

H13272

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

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H13272

LOCALITY

State(s): Hawaii

General Locality: Hawaiian Islands and Vicinity

Sub-locality: Vicinity of Lahaina

2019

CHIEF OF PARTY
Benjamin K. Evans, CAPT/NOAA

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

H13272

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): **Hawaii**

General Locality: **Hawaiian Islands and Vicinity**

Sub-Locality: **Vicinity of Lahaina**

Scale: **5000**

Dates of Survey: **08/09/2019 to 08/16/2019**

Instructions Dated: **06/28/2019**

Project Number: **OPR-T383-RA-19**

Field Unit: **NOAA Ship Rainier (S221)**

Chief of Party: **Benjamin K. Evans, CAPT/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/>.

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Descriptive Report to Accompany Survey H13272

Project: OPR-T383-RA-19

Locality: Hawaiian Islands and Vicinity

Sublocality: Vicinity of Lahaina

Scale: 1:5000

August 2019 - August 2019

NOAA Ship *Rainier*

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

A. Area Surveyed

This survey area is referred to as H13272, "Vicinity of Lahaina" (sheet 2) in the Project Instructions. The assigned survey area encompassed approximately 15 square nautical miles within the Auau Channel, directly west of Lahaina on the Hawaiian Island of Maui. Nearly all of the assigned survey area falls within the Hawaiian Islands Humpback Whale National Marine Sanctuary.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
20° 59' 40.2" N 156° 45' 35.63" W	20° 47' 51.55" N 156° 37' 15.03" W

Table 1: Survey Limits

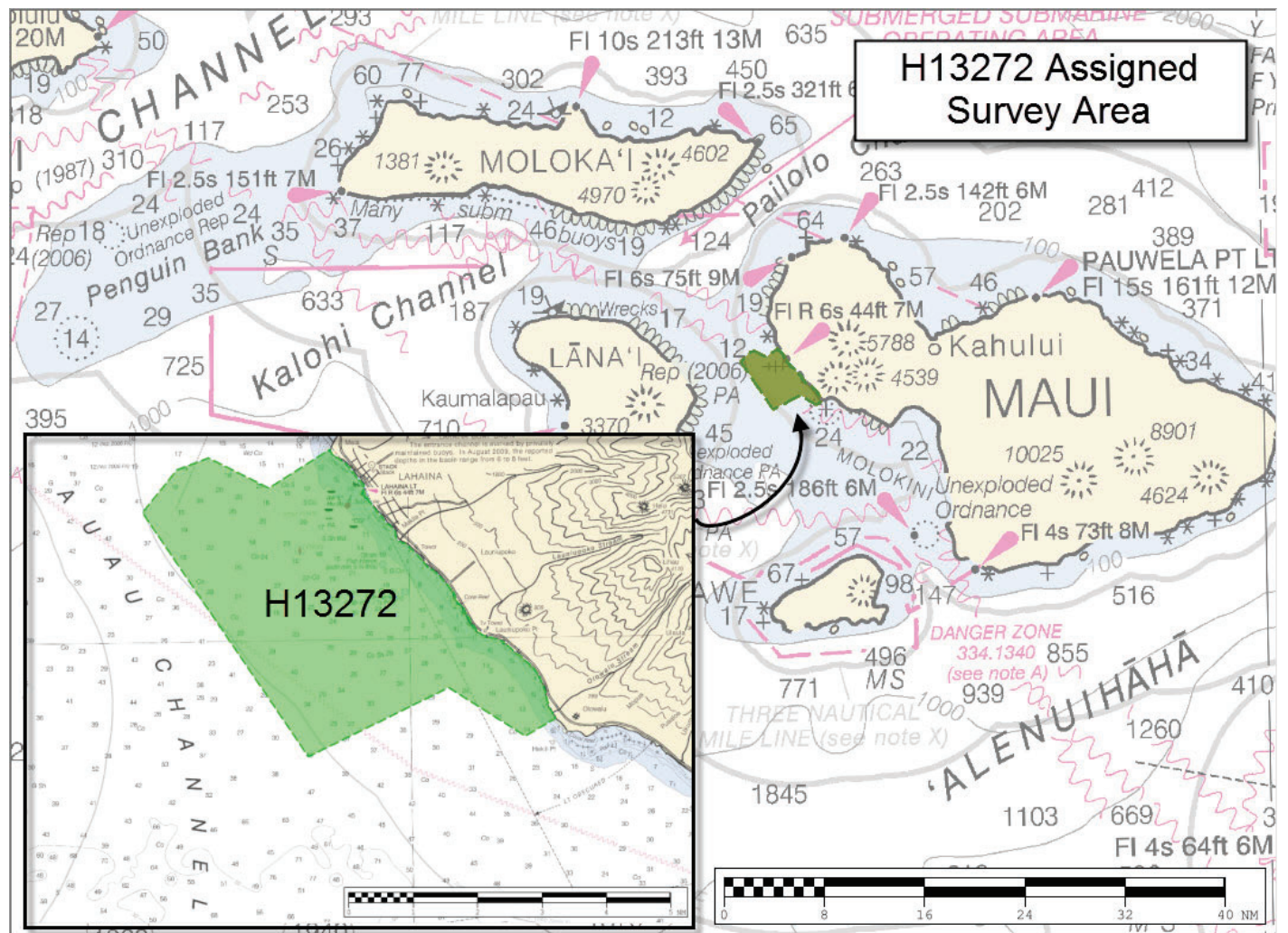


Figure 1: H13272 originally assigned survey area (Charts 19347, 19007).

H13272 survey coverage was extended beyond the originally assigned survey limits in order to investigate three reported shoals (Figure 2). For additional information, refer to Project Manager correspondence submitted in appendix II of this report.

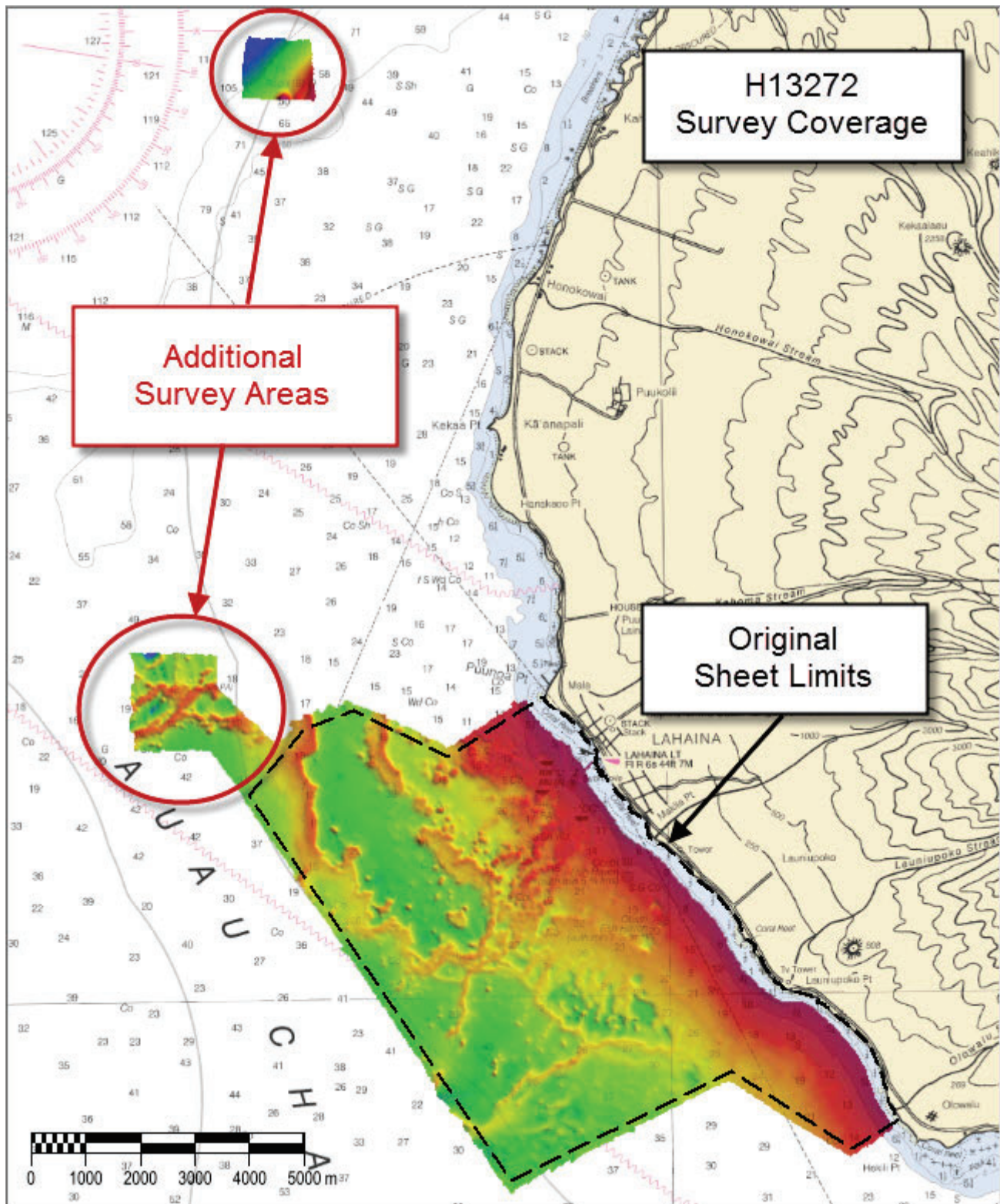


Figure 2: Overview of expanded H13272 survey coverage.

A.2 Survey Purpose

This survey is part of a larger project area encompassing 225 square nautical miles; it is heavily trafficked by container ships, tankers, barges, commercial and recreation fishing vessels, and tourism industry vessels. Lahaina Harbor is home to sport fishing, sailing, diving and whale watching vessels as well as a ferry to Lanai. Despite the volume of maritime traffic, the vast majority of bathymetric data in the project area were acquired prior to 1984. This survey will provide modern bathymetric data for updating National Ocean Service (NOS) charting products as well as support for the Seabed 2030 global mapping initiative. H13272 data is intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools 3 Grid QA was used to analyze H13272 multibeam echosounder (MBES) data density. Software errors were identified when performing quality control checks on Caris variable-resolution surfaces that include discontinuous coverage and large ungridded areas such as found on this survey. In order to work around this error, two separate surfaces were created and analyzed: one of the main survey area (1of2), and a second of the northern shoal investigation area (2of2). The submitted H13272 finalized variable-resolution (VR) surfaces met HSSD density and full coverage requirements as shown in the histograms below.

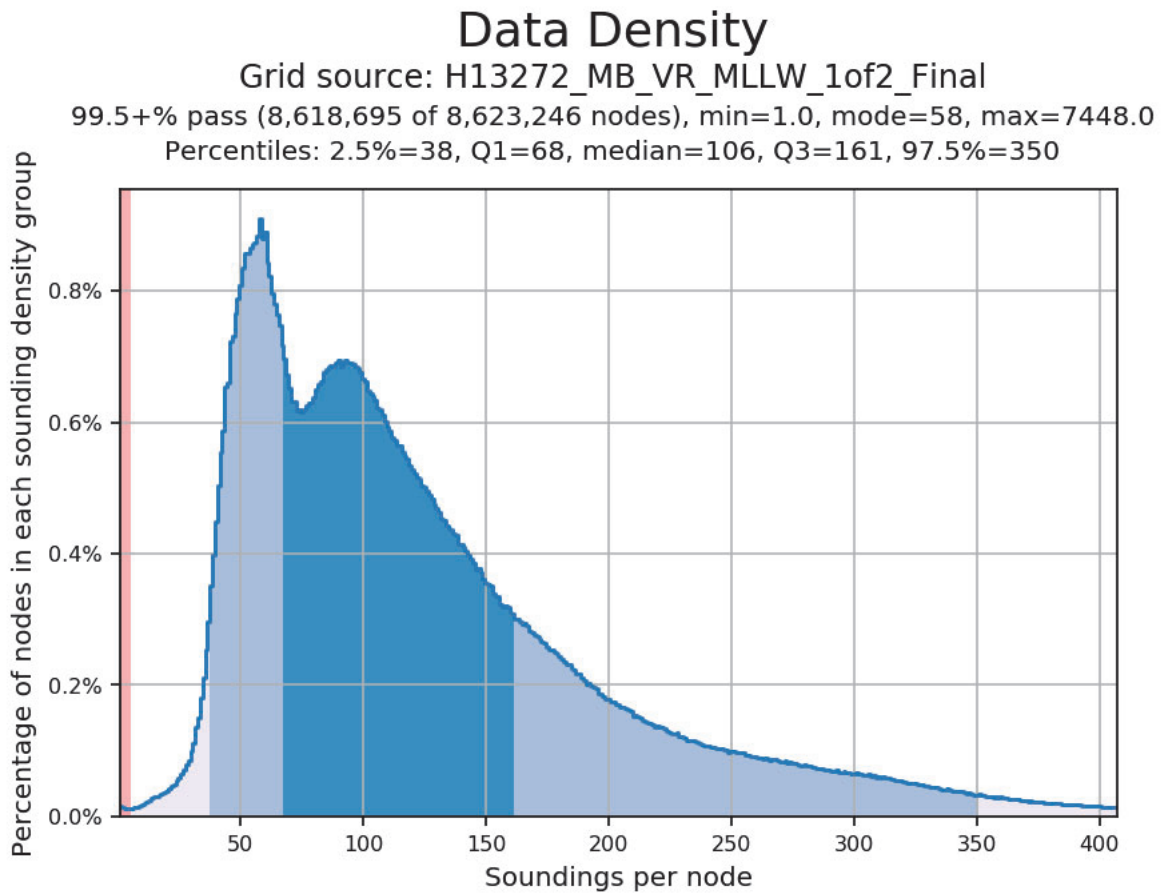


Figure 3: Pydro derived plot showing HSSD density compliance of H13272 finalized variable-resolution MBES data (main survey area).

Resolution Requirements - Full Coverage

Grid source: H13272_MB_VR_MLLW_1of2_Final

99.5+% pass (8,582,923 of 8,623,247 nodes), min=0.50, mode=1.0, max=2.00

Percentiles: 2.5%=1.0, Q1=1.0, median=1.0, Q3=1.0, 97.5%=1.0

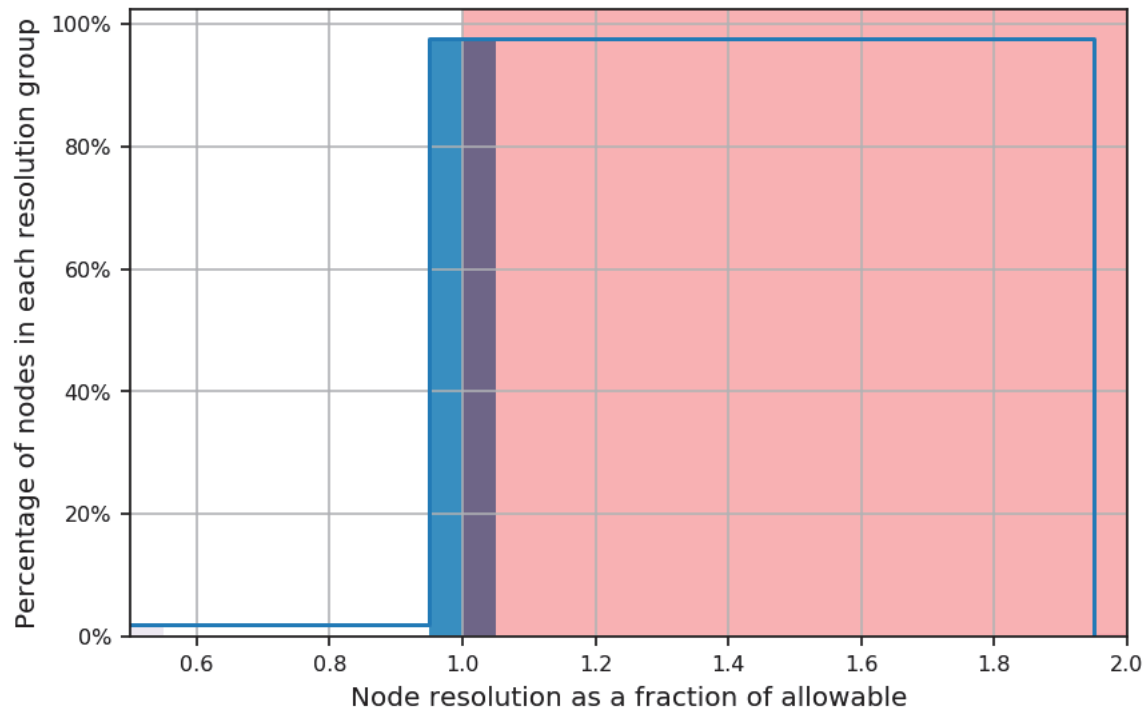


Figure 4: Pydro derived plot showing HSSD full coverage compliance of H13272 finalized variable-resolution MBES data (main survey area).

