H13197

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable Area |
| Registry Number: | H13197 |

## LOCALITY

| | |
|---|---|
| State(s): | California |
| General Locality: | Southern California |
| Sub-locality: | Approaches to Ports of Los Angeles and Long Beach |

**2018**

CHIEF OF PARTY
Benjamin K. Evans, CDR/NOAA

LIBRARY & ARCHIVES

Date:

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

REGISTRY NUMBER:

# HYDROGRAPHIC TITLE SHEET

# H13197

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): | **California** |
| General Locality: | **Southern California** |
| Sub-Locality: | **Approaches to Ports of Los Angeles and Long Beach** |
| Scale: | **6000** |
| Dates of Survey: | **09/02/2018 to 10/29/2018** |
| Instructions Dated: | **08/20/2018** |
| Project Number: | **S-L318-RA-18** |
| Field Unit: | **NOAA Ship *Rainier*** |
| Chief of Party: | **Benjamin K. Evans, CDR/NOAA** |
| 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:

***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/.***

# Table of Contents


A. Area Surveyed ..... 1
A.1 Survey Limits ..... 1
A.2 Survey Purpose ..... 3
A.3 Survey Quality ..... 3
A.4 Survey Coverage ..... 5
A.6 Survey Statistics ..... 10
B. Data Acquisition and Processing ..... 12
B.1 Equipment and Vessels ..... 12
B.1.1 Vessels ..... 12
B.1.2 Equipment ..... 13
B.2 Quality Control ..... 13
B.2.1 Crosslines ..... 13
B.2.2 Uncertainty ..... 16
B.2.3 Junctions ..... 18
B.2.4 Sonar QC Checks ..... 23
B.2.5 Equipment Effectiveness ..... 23
B.2.6 Factors Affecting Soundings ..... 30
B.2.7 Sound Speed Methods ..... 30
B.2.8 Coverage Equipment and Methods ..... 32
B.3 Echo Sounding Corrections ..... 32
B.3.1 Corrections to Echo Soundings ..... 32
B.3.2 Calibrations ..... 32
B.4 Backscatter ..... 32
B.5 Data Processing ..... 34
B.5.1 Primary Data Processing Software ..... 34
B.5.2 Surfaces ..... 34
C. Vertical and Horizontal Control ..... 35
C.1 Vertical Control ..... 35
C.2 Horizontal Control ..... 35
D. Results and Recommendations ..... 36
D.1 Chart Comparison ..... 36
D.1.1 Electronic Navigational Charts ..... 36
D.1.2 Maritime Boundary Points ..... 39
D.1.3 Charted Features ..... 39
D.1.4 Uncharted Features ..... 40
D.1.5 Shoal and Hazardous Features ..... 41
D.1.6 Channels ..... 41
D.1.7 Bottom Samples ..... 41
D.2 Additional Results ..... 41
D.2.1 Shoreline ..... 41
D.2.2 Aids to Navigation ..... 41
D.2.3 Overhead Features ..... 42
D.2.4 Submarine Features ..... 42

D.2.5 Platforms....42
D.2.6 Ferry Routes and Terminals....42
D.2.7 Abnormal Seafloor and/or Environmental Conditions....42
D.2.8 Construction and Dredging....42
D.2.9 New Survey Recommendation....43
D.2.10 Inset Recommendation....43
E. Approval Sheet....44
F. Table of Acronyms....45

# List of Tables

Table 1: Survey Limits....1
Table 2: Survey Coverage....5
Table 3: Hydrographic Survey Statistics....11
Table 4: Dates of Hydrography....12
Table 5: Vessels Used....12
Table 6: Major Systems Used....13
Table 7: Survey Specific Tide TPU Values....16
Table 8: Survey Specific Sound Speed TPU Values....17
Table 9: Junctioning Surveys....19
Table 10: Primary bathymetric data processing software....34
Table 11: Primary imagery data processing software....34
Table 12: Submitted Surfaces....34
Table 13: ERS method and SEP file....35
Table 14: Largest Scale ENCs....36

# List of Figures

Figure 1: H13197 assigned survey area (Chart 18749)....2
Figure 2: H13197 HSSD data density compliance....4
Figure 3: H13197 HSSD object detection compliance....5
Figure 4: H13197 Completed Coverage....7
Figure 5: H13197 Coverage to 6 meter depth....8
Figure 6: H13197 Holidays....9
Figure 7: H13197 "Approaches to Los Angeles and Long Beach, California" Coverage Extents within Project S-L318-RA-18....10
Figure 8: H13197 Crossline surface overlaid on mainscheme tracklines....14
Figure 9: H13197 Mainscheme to Crossline comparison distribution graph....15
Figure 10: H13197 Mainscheme to Crossline absolute difference statistics....16
Figure 11: H13197 Total Vertical Uncertainty (TVU) compliance of finalized variable-resolution MBES data....18
Figure 12: H13197 Junction analysis area with survey H13198....19
Figure 13: H13197 Comparison distribution with H13198....20
Figure 14: H13197 absolute difference comparison with H13198....21

Figure 15: H13197 Fractional Allowable Error results for junction with H13198..... 22
Figure 16: H13197 Launch RA-4 (2801) VR surface uncertainty results as processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right)..... 23
Figure 17: H13197 Launch RA-4 (2801) VR surfaces comparison distribution results as processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right)..... 24
Figure 18: H13197 Launch RA-4 (2801) VR surfaces absolute difference from mean comparison with H13197_XL_VR_MLLW.csar processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right)..... 24
Figure 19: H13197 Launch RA-4 (2801) VR surfaces visual comparison with the original 2801_EM2040.hvf (top) and after the addition of a -0.207 degree roll offset to the .hvf (bottom). A Vertical Exaggeration scale of 10 was added to both surfaces for viewing..... 25
Figure 20: H13197 Sonar sector gaps due to EM2040 "Yaw Stabilization" setting in use..... 26
Figure 21: H13197 Sonar sector gaps due to EM2040 "Yaw Stabilization" setting in use..... 27
Figure 22: H13197 Survey launch 2802 Day Number 259 region of high hypothesis strength before filtering of outer beams..... 28
Figure 23: H13197 Survey launch 2802 Day Number 259 region of high hypothesis strength after filtering of outer beams..... 29
Figure 24: H13197 Sound Velocity Profile (SVP) cast locations..... 31
Figure 25: H13197 Overview of backscatter mosaics (Chart 18749)..... 33
Figure 26: H13197 20 fathom (36.5 meter) contour comparison with ENC US5CA61M depth curve..... 37
Figure 27: H13197 10 fathom (18.2 meter) contour comparison with ENC US5CA62M curve..... 38
Figure 28: H13197 5 fathom (9.1 meter) contour comparison with ENC US5CA62M curve..... 39
Figure 29: H13197 Charted PA dangerous wreck located 31 meters away with least depth 13.0 meters..... 40

**Descriptive Report to Accompany Survey H13197**

Project: S-L318-RA-18

Locality: Southern California

Sublocality: Approaches to Ports of Los Angeles and Long Beach

Scale: 1:6000

September 2018 - October 2018

**NOAA Ship *Rainier***

Chief of Party: Benjamin K. Evans, CDR/NOAA

# A. Area Surveyed

The survey area is referred to as H13197, "Approaches to Ports of Los Angeles and Long Beach" (Sheet 1). The area encompasses approximately 21 square nautical miles of the ports of Los Angeles (POLA) and Long Beach (POLB) as well as the Vessel Traffic Service (VTS) precautionary area, port approach channels, and anchorages south of the San Pedro and Middle Breakwaters. The assigned survey area is depicted in figure 1 below.

## A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit | Southeast Limit |
|---|---|
| 33° 44' 45.89" N<br>118° 16' 35.11" W | 33° 39' 2.98" N<br>118° 10' 5.31" W |

*Table 1: Survey Limits*

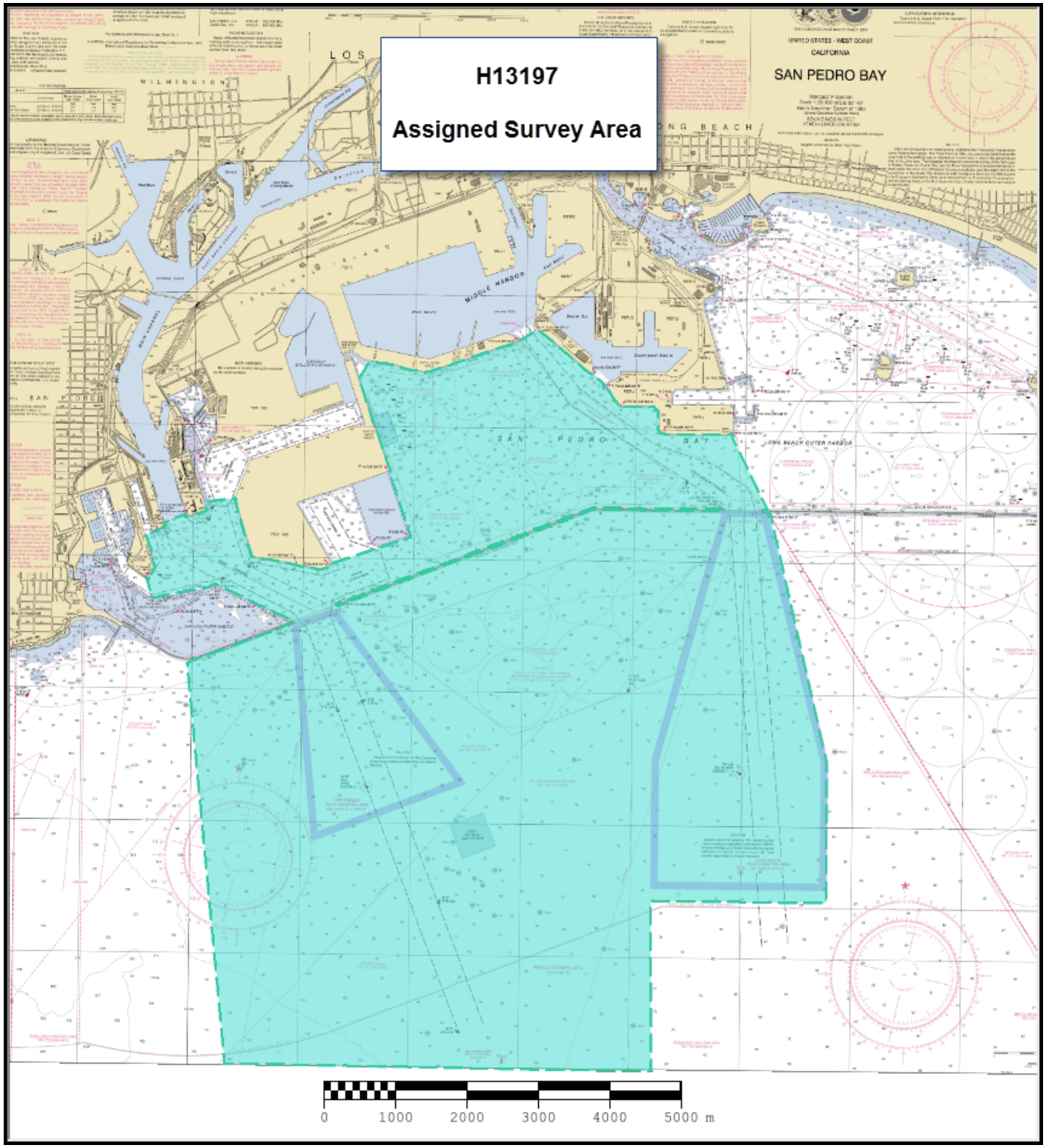



*Figure 1: H13197 assigned survey area (Chart 18749).*

Data were acquired within the assigned H13197 survey limits as required in the Project Instructions and HSSD except as noted below.

## A.2 Survey Purpose

The ports of Los Angeles and Long Beach are critical economic drivers for the California economy handling more shipping containers than any other U.S. port, servicing over 16.8 million twenty-foot equivalent (TEU) containers in 2017. The port complex is a leading terminal for liquid fuel, chemicals, auto carriers, dry bulk, and cruise ships moving over $460 billion in cargo annually and supporting over 190 thousand jobs in Los Angeles and Long Beach.

The harbor has been surveyed as recently as 2013, however in the following year waves propagating from offshore Hurricane Marie breached a breakwater causing nearly $16 million in damage to the Port of Long Beach. There is concern that there is additional hurricane induced shoaling in or near the channels and in approaches. The complex also participates in the NOAA Physical Oceanographic Real-Time (PORTS®) system and NOAA's Precise Navigation Initiative which utilize a battery of local weather, swell, wave, water column, tidal, and bridge air gap sensors to provide in-situ, real-time data to the maritime public. Current water depths provided by this survey will enhance the utility of these systems improving harbor safety, efficiency and decrease the need for tanker lightering offshore. These bathymetric data will provide updated, high-resolution depth and seabed character information to support maritime commerce, update National Ocean Service (NOS) nautical charts and products and help determine the long-range resurvey interval for the area.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

The Pydro XL QC Tools Grid QA function (version 5) was used to analyze H13197 multibeam echosounder (MBES) data density. The submitted H13197 finalized variable-resolution (VR) surface met HSSD data density and object detection requirements as shown in figures 2 and 3 below.

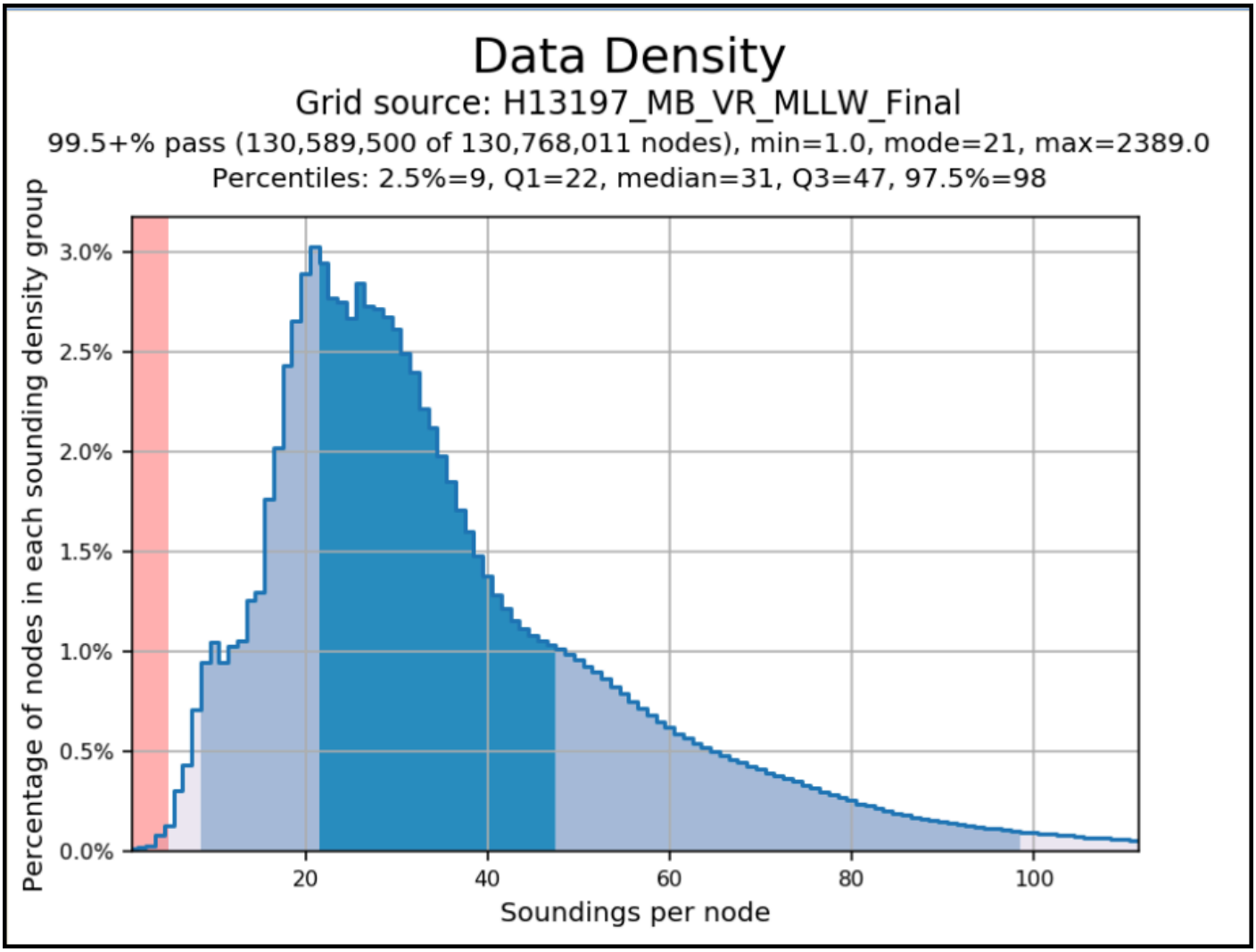



*Figure 2: H13197 HSSD data density compliance.*

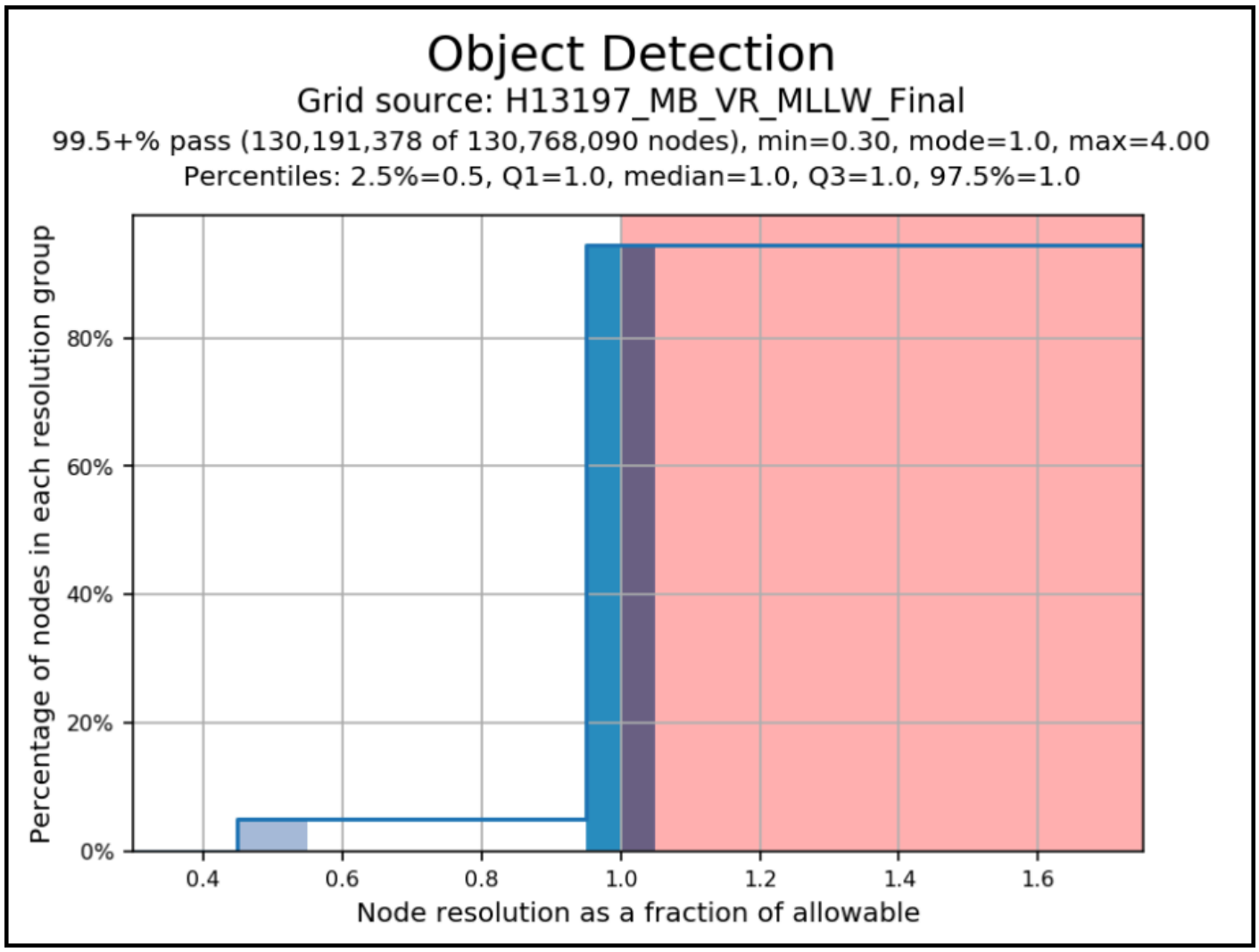



*Figure 3: H13197 HSSD object detection compliance.*

## 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 | Object Detection Coverage (Refer to HSSD Section 5.2.2.2) |

*Table 2: Survey Coverage*

Survey data for H13197 was collected up to the assigned sheet limits or the safe Navigational Area Limit Line (NALL) as determined by the proximity to hazards and the prevailing sea conditions (Figure 4). Some areas along the south side of the Middle Breakwater were surveyed to a depth of 6 meters due to the presence

of numerous lobster pots and small fishing boats near the breakwater which made closer survey operations unsafe (Figure 5).

Pydro Explorer (version 19.4) QC Tool Holiday Finder (version 4) was utilized to detect holidays on the finalized Variable Resolution (VR) surface for submission. A total of 333 certain holidays were detected with 3 possible holidays found (Figure 6). The majority of these holidays, 247 total, were located outside of assigned sheet limits or on the edge of completed coverage up to the NALL. The remaining 89 holidays are all within assigned survey limits and are predominately located in the 19.0 to 21.0 meter depth region around the transition from 0.5 meter to 1.0 meter Object Detection node resolution. Surrounding node depths around the holidays are consistent and appear to honor least depth soundings. Of note, many of these holidays did not manifest themselves in Pydro Holiday Finder or in visual examination of variable-resolution surfaces prior to final data acquisition. Exact reasons for this are unknown but it was observed that the addition of new MBES data to the project frequently changes the resulting VR node resolution matrix and may alter the results of Pydro QC Tools Holiday Finder. These holidays were not re-surveyed due to schedule constraints which prevented further MBES acquisition after the final day of field work.

Four holidays are located in the Long Beach channel and range in depth from 23.36 to 25.01 meters. Eight holidays are located in the Los Angeles channel and range in depth from 25.03 to 27.74 meters. All holidays in the shipping channels were examined closely and generally are located in areas of uniform depth soundings.

Further discussion on an equipment effectiveness issue relating to H13197 holidays can be found in section B.2.5. of this DR under the title "Kongsberg EM2040 Yaw Stabilization settings for Object Detection Surveys".

MBES data for the full H13197 coverage extents was acquired within the S-L318-RA-18 "Approaches to Los Angeles and Long Beach, California" project area (Figure 7).

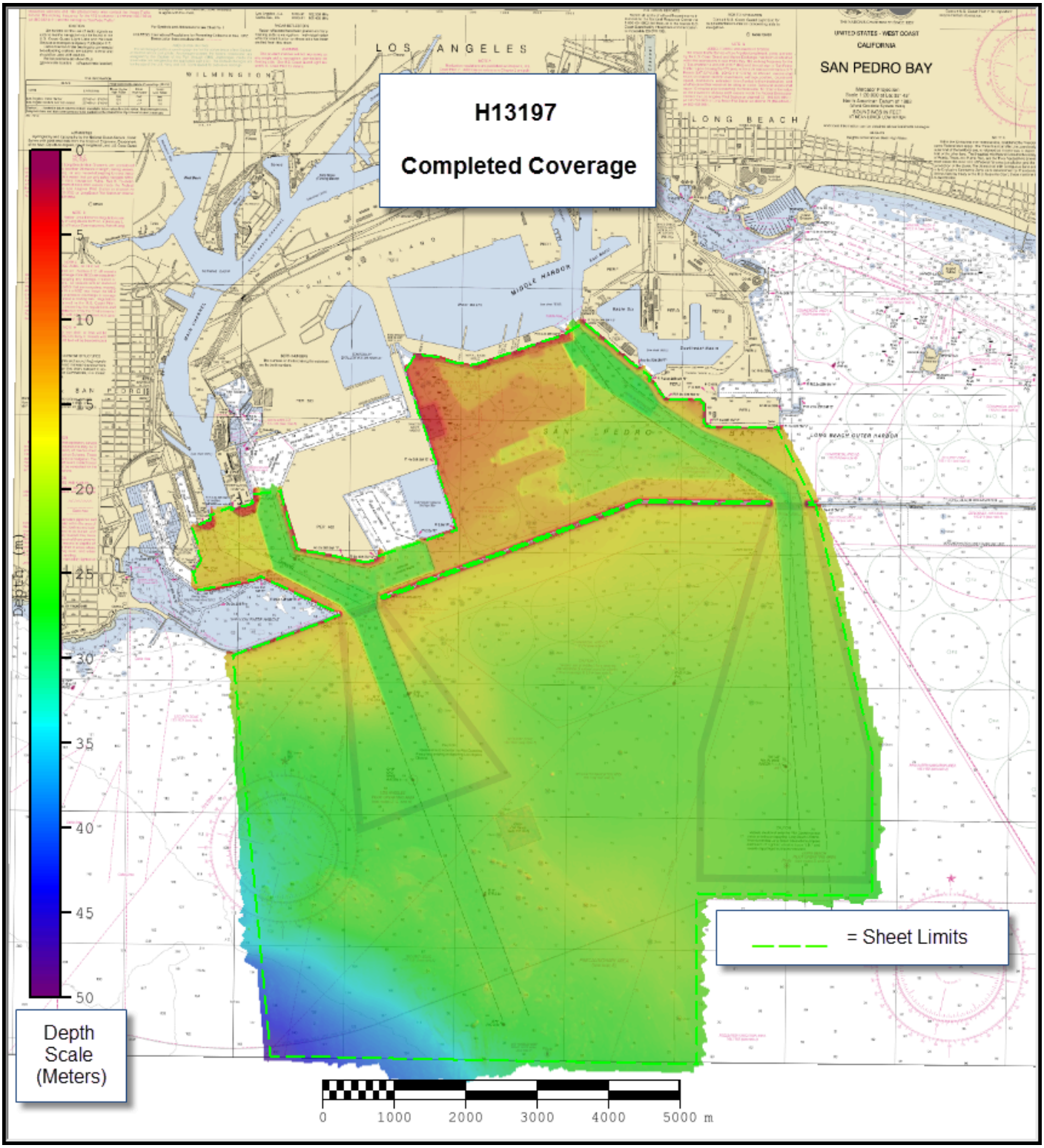



*Figure 4: H13197 Completed Coverage.*

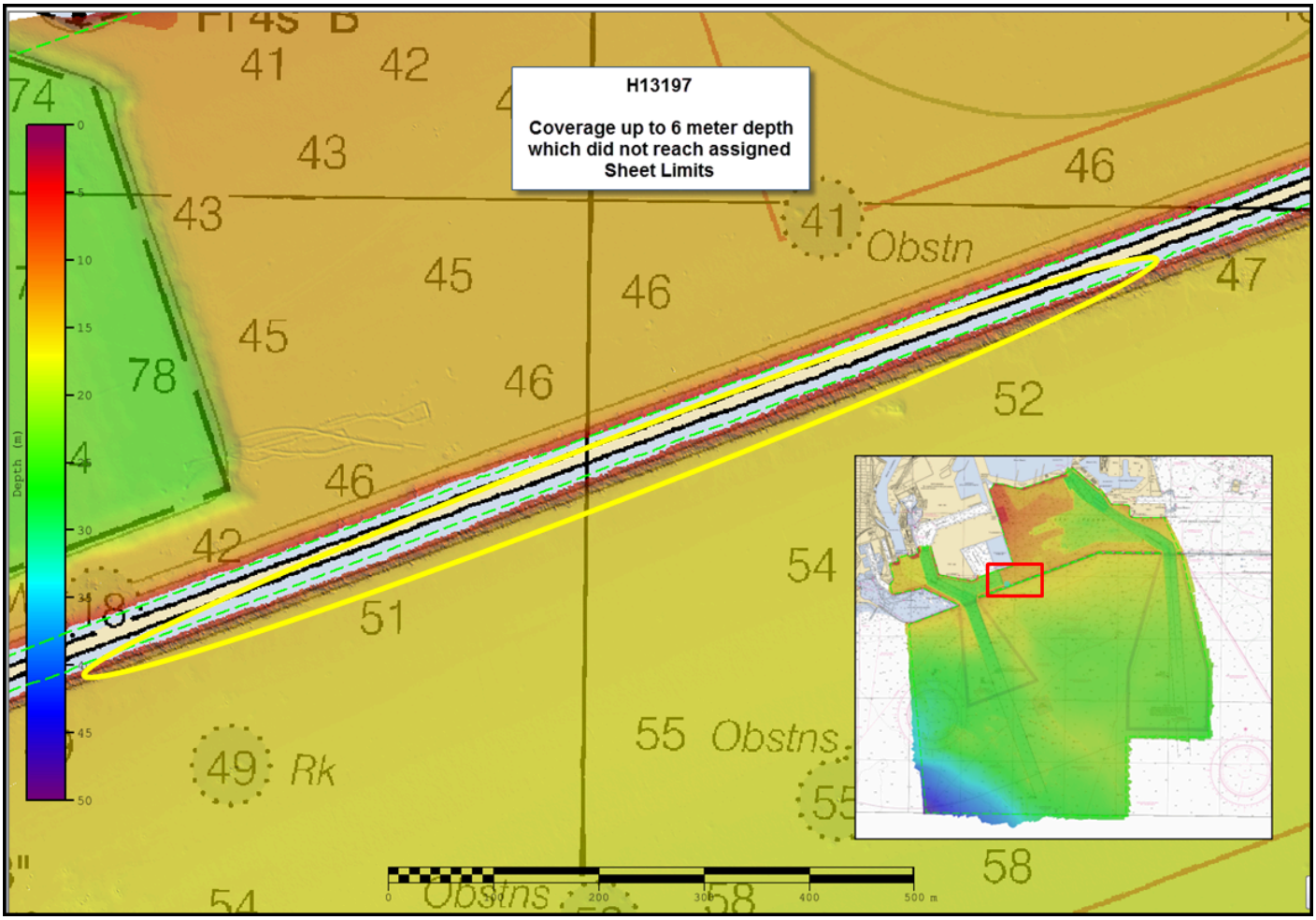



*Figure 5: H13197 Coverage to 6 meter depth.*

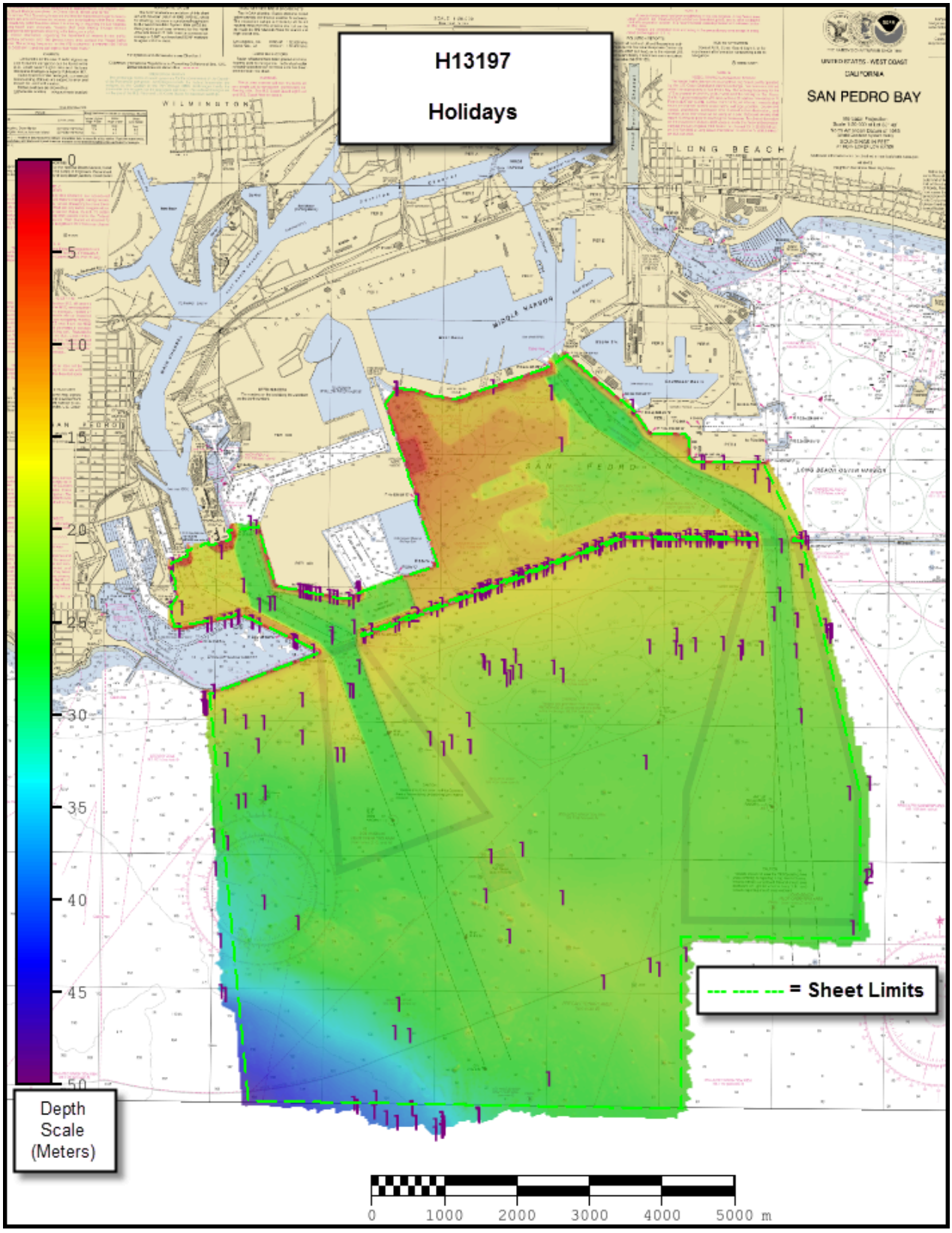



*Figure 6: H13197 Holidays.*

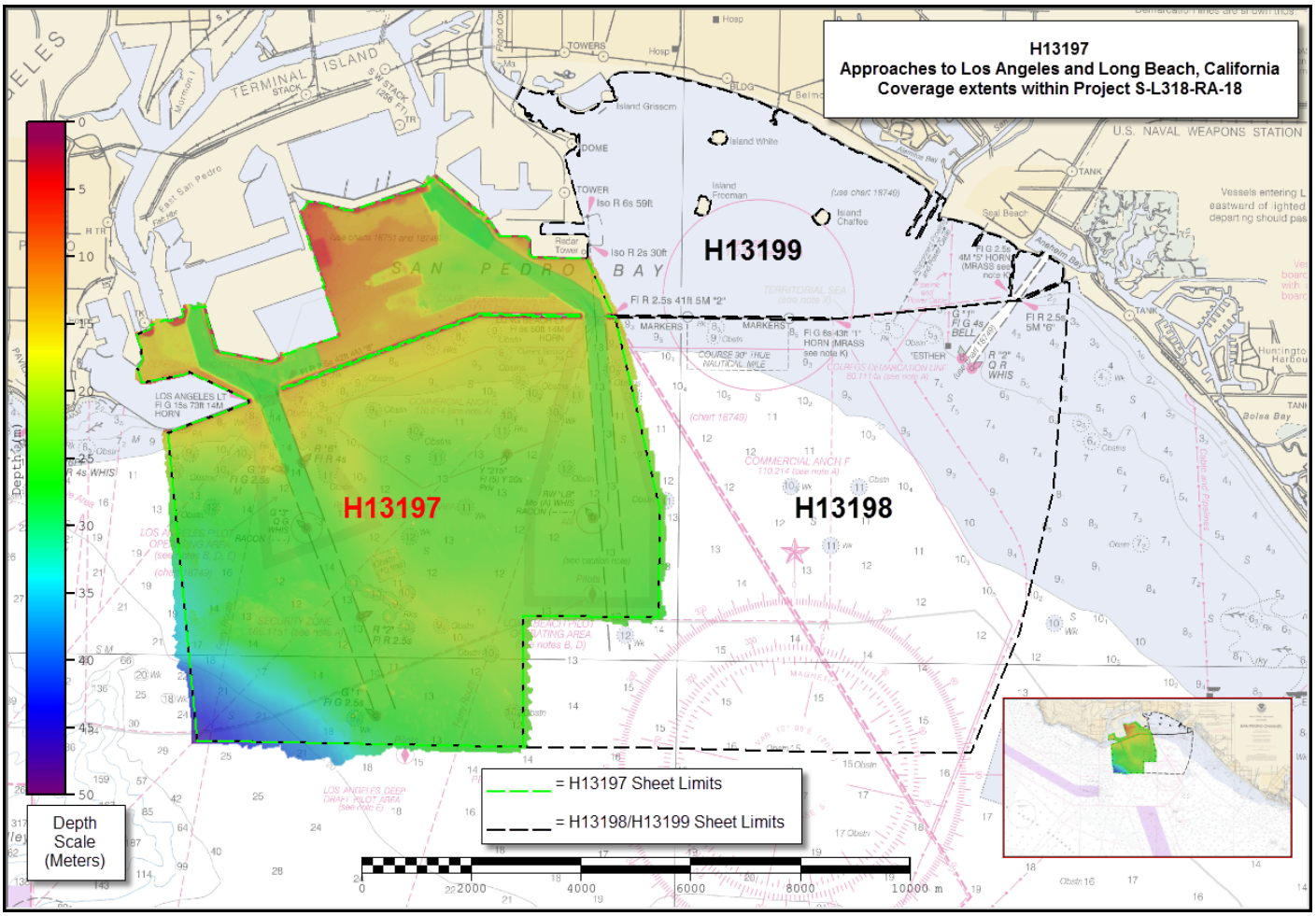



*Figure 7: H13197 "Approaches to Los Angeles and Long Beach, California" Coverage Extents within Project S-L318-RA-18.*

## A.6 Survey Statistics

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

| | HULL ID | *2801* | *2802* | *2803* | *2804* | *Total* |
|---|---|---|---|---|---|---|
| LNM | SBES Mainscheme | 0 | 0 | 0 | 0 | 0 |
| | MBES Mainscheme | 370.96 | 114.08 | 304.04 | 13.18 | 802.26 |
| | 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 | 0 | 30.06 | 0 | 1.58 | 31.64 |
| | Lidar Crosslines | 0 | 0 | 0 | 0 | 0 |
| Number of Bottom Samples | | | | | | 0 |
| Number Maritime Boundary Points Investigated | | | | | | 0 |
| Number of DPs | | | | | | 4 |
| Number of Items Investigated by Dive Ops | | | | | | 0 |
| Total SNM | | | | | | 20.97 |

*Table 3: Hydrographic Survey Statistics*

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

| Survey Dates | Day of the Year |
|---|---|
| 09/02/2018 | 245 |
| 09/03/2018 | 246 |

| Survey Dates | Day of the Year |
|---|---|
| 09/04/2018 | 247 |
| 09/05/2018 | 248 |
| 09/06/2018 | 249 |
| 09/07/2018 | 250 |
| 09/10/2018 | 253 |
| 09/11/2018 | 254 |
| 09/12/2018 | 255 |
| 09/13/2018 | 256 |
| 09/14/2018 | 257 |
| 09/15/2018 | 258 |
| 09/16/2018 | 259 |
| 09/17/2018 | 260 |
| 09/18/2018 | 261 |
| 09/19/2018 | 262 |
| 10/29/2018 | 302 |

*Table 4: Dates of Hydrography*

# B. Data Acquisition and Processing

## B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

### B.1.1 Vessels

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

| Hull ID | *2801* | *2802* | *2803* | *2804* |
|---|---|---|---|---|
| **LOA** | 8.8 meters | 8.8 meters | 8.8 meters | 8.8 meters |
| **Draft** | 1.1 meters | 1.1 meters | 1.1 meters | 1.1 meters |

*Table 5: Vessels Used*

All data for H13197 were acquired by NOAA Ship RAINIER survey launches 2801, 2802, 2803, and 2804. The vessels acquired depth soundings, backscatter imagery, and sound speed profiles. All assigned feature verification was done visually and with MBES data from survey launches 2801, 2802, and 2803.

### B.1.2 Equipment

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

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

*Table 6: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 3.94% of mainscheme acquisition.

The 31.64 nm of crosslines acquired represent nearly the full range of depths found on the H13197_MB_VR_MLLW_Final.csar submission surface and cross data from all survey launches across the full extents of the sheet (Figure 8).

Pydro Explorer (version 19.4) Gridded Surface Comparison tool was used to analyze a finalized H13197 mainscheme only VR surface with a finalized H13197 crossline only VR surface. The final comparison results showed that 99.5% of nodes met HSSD allowable Total Vertical Uncertainty (TVU) standards (Figure 9). Absolute difference statistics between mainscheme and crossline surfaces are also displayed below (Figure 10).

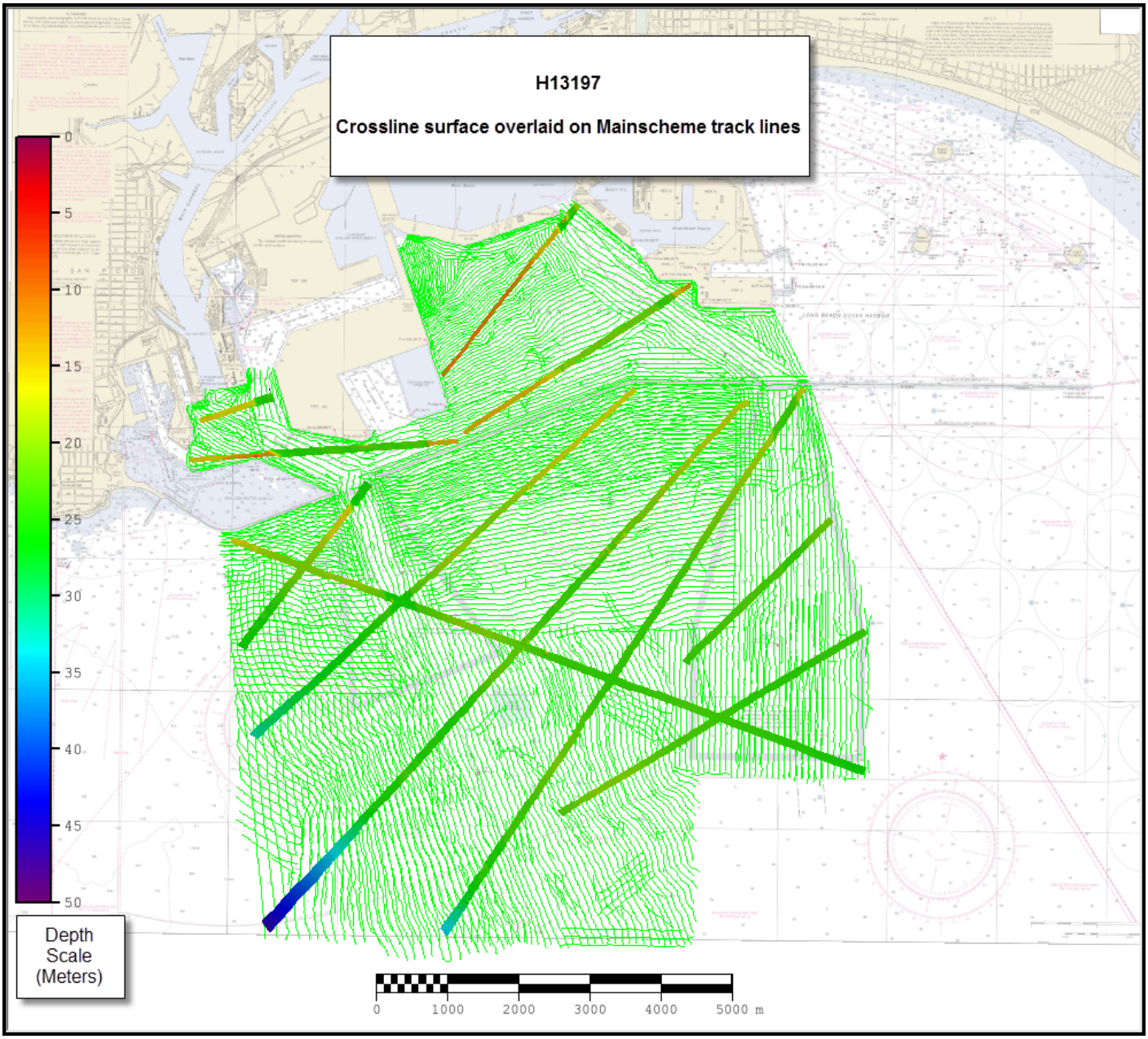



*Figure 8: H13197 Crossline surface overlaid on mainscheme tracklines.*

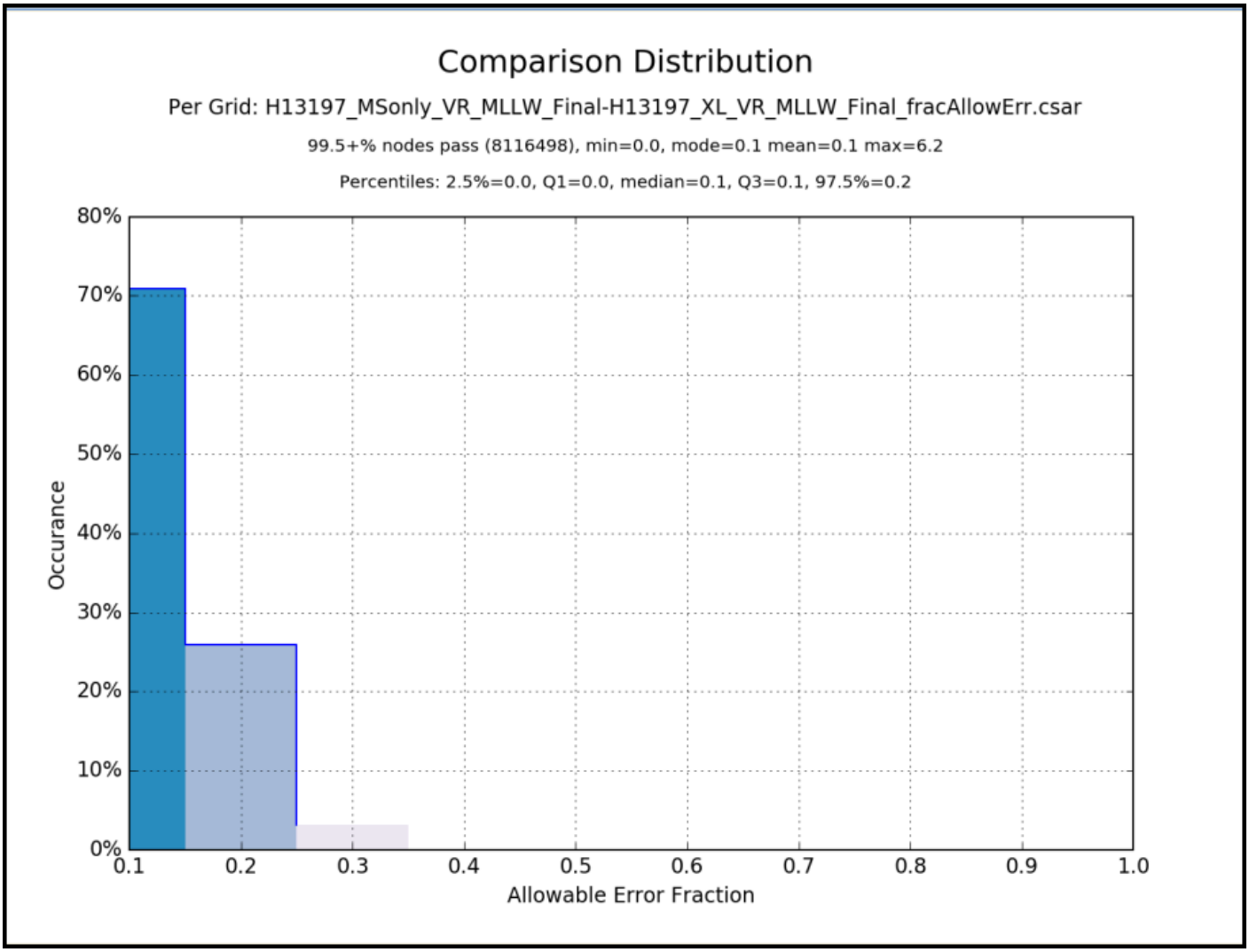
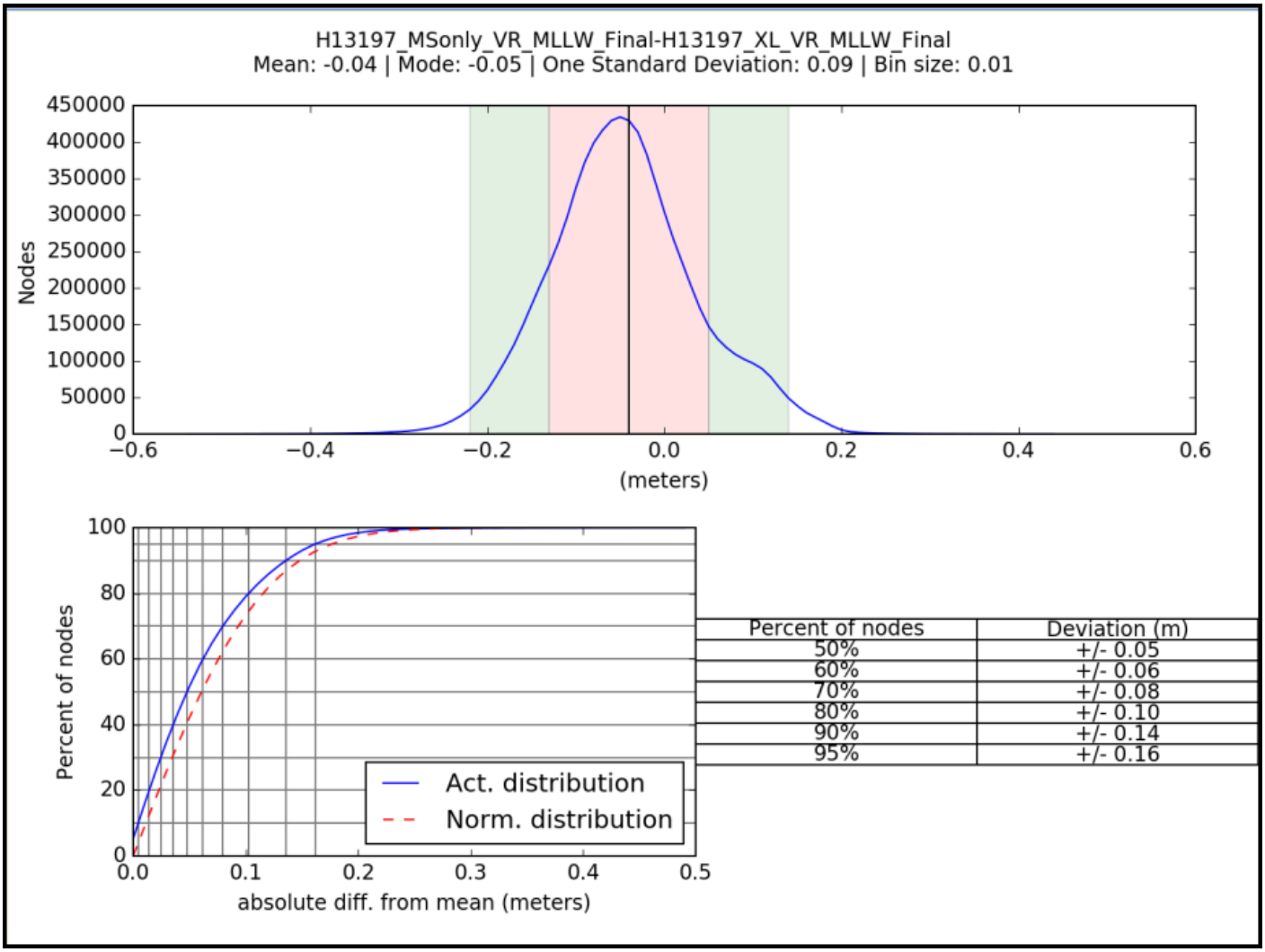



*Figure 9: H13197 Mainscheme to Crossline comparison distribution graph.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.05 |
| 60% | +/- 0.06 |
| 70% | +/- 0.08 |
| 80% | +/- 0.10 |
| 90% | +/- 0.14 |
| 95% | +/- 0.16 |

*Figure 10: H13197 Mainscheme to Crossline absolute difference statistics.*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Method | Measured | Zoning |
|---|---|---|
| ERS via VDATUM | 0 meters | 0.082867 meters |

*Table 7: Survey Specific Tide TPU Values.*

| Hull ID | Measured - CTD | Measured - MVP | Surface |
|---|---|---|---|
| 2801 | 3.0 meters/second | N/A meters/second | 0.05 meters/second |
| 2802 | 3.0 meters/second | N/A meters/second | 0.05 meters/second |
| 2803 | 3.0 meters/second | N/A meters/second | 0.05 meters/second |
| 2804 | 3.0 meters/second | N/A meters/second | 0.05 meters/second |

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

Total Propagated Uncertainty (TPU) values for survey H13197 were derived from a combination of fixed values for equipment and vessel characteristics, as well as from field-assigned values for sound speed uncertainties. The uncertainty value of NOAA's Vertical Datum (VDatum) transformation model was documented in the metadata that accompanied the "VDatum_Outline_Shape_xyNAD83-MLLW_geoid12b.csar" separation model.

In addition to the usual a priori estimates of uncertainty, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from Kongsberg MBES sonars were recorded and applied in post-processing. Applanix TrueHeave (POS) files, which record estimates of heave uncertainty, were also applied during post-processing. Finally, the post-processed uncertainties associated with vessel position and attitude were applied in Caris HIPS using SBET and RMS files generated using POSPac MMS software version 8.2.1.

Uncertainty values of the submitted finalized grid was calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). The Pydro Explorer Grid QA tool (within QC Tools application) was used to analyze H13197 Total Vertical Uncertainty (TVU) compliance (Figure 11).

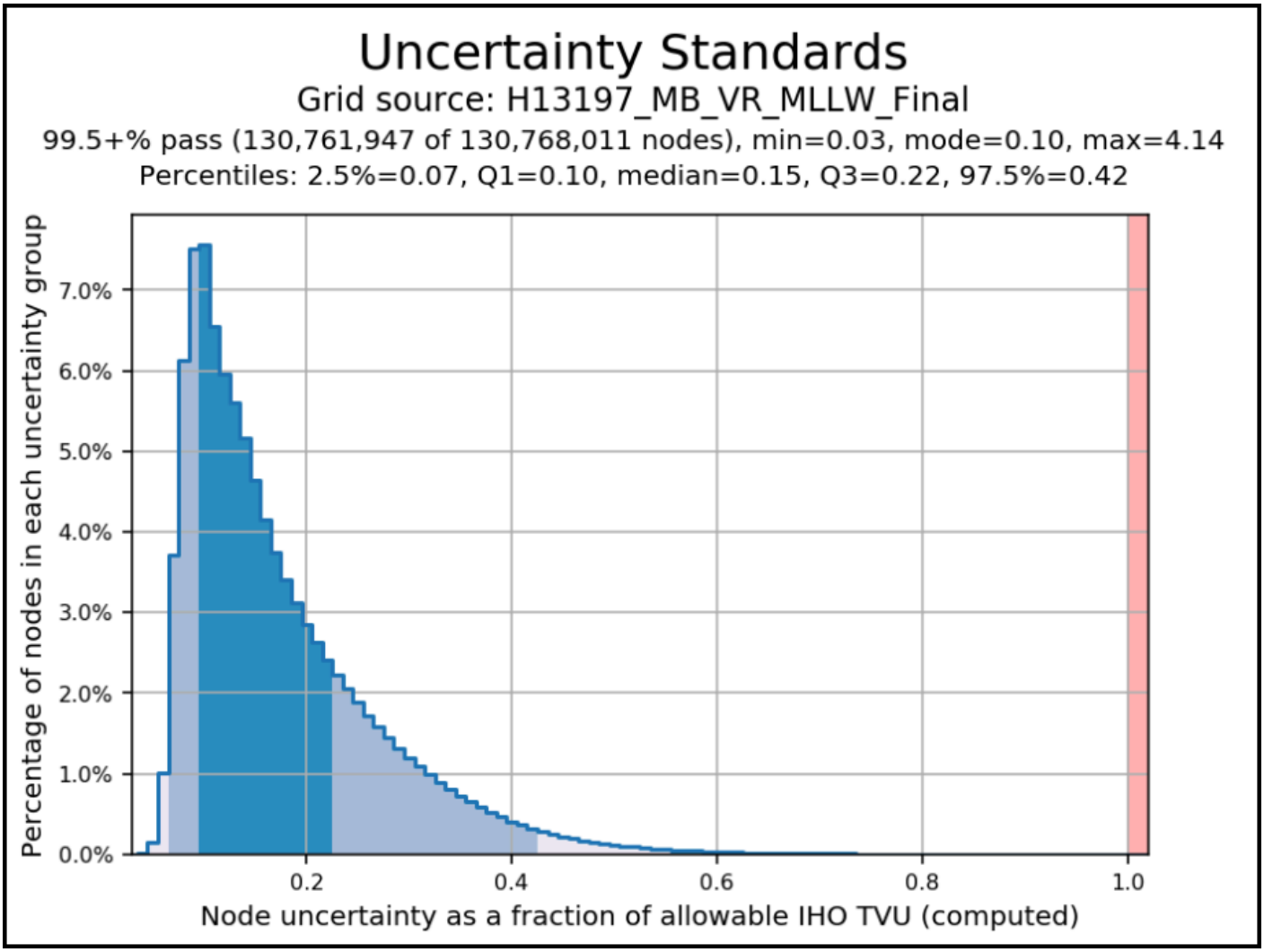



*Figure 11: H13197 Total Vertical Uncertainty (TVU) compliance of finalized variable-resolution MBES data.*

### B.2.3 Junctions

Survey H13197 junctions with one contemporary survey, H13198, conducted by NOAA ship Rainier in 2018 as part of project S-L318-RA-18 (Figure 12). No prior junctioning surveys were provided.

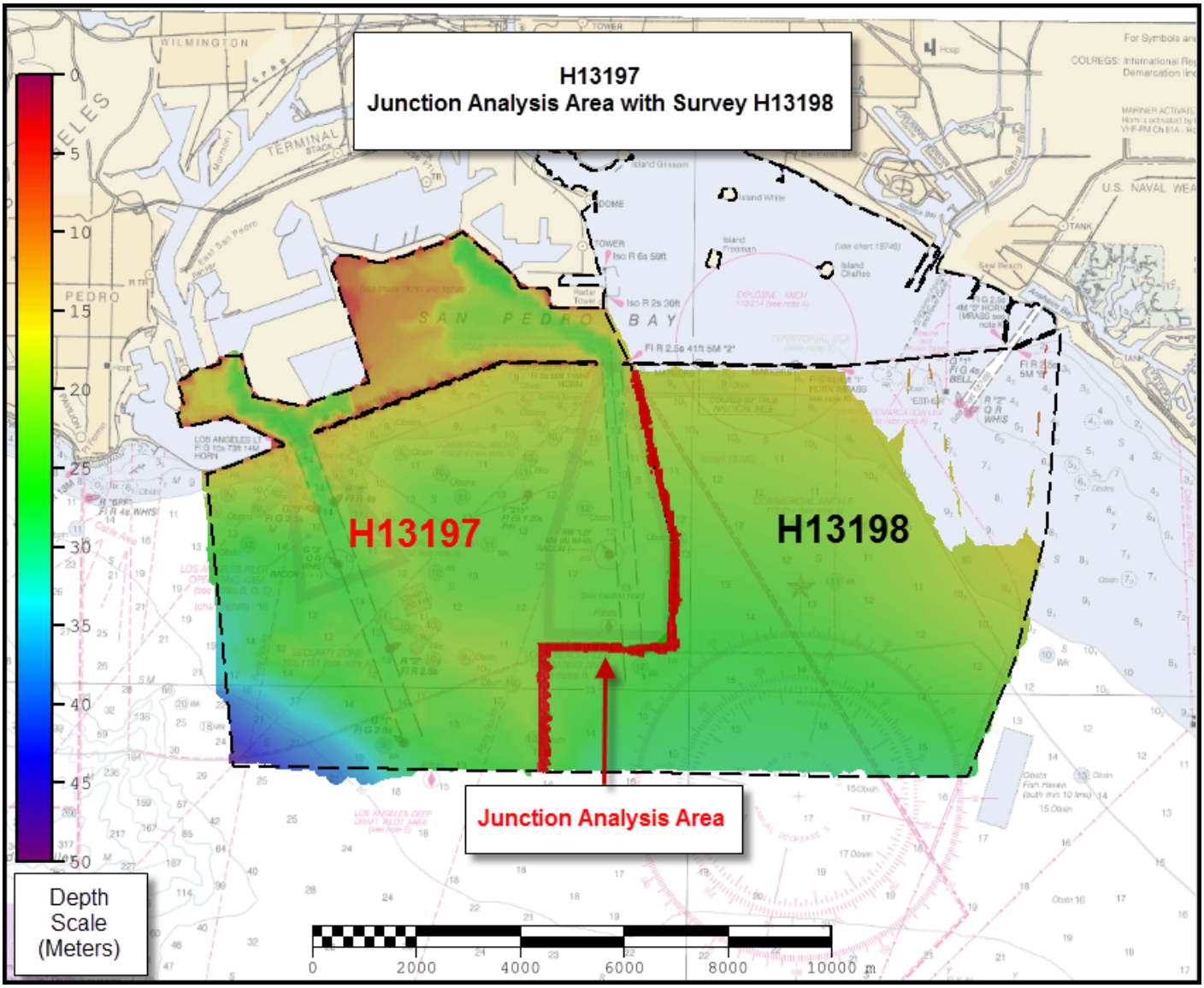



*Figure 12: H13197 Junction analysis area with survey H13198.*

The following junctions were made with this survey:

| Registry Number | Scale | Year | Field Unit | Relative Location |
|---|---|---|---|---|
| H13198 | 1:6000 | 2018 | NOAA Ship RAINIER | E |

*Table 9: Junctioning Surveys*

H13198

The junction with contemporary survey H13198 encompasses an area of 0.541 square nautical miles along the eastern boundary of H13197. Linear overlap with H13198 was approximately 10100 meters long with an approximate average width of 200 meters. Depths in the junction area ranged from 17.7 to 26.6 meters.

Pydro Explorer (version 19.4) Gridded Surface Comparison tool was used to compare H13197 and H13198 finalized variable-resolution surfaces. For the respective depths, the difference surface was compared to the allowable TVU standards specified in the HSSD. In total, 99.5+% of nodes were within the allowable error fraction of 0.3 or less (Figure 13). The absolute difference from mean for the H13917 and H13918 junction surface was better than a normal distribution (Figure 14). Examination of the junction area surface for Fractional Allowable Error indicates all values were passing (Figure 15).

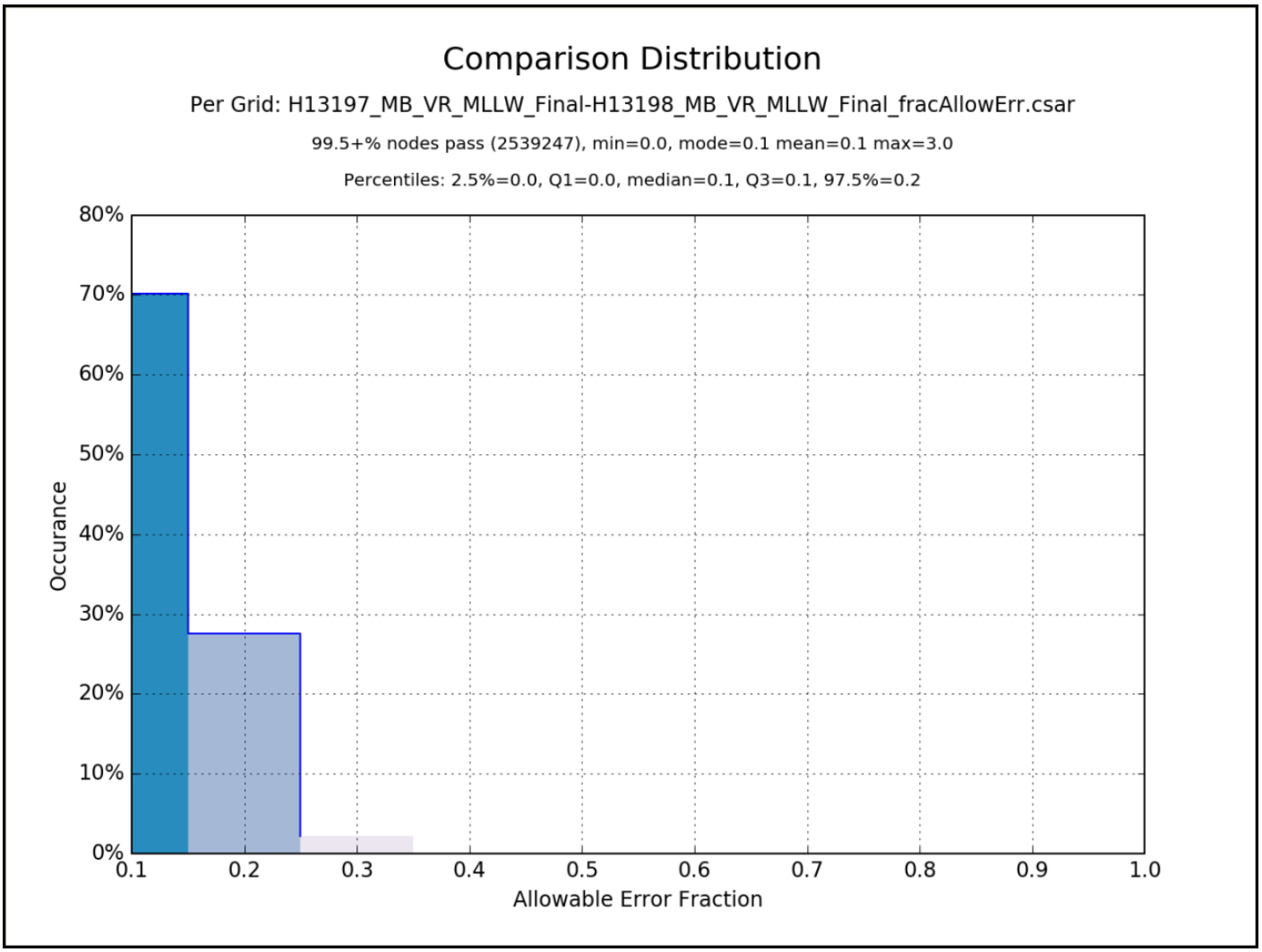
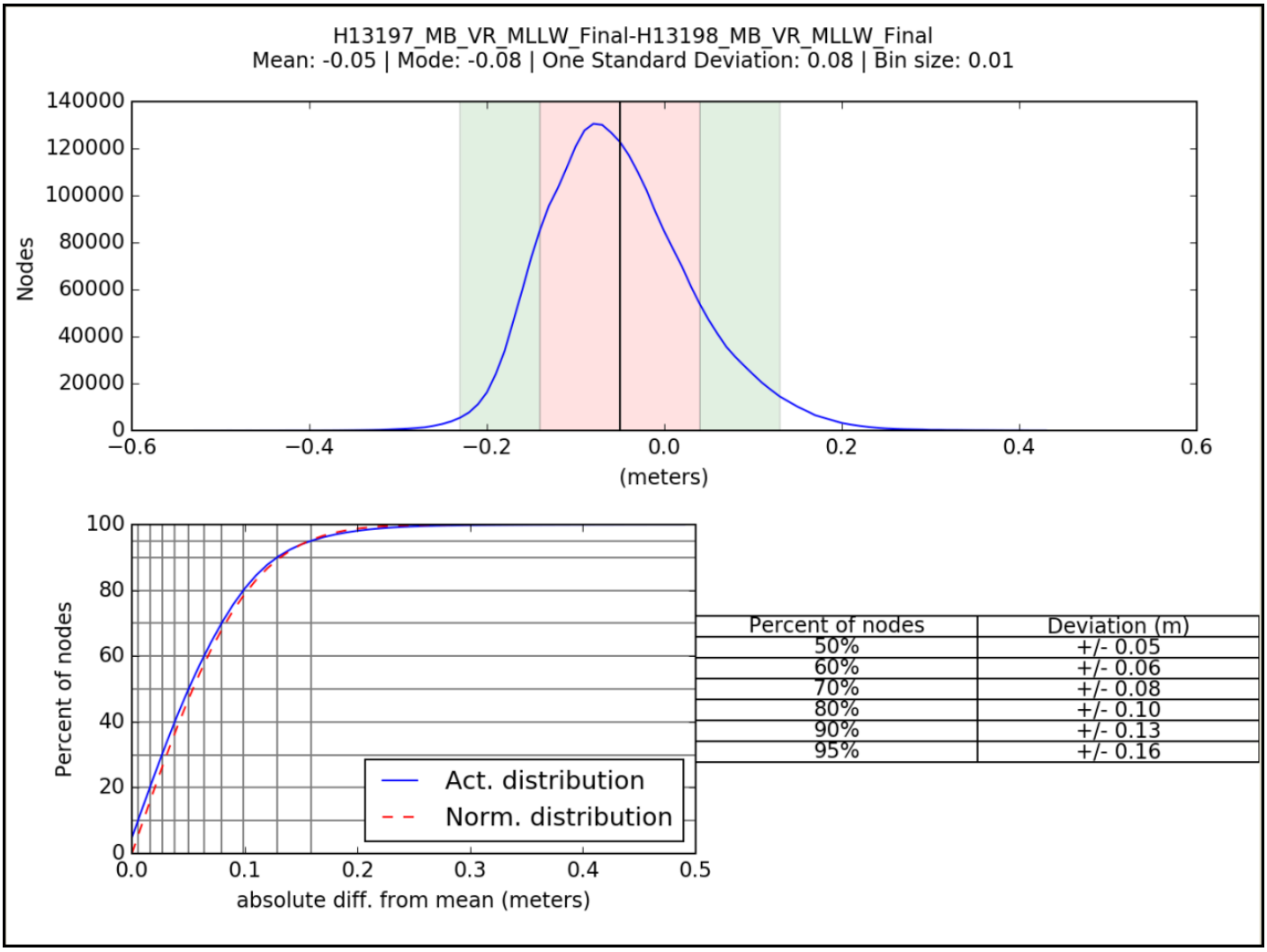



*Figure 13: H13197 Comparison distribution with H13198.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.05 |
| 60% | +/- 0.06 |
| 70% | +/- 0.08 |
| 80% | +/- 0.10 |
| 90% | +/- 0.13 |
| 95% | +/- 0.16 |

*Figure 14: H13197 absolute difference comparison with H13198.*

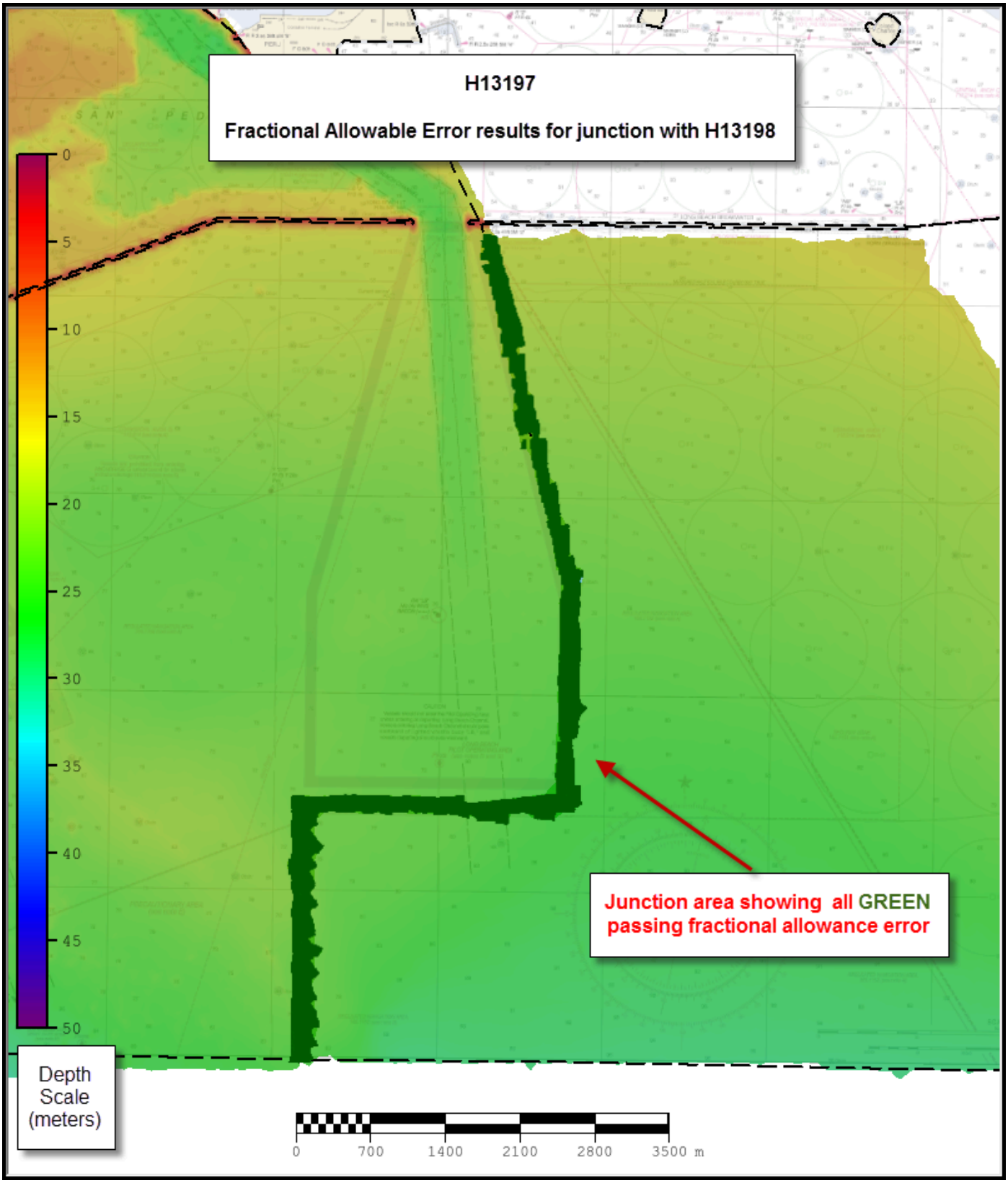



*Figure 15: H13197 Fractional Allowable Error results for junction with H13198.*

### 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

RA-4 (2801) Roll Bias Adjustment

After data acquisition, artifacts were noted in the data from survey launch RA-4 (hull number 2801.) These presented mostly in large flat areas of survey H13197.

An intermittent, minor roll bias was noted on some H13197 2801 MBES data. Numerous possible equipment and software related issues were investigated, however at the time of this report, a conclusive cause of the offset has yet to be determined. A value of -0.207 degrees roll was added to 2801_EM2040.hvf in order to address this slight bias. Pydro Explorer (version 19.4) Gridded Surface Comparison tool was used to compare H13197 launch 2801 VR surfaces (pre and post addition of roll bias value) with each other and with the H13197_MB_XL_MLLW.csar surface. All submitted H13197 MBES data meet HSSD uncertainty specifications (Figure 16). TPU and Crossline Comparison analysis also indicates an improvement in data correlation (Figures 17 and 18). Visual comparison of launch RA-4 (2801) VR and 1m single object detection surfaces with and without the roll offset value applied reveals minor improvement to some areas of the survey (Figure 19).

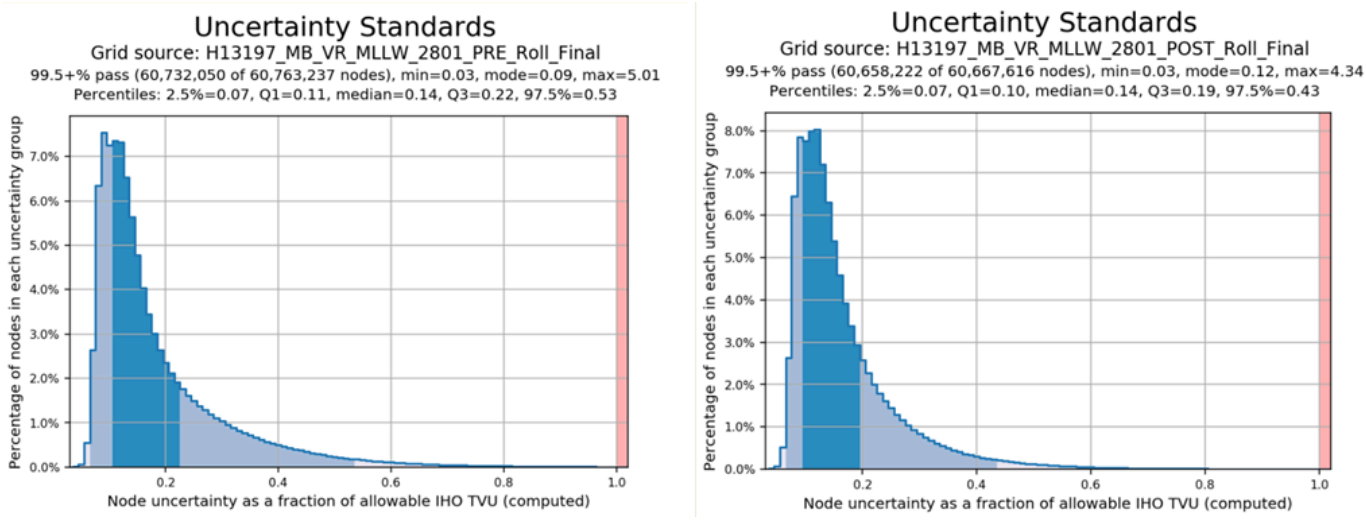



*Figure 16: H13197 Launch RA-4 (2801) VR surface uncertainty results as processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right).*

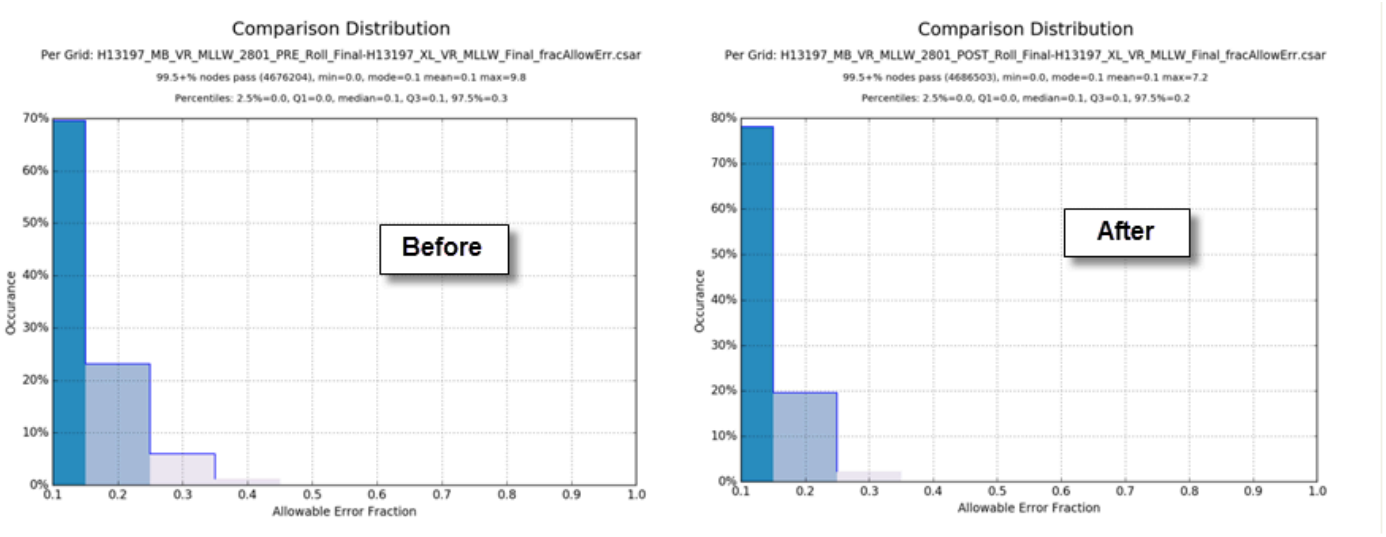



*Figure 17: H13197 Launch RA-4 (2801) VR surfaces comparison distribution results as processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right).*

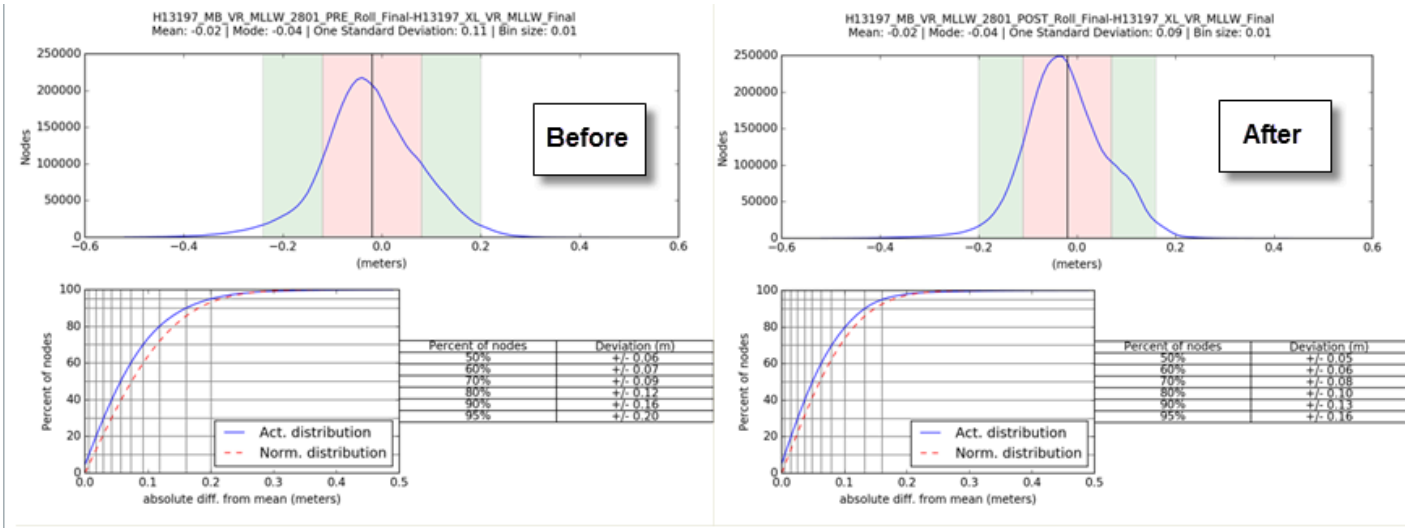



*Figure 18: H13197 Launch RA-4 (2801) VR surfaces absolute difference from mean comparison with H13197_XL_VR_MLLW.csar processed with the original 2801_EM2040.hvf (left) and after the addition of a -0.207 degree roll offset to the .hvf (right).*

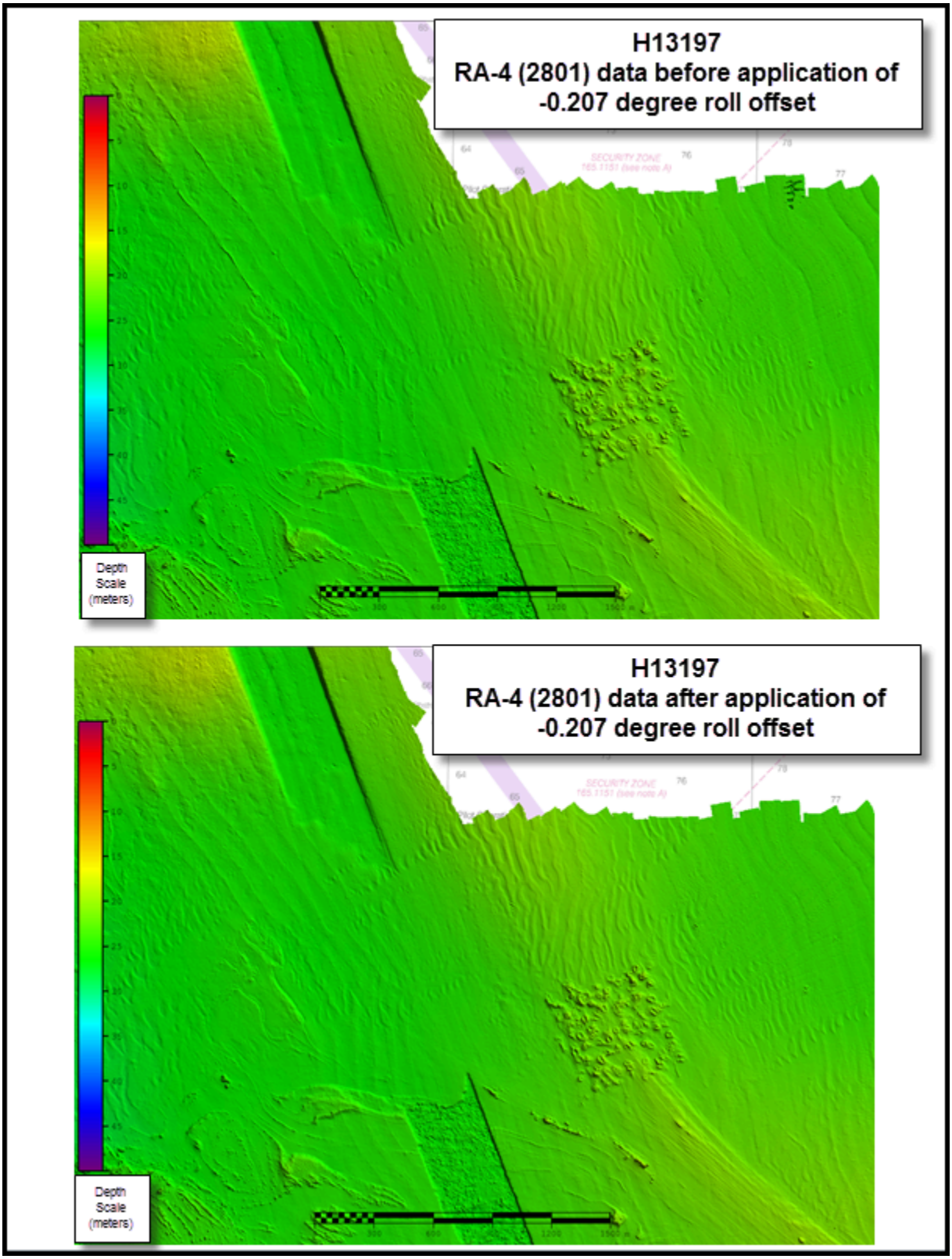



*Figure 19: H13197 Launch RA-4 (2801) VR surfaces visual comparison with the original 2801_EM2040.hvf (top) and after the addition of a -0.207 degree roll offset to the .hvf (bottom). A Vertical Exaggeration scale of 10 was added to both surfaces for viewing.*

Kongsberg EM2040 "Yaw Stabilization" settings for Object Detection Surveys

Inspection of MBES acquisition data acquired by survey launches 2801 and 2803 for day numbers 245, 246, 247, 248, 249, and 250 revealed excessive amounts of along track gaps (holidays) in the sonar sector boundaries (Figures 20 and 21). Consultation with Pacific Hydrographic Branch (PHB) and Hydrographic Systems and Technologies Branch (HSTB) indicated that this was a known issue with the Kongsberg EM2040 sonar "Yaw Stabilization" setting which was in use on launches 2801 and 2803 at the time of acquisition. Processing to Object Detection specifications likely exacerbated the prevalence of holidays due to the more demanding requirements as described in the 2018 HSSD section 5.2.2.2. Per HSTB recommendation, survey areas with holidays present were re-acquired with the Kongsberg EM2040 "Yaw Stabilization" control set to "OFF". All original and re-acquired MBES data has been retained and applied to the project and all correspondence with PHB/HSTB is included in Appendix II of this DR.

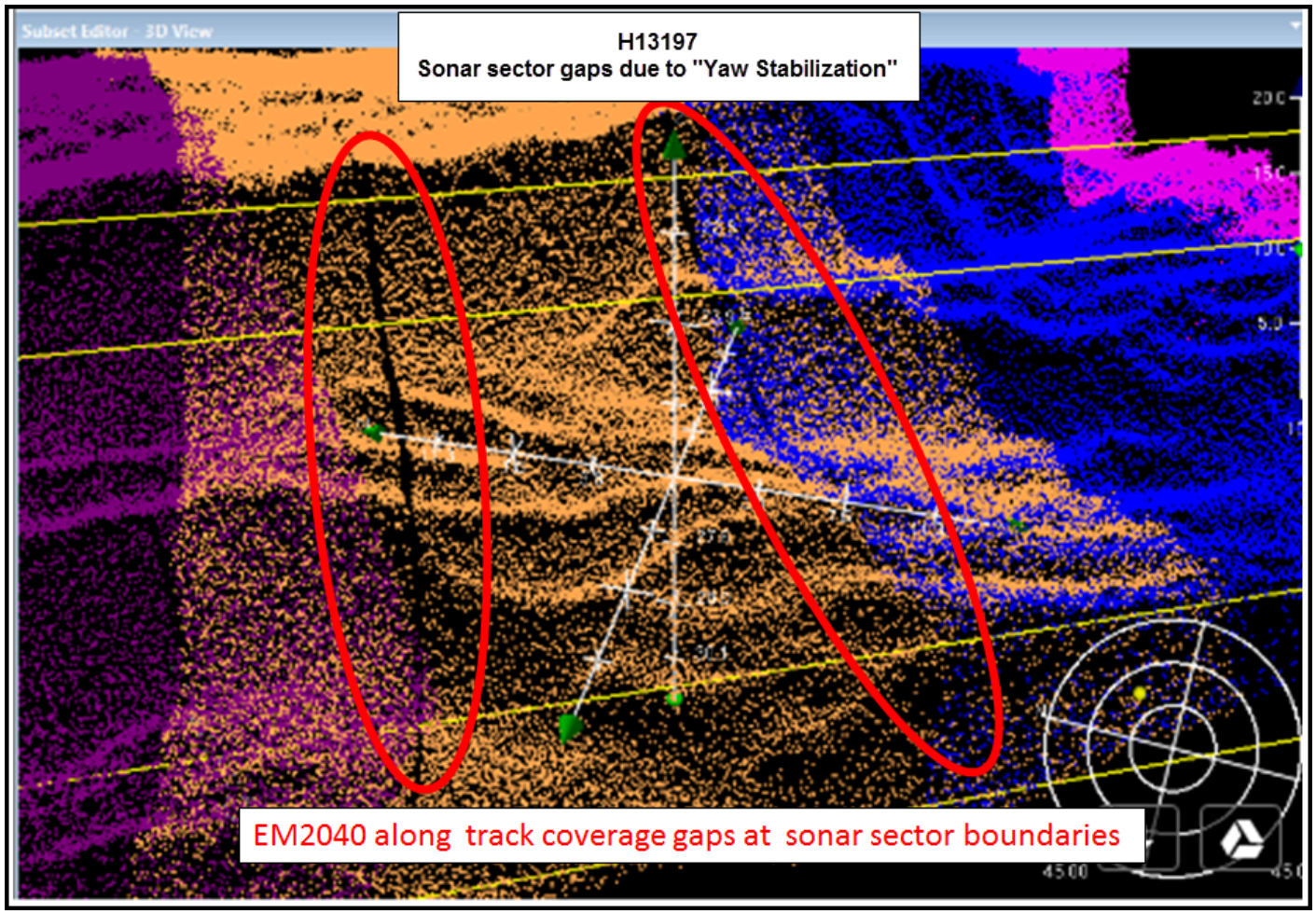



*Figure 20: H13197 Sonar sector gaps due to EM2040 "Yaw Stabilization" setting in use.*

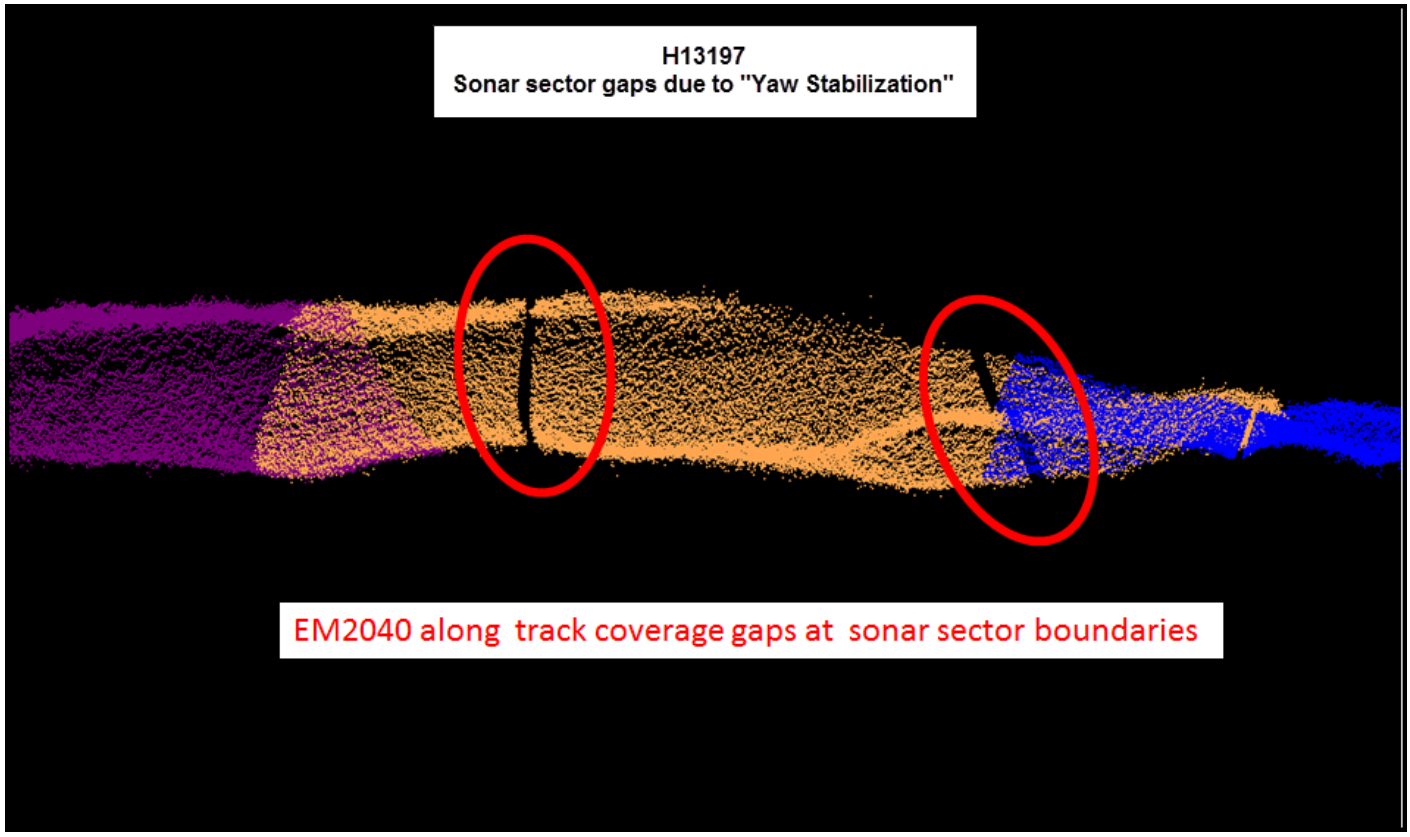



*Figure 21: H13197 Sonar sector gaps due to EM2040 "Yaw Stabilization" setting in use.*

Survey launch 2802 (RA-5) observed vertical offsets in soundings due to outer beam refraction on data collected on day number 259.

Review of variable-resolution surface hypothesis count and hypothesis strength layers for survey launch 2802 (RA-5) on DN259 revealed several areas of excessive outer beam refraction causing vertical offsets in the surface. Vertical differences of up to approximately 1.0 meter from earlier MBES data acquired in the same area by survey launch 2801 (RA-4) were observed in regions that overlapped with outer beam soundings from launch 2802 (Figure 22). The precise cause of the excessive outer beam refraction could not be confirmed but the majority of the affected launch 2802 survey lines were SVP corrected by cast "2018-259 19:56" (location N33-40-49.0 W118-15-37.0). Removal of this cast from the SVP master concatenated file and reapplication of sound velocity to the launch 2802 day number 259 data did not eliminate or significantly reduce the observed outer beam refraction issues. Launch 2802 DN 259 survey lines 0012 through 0027 were edited in Caris swath editor to filter outer port beams 1-60 and outer starboard beams 340-400. All filtered lines were sound velocity corrected with the original "2018-259 19:56" cast, merged, and TPU computed before re-processing in the submission surfaces "H13197_MB_VR_MLLW.csar" and "H13197_MB_VR_MLLW_Final.csar". Inspection of the updated finalized VR submission surface indicates a significant reduction in vertical differences and high hypothesis strength (Figure 23). The filtering of the outer beams did result in the re-appearance of 14 holidays that are a result of coverage gaps between launch 2802 DN259 outer beams which overlapped with launch 2801 data acquired with EM2040 sonar "Yaw Stabilization" setting "ON".

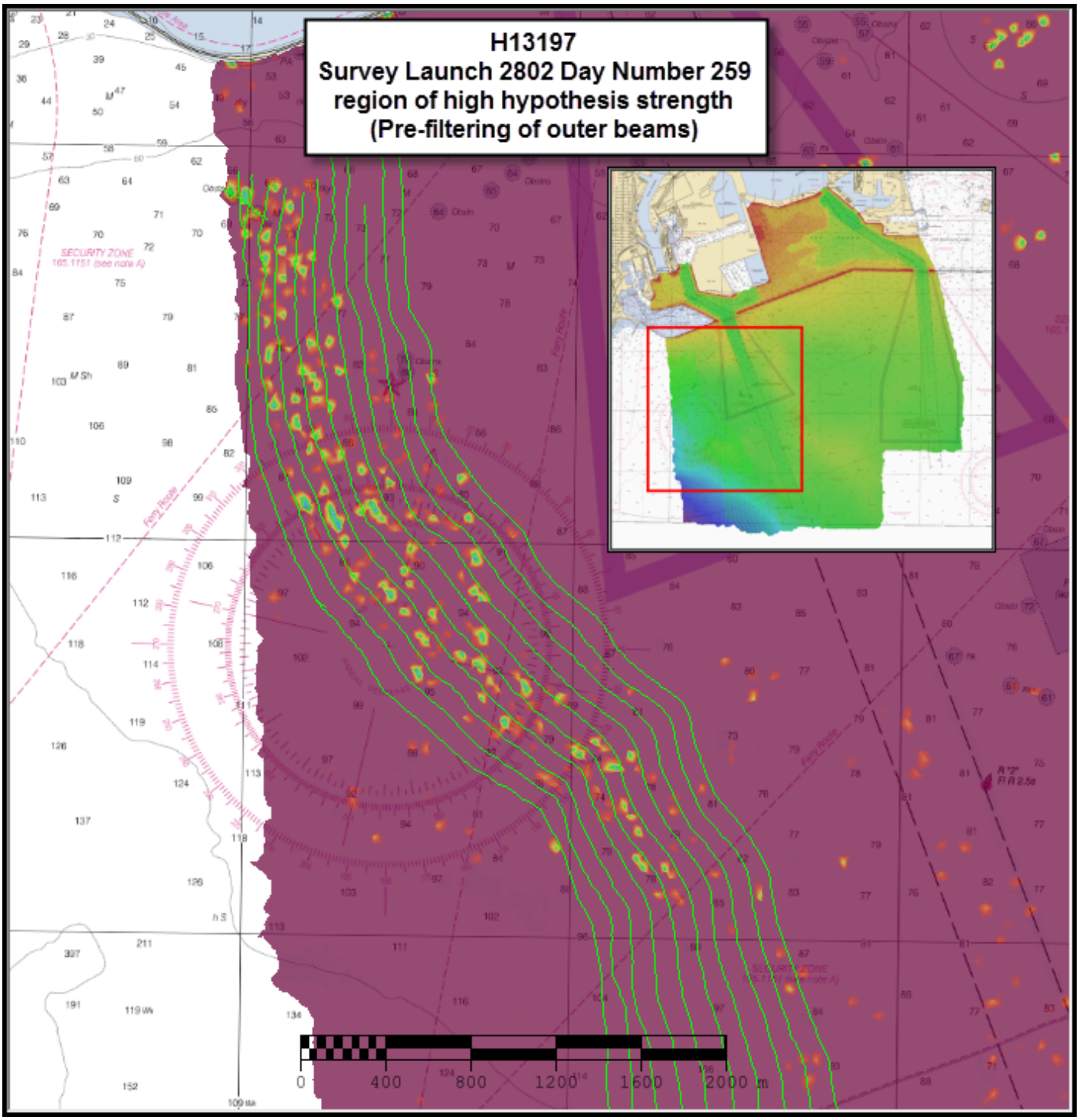



*Figure 22: H13197 Survey launch 2802 Day Number 259 region of high hypothesis strength before filtering of outer beams.*

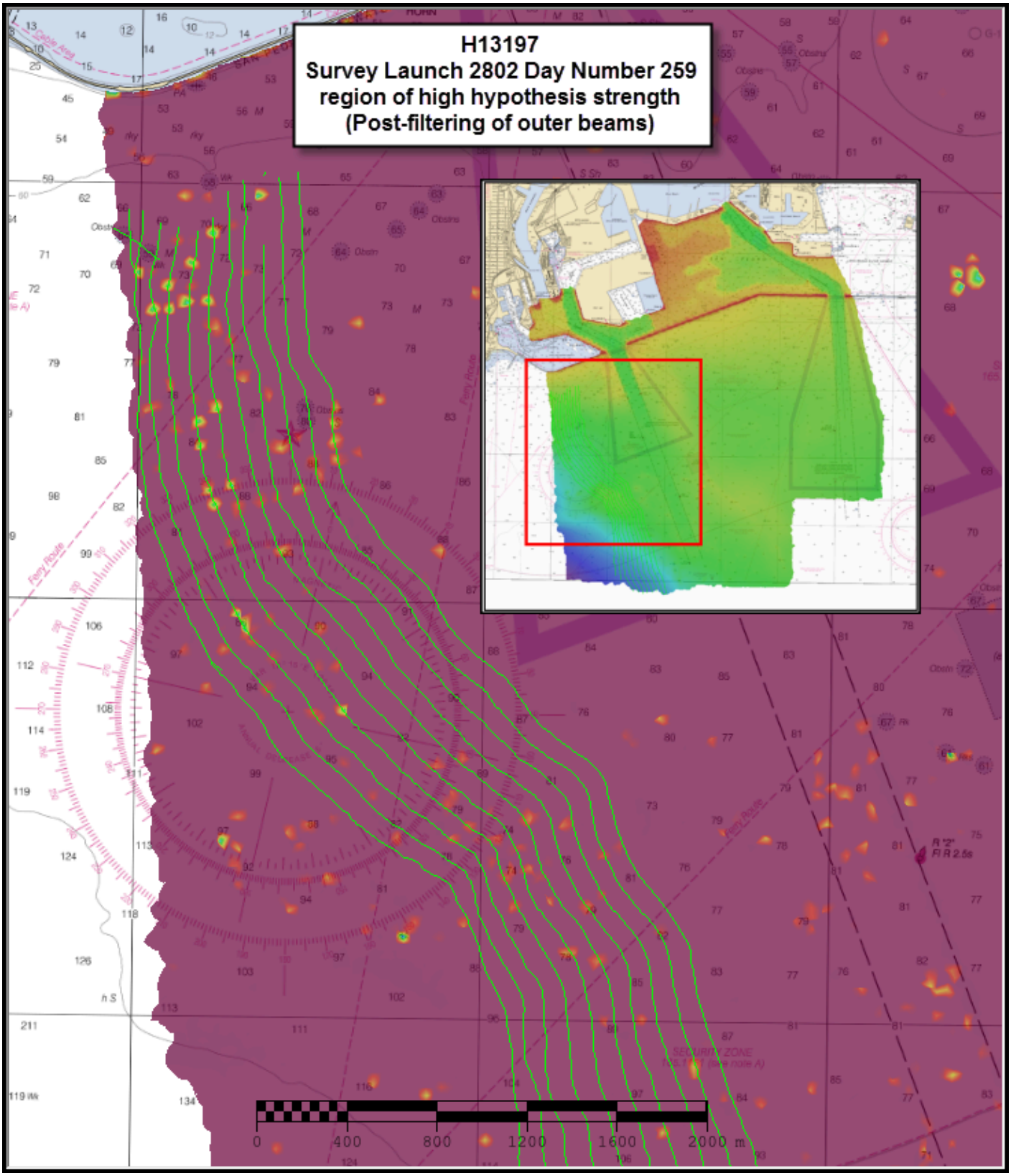



*Figure 23: H13197 Survey launch 2802 Day Number 259 region of high hypothesis strength after filtering of outer beams.*

### 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: Seventy-three sound speed profiles were acquired for this survey at discrete locations within the survey area at least once every four hours, when significant changes to surface sound speed were observed, or when operating in a new area of the survey (Figure 24).

