F00774

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

DESCRIPTIVE REPORT

Type of Survey:	Natural Disaster Response
Registry Number:	F00774

LOCALITY

State(s):	Louisiana
General Locality:	Port Fourchon
Sub-locality:	Port Fourchon

2019

CHIEF OF PARTY
LT John Kidd

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**F00774**

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):	**Louisiana**
General Locality:	**Port Fourchon**
Sub-Locality:	**Port Fourchon**
Scale:	**10000**
Dates of Survey:	**07/15/2019 to 07/17/2019**
Instructions Dated:	**07/11/2019**
Project Number:	**S-K920-NRT1-19**
Field Unit:	**NOAA Navigation Response Team - Stennis**
Chief of Party:	**LT John Kidd**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar**
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 F00774

Project: S-K920-NRT1-19

Locality: Port Fourchon

Sublocality: Port Fourchon

Scale: 1:10000

July 2019 - July 2019

NOAA Navigation Response Team - Stennis

Chief of Party: LT John Kidd

A. Area Surveyed

The survey area is located in LaFourche Parish within the sub locality of Port Fourchon.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
29° 9' 26.51" N 90° 14' 2.52" W	29° 3' 37.72" N 90° 11' 4.11" W

Table 1: Survey Limits

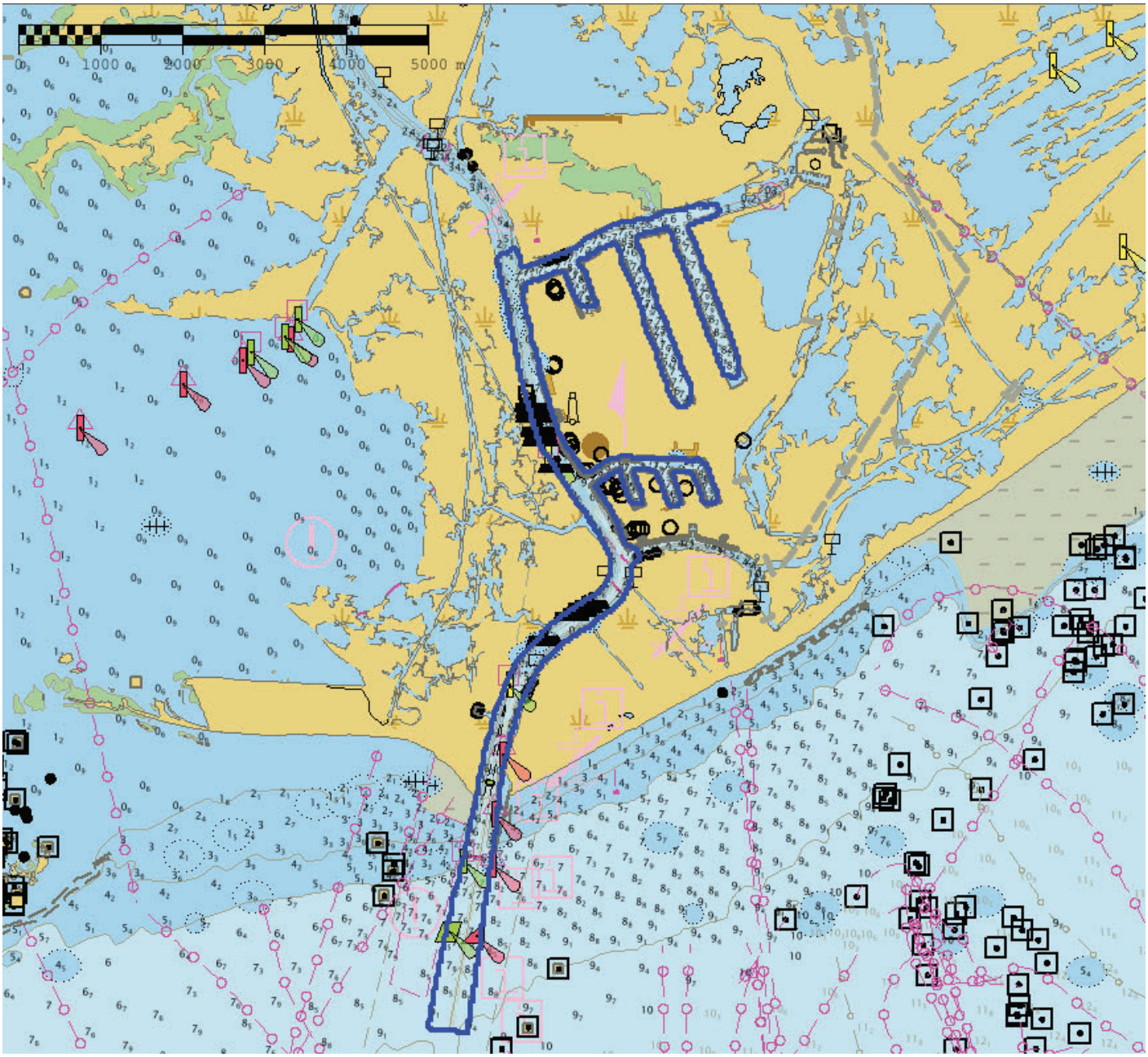


Figure 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the April 2018 NOS Hydrographic Surveys Specifications and Deliverables (HSSD). In all areas where the 3.5 meter depth contour or the sheet limits were not met, the Navigable Area Limit Line (NALL) was defined as the inshore limit of bathymetry due to the risks of maneuvering the survey vessel in close proximity to the steep and rocky shoreline.

A.2 Survey Purpose

The purpose of this survey is to respond to a USCG request for hydrographic survey to reopen the channels in Port Fourchon, due to the effects of Tropical Storm Barry. The survey limits and methods (i.e., sensors used) will be determined by the Team Lead in consult with the NRB Chief and NOAA Navigation Manager. Data will be collected in the most efficient manner to provide USCG information that is critical to make real-time decisions on channel and/or port closures and openings. The data should be collected to meet NOAA nautical chart specification as stated in HSSD and the data will be evaluated for charting.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired for F00774 met (option B) Object Detection and were within CATZOC A1 TPU limits, as defined in the HSSD. This includes crosslines (see Section B.2), NOAA allowable uncertainty (see Section B.2), and density requirements.

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 coverage was in accordance with the requirements listed above and in the HSSD.