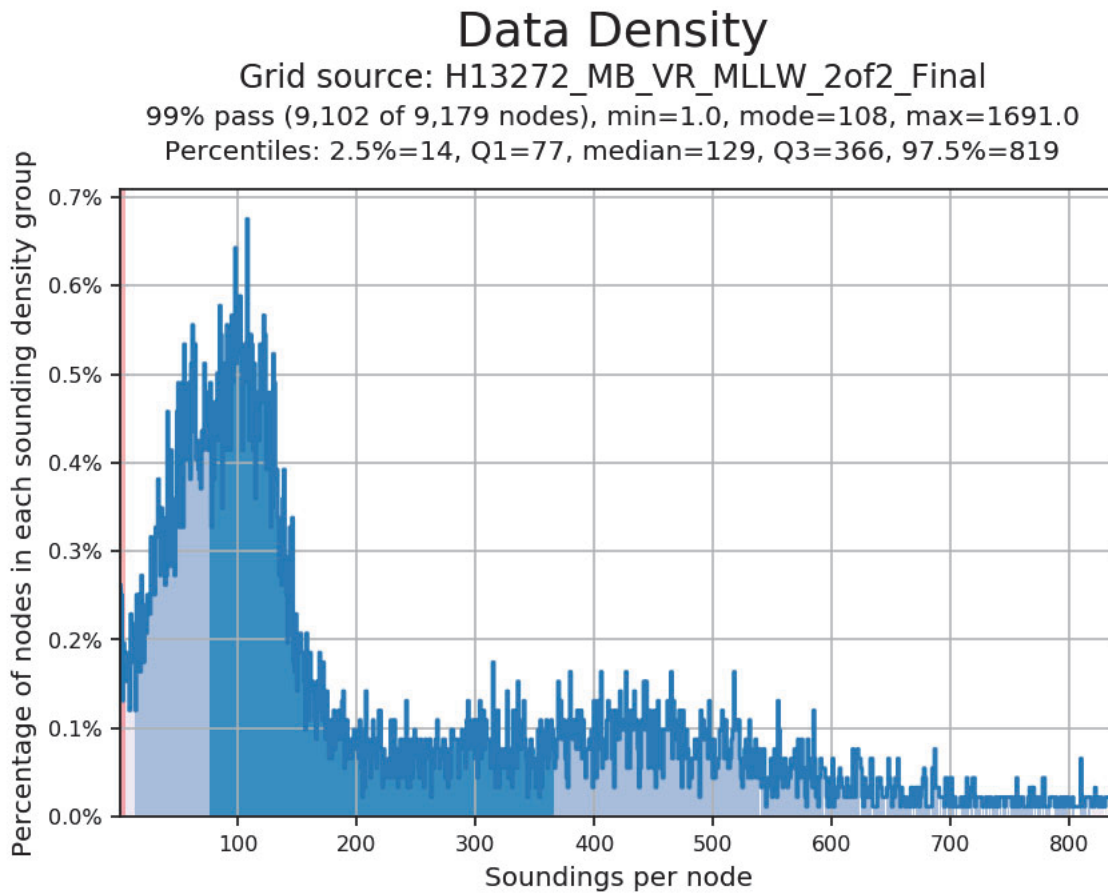


Figure 5: Pydro derived plot showing HSSD density compliance of H13272 finalized variable-resolution MBES data (northern shoal investigation area).

Resolution Requirements - Full Coverage

Grid source: H13272_MB_VR_MLLW_2of2_Final

99% pass (9,092 of 9,179 nodes), min=0.50, mode=1.0, max=2.00

Percentiles: 2.5%=1.0, Q1=1.0, median=1.0, Q3=1.0, 97.5%=1.0

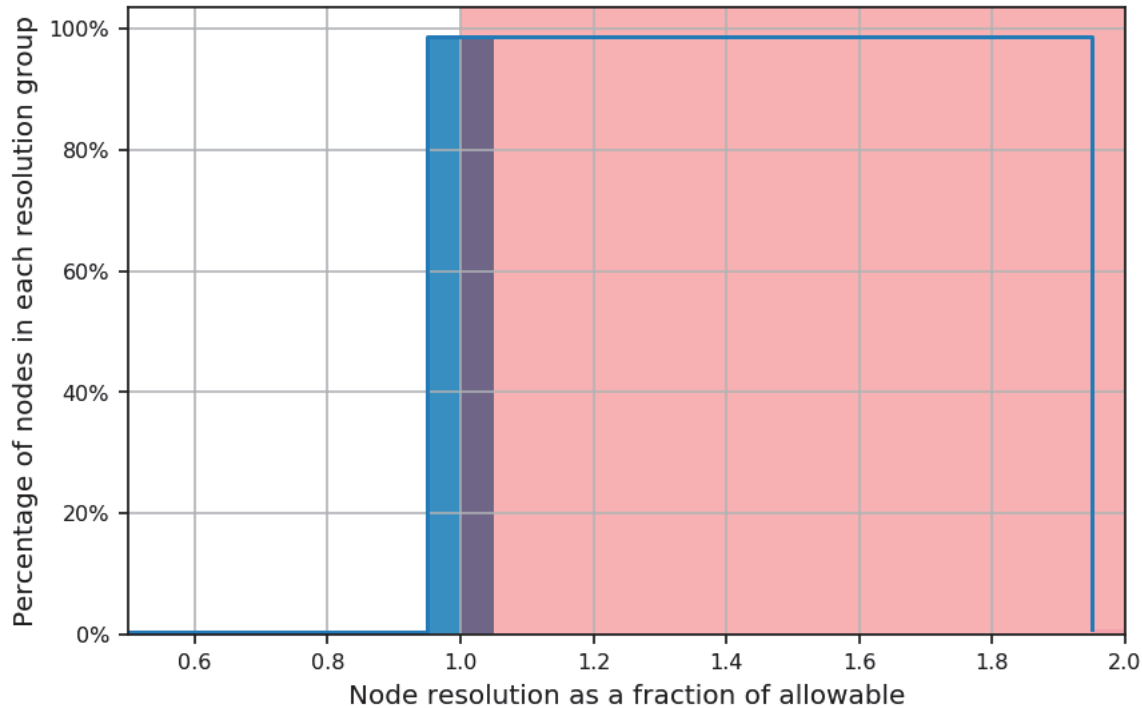


Figure 6: Pydro derived plot showing HSSD full coverage compliance of H13272 finalized variable-resolution MBES data (northern shoal investigation area).

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	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

Complete multibeam echosounder coverage was acquired to the inshore limit of hydrography, the Navigable Area Limit line (NALL). The Project Instructions defined the NALL for this survey as 10-meters water depth, shown as red in Figure 7. Six coverage gaps, "holidays," were identified after leaving the survey area. Unfortunately, most of the holidays were apparently due to inadequate overlap with existing coverage on the final day of acquisition. The largest holiday measures approximately 5 x 119 meters and is located near the southeast end of the survey (Figure 8). Each coverage gap was examined with Caris subset editor; no

navigationally significant features were apparent in the area of the holidays; least depths are believed to be represented.

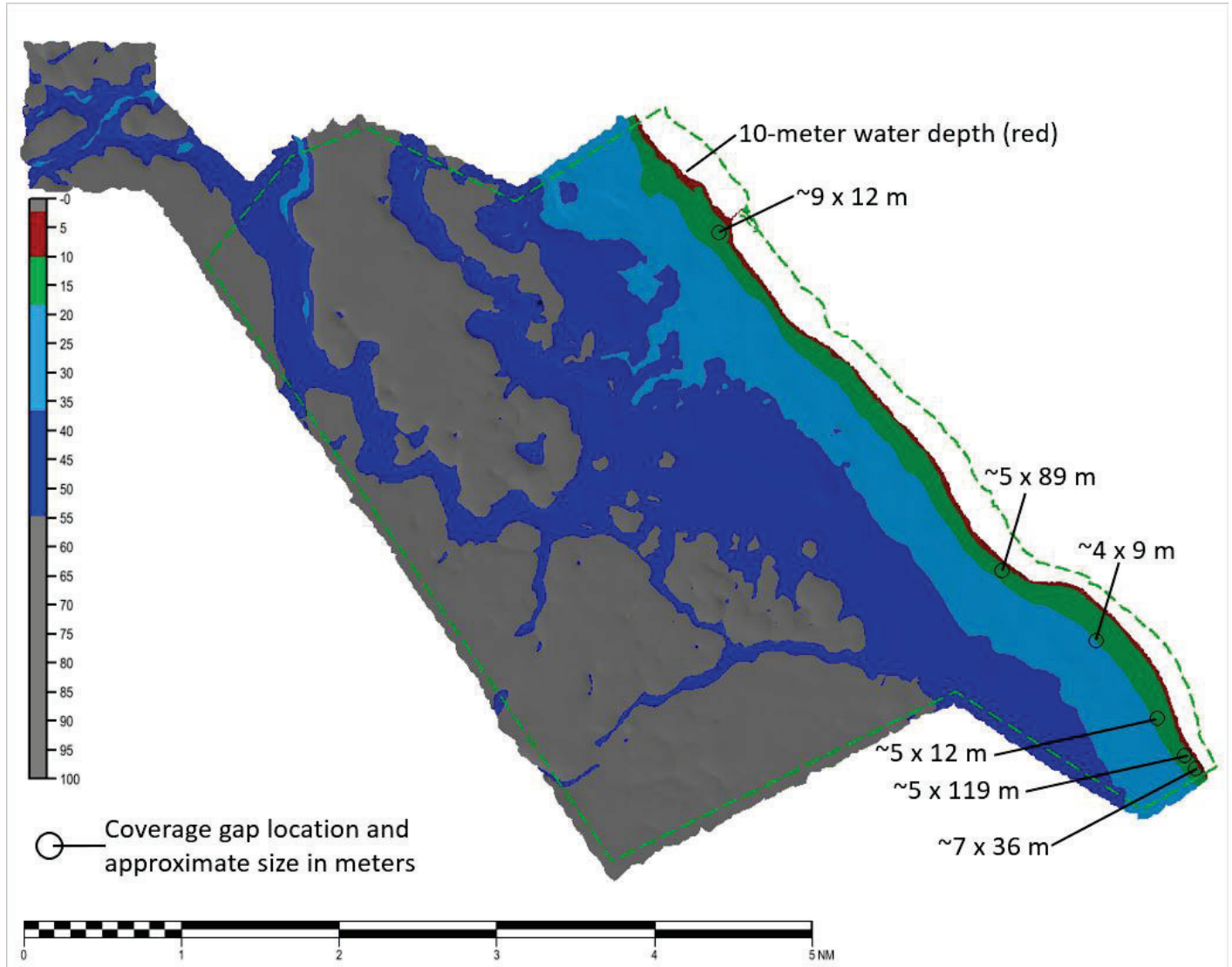


Figure 7: H13272 NALL determination and coverage gap locations / size.

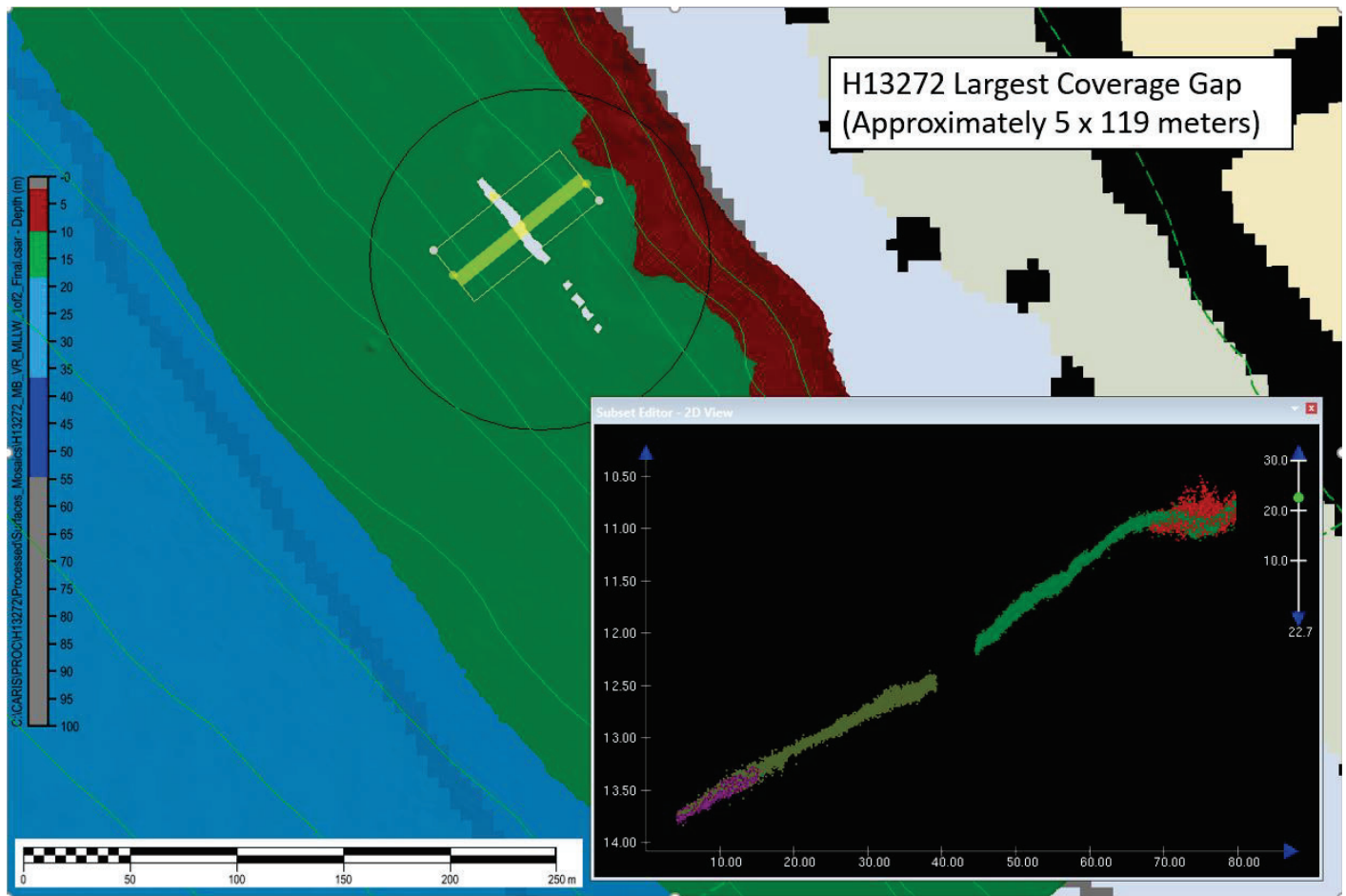


Figure 8: Largest coverage gap in H13272 MBES data. Note inappropriately wide spacing of survey vessel trackline (solid green line).

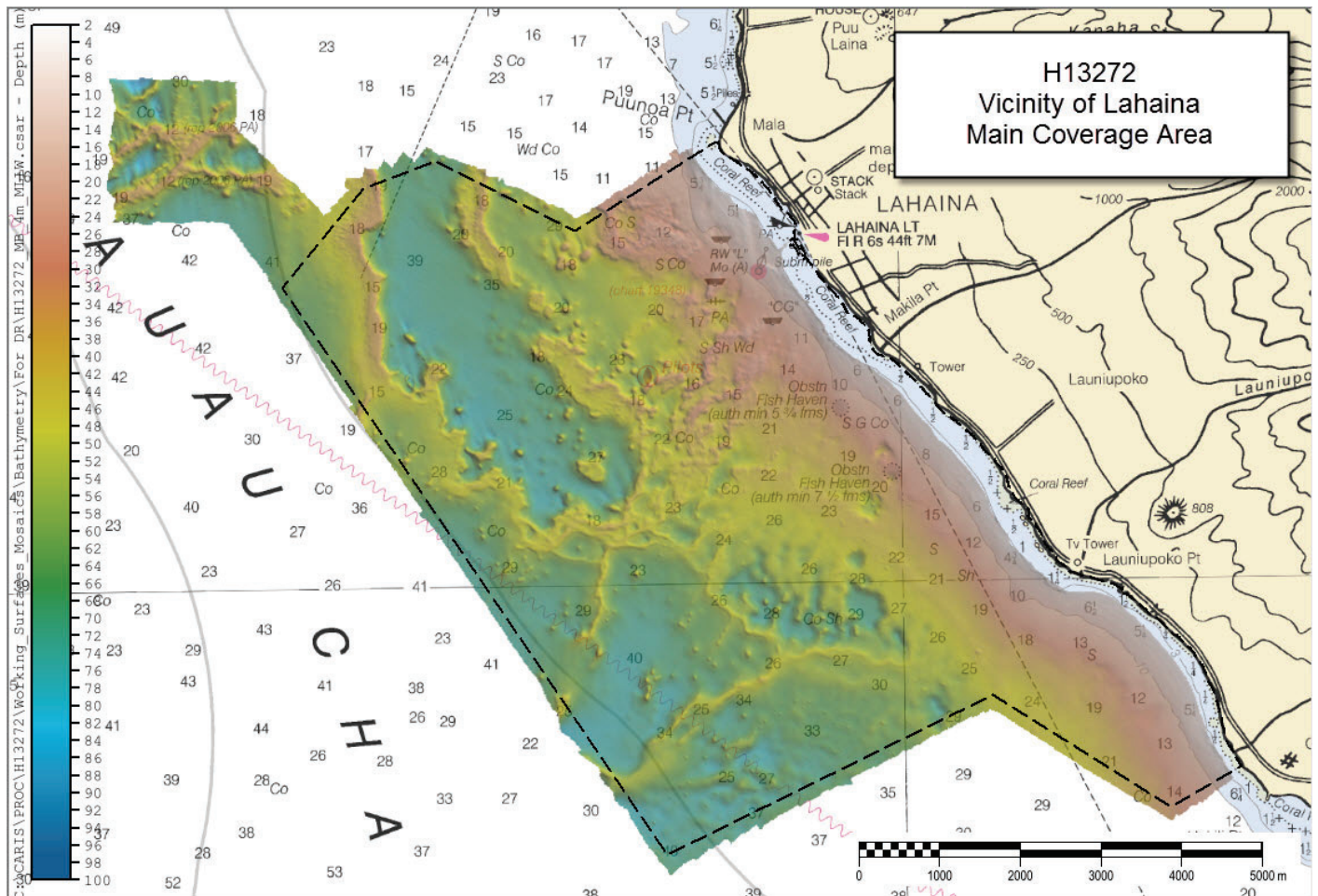


Figure 9: H13272 main survey coverage including shoal investigation area northwest of original assigned sheet limits (shown as black dashed line).

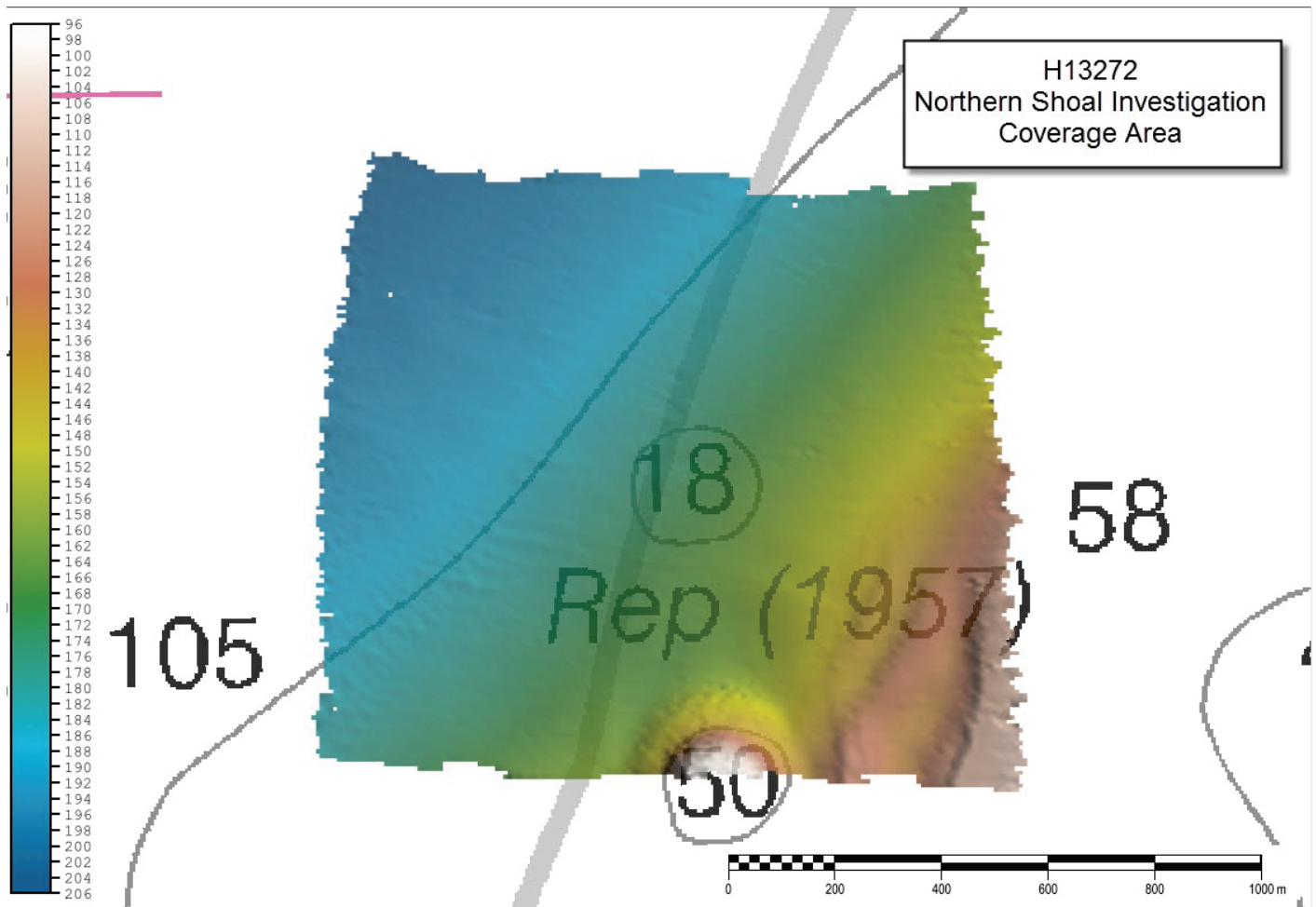


Figure 10: H13272 northern shoal investigation coverage area (Chart 19347). Chart units fathoms, survey units meters.

A.6 Survey Statistics

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

	HULL ID	<i>2801</i>	<i>2803</i>	<i>Total</i>
LNM	SBES Mainscheme	0	0	0
	MBES Mainscheme	115.30	138.34	253.64
	Lidar Mainscheme	0	0	0
	SSS Mainscheme	0	0	0
	SBES/SSS Mainscheme	0	0	0
	MBES/SSS Mainscheme	0	0	0
	SBES/MBES Crosslines	7.41	9.45	16.86
	Lidar Crosslines	0	0	0
Number of Bottom Samples				0
Number Maritime Boundary Points Investigated				0
Number of DPs				1
Number of Items Investigated by Dive Ops				0
Total SNM				16.93

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/09/2019	221
08/10/2019	222

Survey Dates	Day of the Year
08/11/2019	223
08/12/2019	224
08/13/2019	225
08/14/2019	226
08/15/2019	227
08/16/2019	228

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	2803
LOA	8.8 meters	8.8 meters
Draft	1.1 meters	1.1 meters

Table 5: Vessels Used



Figure 11: NOAA Ship RAINIER survey launch 2803 moored in Lahaina boat basin.

All H13272 data were acquired by NOAA Ship RAINIER survey launches 2801 and 2803. These vessels acquired depth soundings, backscatter imagery and sound speed profiles. Limited shoreline feature verification was also conducted from launch 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

Refer to the Data Acquisition and Processing Report (DAPR) for a comprehensive description of data acquisition and processing systems, survey vessels, quality control and processing methods. Additional

information to supplement soundings and other survey data and any deviations from the DAPR are discussed in this report.

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 6.65% of mainscheme acquisition.

RAINIER launches 2801 and 2803 acquired 16.86 nautical miles of MBES crosslines across all depth ranges, water masses and boat days that were safe and operationally practical. Crosslines were not acquired outside the originally assigned survey area, however the Hydrographer deems them adequate for verifying and evaluating the internal consistency of H13272 sonar data. Crossline analysis was performed using the Compare Grids function within Pydro Explorer on Caris variable-resolution surfaces of H13272 mainscheme only and crossline only data. 99.5+% of grid nodes met allowable uncertainties, see Pydro generated histograms below.

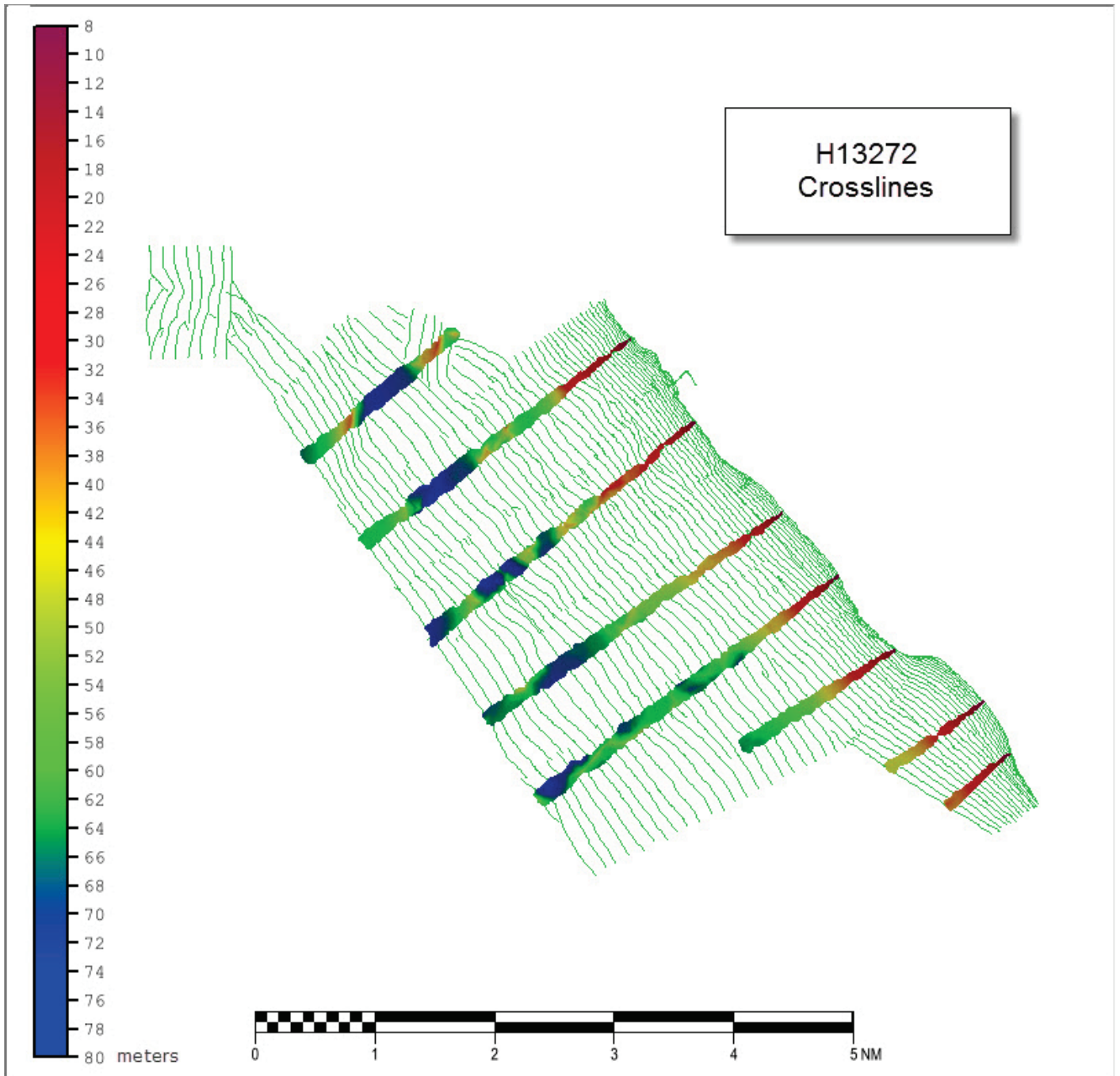


Figure 12: H13272 VR crossline surface overlaid on mainscheme tracklines.

Comparison Distribution

Per Grid: H13272_MB_MS_Only_VR_MLLW-Diff_H13272_MB_XL_Only_VR_MLLW_fracAllowErr.csar

99.5+% nodes pass (679307), min=0.0, mode=0.1 mean=0.1 max=4.9

Percentiles: 2.5%=0.0, Q1=0.0, median=0.1, Q3=0.1, 97.5%=0.3

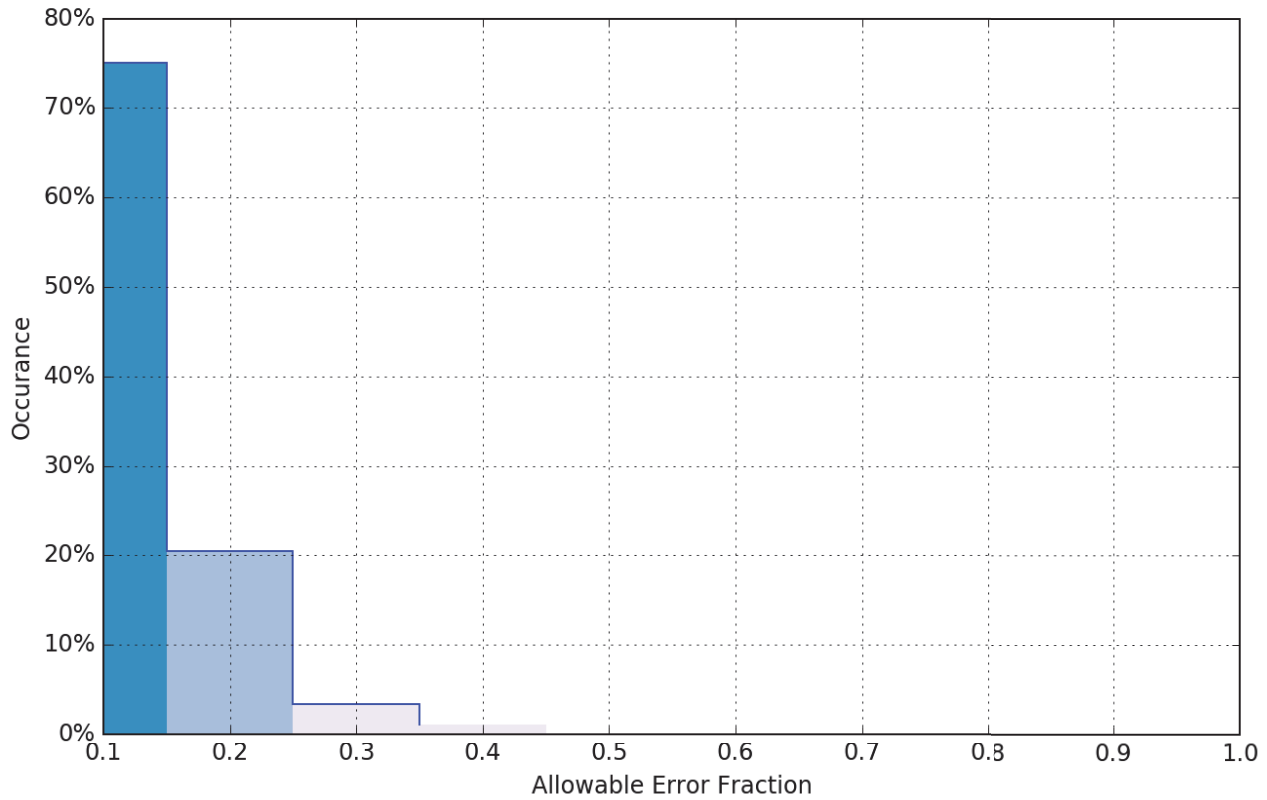


Figure 13: Pydro derived plot showing node percentage-pass value of H13272 mainscheme to crossline data.

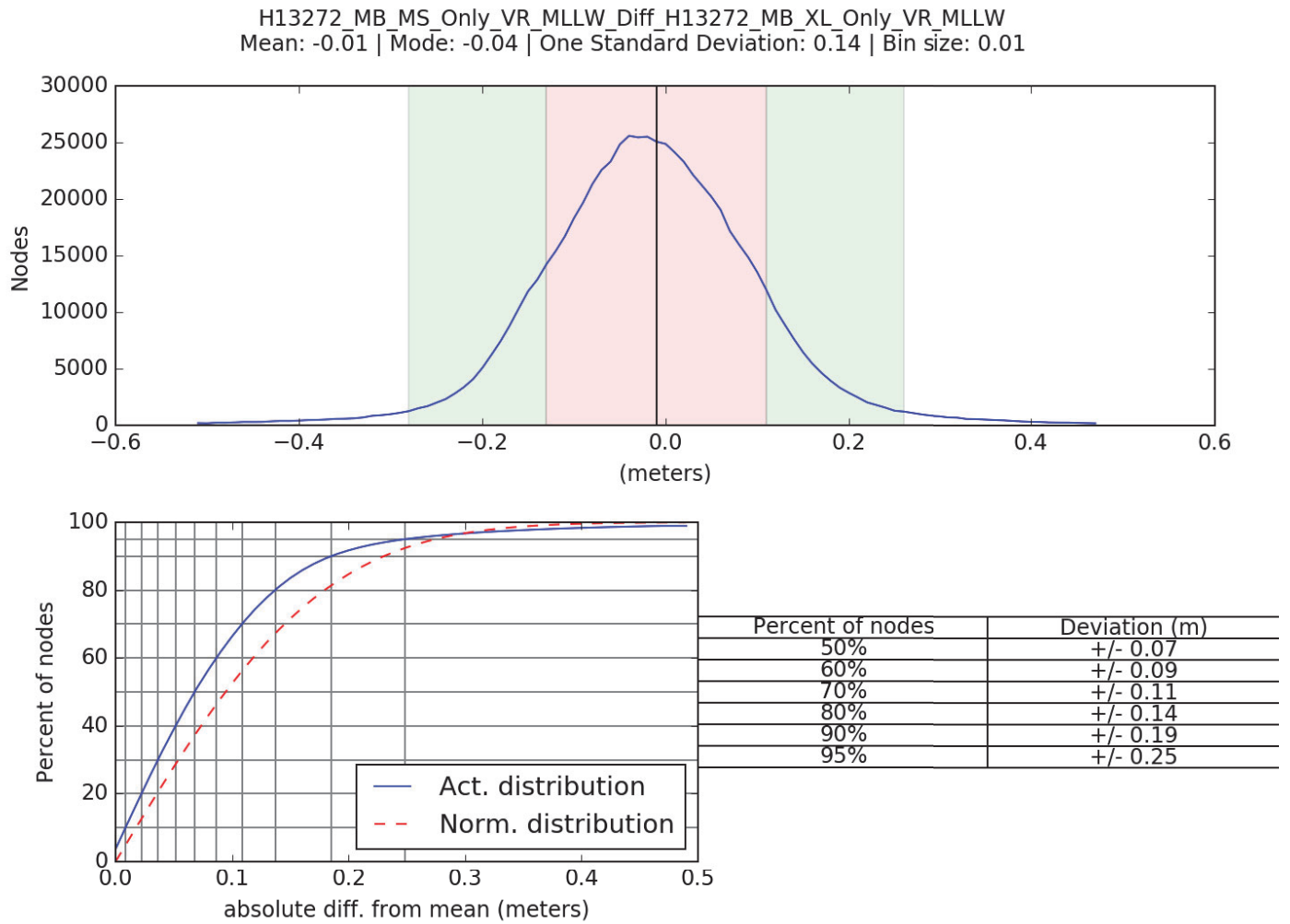


Figure 14: Pydro derived plot showing absolute difference statistics of H13272 mainscheme to crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0 meters	0.12 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
2801, 2803	3 meters/second	N/A	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13272 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 Ellipsoid Referenced Tidal Datum Model (ERTDM) was provided with the Project Instructions.

In addition to the usual a priori estimates, 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 associated with vessel position and attitude were applied in Caris HIPS using SBET and RMS files generated using POSpac MMS software.

Uncertainty values of the submitted finalized grid was calculated in Caris using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA within Pydro QC Tools 3 was used to analyze H13272 Total Vertical Uncertainty (TVU) compliance; a histogram plot of the results is shown below.

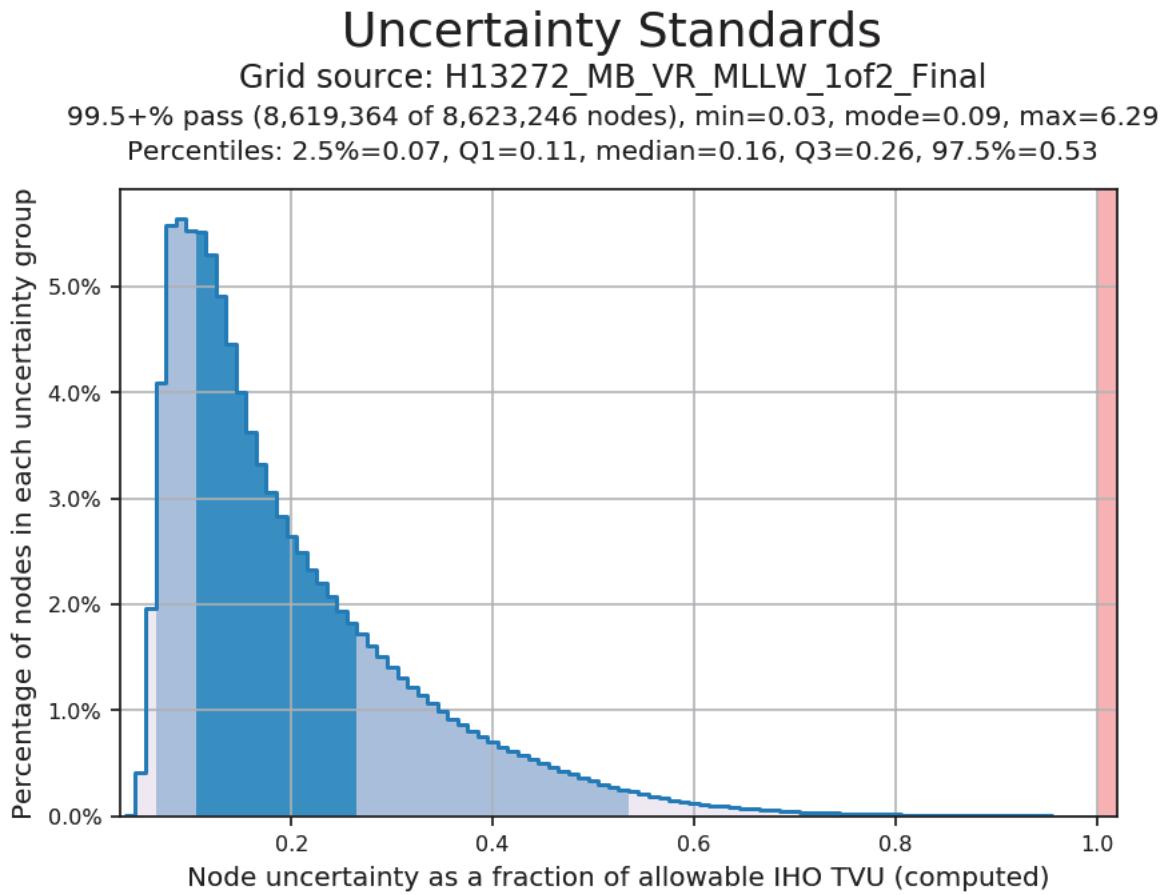


Figure 15: Pydro derived plot showing TVU compliance of H13272 finalized multi-resolution MBES data (main survey area).

Uncertainty Standards

Grid source: H13272_MB_VR_MLLW_2of2_Final

99.5+% pass (9,178 of 9,179 nodes), min=0.04, mode=0.15, max=1.82

Percentiles: 2.5%=0.09, Q1=0.13, median=0.17, Q3=0.22, 97.5%=0.39

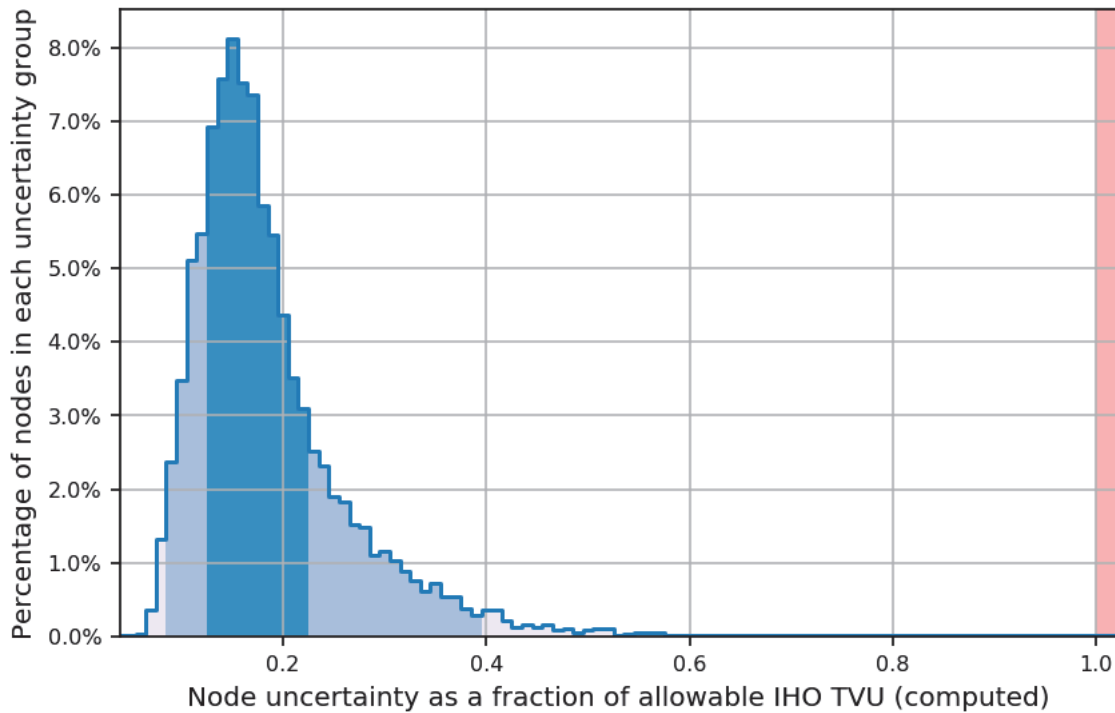


Figure 16: Pydro derived plot showing TVU compliance of H13272 finalized multi-resolution MBES data (northern shoal investigation area).

B.2.3 Junctions

There are no contemporary surveys that junction with this survey.

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: Twenty eight 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. Sound speed profiles were acquired using Sea-Bird Scientific SBE 19plus profilers. All casts were concatenated into a master file and applied using the "Nearest distance within Time" (4 hours) profile selection method within Caris.

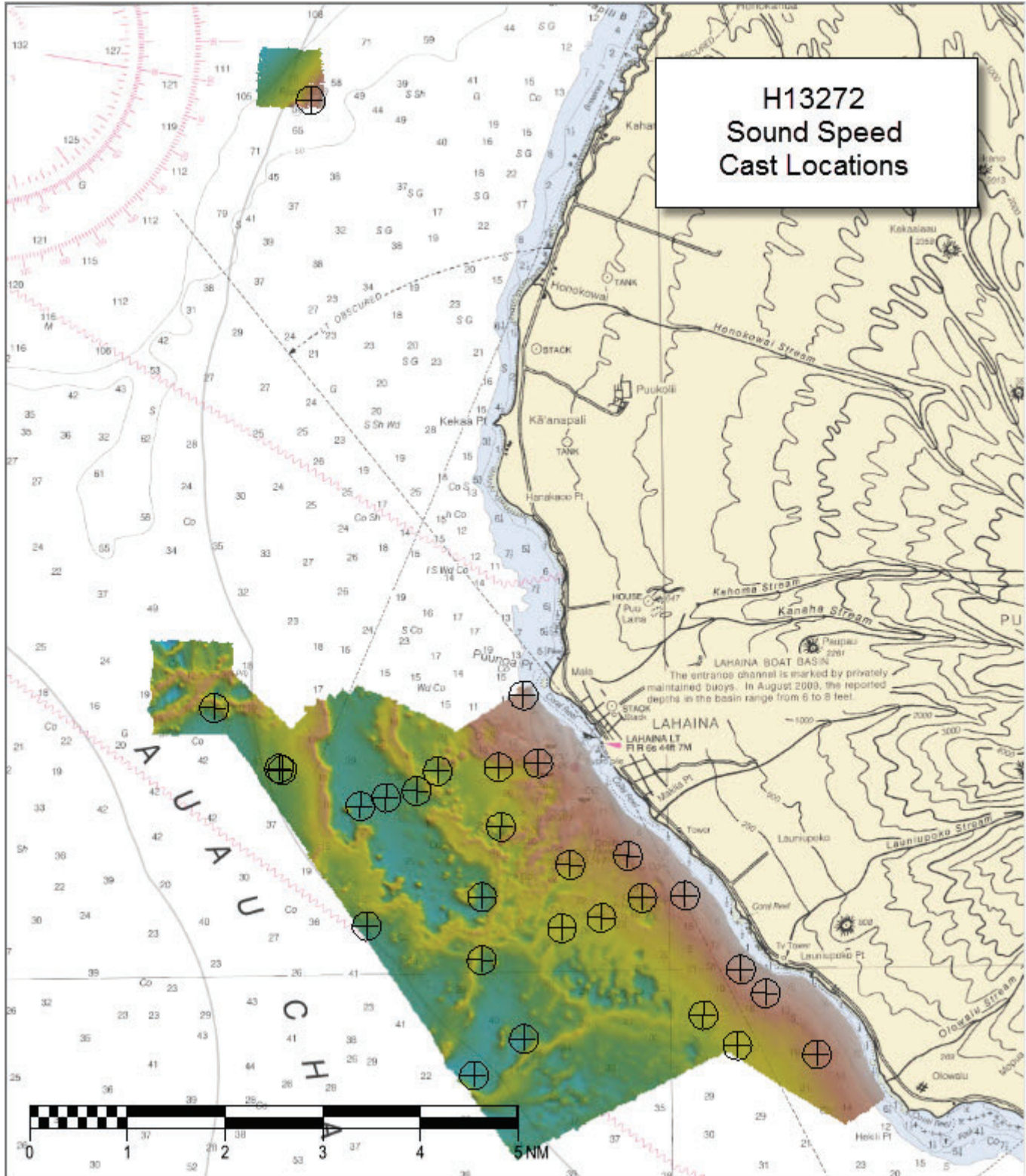


Figure 17: H13272 sound speed cast locations.

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 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 was acquired as .all files logged during MBES operations and subsequently processed by RAINIER personnel. The .GSF files created during processing and backscatter mosaics separated by vessel and frequency have been delivered with this report. Backscatter processing procedures are described in the DAPR.

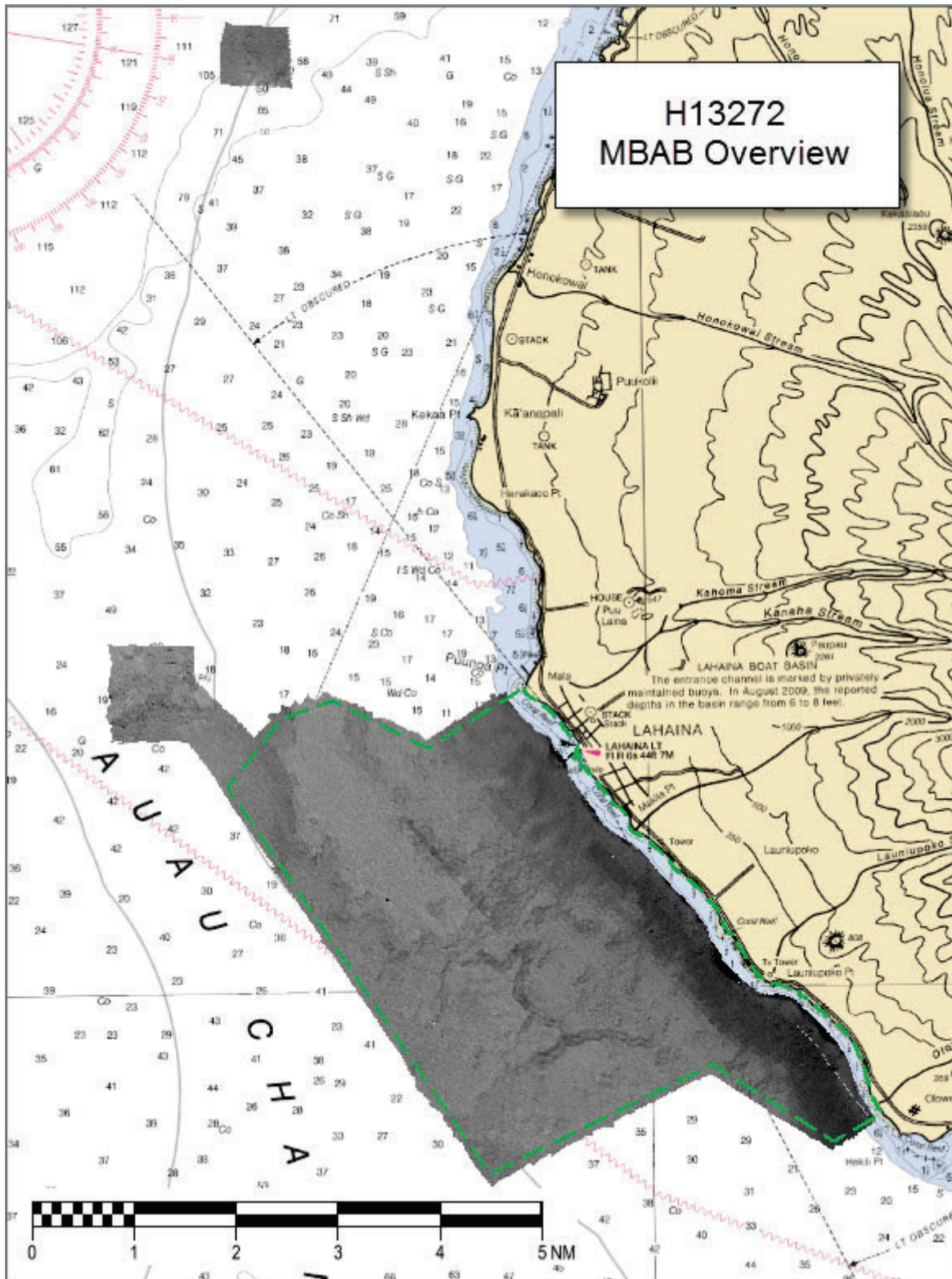


Figure 18: Overview of H13272 multibeam acoustic backscatter coverage (assigned sheet limits shown in green).

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	11.1.03

Table 9: 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 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2019v1.

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
H13272_MB_VR_MLLW_1of2	CARIS VR Surface (CUBE)	Variable Resolution	2.18 meters - 97.84 meters	NOAA_VR	Complete MBES
H13272_MB_VR_MLLW_1of2_Final	CARIS VR Surface (CUBE)	Variable Resolution	2.18 meters - 97.84 meters	NOAA_VR	Complete MBES
H13272_MB_VR_MLLW_2of2	CARIS VR Surface (CUBE)	Variable Resolution	97.88 meters - 204.76 meters	NOAA_VR	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13272_MB_VR_MLLW_2of2_Final	CARIS VR Surface (CUBE)	Variable Resolution	97.88 meters - 204.76 meters	NOAA_VR	Complete MBES

Table 11: Submitted Surfaces

Submitted surfaces were generated using NOAA recommended parameters for depth-based (Ranges) Caris variable-resolution bathymetric grids. One sounding was designated for an uncharted, non-dangerous wreck; the feature was included in the H13272 Final Feature File submitted with this report. No Dangers to Navigation were identified within the survey area.

Pydro QC Tools 3 Find Fliers (v8) program with default settings was used to identify sounding fliers in H13272 MBES data; no fliers were detected.

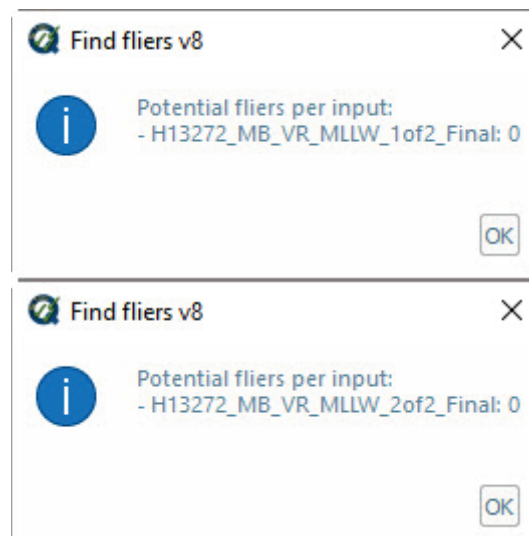


Figure 19: Screen grab of Pydro Find Fliers results of submitted H13272 VR surfaces.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying 2019 DAPR.

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 ERTDM	OPR-T383-RA-19_ERTDM_NAD83(2011)_MLLW_ext.csar

Table 12: ERS method and SEP file

Immediately following each H13272 MBES acquisition day, predicted tides were applied to the data using preliminary TCARI grid T383RA2019.tc. This was done solely to provide an initial vertical reference datum during QC analysis and preparation of the next day's survey launch materials. All submitted H13272 MBES data were reduced to MLLW using ERTDM processing methods. Final water levels were not requested and no other traditional vertical control steps were taken.

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 4.

The following PPK methods were used for horizontal control:

- RTX

Precise Positioning-Real Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS (8.2.1) software to produce SBETs for post-processing horizontal correction.

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control for this survey.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was made between H13272 survey data and Electronic Navigational Charts (ENC) US5HA24M and US4HA23M 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?
US5HA24M	1:15000	8	08/29/2017	08/29/2017	NO
US4HA23M	1:80000	15	08/03/2018	09/27/2019	NO

Table 13: Largest Scale ENCs

US5HA24M

ENC US5HA24M covers all of H13272 with the exception of a small triangular shaped area of 0.06 square nautical miles located at the western most extent of the sheet (Figure 20).

The seafloor within the H13272 survey area is highly dynamic, especially in the more offshore areas. As expected, there were numerous inconsistencies between H13272 complete coverage MBES data and NOS charting products that used historic, partial bottom coverage data. Figure 21 illustrates the differences between the 30-fathom depth areas derived from H13272 data and the 30-fathom depth curves found on ENC US5HA24M. There is general overall agreement but significant discrepancies exist between the two data sets.

The ENC (US5HA24M) 20-fathom depth curve and the H13272 20-fathom contour generally agree, although the survey derived contour is inshore of the ENC by up to 300 meters in some areas. The ENC also displays several small 20-fathom areas well to the west of any 20-fathom depths identified by H13272 data (Figure 22).

Figure 23 illustrates that the ENC 10-fathom depth curve and H13272 derived contours are in close agreement; the survey 10-fathom contour is slightly inshore of the charted position. Similarly, the ENC 5-fathom depth curve and H13272 5-fathom contours show close agreement (Figure 24). Insufficient data

exists to perform a meaningful comparison of depths shoaler than 5-fathoms, however where H13272 MBES coverage extended to the 3-fathom range, it agreed closely with the ENC (Figure 25).

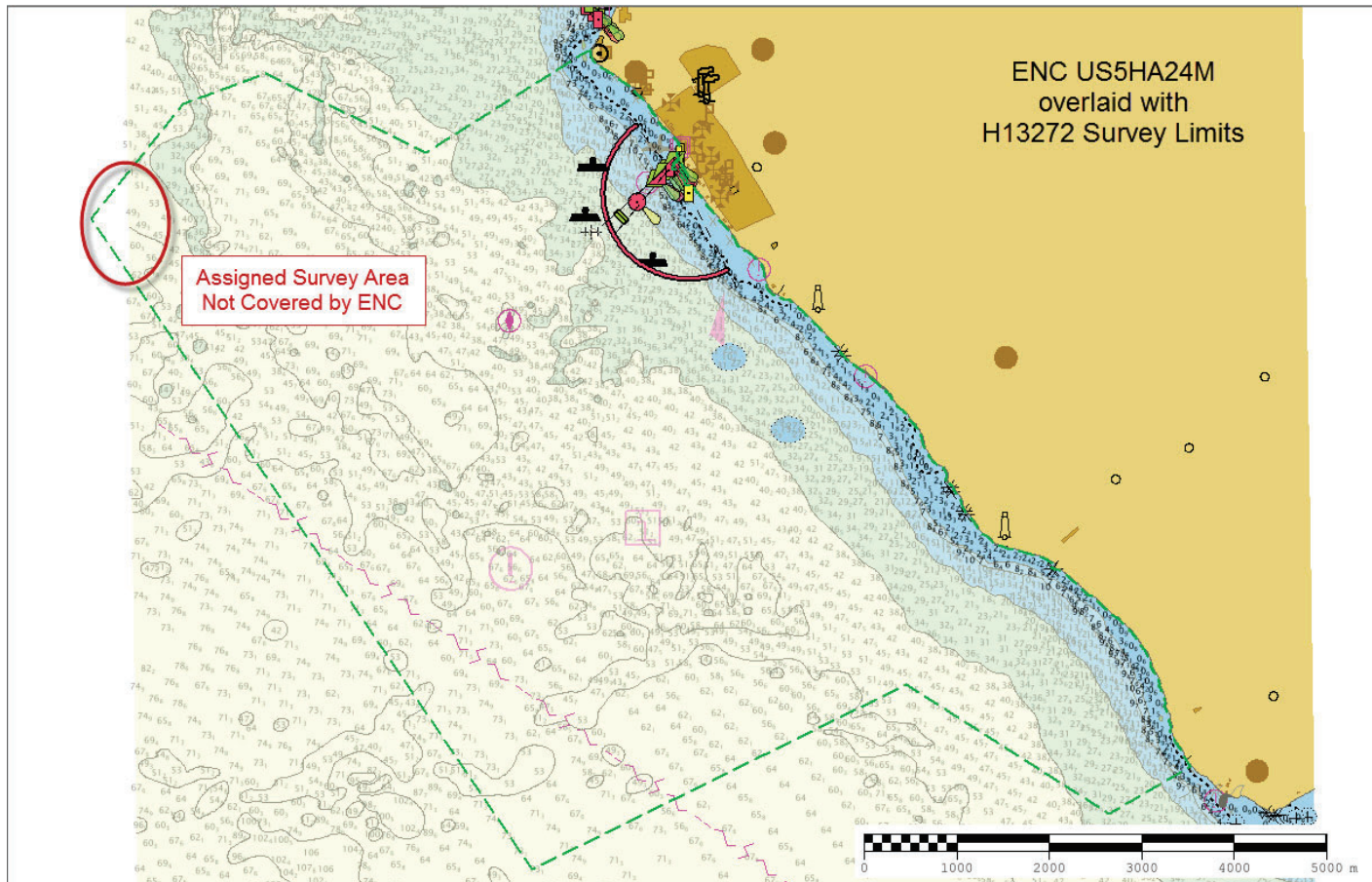


Figure 20: ENC US5HA24M overlaid with H13272 survey limits (dashed green line). The area not covered by ENC is circled in red.

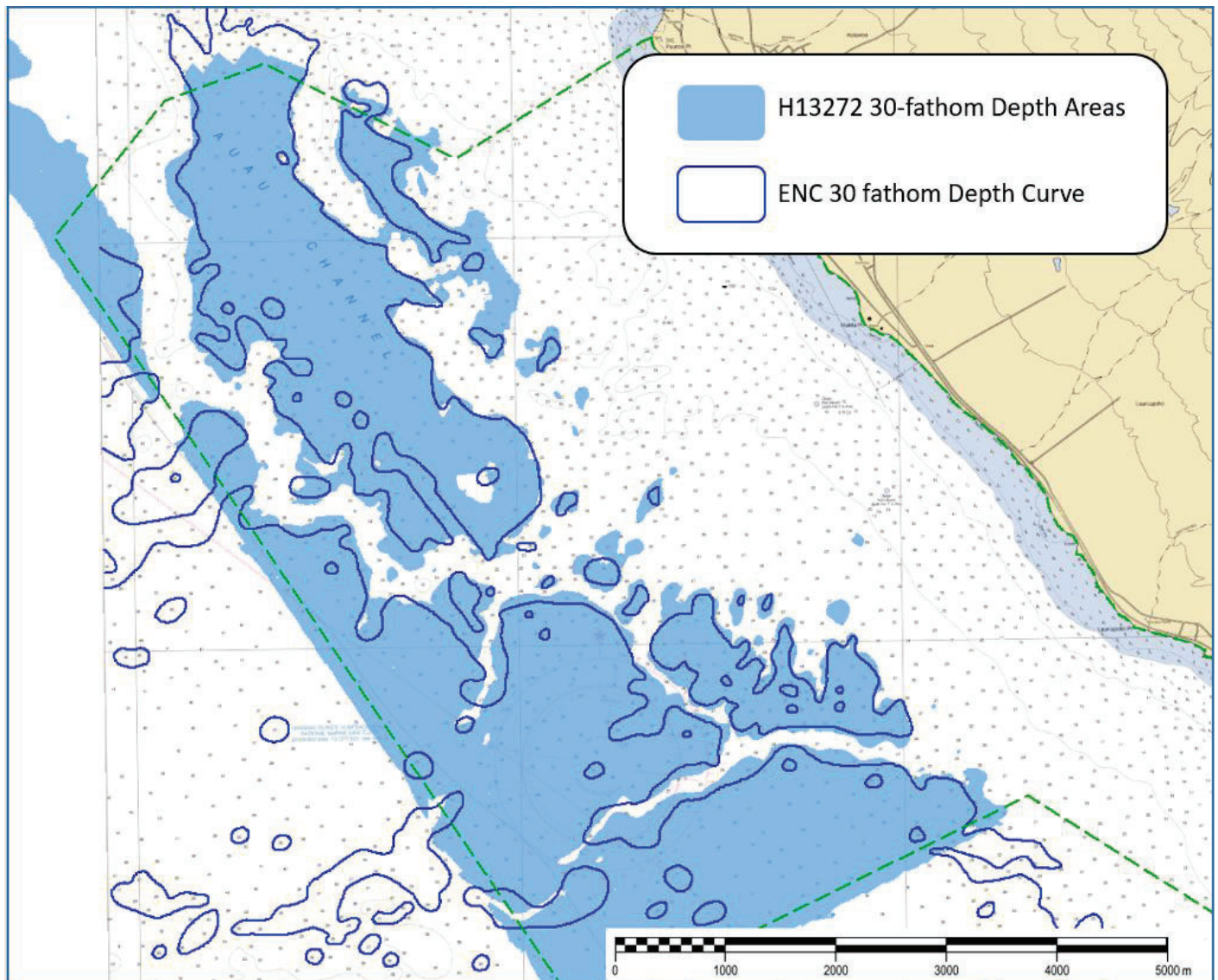


Figure 21: ENC US5HA24M 30-fathom depth curves (dark blue outline) overlaid on H13272 30-fathom depth areas (light blue solid fill). Assigned sheet limits shown as dashed green line, Chart 19348.

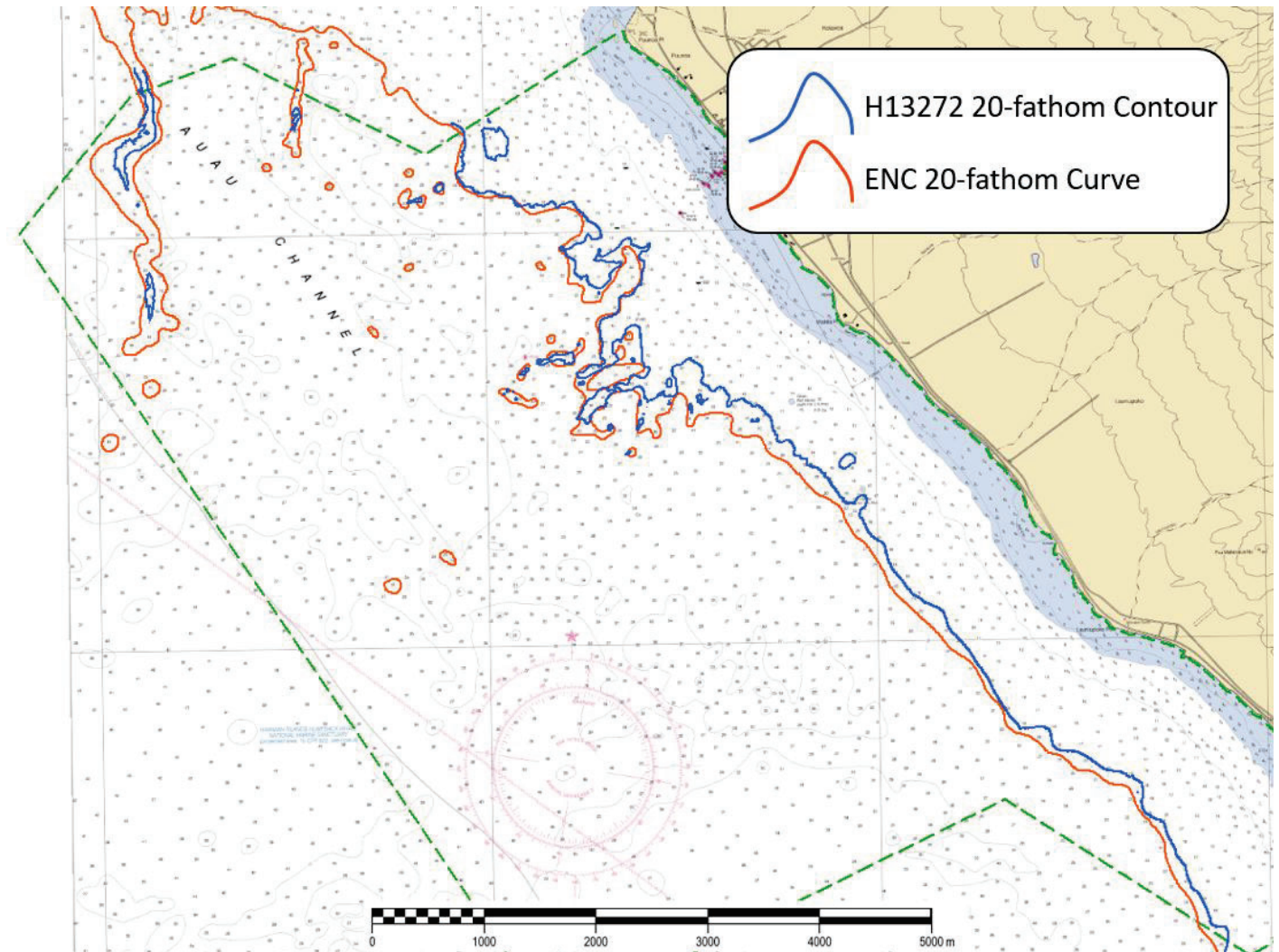


Figure 22: ENC US5HA24M 20-fathom depth curve (orange) and H13272 20-fathom contour (blue) overlaid on Chart 19348. Assigned sheet limits shown as dashed green line.

