 944-2396
Lat. 47° 54.8' N Long. 124° 38.2' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.362 meters

TIDE STATION USED: Neah Bay, WA 944-3090
Lat. 48° 22.2' Long. 124° 36.1'
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.168 meters

TIDE STATION USED: Westport, WA 944-1102
Lat. 46° 54.2' Long. 124° 06.3'
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.565 meters

REMARKS: RECOMMENDED Grid

Please use the TCARI grid "RA1601IOCM.tc" as the final grid for project M-N908-RA-2016, W00311, during the time period between May 09 and May 12, 2016.

Refer to attachments for grid 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: Annual leveling for Port Angeles, WA (9444090) was not completed in FY15. A review of the verified leveling records from 2005-2014 shows the tide station benchmark network to be stable within an allowable tolerance. CO-OPS will immediately provide a revised Tide Note should subsequent leveling indicate any instability.

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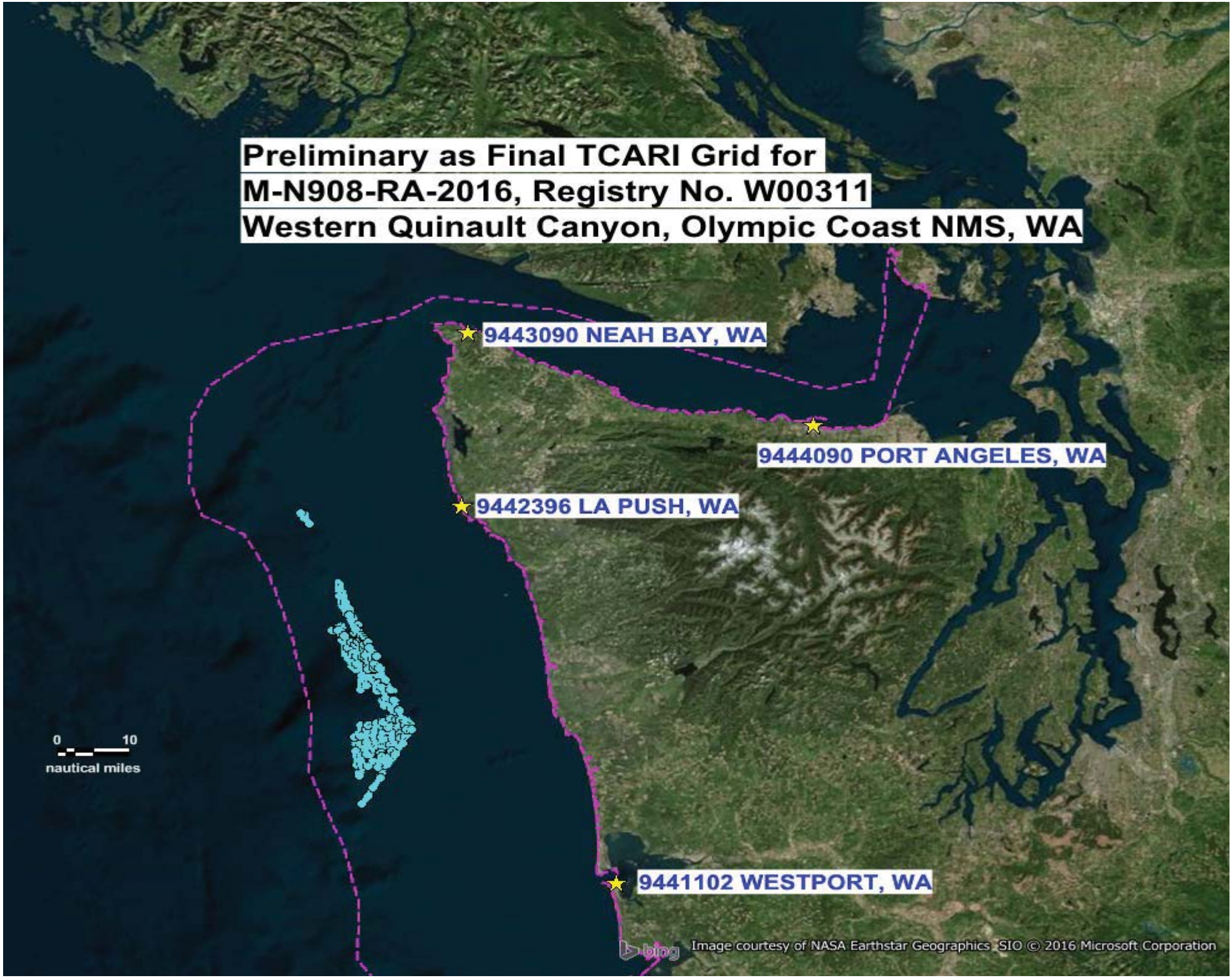
CHIEF, PRODUCTS AND SERVICES BRANCH


Preliminary as Final TCARI Grid for
M-N908-RA-2016, Registry No. W00311
Western Quinault Canyon, Olympic Coast NMS, WA
9443090 NEAH BAY, WA
9444090 PORT ANGELES, WA
9442396 LA PUSH, WA
9441102 WESTPORT, WA
0
10
nautical miles
Image courtesy of NASA Earthstar Geographics SIO © 2016 Microsoft Corporation

APPROVAL PAGE

W00311

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 NCEI for archive

- W00311_DR_Summary.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- W00311_GeoImage.pdf

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

Approved: 
Digitally signed by HOLMBERG.PETER.SCOTT.1365886101
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Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

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


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Approved:

CDR Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch