H13412

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable Area |
| Registry Number: | H13412 |

## LOCALITY

| | |
|---|---|
| State(s): | Washington |
| General Locality: | Approaches to Puget Sound |
| Sub-locality: | Kydaka Point to Neah Bay |

**2020**

CHIEF OF PARTY
CDR John Lomnicky

LIBRARY & ARCHIVES

Date:

| U.S. DEPARTMENT OF COMMERCE<br>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | REGISTRY NUMBER: |
|---|---|
| **HYDROGRAPHIC TITLE SHEET** | **H13412** |

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(s): | **Washington** |
| General Locality: | **Approaches to Puget Sound** |
| Sub-Locality: | **Kydaka Point to Neah Bay** |
| Scale: | **5000** |
| Dates of Survey: | **11/22/2020 to 12/06/2020** |
| Instructions Dated: | **10/21/2020** |
| Project Number: | **OPR-N305-FA-20** |
| Field Unit: | **NOAA Ship *Fairweather*** |
| Chief of Party: | **CDR John Lomnicky** |
| Soundings by: | **Multibeam Echo Sounder** |
| Imagery by: | **Multibeam Echo Sounder Backscatter** |
| Verification by: | **Pacific Hydrographic Branch** |
| Soundings Acquired in: | **meters at Mean Lower Low Water** |

Remarks:

***Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in NAD83 UTM 10N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.***

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# Descriptive Report to Accompany Survey H13412

Project: OPR-N305-FA-20

Locality: Approaches to Puget Sound

Sublocality: Kydaka Point to Neah Bay

Scale: 1:5000

November 2020 - December 2020

**NOAA Ship *Fairweather***

Chief of Party: CDR John Lomnicky

# A. Area Surveyed

The survey area is located from Kydaka Point to Neah Bay, Washington.

## A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit | Southeast Limit |
|---|---|
| 48° 25' 2.93" N<br>124° 41' 22.92" W | 48° 16' 31.13" N<br>124° 18' 36.72" W |

*Table 1: Survey Limits*

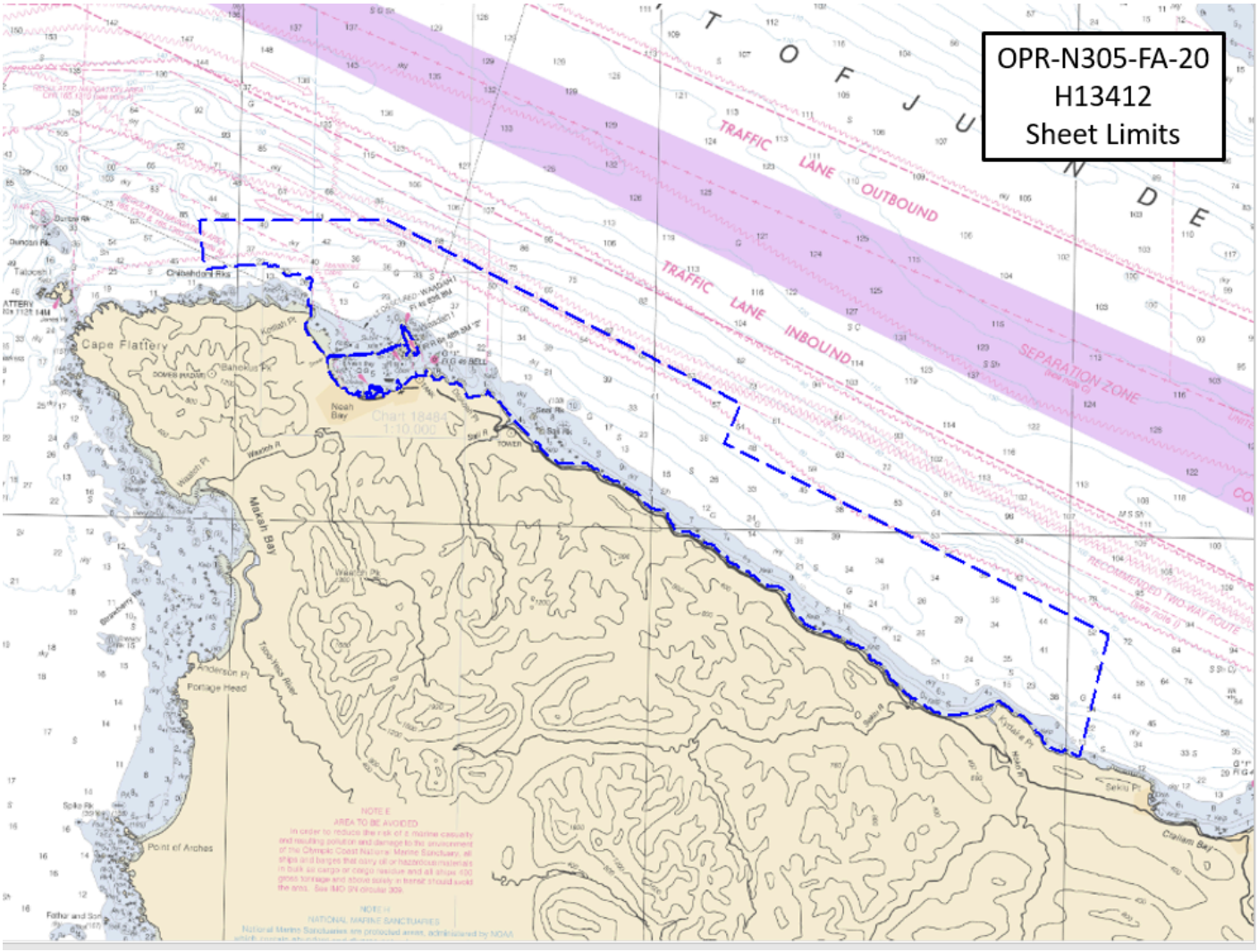



*Figure 1: H13412 sheet limits (in blue) overlaid onto Chart 18460*

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2020 NOS Hydrographic Surveys Specifications and Deliverables (HSSD). Coverage acquired in H13412 is shown in Figure 1. In all areas where the 3.5 meter depth contour or the sheet limits were not met, the Navigable Area Limit Line (NALL) was defined as the inshore limit of bathymetry due to the risks of maneuvering the survey vessel in close proximity to the dense kelp beds or intermittent volcanic rocky shoreline and at Hydrographers discretion due to dangerous swell. An example of such an area is shown in Figure 2.

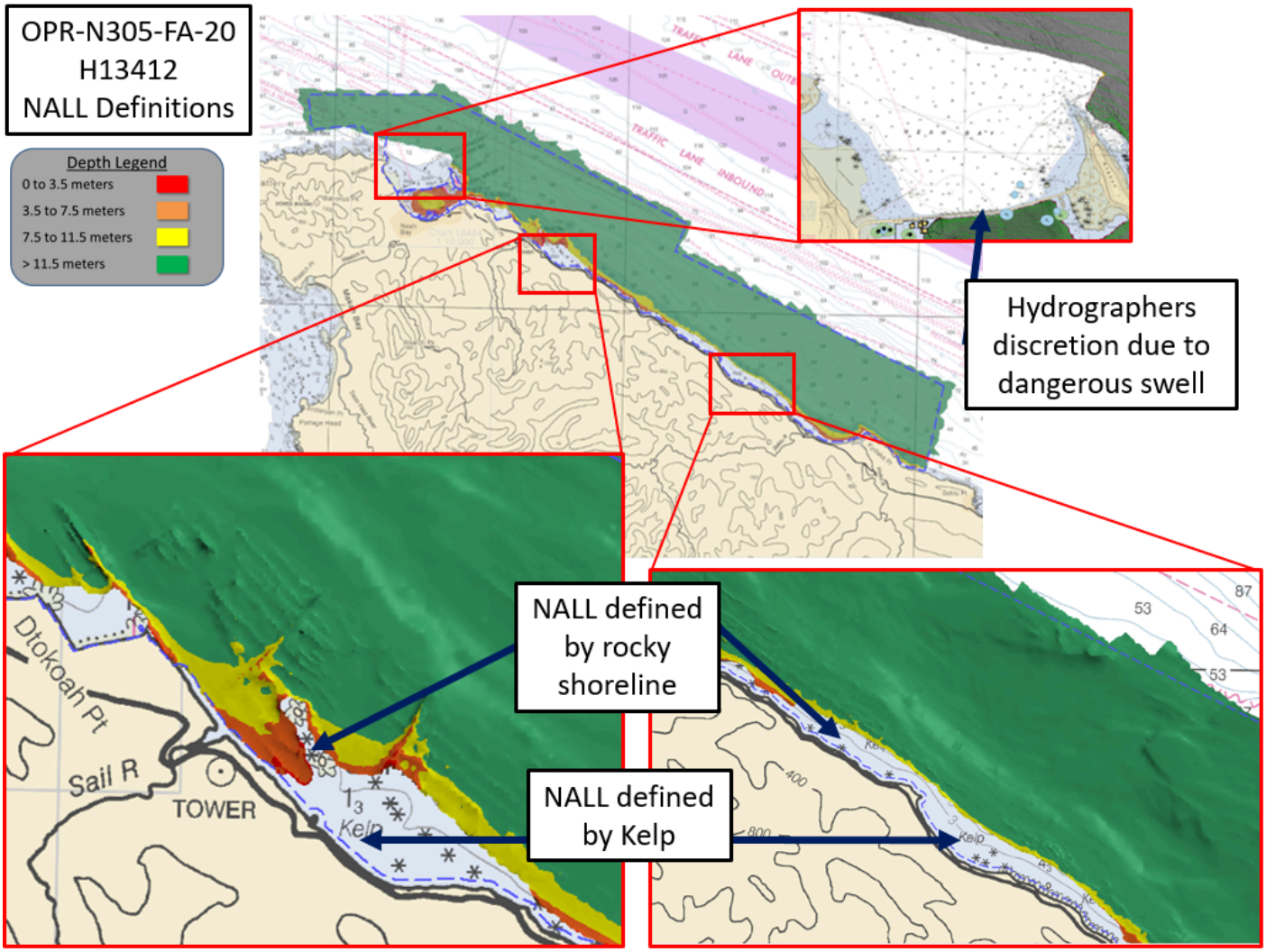



*Figure 2: NALL Defined by Rocks and Kelp*

## A.2 Survey Purpose

This 30 square nautical mile project is located within the Strait of Juan de Fuca, WA, a major coastal waterway within the Salish Sea. This area is a navigationally significant waterway within the Salish Sea, which supports transits of deep-draft container ships, cargo and chemical carriers, oil tankers, fuel and coal barges arriving and departing from Puget Sound and Vancouver, Canada along with fishing, recreational, tug and barge vessels, and Washington State Ferries. Furthermore, the region is home to 8 million people including fifty First Nation communities with centuries old cultural ties to traditional fishing.

This project will occur within the Makah Tribe Usual and Accustomed Fishing Area that includes the Neah Bay emergency tugboat marina and 5 SNM of the Olympic Coast National Marine Sanctuary. The majority of the area was last surveyed in the 1940s and 1960s, with Neah Bay surveyed in 2000. This project will provide modern bathymetry for updating National Ocean Service Nautical charting products improving

maritime safety in this navigationally busy region as well as support the Seabed 2030 global mapping initiative.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13412 meet multibeam echo sounder (MBES) coverage requirements for complete coverage as required by the HSSD. This includes crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.10), and density requirements (see Section B.2.11).

## A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

| Water Depth | Coverage Required |
|---|---|
| All waters in survey area | Complete Coverage |

*Table 2: Survey Coverage*

The entirety of H13412 was acquired with complete coverage, meeting the requirements listed above and in the HSSD. See Figure 3 for an overview of coverage.

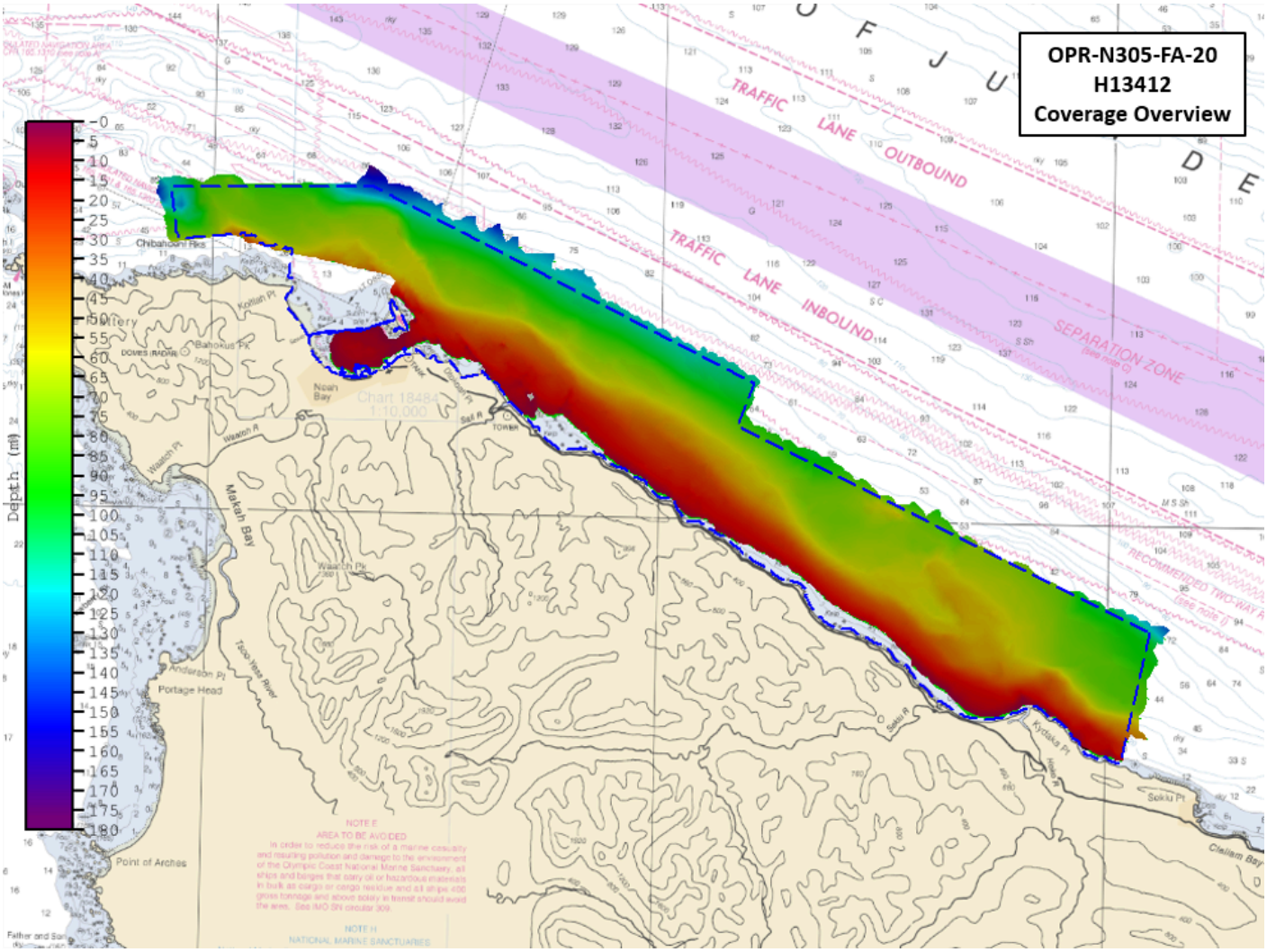



*Figure 3: H13412 survey coverage overlaid onto Chart 18460*

## A.6 Survey Statistics

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

| | HULL ID | *FA 2805* | *FA 2807* | *FA 2808* | *S220* | *Total* |
|---|---|---|---|---|---|---|
| **LNM** | **SBES Mainscheme** | 0 | 0 | 0 | 0 | 0 |
| | **MBES Mainscheme** | 90.38 | 71.57 | 130.38 | 252.10 | 568.49 |
| | **Lidar Mainscheme** | 0 | 0 | 0 | 0 | 0 |
| | **SSS Mainscheme** | 0 | 0 | 0 | 0 | 0 |
| | **SBES/SSS Mainscheme** | 0 | 0 | 0 | 0 | 0 |
| | **MBES/SSS Mainscheme** | 0 | 0 | 0 | 0 | 0 |
| | **SBES/MBES Crosslines** | 10.37 | 0 | 13.69 | 0 | 24.07 |
| | **Lidar Crosslines** | 0 | 0 | 0 | 0 | 0 |
| **Number of Bottom Samples** | | | | | | 6 |
| **Number Maritime Boundary Points Investigated** | | | | | | 0 |
| **Number of DPs** | | | | | | 0 |
| **Number of Items Investigated by Dive Ops** | | | | | | 0 |
| **Total SNM** | | | | | | 29.46 |

*Table 3: Hydrographic Survey Statistics*

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

| Survey Dates | Day of the Year |
|---|---|
| 11/22/2020 | 327 |

| Survey Dates | Day of the Year |
|---|---|
| 11/23/2020 | 328 |
| 11/28/2020 | 333 |
| 11/29/2020 | 334 |
| 11/30/2020 | 335 |
| 12/01/2020 | 336 |
| 12/02/2020 | 337 |
| 12/03/2020 | 338 |
| 12/04/2020 | 339 |
| 12/06/2020 | 341 |

*Table 4: Dates of Hydrography*

# B. Data Acquisition and Processing

## B.1 Equipment and Vessels

Refer to the OPR-N305-FA-20 Data Acquisition and Processing Report 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 | *S220* | *2805* | *2807* | *2808* |
|---|---|---|---|---|
| **LOA** | 70.4 meters | 8.6 meters | 8.6 meters | 8.6 meters |
| **Draft** | 4.8 meters | 1.1 meters | 1.1 meters | 1.1 meters |

*Table 5: Vessels Used*

### B.1.2 Equipment

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

| Manufacturer | Model | Type |
|---|---|---|
| Kongsberg Maritime | EM 2040 | MBES |
| Kongsberg Maritime | EM 710 | MBES |
| Sea-Bird Scientific | SBE 19plus V2 | Conductivity, Temperature, and Depth Sensor |
| Applanix | POS MV 320 v5 | Positioning and Attitude System |
| AML Oceanographic | MVP200 | Conductivity, Temperature, and Depth Sensor |
| Teledyne RESON | SVP 70 | Sound Speed System |
| Teledyne RESON | SVP 71 | Sound Speed System |

*Table 6: Major Systems Used*

The equipment was installed on the survey platform as follows: S220 utilizes the Kongsberg EM 710 MBES, a POS M/V v5 system for position and attitude, SVP 70 surface sound speed sensors, and AML Oceanographic MVP 200 for conductivity, temperature, and depth (CTD) casts. All launches utilize the Kongsberg EM 2040 MBES, a POS M/V v5 system for positon and attitude, SVP 71 surface sound speed sensors, and Sea-Bird SBE 19plus v2 CTDs for conductivity, temperature, and depth casts.

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines were collected, processed and compared in accordance with Section 5.2.4.2 of the HSSD. To evaluate crosslines, a surface generated via data strictly from mainscheme lines and a surface generated via data strictly from crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated (Figure 4), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from mainscheme data and crossline data was 0.00 meters and 95% of nodes falling within 0.13 meters (with mainscheme being shoaler, as shown in Figure 5). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards (Figure 5). In total, 99.5% of the depth differences between H13412 mainscheme and crossline data were within allowable NOAA uncertainties.

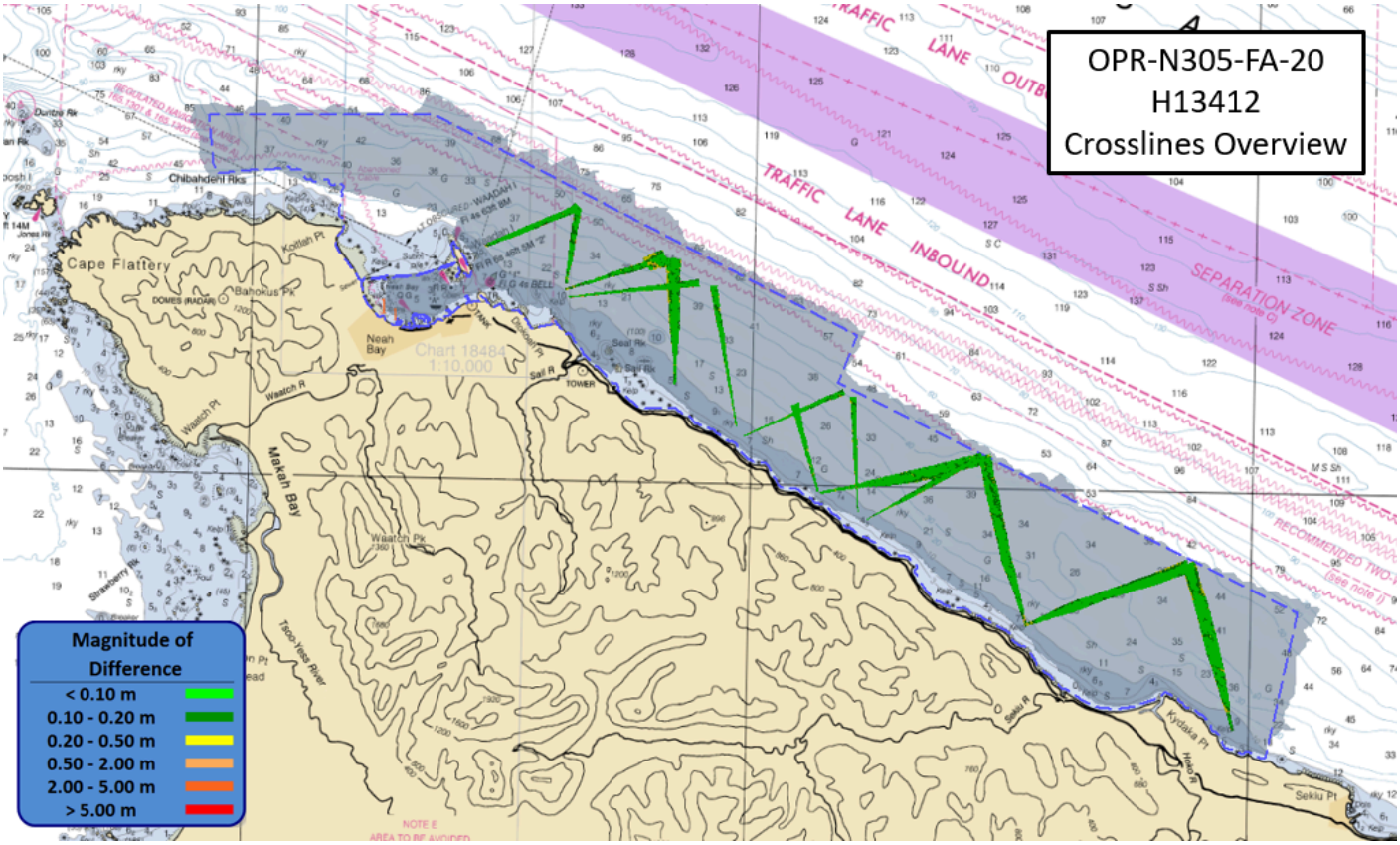
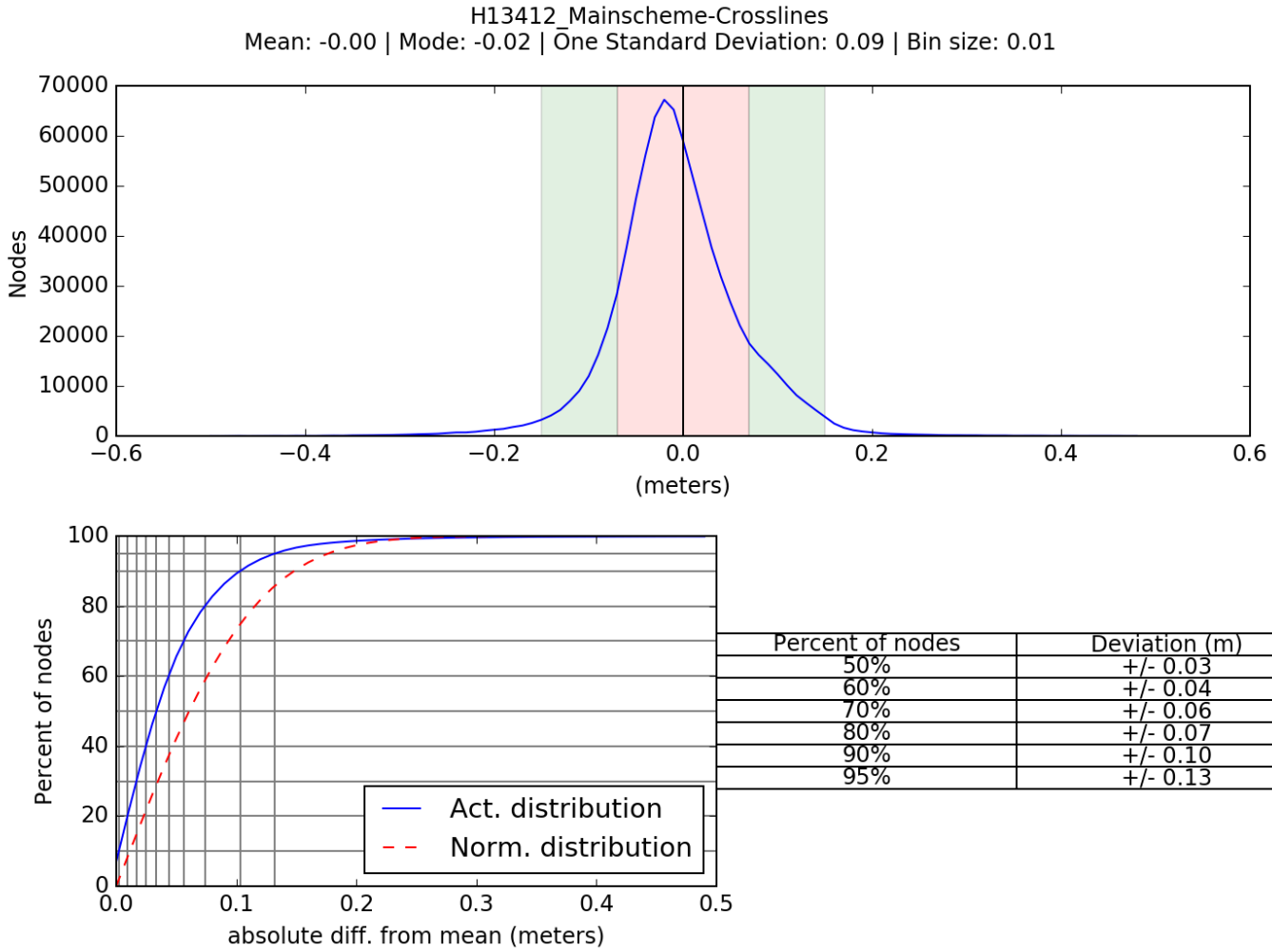



*Figure 4: Overview of H13412 Crosslines*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.03 |
| 60% | +/- 0.04 |
| 70% | +/- 0.06 |
| 80% | +/- 0.07 |
| 90% | +/- 0.10 |
| 95% | +/- 0.13 |

*Figure 5: H13412 Crossline and mainscheme difference statistics*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Method | Measured | Zoning |
|---|---|---|
| ERS via VDATUM | N/A | 13.2 centimeters |

*Table 7: Survey Specific Tide TPU Values.*

| Hull ID | Measured - CTD | Measured - MVP | Measured - XBT | Surface |
|---|---|---|---|---|
| 280X (All Launches) | 2 meters/second | N/A meters/second | N/A meters/second | 0.5 meters/second |
| S220 | N/A meters/second | 1 meters/second | N/A meters/second | 0.5 meters/second |

*Table 8: Survey Specific Sound Speed TPU Values*.

In addition to the usual a priori estimates of uncertainty via device models for vessel motion and VDATUM, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13412. Real-time uncertainties were provided via EM 710 and EM 2040 MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel roll, pitch, gyro and navigation were applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac.

### B.2.3 Junctions

H13412 junctions with 1 adjacent survey from this project, H13414 and H11083 from a prior project, as shown in Figure 6. These areas of overlap between surveys were reviewed in CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement. The junctions with H13412 are generally within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H13412, a negative difference indicates H13412 was shoaler and a positive difference indicates H13412 was deeper.