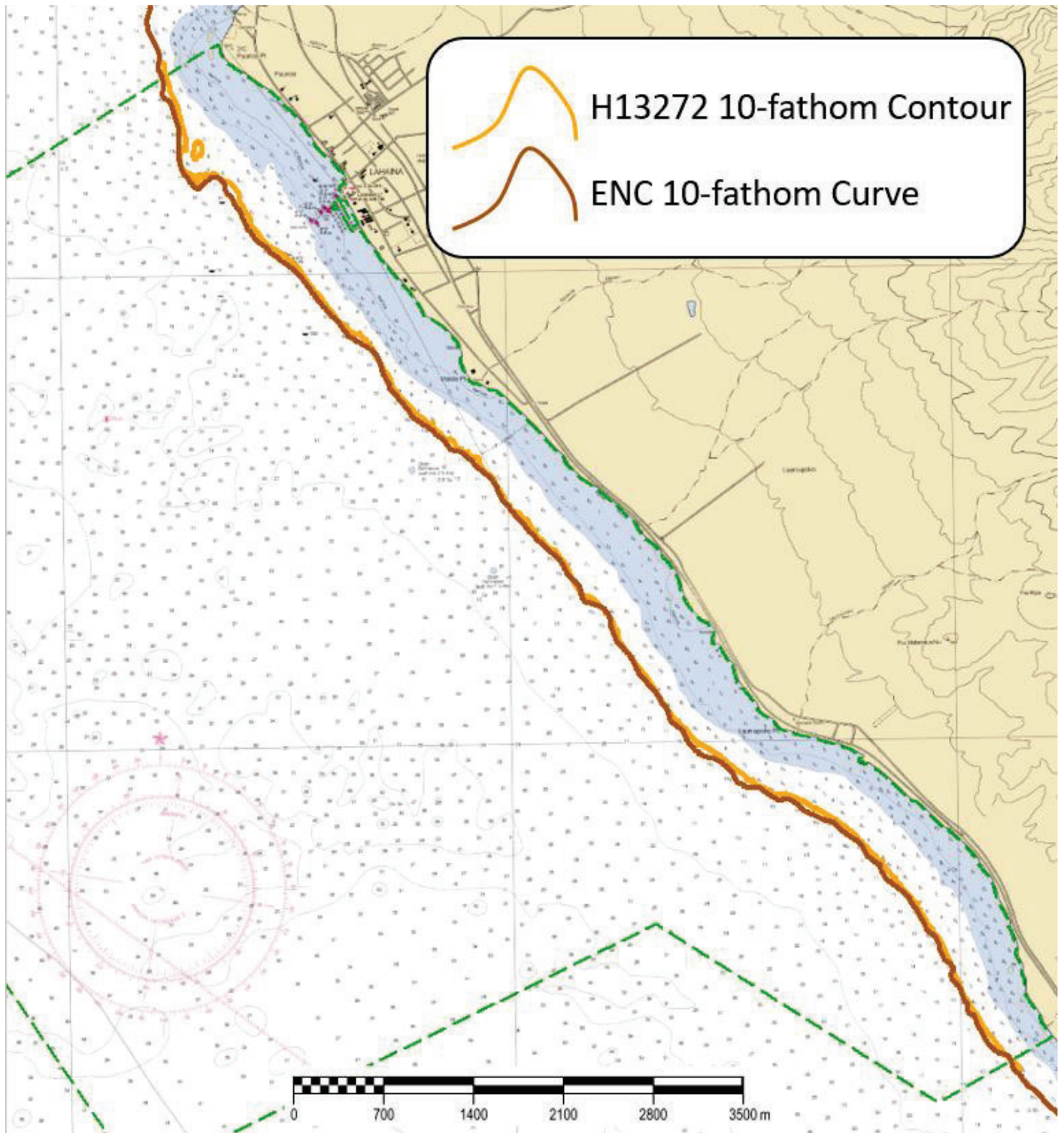


Figure 23: ENC US5HA24M 10-fathom depth curve (brown) and H13272 10-fathom contour (gold) overlaid on Chart 19348.

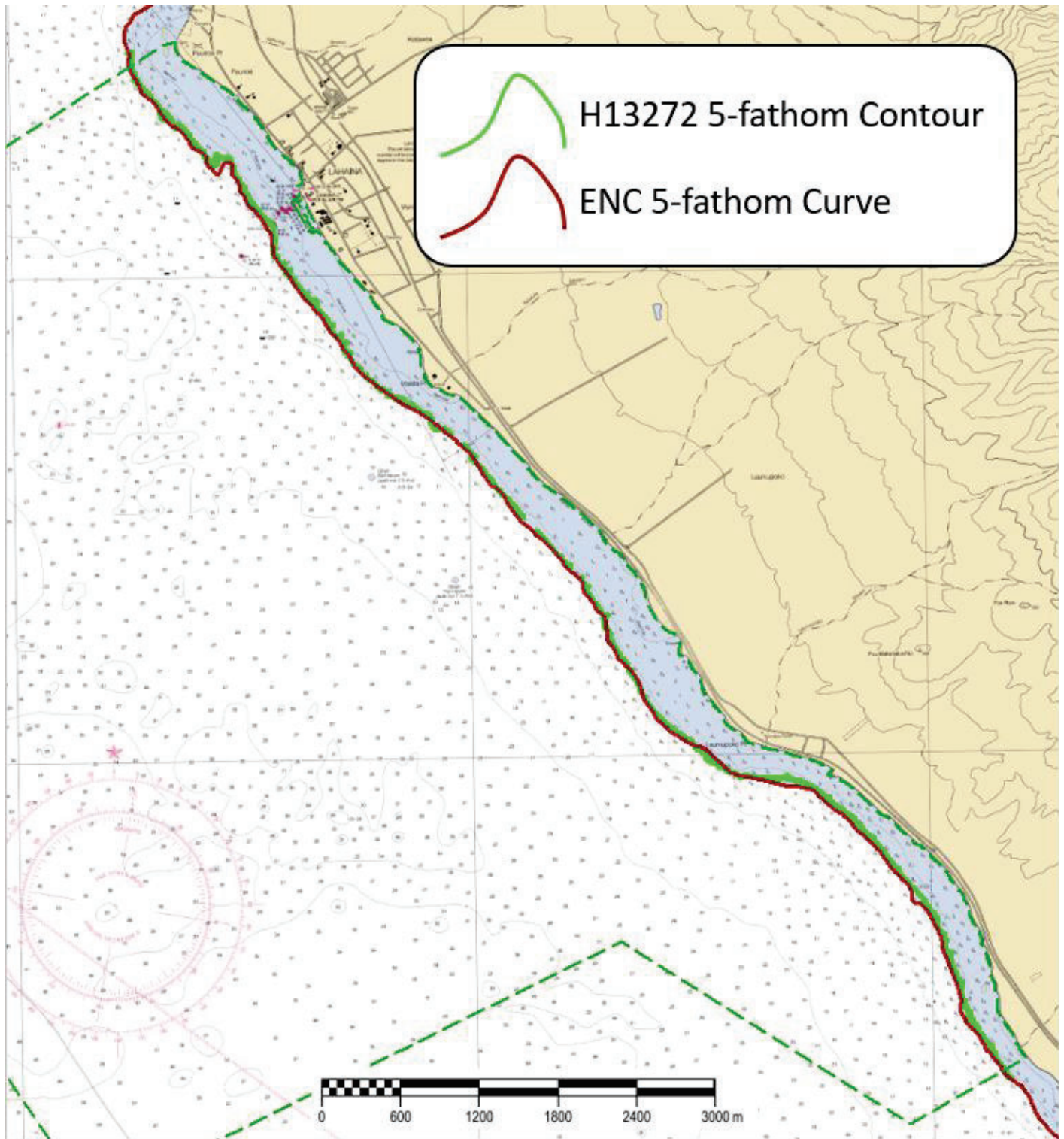


Figure 24: ENC US5HA24M 5-fathom depth curve (red) and H13272 5-fathom contour (bright green) overlaid on Chart 19348. Assigned sheet limits shown as dashed green line.

ENC US4HA23M covers the small area of H13272 not included on ENC US5HA24M and the additional shoal investigation areas located to the north and west. Within the northern-most shoal investigation area, H13272 complete MBES coverage disproved the 18-fathom shoal reported in 1957 and the corresponding 50-fathom depth curve; the actual depths in the area are approximately 90 to 96-fathoms (Figure 26). The H13272 derived 100-fathom depth contour in this area closely agreed with the ENC 100-fathom curve located approximately 30 meters northwest.

H13272 complete MBES coverage disproved the two 12-fathom shoals reported in 2006 located northwest of the originally assigned survey area. Least depths over the 2006 reported PA shoals were approximately 18-fathoms (Figures 27-28). There are no charted depth curves included on the ENC within this shoal investigation area.

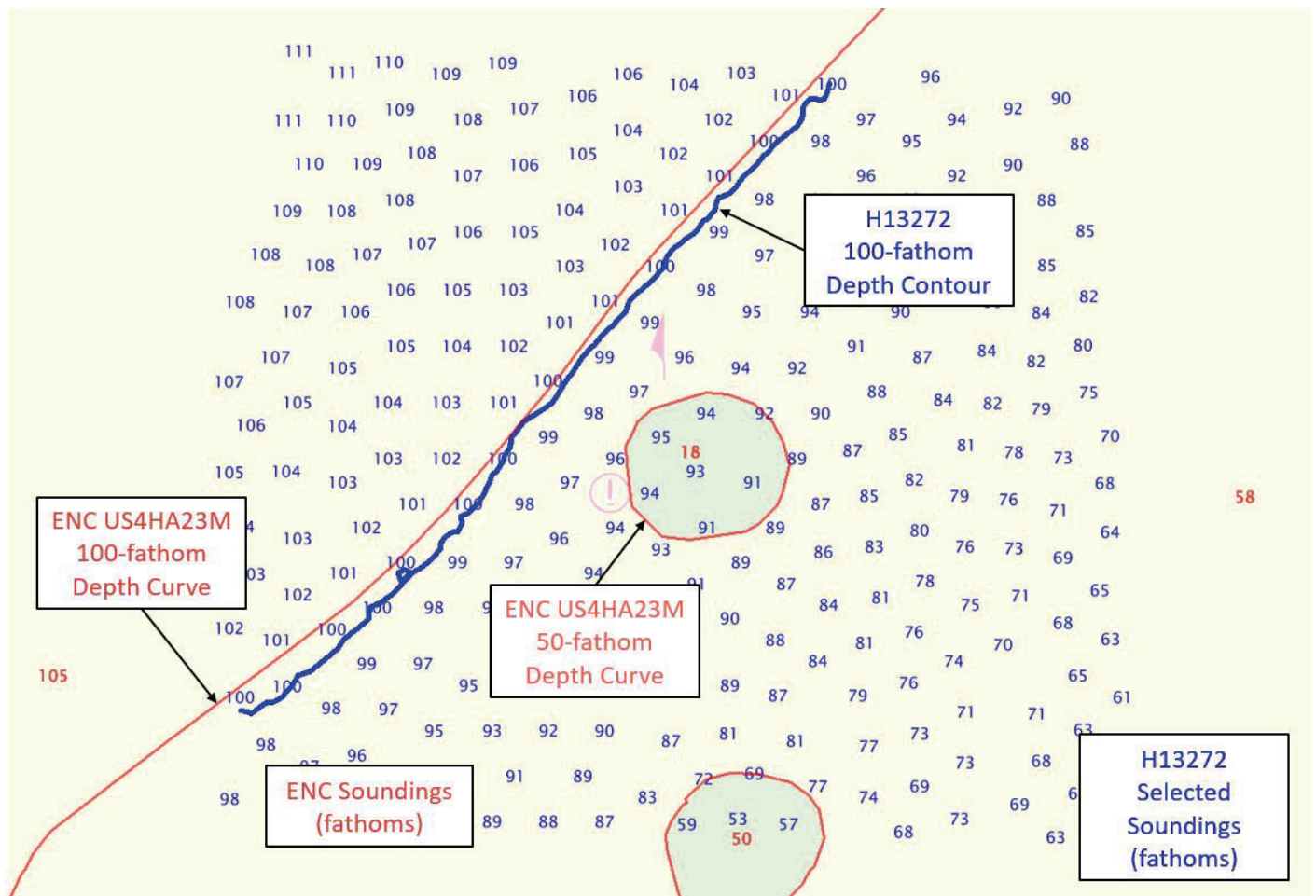


Figure 26: Section of ENC US4HA23M covering the northern shoal investigation area. H13272 derived 100-fathom depth contour and selected soundings are overlaid (shown in blue).

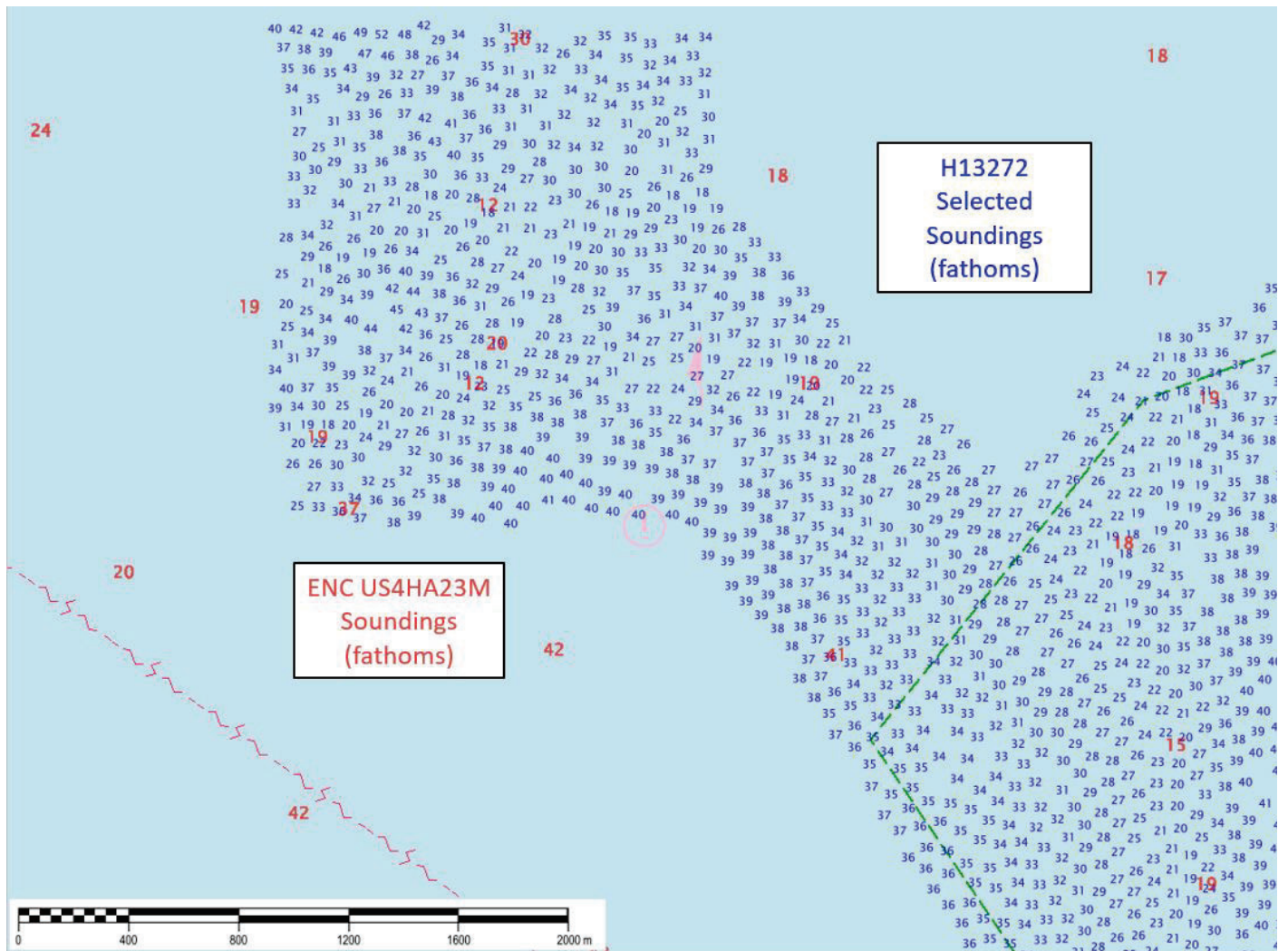


Figure 27: Section of ENC US4HA23M covering the northwestern shoal investigation area with H13272 selected soundings overlaid in blue.