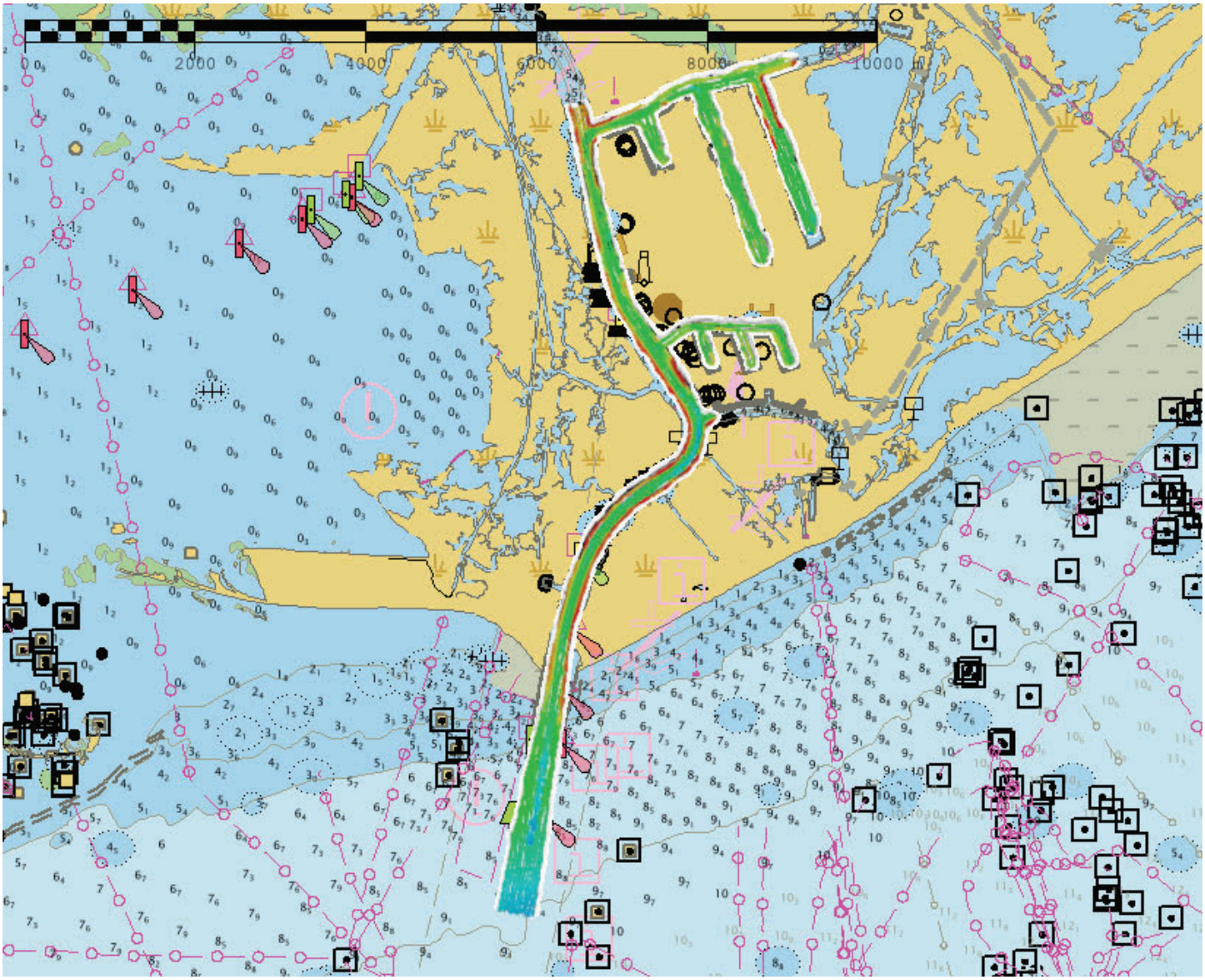


Figure 2: MBES and SSS coverage of Port Fourchon for F00774

A.6 Survey Statistics

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

	HULL ID	*S3005*	*Total*
LNM	**SBES Mainscheme**	0.00	0.00
	MBES Mainscheme	90.04	90.04
	Lidar Mainscheme	0.00	0.00
	SSS Mainscheme	94.71	94.71
	SBES/SSS Mainscheme	0.00	0.00
	MBES/SSS Mainscheme	0.00	0.00
	SBES/MBES Crosslines	7.77	7.77
	Lidar Crosslines	0.00	0.00
Number of Bottom Samples			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			0.759

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/15/2019	196
07/16/2019	197

Survey Dates	Day of the Year
07/17/2019	198

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the S-K920-NRT1-19 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	*S3005*
LOA	31 feet
Draft	1.5 feet