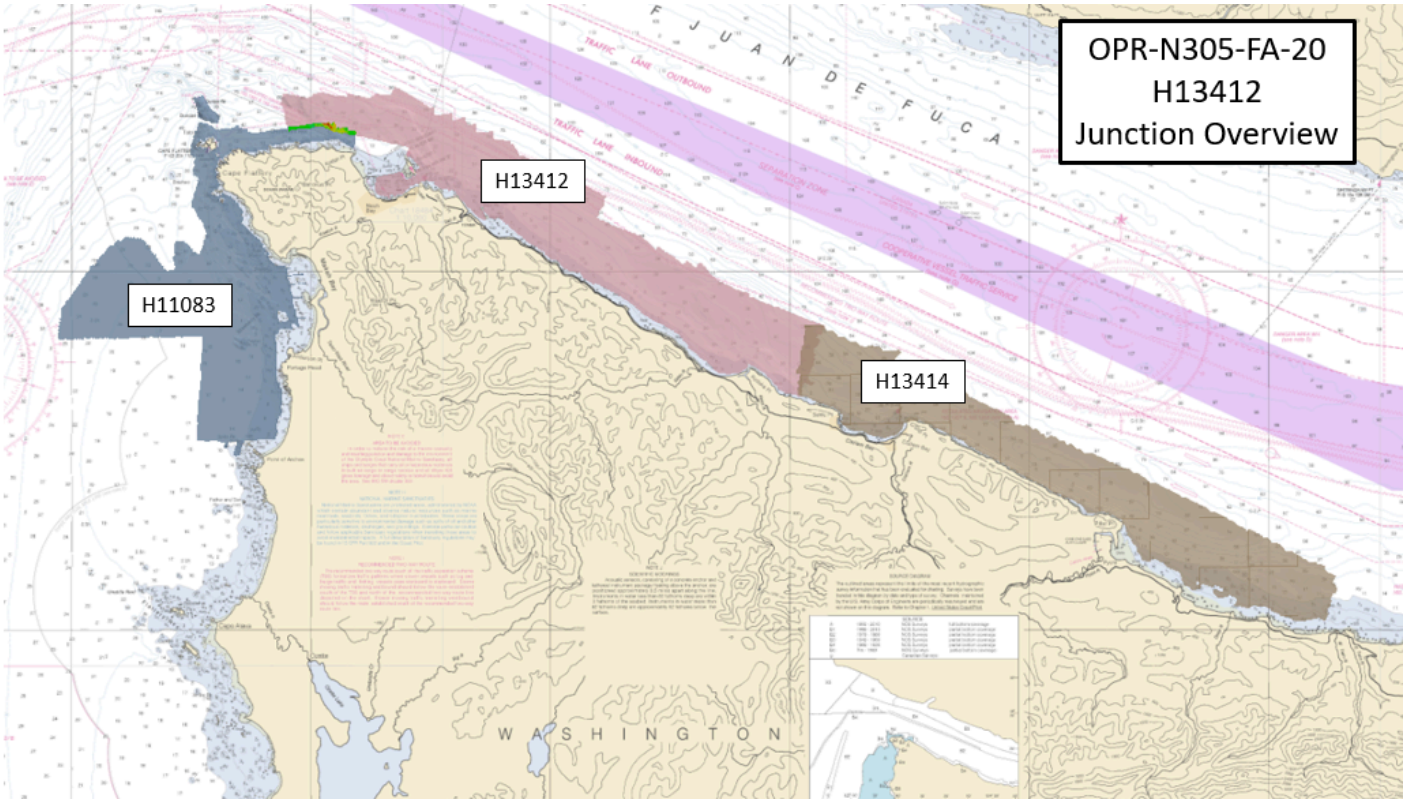



*Figure 6: Overview of H13412 junction surveys*

The following junctions were made with this survey:

| Registry Number | Scale | Year | Field Unit | Relative Location |
|---|---|---|---|---|
| H13414 | 1:20000 | 2020 | NOAA Ship Fairweather | SE |
| H11083 | 1:5000 | 2000 | NOAA Ship Rainier | W |

*Table 9: Junctioning Surveys*

H13414

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13412 and the surface from H13414 (Figure 7). The statistical analysis of the difference surface shows a mean of 0.02 meters with 95% of the nodes having a maximum deviation of +/- 0.16 meters, as seen in Figure 8. It was found that 99.5% of nodes are within NOAA allowable uncertainty.

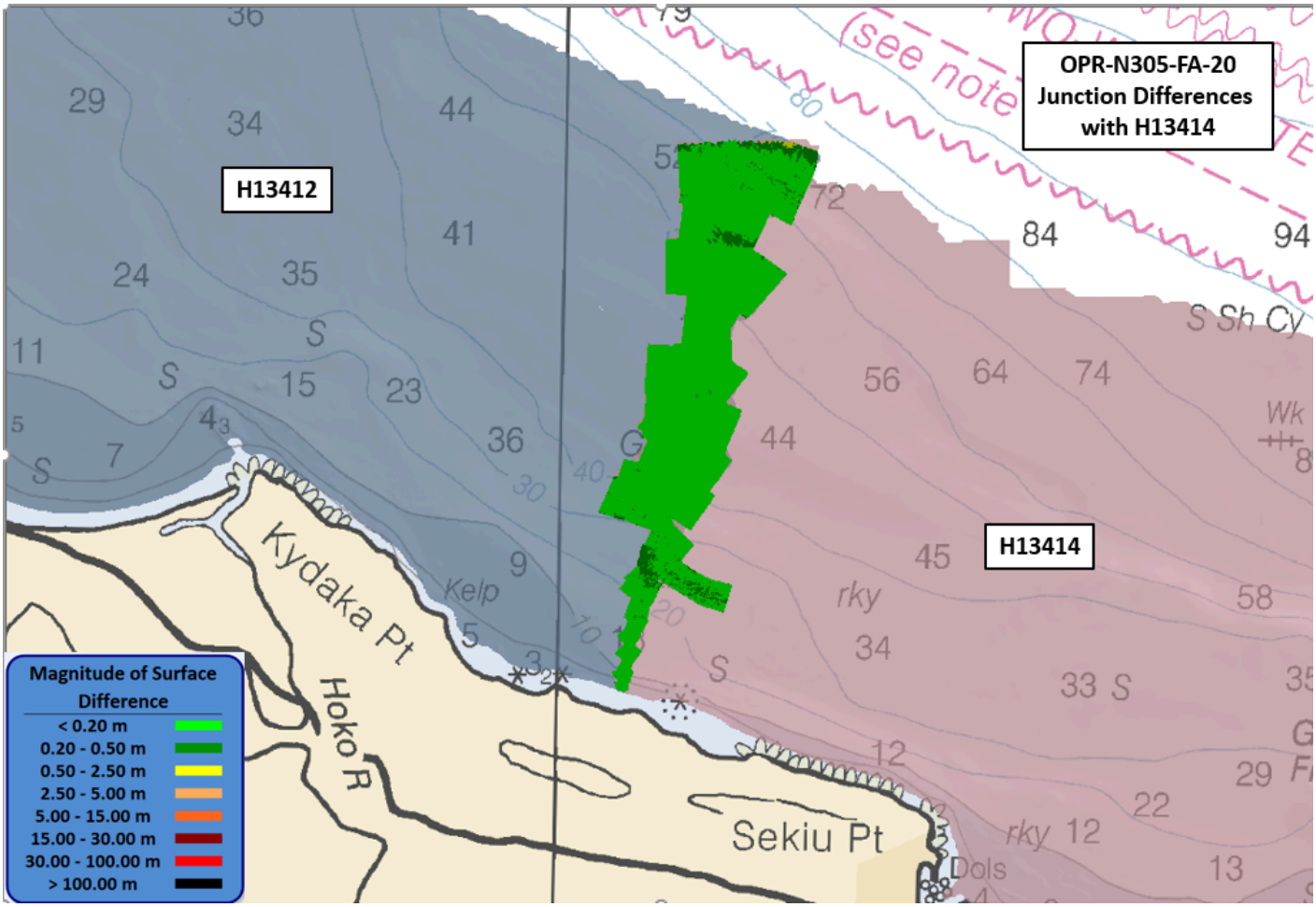
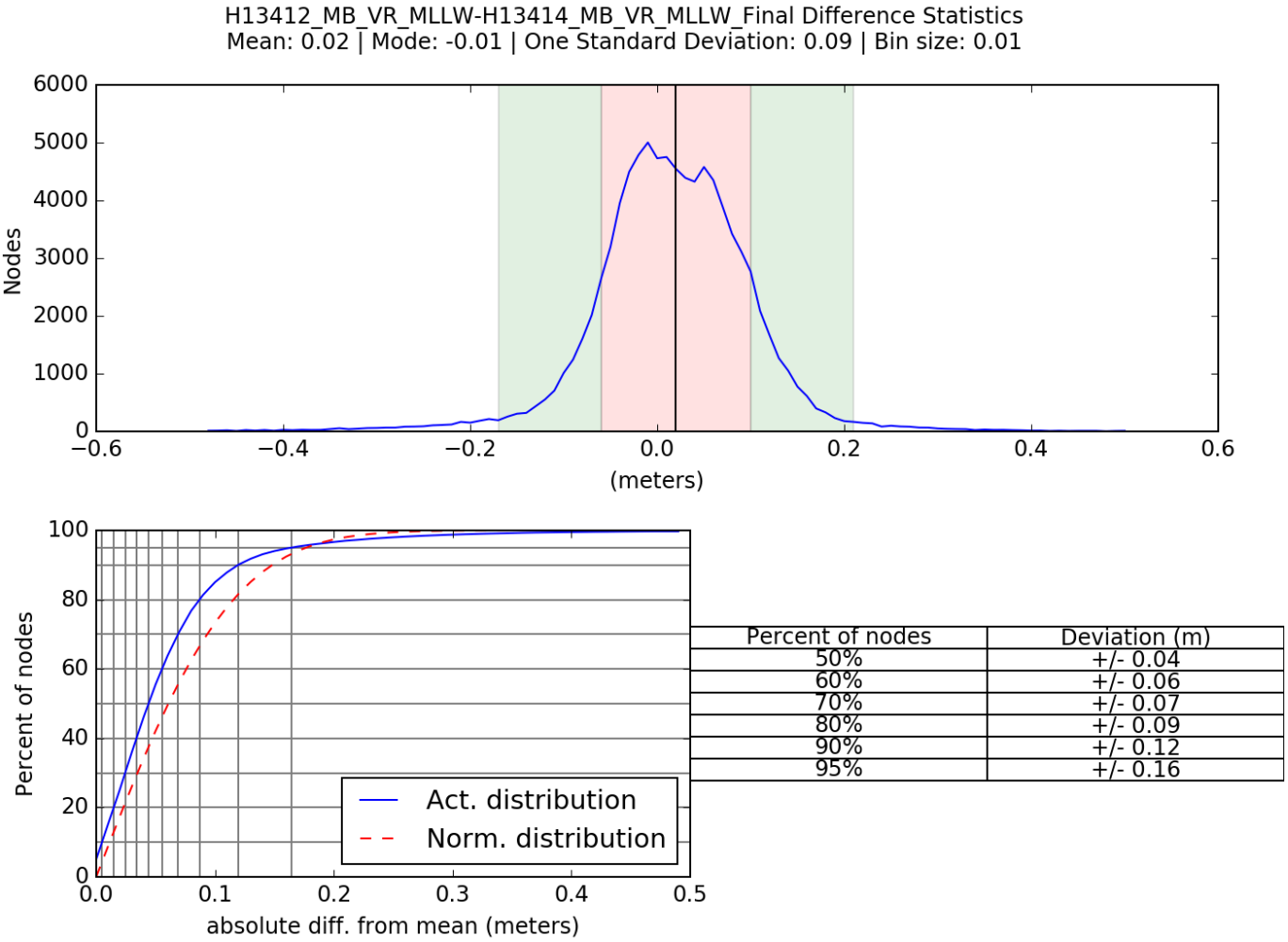