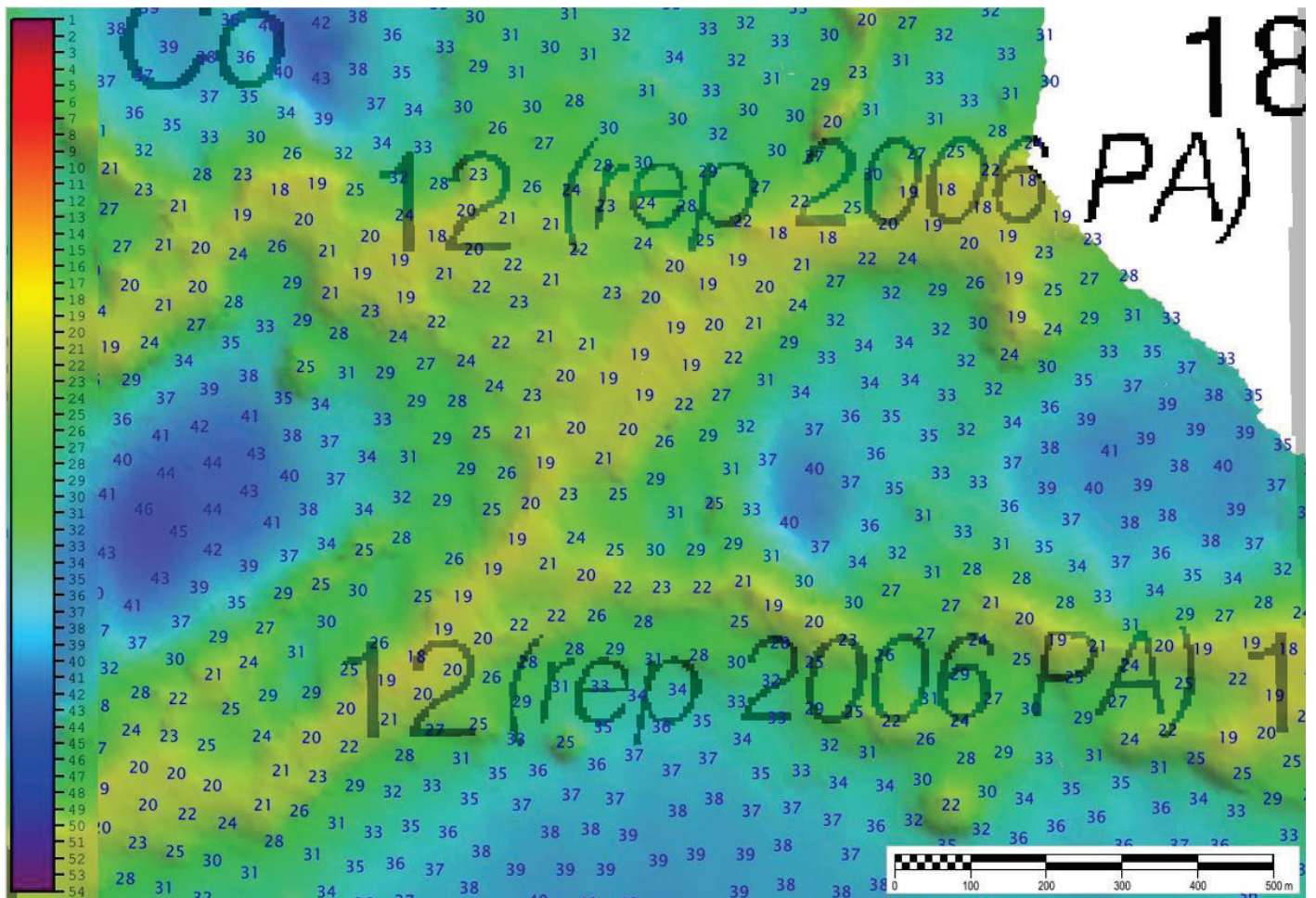


Figure 28: H13272 selected soundings and variable-resolution surface overlaid on Chart 19347. Note that least depth over both reported 12-fathom shoals is approximately 18-fathoms.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

Three reported shoal areas located outside the originally assigned survey limits, were investigated and are addressed in section D.1 of this report. One non-dangerous wreck, charted approximately 0.65 nautical miles southwest of the Lahaina boat basin, was not apparent in H13272 complete coverage MBES data (Figure 29).

A wreck charted as "showing any portion of hull or superstructure" was not visually apparent during H13272 survey operations (Figure 30). The charted location was inshore of the NALL, therefore no MBES coverage

was possible. Subsequent communication with the Lahaina Harbor Agent confirmed that the entire wreck was removed a few years ago. See Supplemental Correspondence for more information.

Lahaina Light, a prominent and picturesque lighthouse located on the Lahaina waterfront (Figure 31), is mischarted on ENC US5HA24M (Figure 32). The actual position should be approximately 388 meters north of its ENC position. Chart 19007 is indicated as the source for the feature; the scale of 19007 is 1:1,650,000. Positional accuracy of such a small-scale chart is not high and is the likely cause of the incorrect location for the light. RNC 19348 shows the actual position of Lahaina Light much more accurately (Figure 30). ENC US4HA23M shows the same incorrect position for Lahaina Light, but also mistakenly shows a land area point feature at the actual location of the Light. The H13272 Final Feature File addresses the positional discrepancy of the ATON. Notification of this error was made using ASSIST, the on-line system for reporting nautical chart errors to NOAA's Office of Coast Survey (see Supplemental Correspondence). The error has been corrected on NOS charting products.

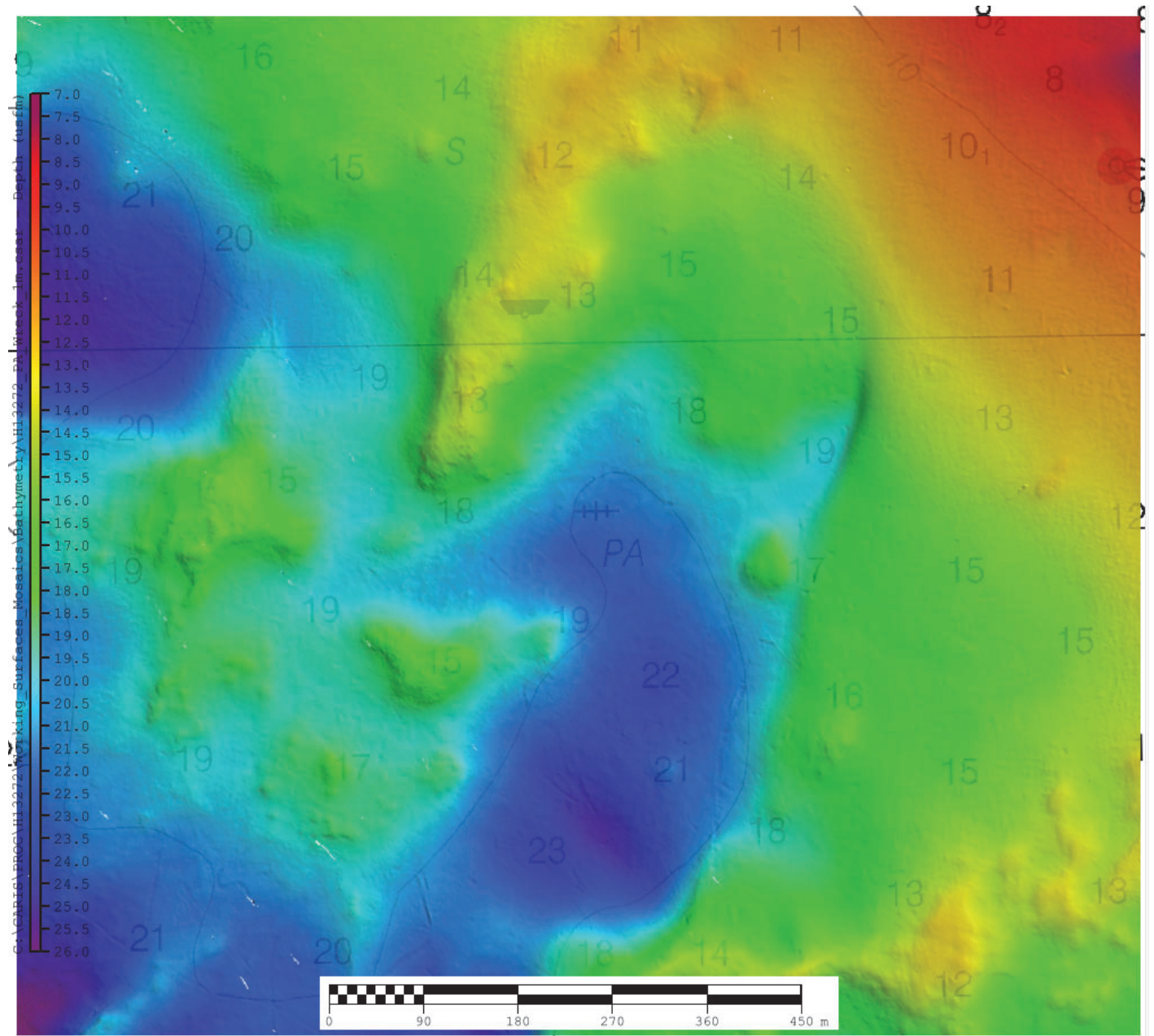


Figure 29: Section of Chart 19348 showing location of wreck PA, overlaid with H13272 1-meter resolution surface. No indication of this offshore wreck was apparent.

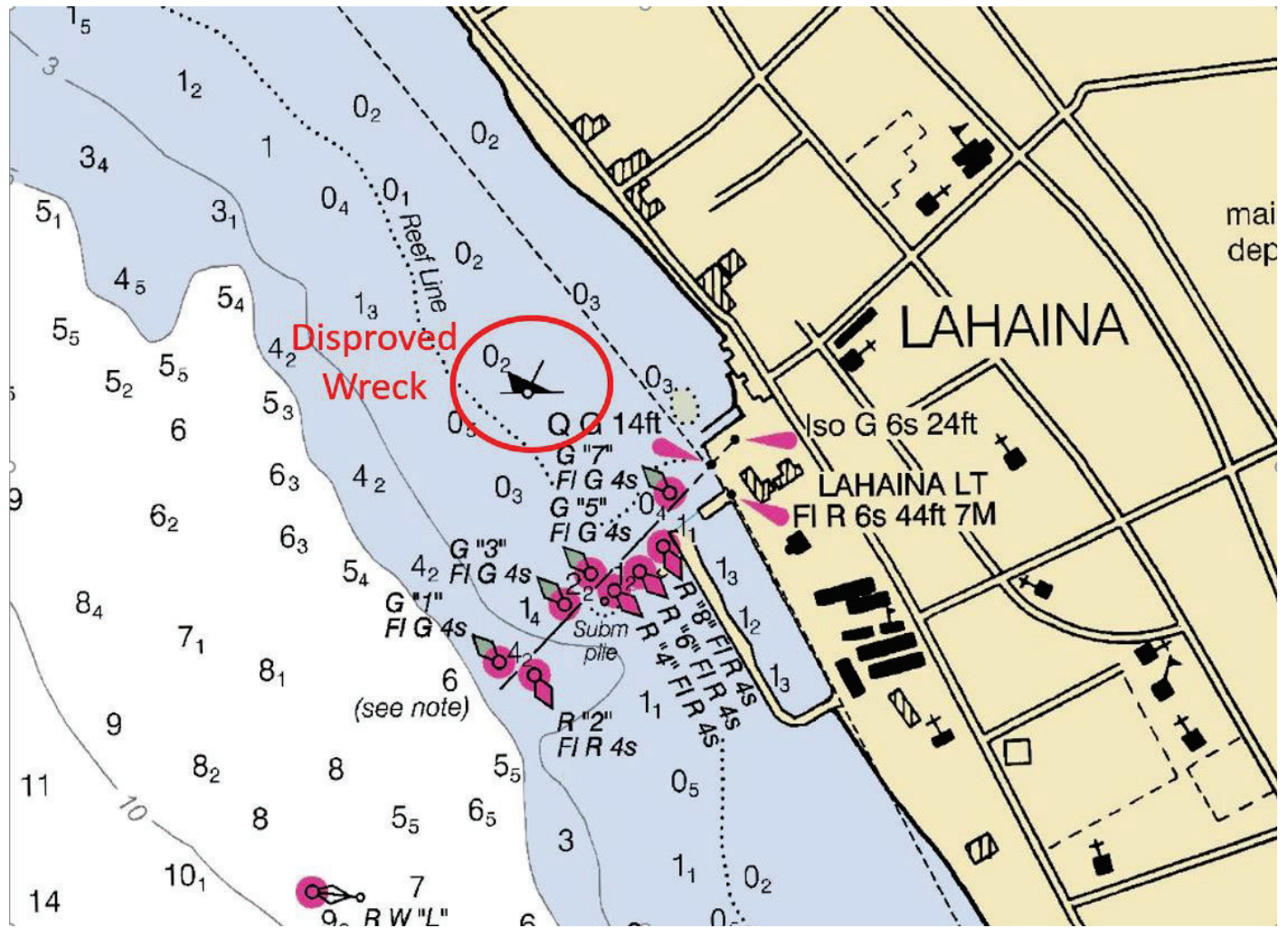


Figure 30: Lahaina Harbor Agent stated this charted wreck has been completely removed.

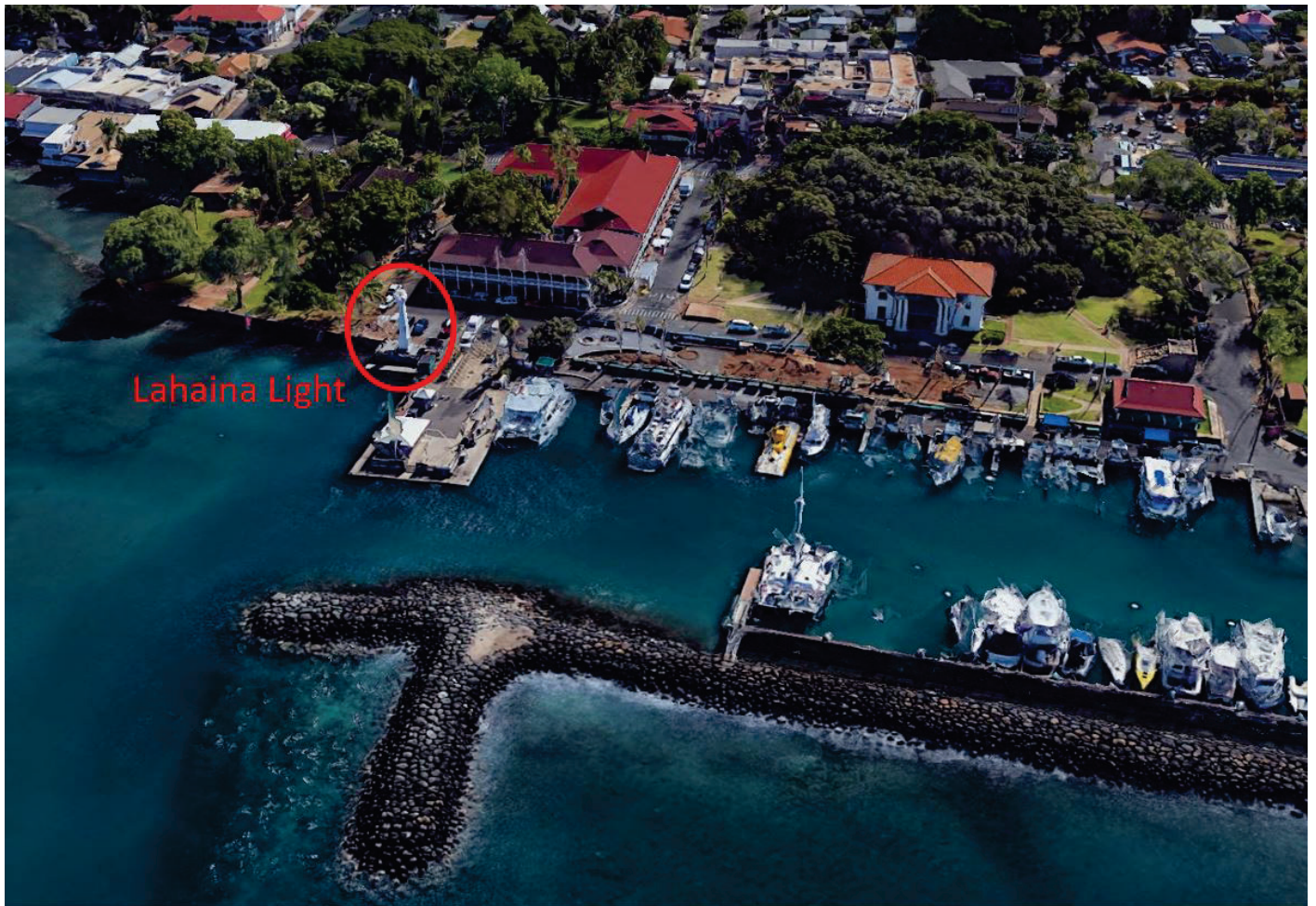


Figure 31: Lahaina Light as seen in Google Earth image.