Table 5: Vessels Used

Figure 3: S3005

B.1.2 Equipment

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

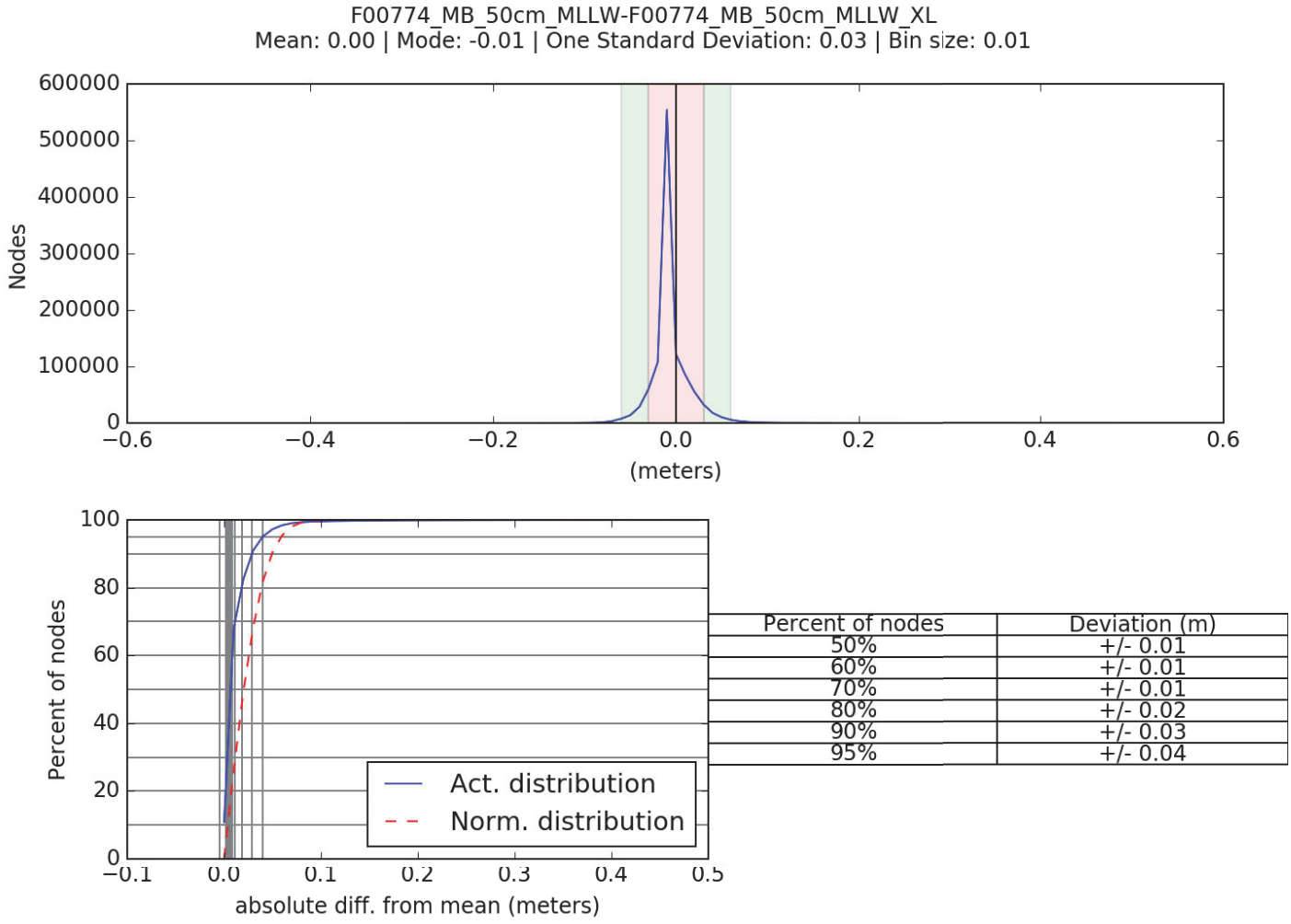
Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
EdgeTech	4125	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	MicroX SV	Sound Speed System
YSI	CastAway-CTD	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

7.77 LNM of crossline multibeam data were collected and 90.04 LNM of main scheme multibeam data were collected. This describes an 11.59 % ratio of crosslines to main scheme multibeam collected. 99.5% of the differences between the crossline multibeam depths and the main scheme multibeam depths do not exceed the Allowable Error Fraction. The Allowable Error Fraction is computed by dividing the observed difference by the IHO-based HSD maximum allowable error for soundings (TVUmax) scaled according to the variance sum law, assuming independent, identically distributed observations. The results automatically handle the TVUmax 100-m depth switchover point for using IHO Order 1a (0-100m) or IHO Order 2a (100m+).



Percent of nodes	Deviation (m)
50%	+/- 0.01
60%	+/- 0.01
70%	+/- 0.01
80%	+/- 0.02
90%	+/- 0.03
95%	+/- 0.04

Figure 4: Distribution of the differences, between the crossline multibeam CUBE depth surface and the main scheme multibeam CUBE depth surface, about the mean