*Figure 7: Difference surface between H13412 (blue) and junctioning survey H13414 (pink)*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.04 |
| 60% | +/- 0.06 |
| 70% | +/- 0.07 |
| 80% | +/- 0.09 |
| 90% | +/- 0.12 |
| 95% | +/- 0.16 |

*Figure 8: Difference surface statistics between H13412 and H13414 (VR surface)*

H11083

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13412 and the surface from H11083 (Figure 9 ). The statistical analysis of the difference surface shows a mean of 0.35 meters with 95% of the nodes having a maximum deviation of +/- 0.82 meters, as seen in Figure 10. It was found that 95.49% of nodes are within NOAA allowable uncertainty.

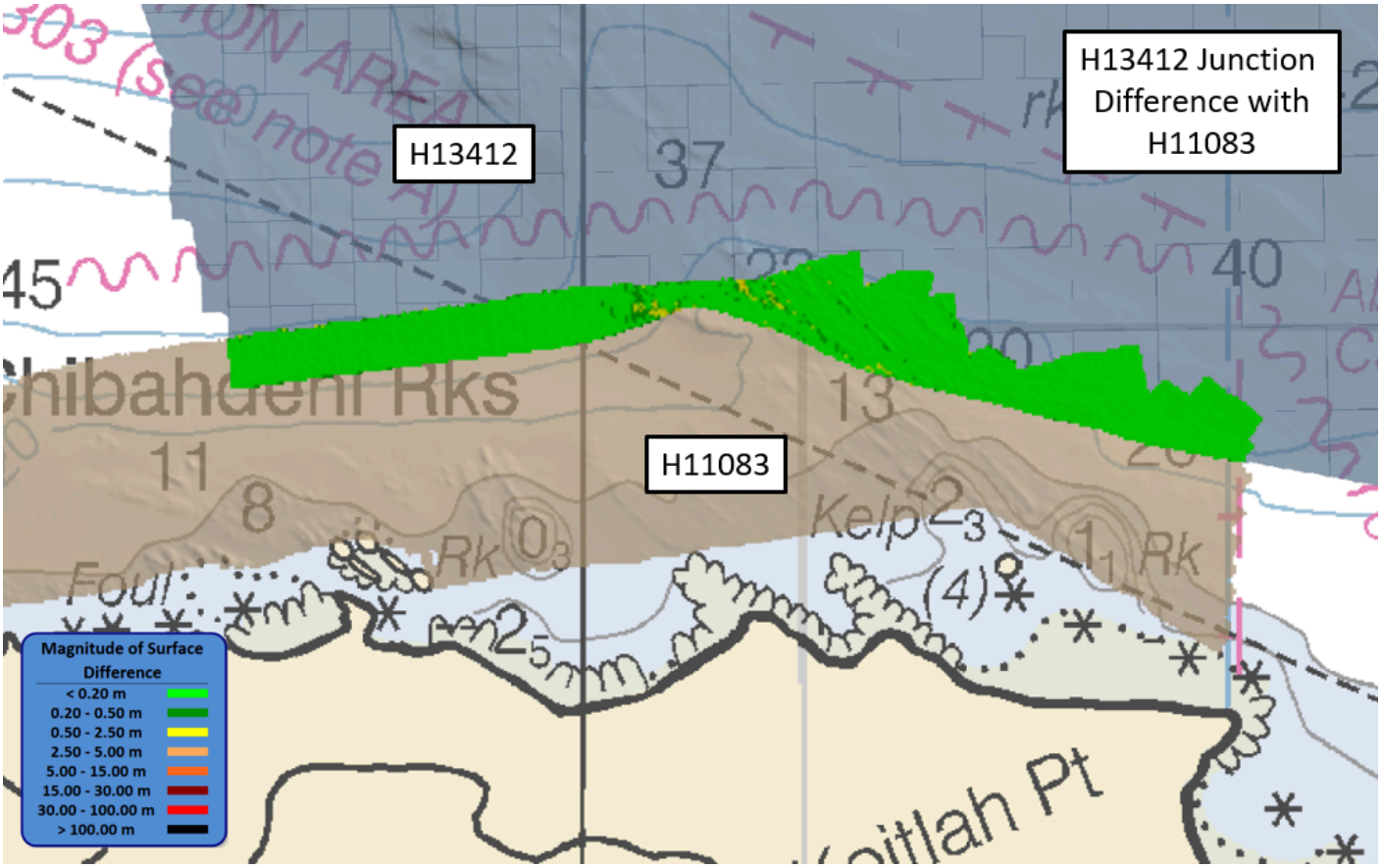
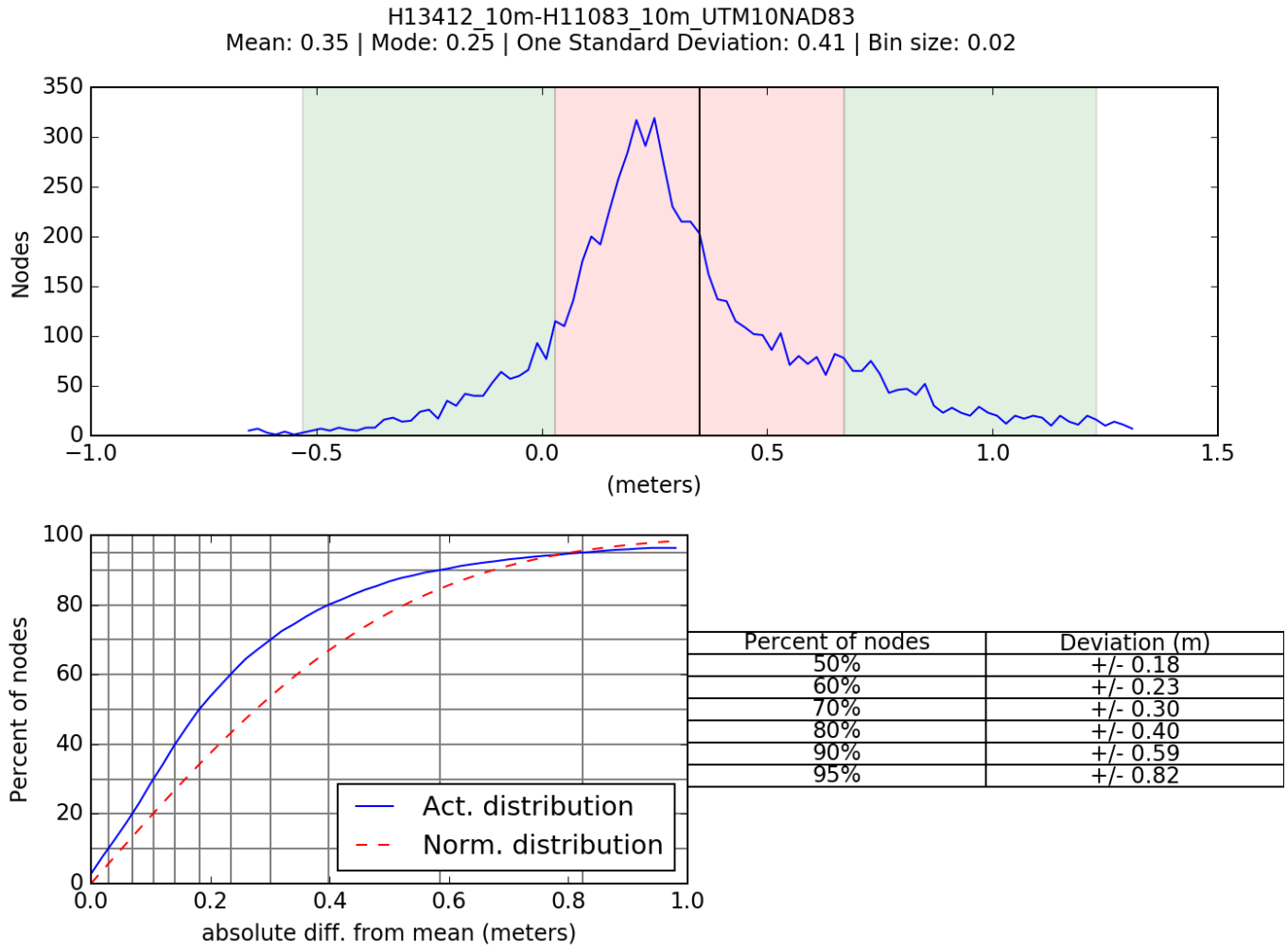



*Figure 9: Difference surface between H13412 (blue) and junctioning survey H11083 (brown)*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.18 |
| 60% | +/- 0.23 |
| 70% | +/- 0.30 |
| 80% | +/- 0.40 |
| 90% | +/- 0.59 |
| 95% | +/- 0.82 |

*Figure 10: Difference surface statistics between H13412 and H11083 (10 meter surface)*

### 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

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

### B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

### B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at a minimum of one every four hours during launch acquisition. Casts were conducted more frequently when there was a change in surface sound speed greater than two meters per second. MVP casts on S220 were conducted at an average interval of 179 minutes, guided by observation of the surface sound speed and targeted to deeper areas. All sound speed methods were used as detailed in the DAPR.