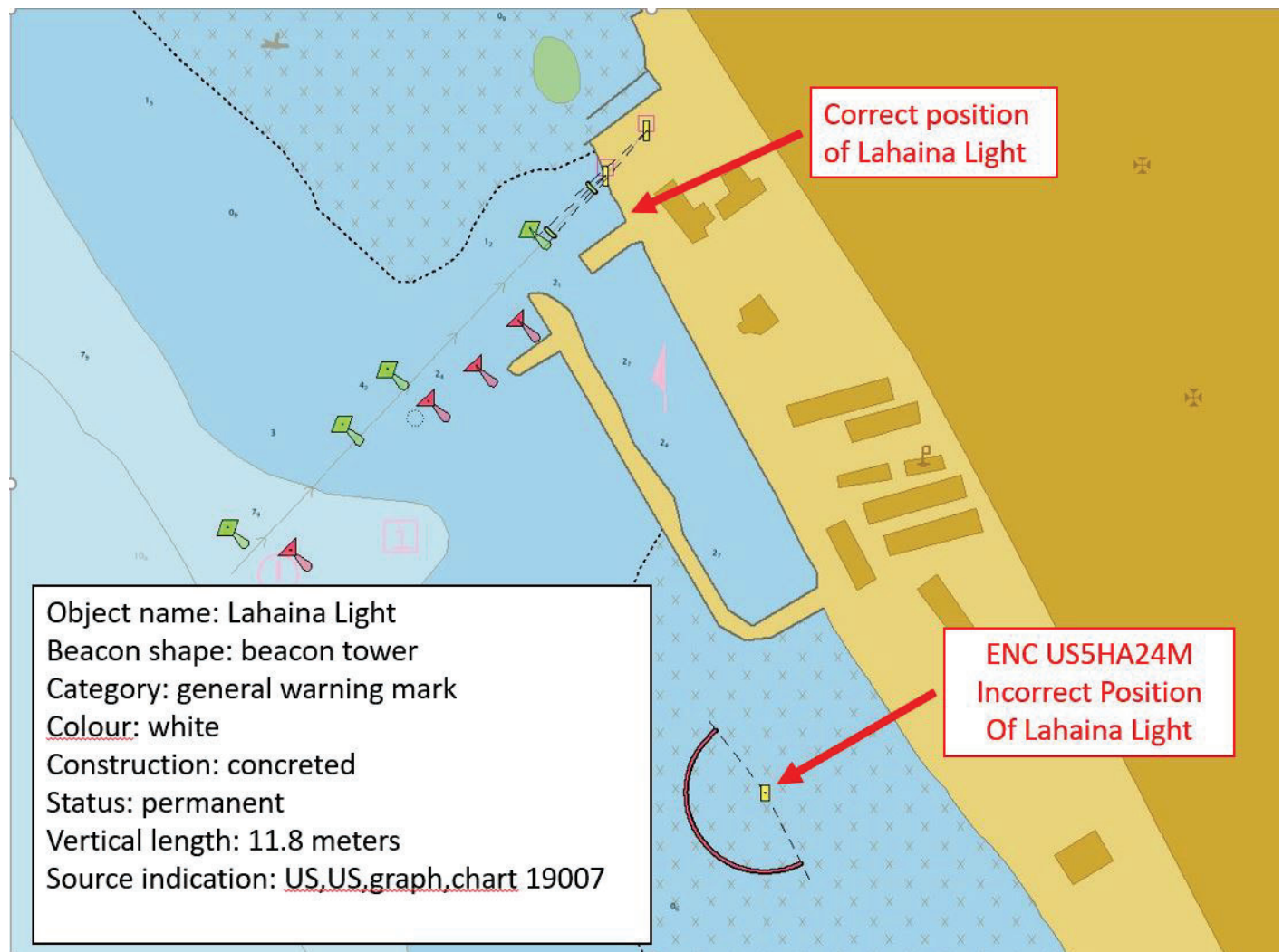


Figure 32: ENC US5HA24M showing incorrect position of Lahaina Light.

D.1.4 Uncharted Features

H13272 located an uncharted wreck between two charted fish havens, approximately 0.6 nautical miles south of Makila Point (Figure 33). The least depth of the 30-meter long wreck is 13-fathoms. The wreck appears to be well-known locally as it is regularly visited by commercial dive boats. The wreck is included in the H13272 Final Feature File submitted with this report.

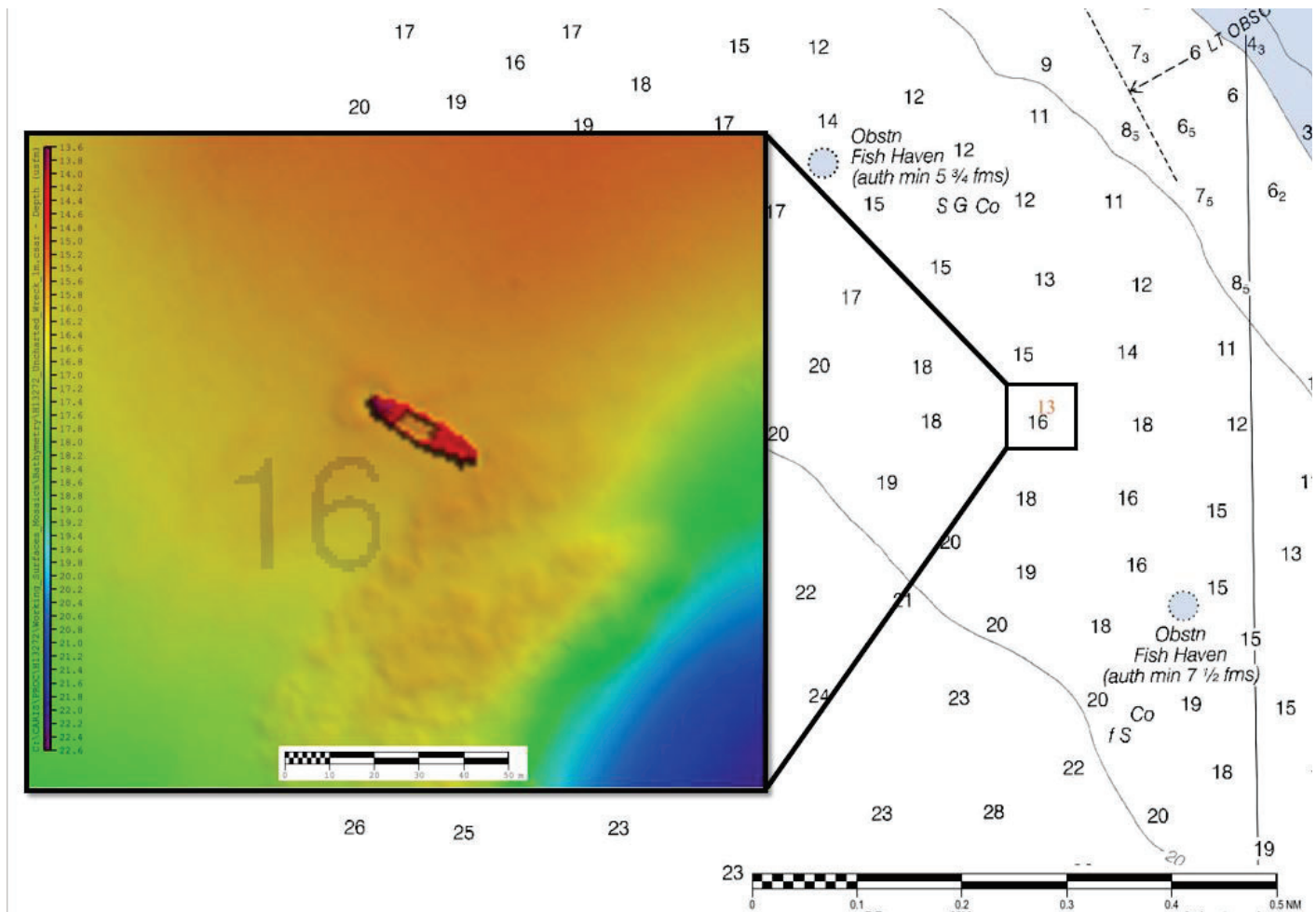


Figure 33: H13272 well-known uncharted wreck.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features were identified in the survey area that are not discussed elsewhere in this report or included in the H13272 Final Feature File.

D.1.6 Channels

NOS charting products for the vicinity of Lahaina include an information note that reads: "The entrance channel is marked by privately maintained buoys. In August 2009, the reported depths in the basin range from 6 to 8 feet (1.8 to 2.4 meters)." Most H13272 depths within the boat basin ranged from 9 to 11 feet. It should be noted that maneuverability was extremely restricted within Lahaina's confined and busy harbor, therefore survey operations within were significantly hampered.

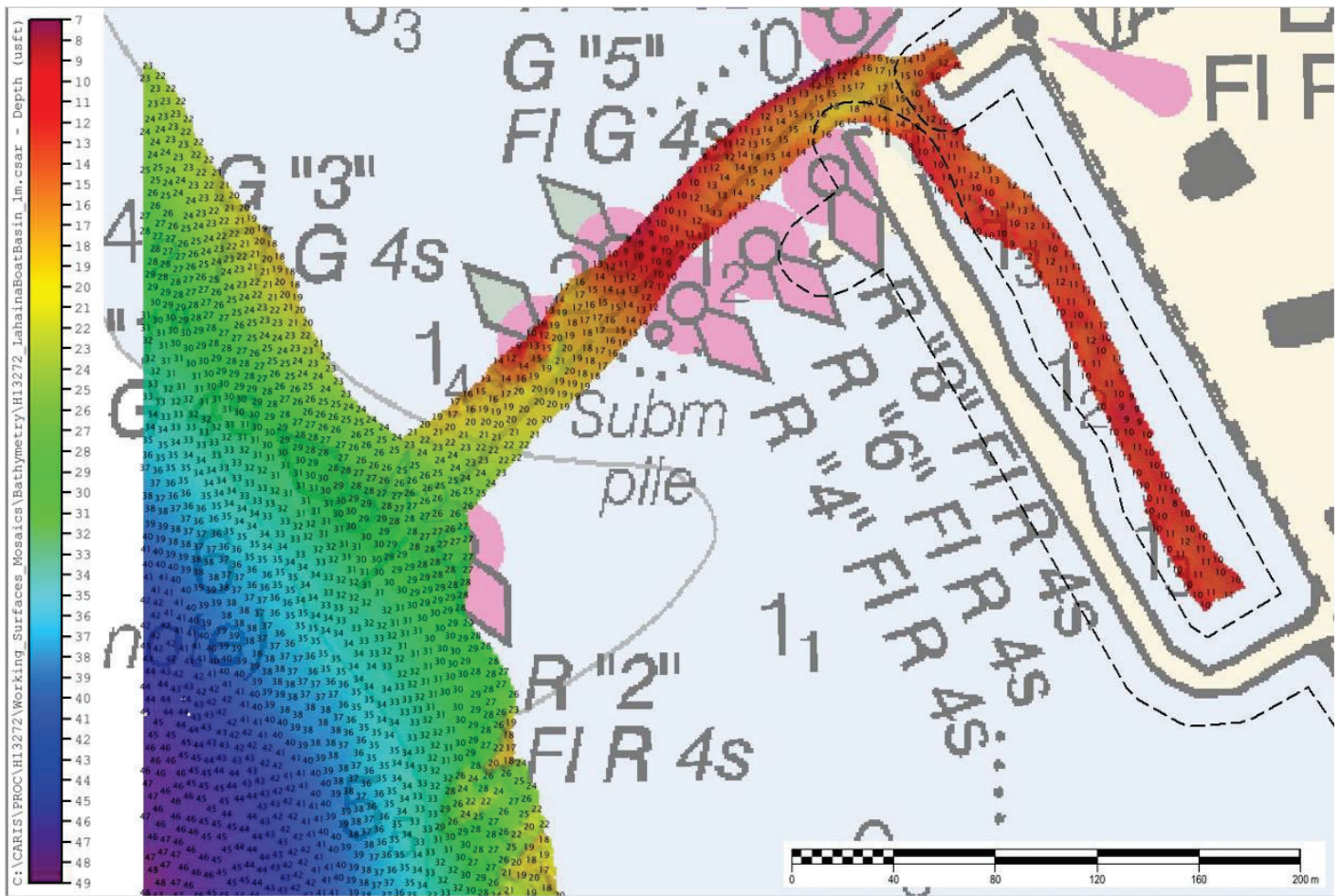


Figure 34: Chart 19348 overlaid with H13272 1-meter resolution MBES surface and selected soundings.

D.1.7 Bottom Samples

Bottom samples were not required for this survey.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was conducted within the H13272 survey area using the Composite Source File (CSF) provided by NOAA HSD Operations Branch. In the field, all assigned features that were deemed safe to approach, were addressed as required with S-57 attribution and recorded in the H13272 Final Feature File (FFF) to best represent features at chart scale. This file also includes new features found in the field as well as recommendations to update, retain or delete assigned features. Features that were unsafe to approach were attributed in the FFF as Not Addressed and the reason stated.

D.2.2 Aids to Navigation

The Lahaina boat basin entrance channel is marked by privately maintained buoys; their position and status appear more subject to change than do USCG navigation aids. Mariners operating in the Lahaina boat basin are advised to seek local knowledge of the area. Further information regarding ATONs within the survey area is included in the H13272 Final Feature File submitted with this report.



Figure 35: Outbound view of privately maintained buoys marking Lahaina entrance channel.

D.2.3 Overhead Features

No overhead features were observed within the survey area.

D.2.4 Submarine Features

A charted cable area extends approximately 2.7 nautical miles along the southwestern corner of the survey area. No indication of the cable was evident in H13272 MBES or MBAB data.

D.2.5 Platforms

No platforms were located in the survey area.

D.2.6 Ferry Routes and Terminals

There is daily scheduled ferry service across Auau Channel between Lahaina Harbor and Manele Harbor on the island of Lanai.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

Nearly the entire seafloor within H13272 display physical characteristics of potential interest to researchers in the fields of marine geology, seismology, benthic ecology and more.

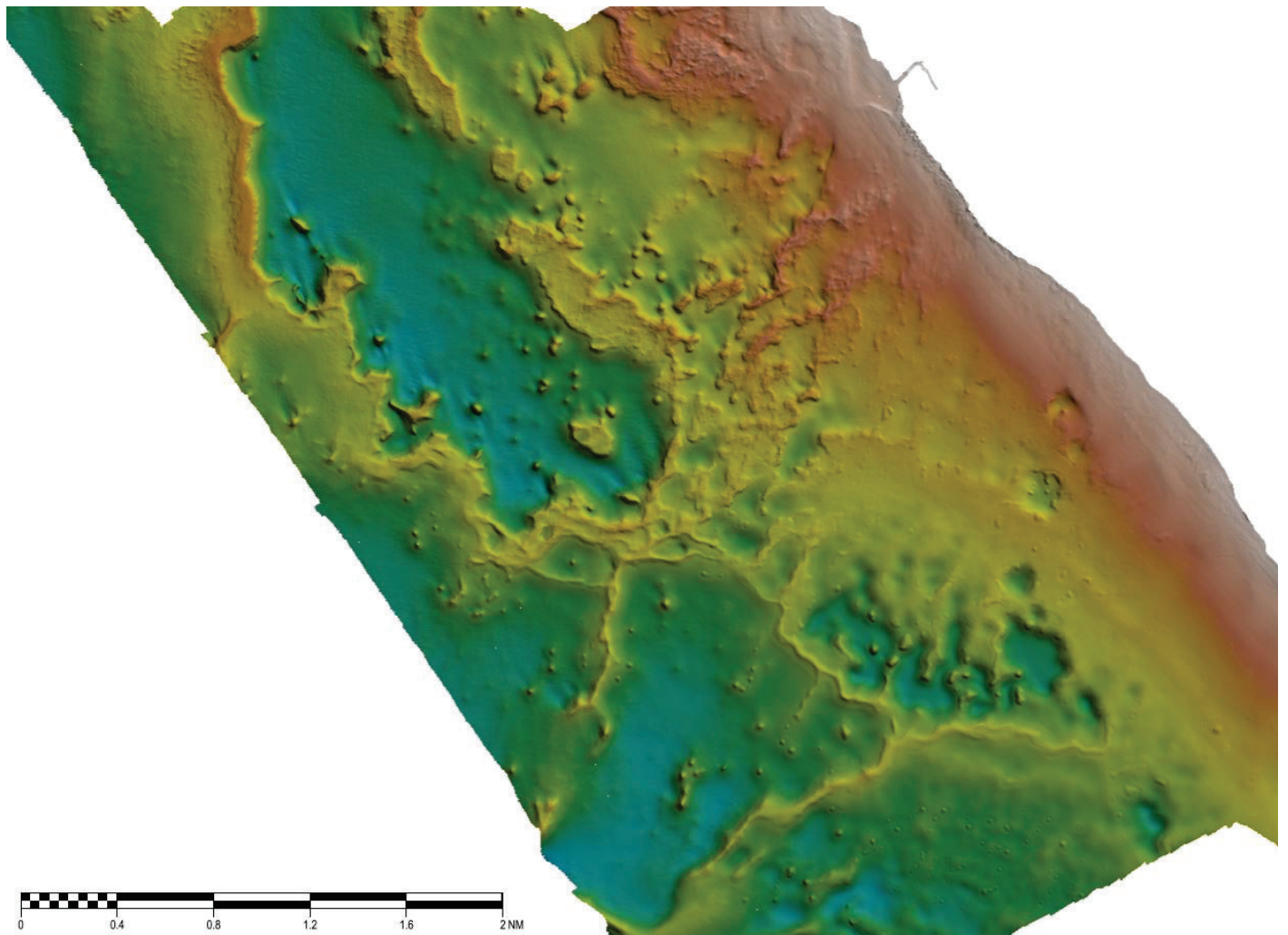


Figure 36: Section of seafloor within the H13272 survey area (4-meter resolution, vertical exaggeration = 3).

D.2.8 Construction and Dredging

No present or planned construction or dredging 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, CAPT/NOAA	Commanding Officer	11/13/2019	 Digitally signed by EVANS.BENJAMIN.K.123721 7094 Date: 2019.11.15 11:11:26 -08'00'
Hadley A. Owen, LT/NOAA	Field Operations Officer	11/13/2019	 Digitally signed by OWEN.HADLEY.ANNE.14 10967070 Date: 2019.11.14 09:05:35 -08'00'
James B. Jacobson	Chief Survey Technician	11/13/2019	 JACOBSON.JAMES.BRYAN.12 69664017 I have reviewed this document 2019.11.14 08:02:18 -08'00'
B.D. Jackson	Senior Survey Technician	11/13/2019	

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