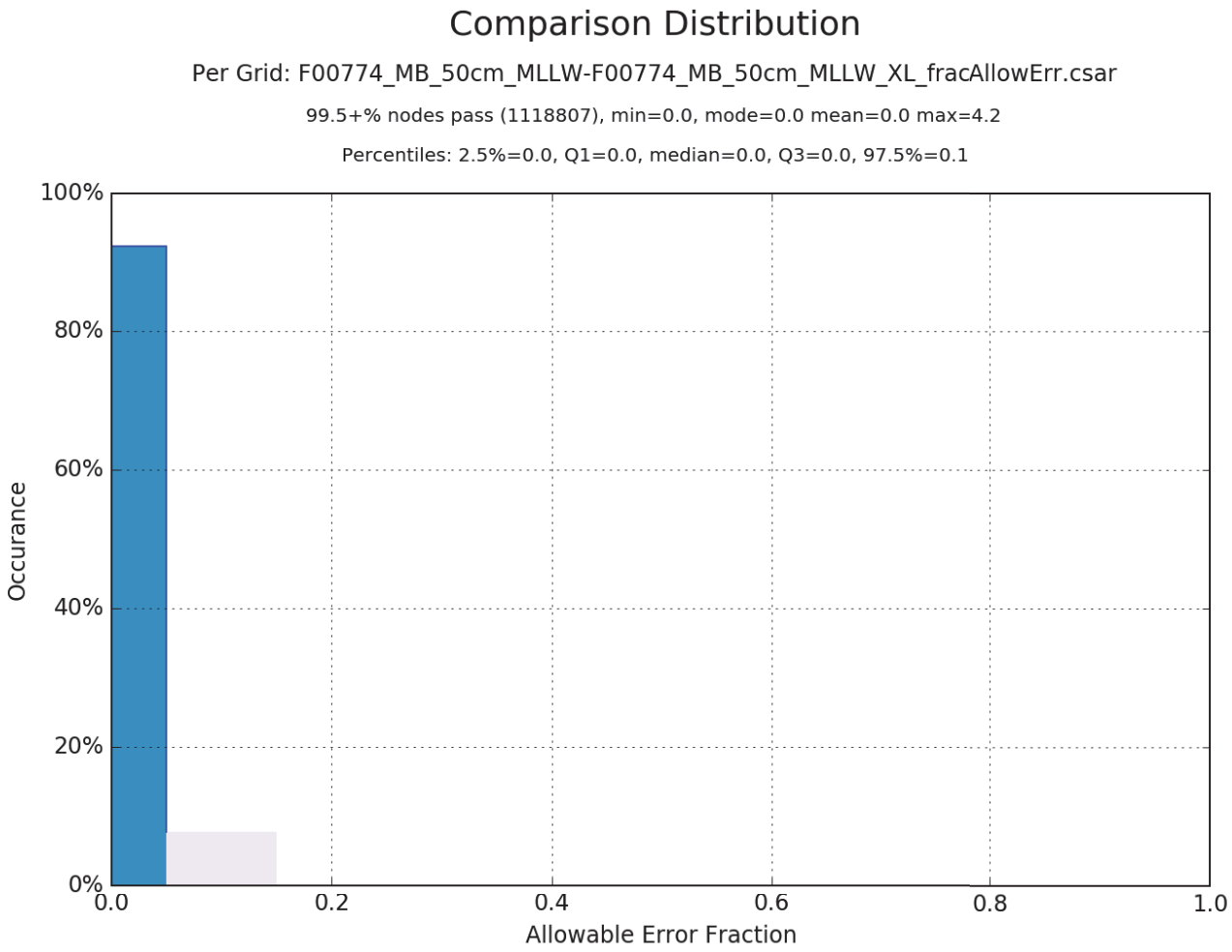


Figure 5: Comparison Distribution of the Allowable Error Fraction

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERZT	N/A	0.06 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S3005	4 meters/second	0 meters/second	0 meters/second	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty provided via device models for vessel motion, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey F00774. Real-time uncertainties were provided via MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel gps height and navigation were applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac. A TCARI tide model and ERZT sep model were applied to reference depths to MLLW and the ellipsoid. Error associated with the ERZT sep model was calculated in the figure below in collaboration with PHB. Related correspondence can be found in the Project_Correspondence folder. F00774 meets CATZOC A1 and HSSD TVU uncertainty standards.

The variable $\sigma_{ERZTsep}$ is what we are solving for.

$$\sigma^2_{ERZTsep} = \frac{\sigma^2_{ERZTobs}}{M}$$

For F00774: TCARI tide error ranges up to about 6 cm (1 sigma), SBET uncertainty is ~10 cm (1 sigma)

$$\sigma^2_{ERZTobs} = \sigma^2_{TICARI} + \sigma^2_{SBET}$$

$$\sigma_{ERZTobs} = \sqrt{\sigma^2_{TICARI} + \sigma^2_{SBET}}$$

$$\sigma_{ERZTobs} = \sqrt{6^2 + 10^2} = \sqrt{136} = 11.7\ cm$$

The variable M is estimated as follows:

$$M = \left(\frac{Linear\ Survey\ "Mileage"\ [units]}{(ERZTsep\ grid\ spacing\ [units]) \times (\#\ of\ ERZTsep\ nodes)}\right)$$

$$M = \left(\frac{181{,}482\ m}{(1000\ m) \times (40)}\right) = 4.54 \rightarrow 4\ obs/node$$

M ≡ # of independent ERZT observations per ERZT sep model node –so, 4.