Sound speed profiles were acquired using Sea-Bird Scientific 19plus Conductivity, Temperature, and Depth (CTD) profilers. All casts were concatenated into a master file and applied to soundings using the "Nearest in distance within Time" (4 hours) profile selection method.

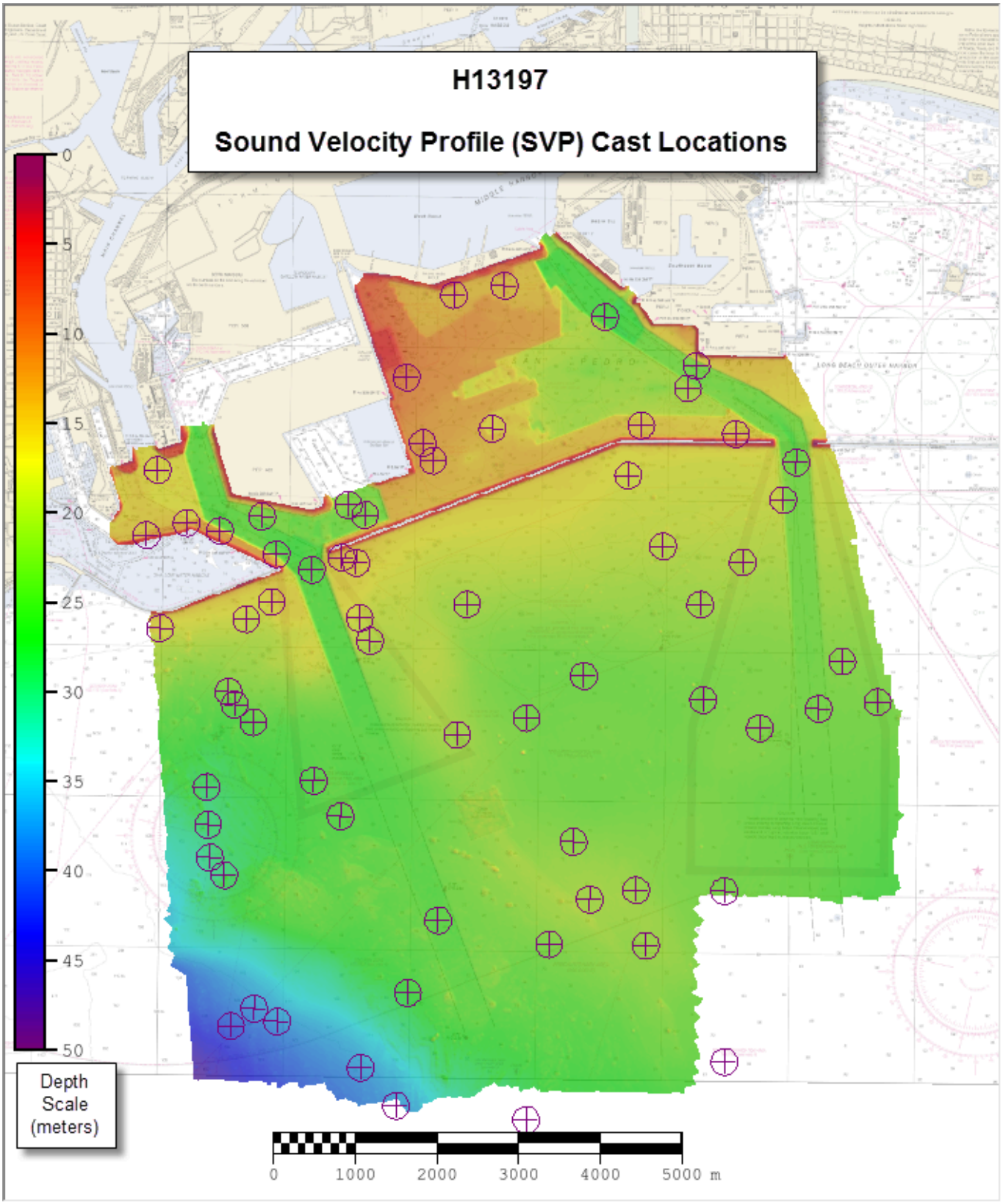



*Figure 24: H13197 Sound Velocity Profile (SVP) cast locations.*

### 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 correction 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 was acquired as .all files logged during MBES operations and subsequently processed by personnel aboard RAINIER using Fledermaus FMGT software. Each survey launch had its data processed as 2 meter resolution backscatter mosaics for the 300 kHz frequency. All mosaics have been delivered with this survey data as .gsf TIFF format files. A combined 2m resolution mosaic for the H13197 survey area is included for reference (Figure 25). Backscatter processing procedures are described in the DAPR.

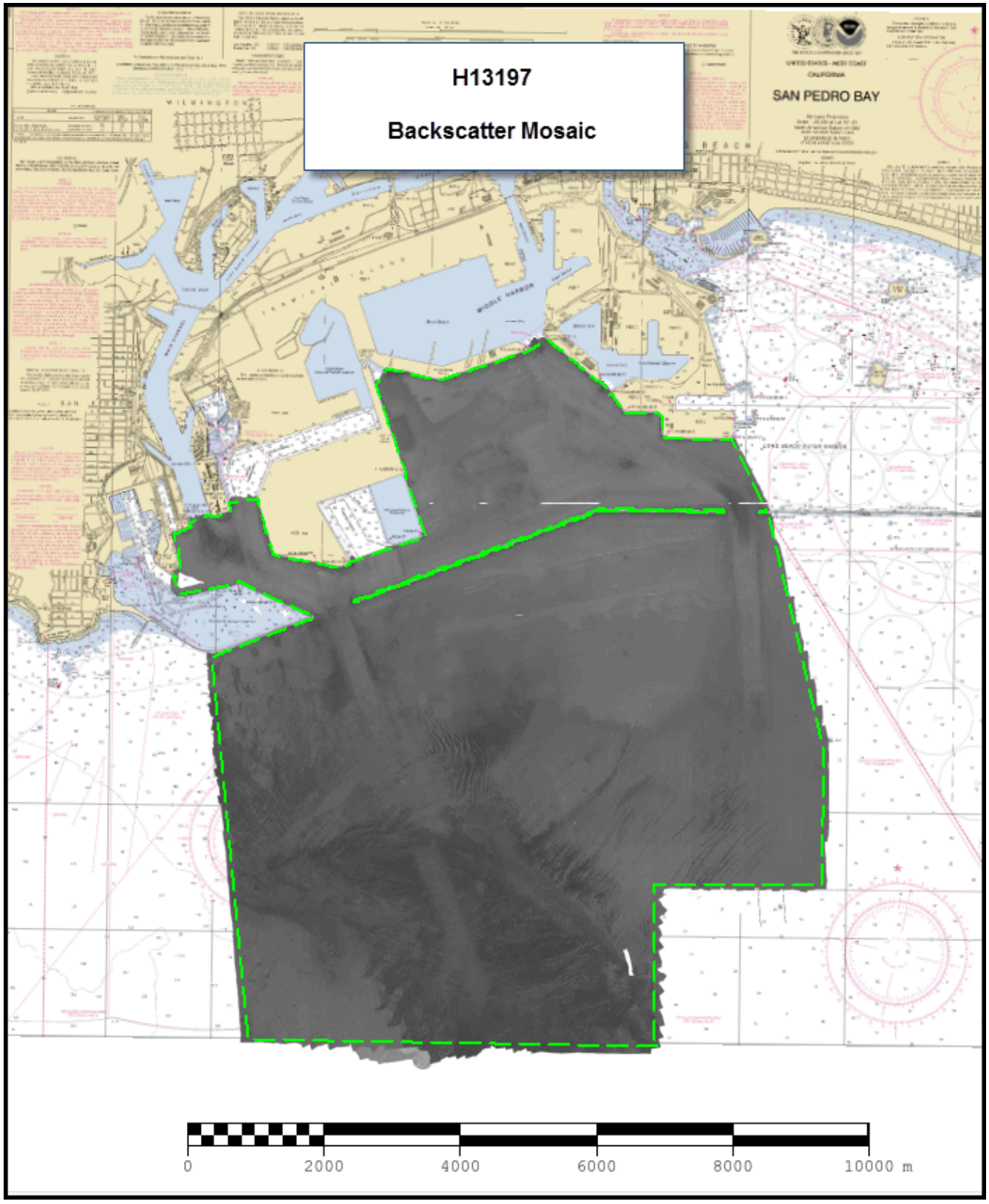



*Figure 25: H13197 Overview of backscatter mosaics (Chart 18749)*

## 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 | 10.3.3 |

*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 Geocoder Tool Box (FMGT) | 7.8.1 |

*Table 11: Primary imagery data processing software*

The following Feature Object Catalog was used: NOAA Profile V_5_7.

NOAA Extended Attribute file Version 5.7.

### 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 |
|---|---|---|---|---|---|
| H13197_MB_VR_MLLW | CARIS VR Surface (CUBE) | Variable Resolution | 1.003 meters - 48.723 meters | NOAA_VR | Object Detection |
| H13197_MB_VR_MLLW_Final | CARIS VR Surface (CUBE) | Variable Resolution | 1.003 meters - 48.723 meters | NOAA_VR | Object Detection |

*Table 12: Submitted Surfaces*

Submitted surfaces were generated using the NOAA recommended parameters for depth-based (Ranges) CARIS variable-resolution bathymetric grids as specified in the 2018 HSSD.

Pydro Explorer (version 19.4) QC Tools "Detect Fliers" (version 8) program with default settings was used to identify fliers in the data. The data was examined closely and obvious noise or erroneous soundings were rejected. Results from Pydro QC Tools are included in the "Separates" section of this report.

Seventy-nine critical soundings were designated for this survey. None were identified as a Danger to Navigation (DTON). All were designated to honor the least depth over assigned and previously charted features (underwater obstructions, wrecks, or rocks). See sections D.1.3 and D.1.5 below for further detail.

# C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

## 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 | VDatum_Outline_Shape_xyNAD83-MLLW_geoid12b.csar |

*Table 13: ERS method and SEP file*

## 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 11.

PPP

All Smoothed Best Estimate of Trajectory (SBET) and associated Root-mean square (RMS) files were processed in Applanix POSPac MMS (version 8.2.1) software using the Precise Point-Real Time Extended (PP-RTX) method. No terrestrial reference stations were used directly in the processing of horizontal and vertical correctors to acquired multi-beam data. Further details for equipment and methods used can be found in the DAPR.

# D. Results and Recommendations

## D.1 Chart Comparison

A comparison was made between H13197 survey data and the largest scale Electronic Navigational Charts (ENC) for the area (US5CA61M and US5CA62M) using CUBE surfaces, selected soundings, and contours created in Caris.

### 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 | Preliminary? |
|---|---|---|---|---|---|
| US5CA61M | 1:20000 | 42 | 10/23/2018 | 10/23/2018 | NO |
| US5CA62M | 1:12000 | 59 | 06/18/2018 | 08/10/2018 | NO |

*Table 14: Largest Scale ENCs*

US5CA61M

ENC US5CA61M encompasses the southern half of the H13197 survey area. The ENC charted 20 fathom (36.5 meter) depth curve in the southwest corner of the survey area was generally seaward of the computed H13197 20 fathom contour by 10 to 86 meters (Figure 26).

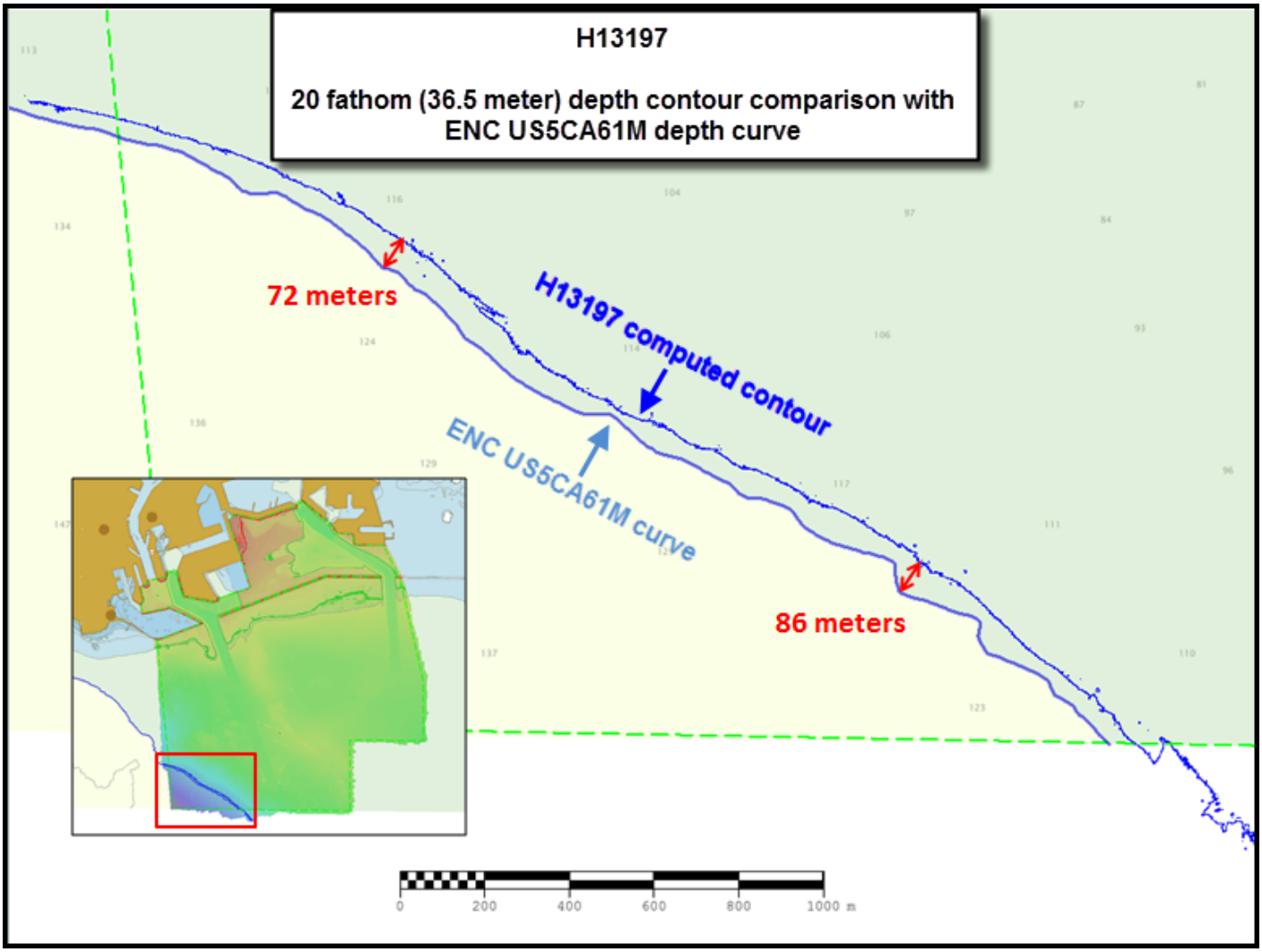



*Figure 26: H13197 20 fathom (36.5 meter) contour comparison with ENC US5CA61M depth curve.*

US5CA62M

ENC US5CA62M encompass the northern portion of the H13197 survey area. The ENC charted 10 fathom (18.2 meter) depth curve was in general agreement with the computed H13197 10 fathom depth contour in the areas north of the San Pedro, Middle, and Long Beach breakwaters. In survey areas south of the breakwaters, the ENC curve was observed to be 100 to 518 meters seaward of the computed H13197 contour (Figure 27). The ENC charted 5 fathom (9.1 meter) depth curve was in general agreement with the computed H13197 5 fathom contour throughout the survey area. In the northwest corner of the San Pedro Bay "Bravo Anchorages" the ENC curve was observed to be 100 to 135 meters seaward of the computed H13197 contour (Figure 28). All ENC charted 3 fathom (5.4 meter) and 2 fathom (3.6 meter) depth curves were in close alignment with their respective H13197 computed depth contours. The ENC 1 fathom (1.8 meter) curve was not compared to H13197 multi-beam data as it was beyond the 3.5 meter NALL and/or assigned sheet limits in most areas.