### B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR

### B.2.9 NOAA Allowable Uncertainty

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, 99.5% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13412 (Figure 11).

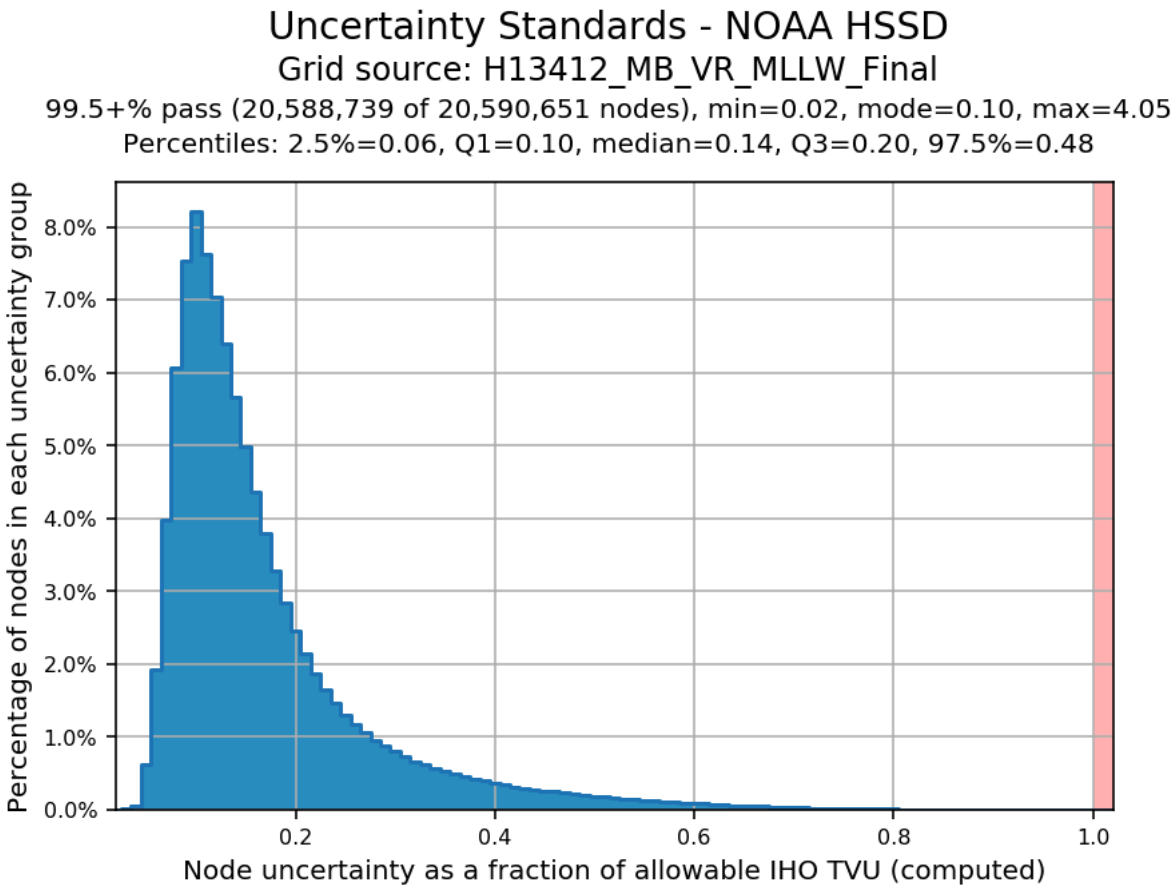



*Figure 11: H13412 Allowable uncertainty statistics*

### B.2.10 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13412 were achieved with at least 99.5% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3 (Figure 12).

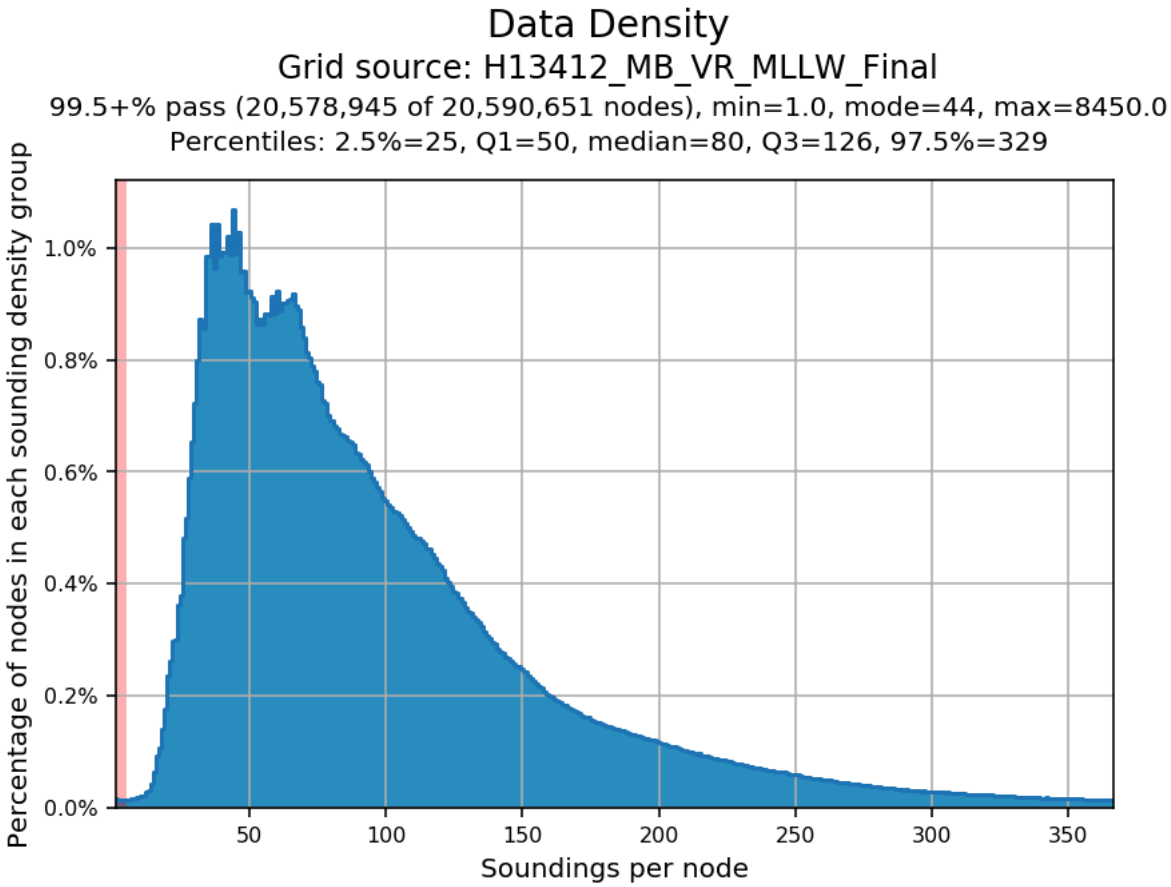



*Figure 12: H13412 Data density statistics*

### B.2.11 Gaps at NALL

Gaps in coverage are present at the inshore limits of H13412 and are a result of sparse outer beam data while launches developed the inshore limit of safe navigation (NALL). These gaps are most prevalent in the exposed, rocky areas of H13412 as kelp and nearshore topography made it too dangerous to acquire additional bathymetry, as shown in Figures 13 and Figure 14.

*Figure 13: Rock outcropping along shore*

*Figure 14: Kelp beds along coast adjacent to Kydaka Point to Neah Bay*

## 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

Raw backscatter data were stored in the .all file for Kongsberg systems. All backscatter were processed to GSF files and a floating point mosaic was created by the field unit via Fledermaus FMGT 7.9.0 . See Figure 15 for a greyscale representation of the complete mosaic. A relative backscatter calibration was performed by the field unit via a patch test in order to bring the survey systems on each of the launches into alignment. See Figure 16 for a table of the calibration values entered into the Processing Settings within FMGT. Approximate inter-calibration corrections for offsets between sonar systems were applied to the mosaic.