Solving for $\sigma_{ERZTsep}$:

$$\sigma^2_{ERZTsep} = \frac{\sigma^2_{ERZTobs}}{M}$$

$$\sqrt{\sigma^2_{ERZTsep}} = \sqrt{\frac{\sigma^2_{ERZTobs}}{M}} = \frac{\sigma_{ERZTobs}}{\sqrt{M}}$$

$$\sigma_{ERZTsep} = \frac{11.7\ cm}{\sqrt{4}} \cong 6\ cm$$

$$\sigma_{ERZTsep} = 6\ cm\ or\ 0.06\ m$$

We propose using 0.06 m as our ERZT error.

Figure 6: ERZT Error Calculation

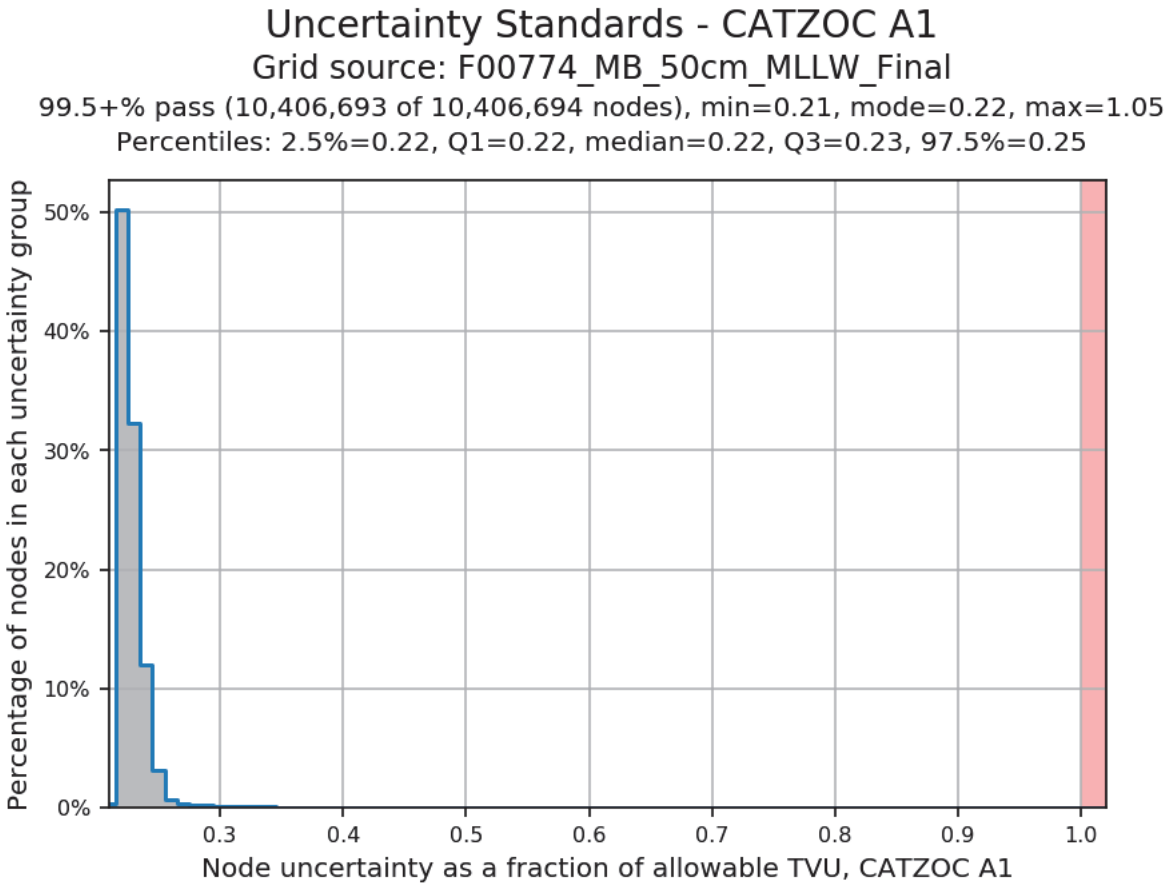


Figure 7: CATZOC uncertainty standards for surface F00774_MB_50cm_MLLW_Final.csar