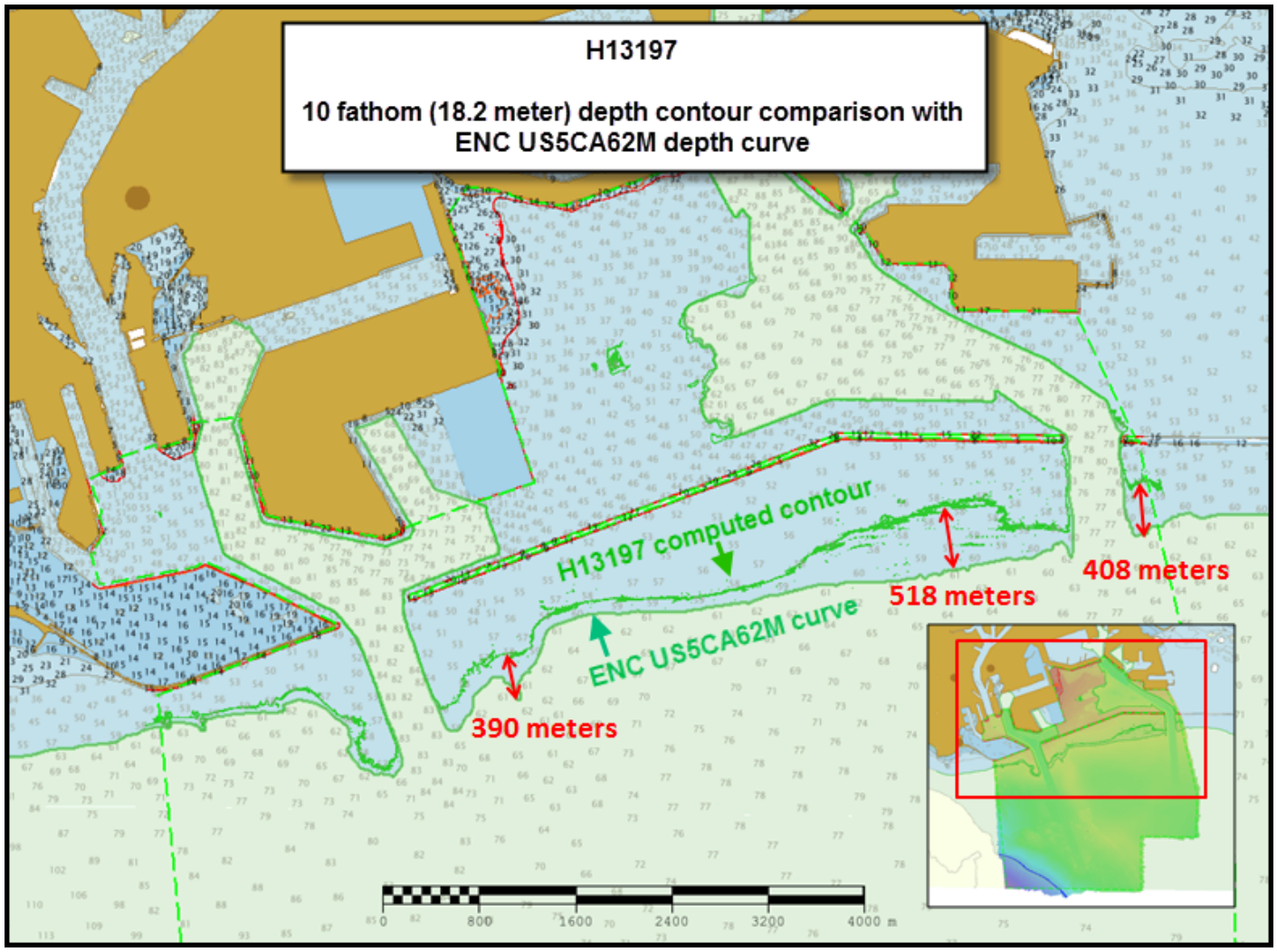



*Figure 27: H13197 10 fathom (18.2 meter) contour comparison with ENC US5CA62M curve.*

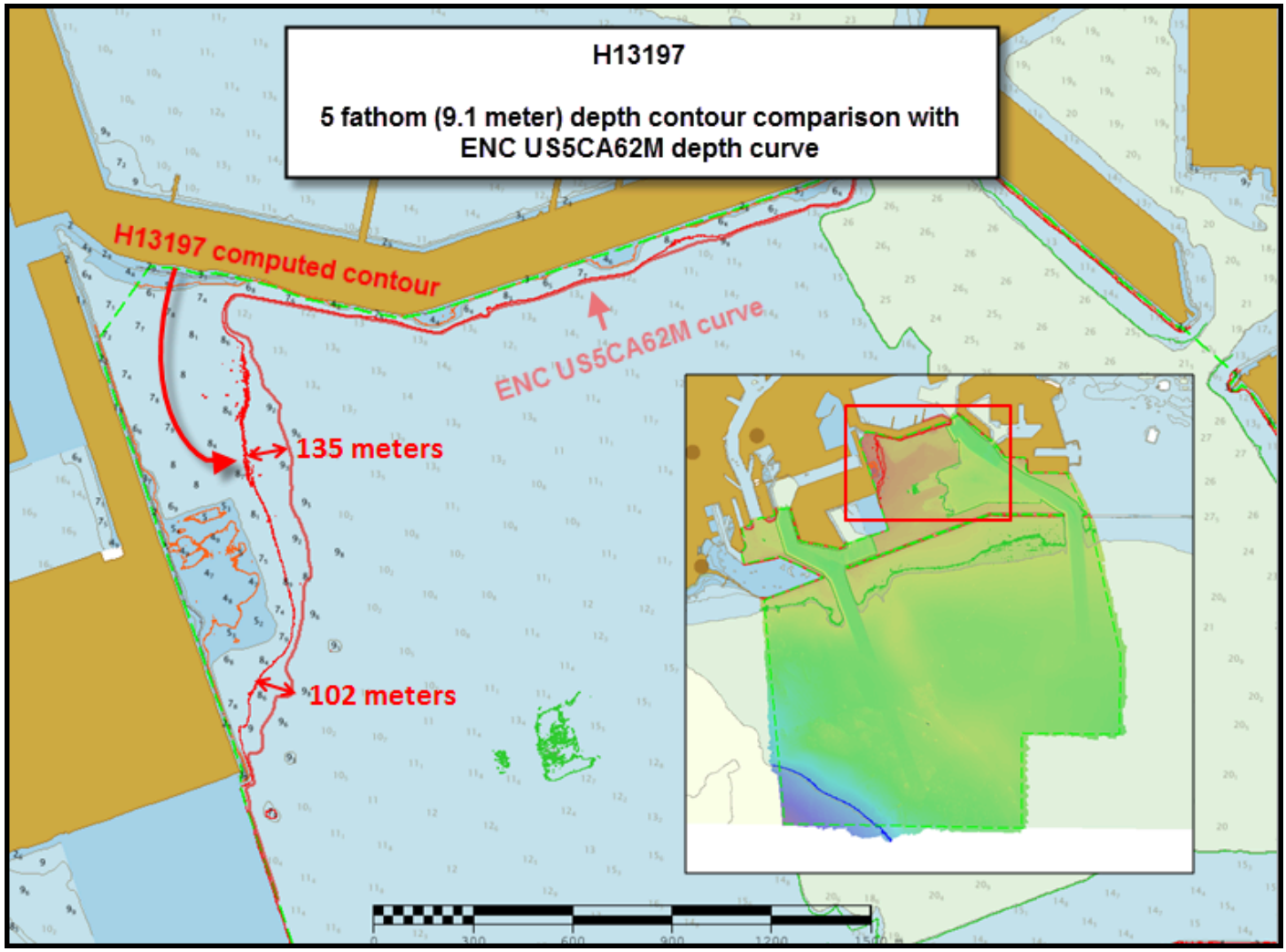



*Figure 28: H13197 5 fathom (9.1 meter) contour comparison with ENC US5CA62M curve.*

### D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

### D.1.3 Charted Features

A charted dangerous wreck feature was labeled PA just to the south of the San Pedro Breakwater (located to the west of the Los Angeles main channel). This wreck feature was located in multi-beam sonar data 31 meters north-west of its charted location (Figure 29). A new wreck feature with known least depth and updated position has been added to the final feature file and the PA feature has been recommended for deletion.

A charted underwater offshore platform feature labeled PA was investigated as assigned in the final feature file. The offshore platform is charted as a current sensor on the sea floor. Examination of multi-beam sonar data reveals the presence of possible structural elements in the extents of the feature symbol. This feature is discussed further in section D.2.6 below and the H13197 Final Feature File.

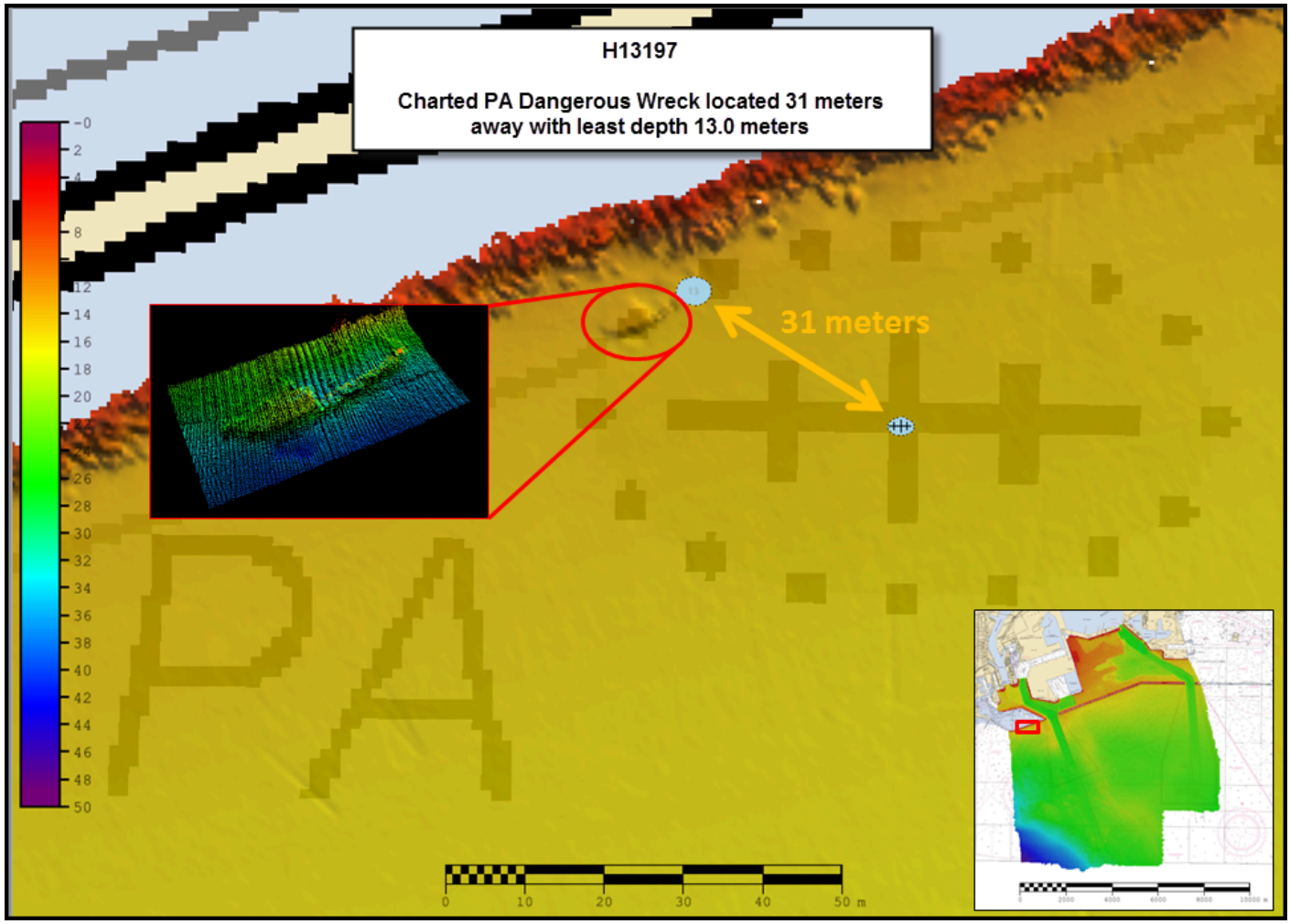



*Figure 29: H13197 Charted PA dangerous wreck located 31 meters away with least depth 13.0 meters.*

### D.1.4 Uncharted Features

Four new mooring buoys (MORFAC) were added to the H13197 Final Feature File. The previously uncharted mooring buoys are located in the San Pedro Bay Special Anchorage area B-1 of the Port of Long Beach "Bravo anchorages". Photographs and further attribution descriptions are provided in the H13197 Final Feature File.

### D.1.5 Shoal and Hazardous Features

Charted wrecks, obstructions, and rocks were all examined closely and a detailed evaluation of position and least depth values was made using the "Find designate" function within Caris 10.3.3 processing software. Where necessary, new features were created to replace incorrect positions and/or depths. Positional changes were generally on the order of 5 meters or less and least depths were less than 0.5 meters different.

No Danger to Navigation (DTON) reports were submitted for this survey.

### D.1.6 Channels

A visual comparison was made between charted depth soundings and updated H13197 variable-resolution surface depth soundings for both the Los Angeles and Long Beach main channels to include pilot boarding areas. No discrepancies were noted.

Additionally, visual examinations were made of all soundings in and around the Port of Long Beach "Bravo" anchorage area in San Pedro Bay as well as the "Golf" anchorages south of the Middle Breakwater in the LA-LB precautionary area. No shoal areas or uncharted features were observed in the data.

### D.1.7 Bottom Samples

No bottom samples were required for this survey.

## D.2 Additional Results

### D.2.1 Shoreline

Limited shoreline verification was conducted in accordance with applicable sections of NOAA HSSD and FPM using the Project Reference File (PRF) and Composite Source File (CSF) provided with the Project Instructions. In the field, all assigned features that were safe to approach, were addressed as required with S-57 attribution and recorded in the H13197_FFF (Final Feature File) to best represent the features at chart scale.

Only features located within the surveyed multibeam coverage were investigated, others were flagged as “Not Addressed” in the H13197_FFF. The H13197_FFF also includes new features found in the field as well as recommendations to update, retain or delete assigned features.

### D.2.2 Aids to Navigation

All assigned aids to navigation within the H13197 survey area were confirmed on station and appear to be serving their intended purpose. A total of ten assigned lateral buoys, one safe water buoy, and one navigational range (special purpose beacon) were all investigated and results were documented in the

H13197_FFF. Additionally, an assigned wave measuring special buoy operated by the Scripps Institute of Oceanography was confirmed to be in its charted position to the west of the Long Beach channel and was verified in the H13197_FFF.

### D.2.3 Overhead Features

No overhead features exist for this survey.

### D.2.4 Submarine Features

An assigned submarine cable was investigated but could not be verified nor disproved in multi-beam sonar data. The submarine cable is charted from the eastern end of the Middle Breakwater to a charted underwater current monitoring sensor located 700 meters south-southwest of the Queens Gate entrance of the Long Beach main channel.

### D.2.5 Platforms

Two assigned offshore platform features were investigated in the H13197 survey area. One is a charted current sensor located 700 meters south-southwest of the of the Queens Gate entrance of the Long Beach main channel. The other is a pier ruins charted on the southeast face of the mole protecting the Long Beach "Middle Harbor West Basin". Neither of these platform exist and examination of multi-beam sonar data for both areas indicates the presence of underwater debris on the bottom. Both platforms are recommended for deletion and replacement by new obstruction features depicting foul ground around the submerged debris. All recommendations for deletion and addition of features are submitted in the H13197_FFF.

### D.2.6 Ferry Routes and Terminals

Charted ferry routes from both San Pedro (Los Angeles) and Long Beach ports to Santa Catalina island were confirmed accurate. Multiple fast ferry boats operated by the Catalina Express company were observed operating on scheduled voyages to and from Santa Catalina island using the charted ferry routes.

### D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

### D.2.8 Construction and Dredging

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

### D.2.9 New Survey Recommendation

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

### D.2.10 Inset Recommendation

No new insets 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 |
|---|---|---|---|
| Benjamin K. Evans, CDR/NOAA | Chief of Party | 06/12/2019 | Digitally signed by EVANS.BENJAMIN.K.1237217094 Date: 2019.06.22 15:36:13 -08'00' |
| Hadley A. Owen, LT/NOAA | Field Operations Officer | 06/12/2019 | Digitally signed by OWEN.HADLEY.ANNE.1410967070 Date: 2019.06.12 14:45:54 -08'00' |
| James B. Jacobson | Chief Survey Technician | 06/12/2019 | JACOBSON.JAMES.BRYAN.1269664017 I have reviewed this document 2019.06.12 14:37:12 -08'00' |
| Gregory J. Gahlinger | Senior Survey Technician | 06/12/2019 | GAHLINGER.GREGORY.JOS.1100701304 2019.06.12 14:19:13 -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 |
| **TPE** | Total Propagated Error |
| **TPU** | Topside Processing Unit |
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United States Coast Guard |
| **UTM** | Universal Transverse Mercator |
| **XO** | Executive Officer |
| **ZDF** | Zone Definition File |

APPROVAL PAGE

H13197

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

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- GeoPDF of survey products

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: Digitally signed by Peter Holmberg
Reason: I am approving this document
Date: 2019.11.15 14:37:44 -08'00'

**Peter Holmberg**
Products Team Lead, Pacific Hydrographic Branch