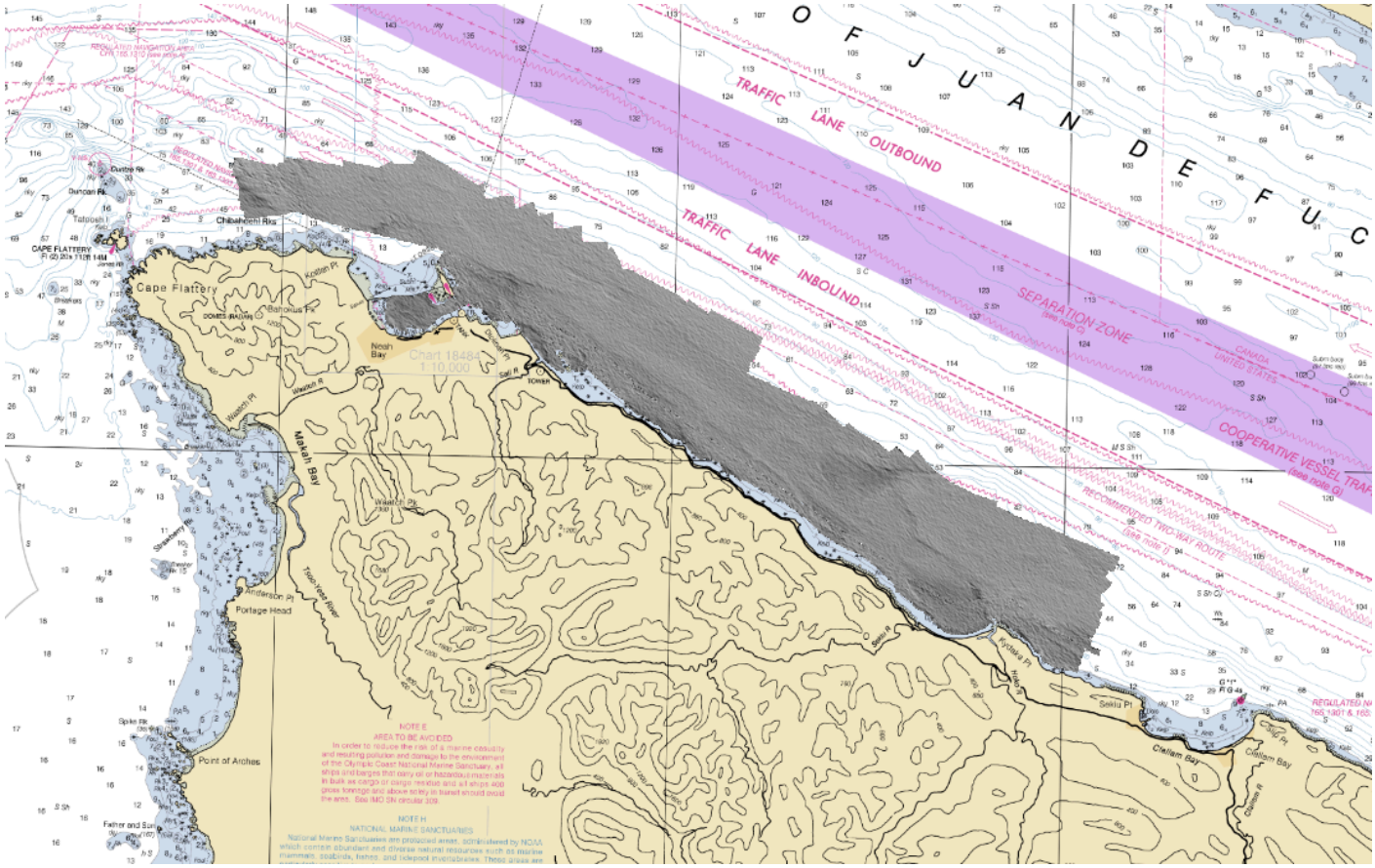



*Figure 15: Backscatter mosaic for H13412*

| | 200 | | | | 300 | | | | 400 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Short CW | Med CW | Long CW | FM (Both) | Short CW | Med CW | Long CW | FM (Both) | Short CW | Med CW | Long CW |
| **2805** | -1.1 | -1.4 | -1.8 | 2.7 | -0.7 | -0.9 | -1.0 | -1.4 | 3 | 3.9 | 4.8 |
| **2806** | 1.8 | 1.8 | 1.8 | 2.4 | -0.1 | -0.3 | -0.4 | -0.8 | 3.6 | 4.65 | 5.7 |
| **2807** | -0.3 | -0.15 | 0 | 0 | 0 | -0.2 | -0.3 | -0.7 | 3.3 | 4.2 | 5.1 |
| **2808** | 0 | 0.6 | 1.2 | 1.6 | -0.3 | -0.5 | -0.6 | -1.0 | 1.8 | 2.7 | 3.6 |

*Figure 16: Backscatter calibration values*

## B.5 Data Processing

### B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

| Manufacturer | Name | Version |
|---|---|---|
| CARIS | HIPS and SIPS | 11.3 |

*Table 10: Primary bathymetric data processing software*

The following software program was the primary program used for imagery data processing:

| Manufacturer | Name | Version |
|---|---|---|
| QPS | Fledermaus | 7.9.0 |

*Table 11: Primary imagery data processing software*

The following Feature Object Catalog was used: NOAA Profile Version 2020.

### B.5.2 Surfaces

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

| Surface Name | Surface Type | Resolution | Depth Range | Surface Parameter | Purpose |
|---|---|---|---|---|---|
| H13412_MB_VR_MLLW | CARIS VR Surface (CUBE) | Variable Resolution | 0.8 meters - 177.1 meters | NOAA_VR | Complete MBES |
| H13412_MB_VR_MLLW_Final | CARIS VR Surface (CUBE) | Variable Resolution | 0.8 meters - 177.1 meters | NOAA_VR | Complete MBES |

*Table 12: Submitted Surfaces*

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13412. The surfaces have been reviewed where noisy data, or "fliers" are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to vary from the reliably measured seabed by greater than the maximum allowable

Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed.

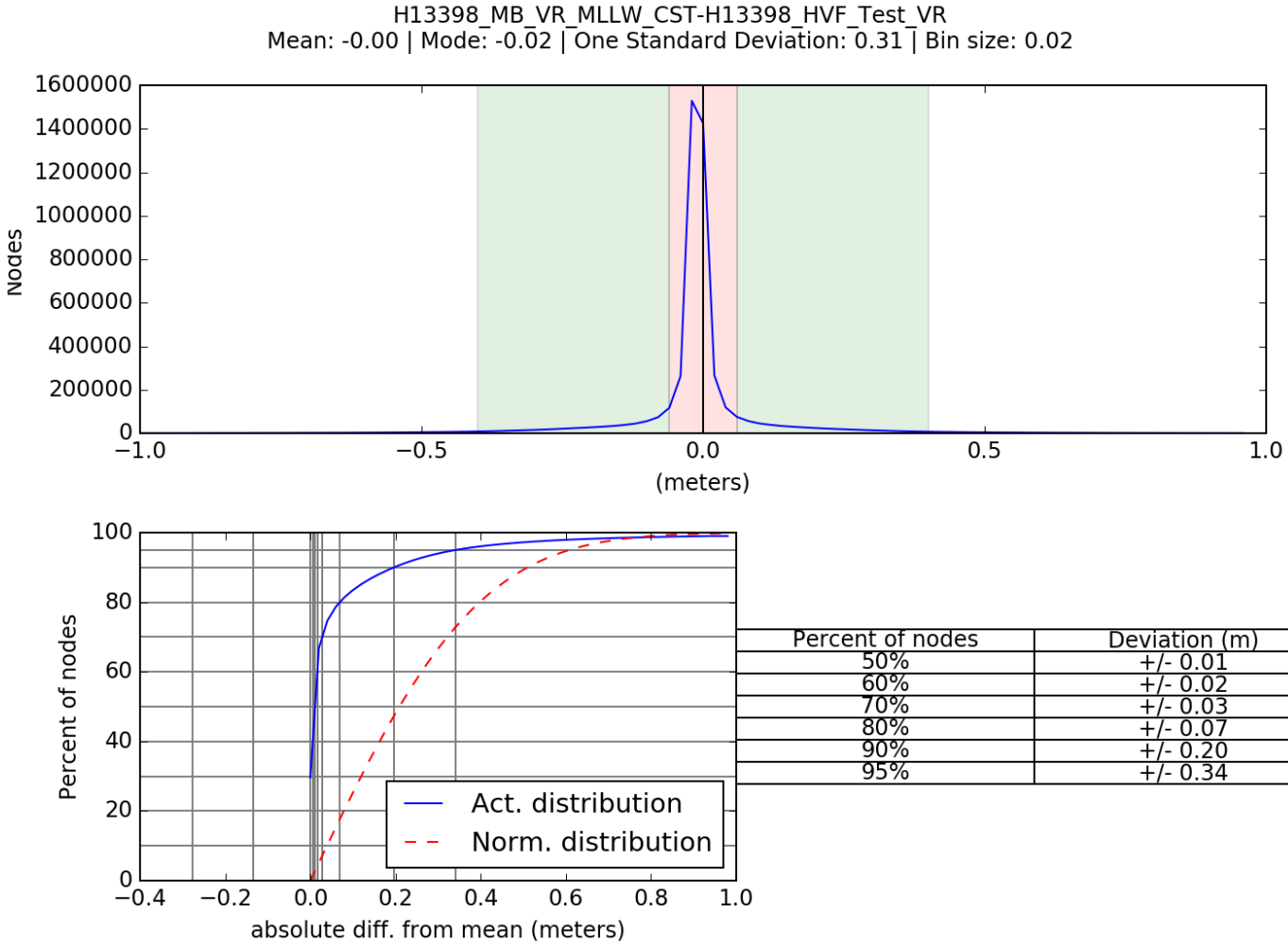
Flier Finder, part of the QC Tools package within HydrOffice, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run iteratively until all remaining flagged fliers were deemed to be valid aspects of the surface.

### B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final separation model reduction and sound speed application are noted in the H13412 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

### B.5.4 HVF Error

The DAPR includes the correct offsets in terms of what information is input into our systems. This information, unfortunately, did not make its way into the HVF. The offset inputs in the HVF are not applied directly to the data and are only used to determine uncertainty. These small differences do not seem to impact the uncertainty values. To assess this we created a test project and processed a small section of the data with the updated HVF and created a surface. We then compared the resulting uncertainty with the old HVF and new HVF which mirrors the DAPR and the POS offsets. We then utilized compare grids to assess the differences between "Correct HVF Surface" and the "Incorrect HVF Surface". The mean difference was 0.0m. Output graphs are attached.




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.01 |
| 60% | +/- 0.02 |
| 70% | +/- 0.03 |
| 80% | +/- 0.07 |
| 90% | +/- 0.20 |
| 95% | +/- 0.34 |

*Figure 17: Surface Comparison between Incorrect HVF and Correct HVF data*

# C. Vertical and Horizontal Control

Per Section 5.2.2.1.3 of the 2020 Field Procedures Manual no Horizontal and Vertical Control Report has been generated for H13412.

## C.1 Vertical Control

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

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

| Method | Ellipsoid to Chart Datum Separation File |
|---|---|
| ERS via VDATUM | OPR-N305-RA-20_sheetsuffforVdat__100m_NAD83-MLLW_geoid12b.csar |

*Table 13: ERS method and SEP file*

ERS methods were used as the final means of reducing H13412 to MLLW for submission.

## C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 10.

The following PPK methods were used for horizontal control:

- RTX

Vessel kinematic data were post-processed using Applanix POSPac processing software and RTX positioning methods described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all MBES data in CARIS HIPS and SIPS.

WAAS

During real-time acquisition, all platforms received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to USCG DGPS stations. WAAS and SBETs were the sole methods of positioning for H13412 as no DGPS stations were available for real-time horizontal control.

# D. Results and Recommendations

## D.1 Chart Comparison

### D.1.1 Electronic Navigational Charts

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

| ENC | Scale | Edition | Update Application Date | Issue Date |
|---|---|---|---|---|
| US5WA20M | 1:10000 | 14 | 05/28/2018 | 02/04/2019 |
| US4WA36M | 1:100000 | 30 | 07/09/2020 | 07/09/2020 |

*Table 14: Largest Scale ENCs*

### D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

### D.1.3 Charted Features

All assigned charted features are attributed in the Final Feature File.

### D.1.4 Uncharted Features

Survey H13412 has 19 new features that are addressed in the H13412 Final Feature File. Of these features, there are 1 new wreck, 2 new obstructions, 6 new seabed areas, 1 new pontoon areas, 2 new piles, and 7 new kelp features.

### D.1.5 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.

## D.2 Additional Results

### D.2.1 Aids to Navigation

There where 7 assigned ATONs for H13412. They are fully attributed in the Final Feature File.

### D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

### D.2.3 Bottom Samples

6 bottom samples were acquired in accordance with the Project Instructions for survey H13412. All bottom samples were entered in the H13412 Final Feature File. See Figure 17 for a graphical overview of sample locations.

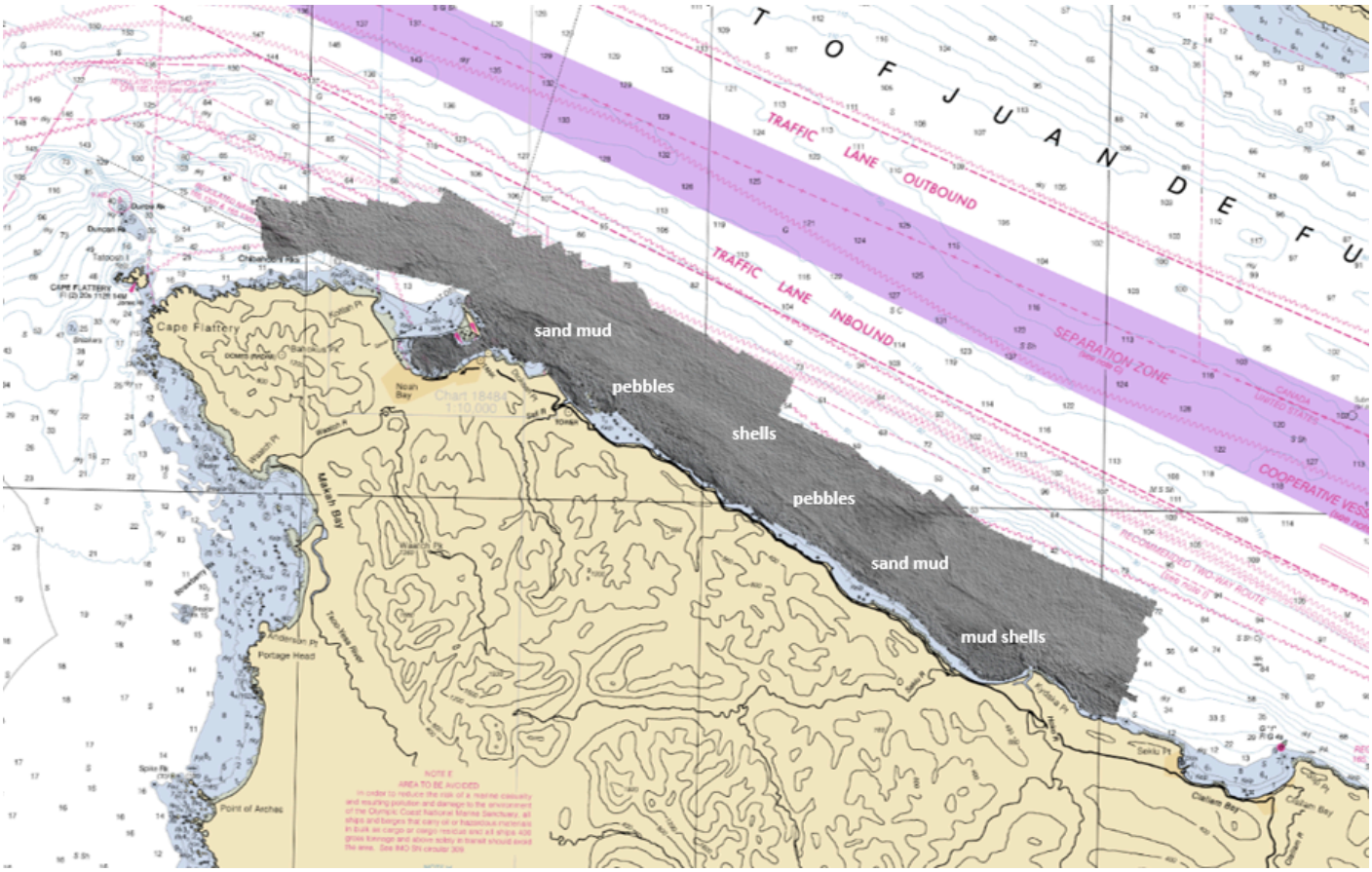



*Figure 18: H13412 Bottom sample locations*

### D.2.4 Overhead Features

No overhead features exist for this survey.

### D.2.5 Submarine Features

The CBLSUB features were not observed in the multibeam bathymetry nor the backscatter mosaic.

### D.2.6 Platforms

No platforms exist for this survey.

### D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

### D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

### D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

### D.2.10 New Survey Recommendations

No new surveys or further investigations are recommended for this area.

### D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this 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 Specifications and Deliverables, Field Procedures Manual, 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 |
|---|---|---|---|
| CDR John Lomnicky | Chief of Party | 05/30/2021 | Digitally signed by LOMNICKY.JOHN.JOSEPH.1257920239 Reason: I attest to the accuracy and integrity of this document Location: CO, NOAA Ship Fairweather Date: 2021.06.25 09:32:26 -08'00' |
| LT Marybeth Head | Operations Officer | 05/30/2021 | HEAD.MARYBETH.1474026490 Digitally signed by HEAD.MARYBETH.1474026490 Date: 2021.06.25 09:14:46 -08'00' |
| CHST Alissa Johnson | Chief Survey Technician | 05/30/2021 | JOHNSON.ALISSA.JEAN.1537531165 Digitally signed by JOHNSON.ALISSA.JEAN.1537531165 Date: 2021.06.18 11:10:32 -08'00' |
| HAST Brent Humphries | Sheet Manager | 05/30/2021 | HUMPHRIES.BRENT.CROSSLEY.1297116807 Digitally signed by HUMPHRIES.BRENT.CROSSLEY.1297116807 Date: 2021.06.18 16:14:01 -08'00' |

# F. Table of Acronyms

| Acronym | Definition |
|---|---|
| **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** | Continuously Operating Reference Station |
| **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** | Detached Position |
| **DR** | Descriptive Report |
| **DTON** | Danger to Navigation |
| **ENC** | Electronic Navigational Chart |
| **ERS** | Ellipsoidal Referenced Survey |
| **ERTDM** | Ellipsoidally Referenced Tidal Datum Model |
| **ERZT** | Ellipsoidally Referenced Zoned Tides |
| **FFF** | Final Feature File |
| **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 |

| Acronym | Definition |
|---|---|
| **HSSD** | Hydrographic Survey Specifications and Deliverables |
| **HSTB** | Hydrographic Systems Technology Branch |
| **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** | Linear Nautical Miles |
| **MBAB** | Multibeam Echosounder Acoustic Backscatter |
| **MCD** | Marine Chart Division |
| **MHW** | Mean High Water |
| **MLLW** | Mean Lower Low Water |
| **NAD 83** | North American Datum of 1983 |
| **NALL** | Navigable Area Limit Line |
| **NTM** | 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 |
| **RNC** | Raster Navigational Chart |
| **RTK** | Real Time Kinematic |
| **RTX** | Real Time Extended |
| **SBES** | Singlebeam Echosounder |
| **SBET** | Smooth Best Estimate and Trajectory |
| **SNM** | Square Nautical Miles |
| **SSS** | Side Scan Sonar |
| **SSSAB** | Side Scan Sonar Acoustic Backscatter |
| **ST** | Survey Technician |
| **SVP** | Sound Velocity Profiler |
| **TCARI** | Tidal Constituent And Residual Interpolation |
| **TPU** | Total Propagated Uncertainty |
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United States Coast Guard |
| **UTM** | Universal Transverse Mercator |
| **XO** | Executive Officer |
| **ZDF** | Zone Definition File |