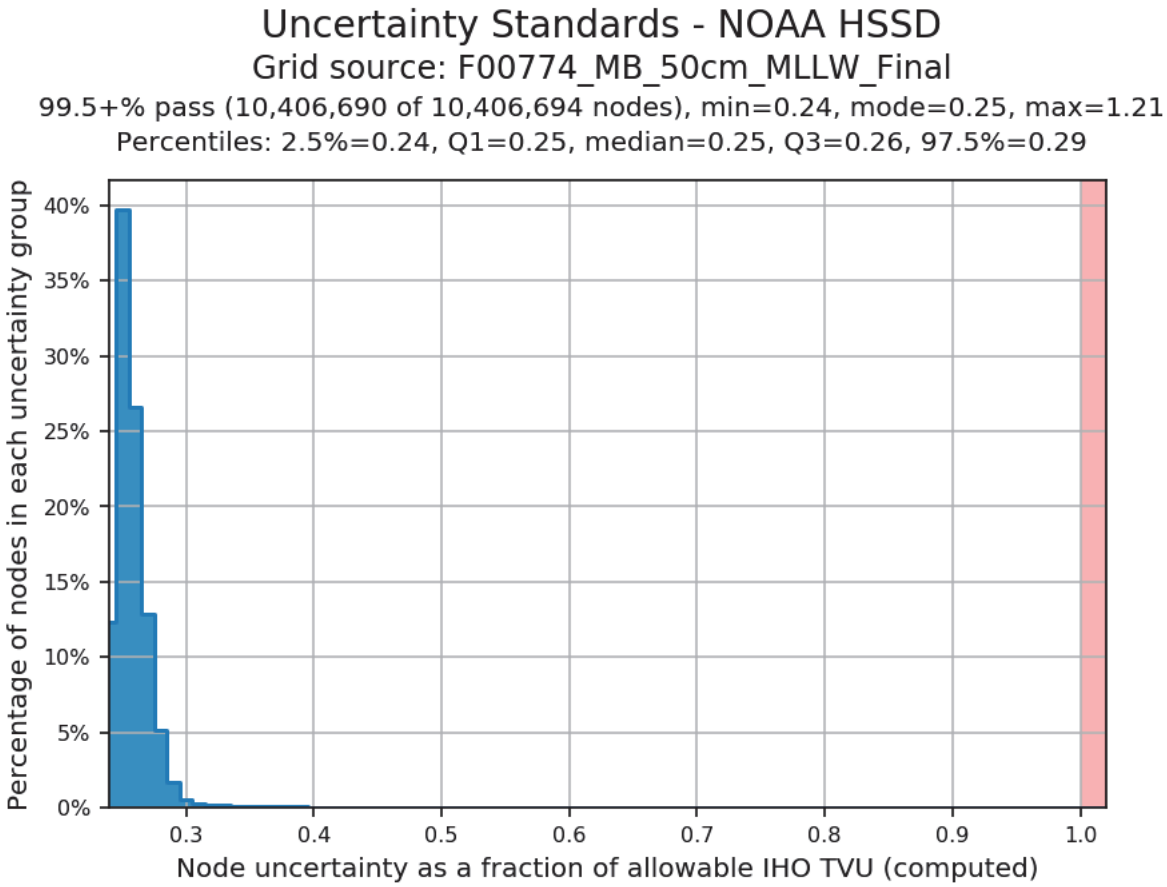


Figure 8: HSSD uncertainty standards for surface F00774_MB_50cm_MLLW_Final.csar

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: Casts were conducted at a minimum of one every four hours during launch acquisition.

Casts were conducted at a minimum of one every four hours during launch acquisition. Casts were conducted more frequently in areas where the influx of freshwater had an effect on the speed of sound in the water column and when there was a change in surface sound speed greater than two meters per second. All sound speed methods were used as detailed in the DAPR.

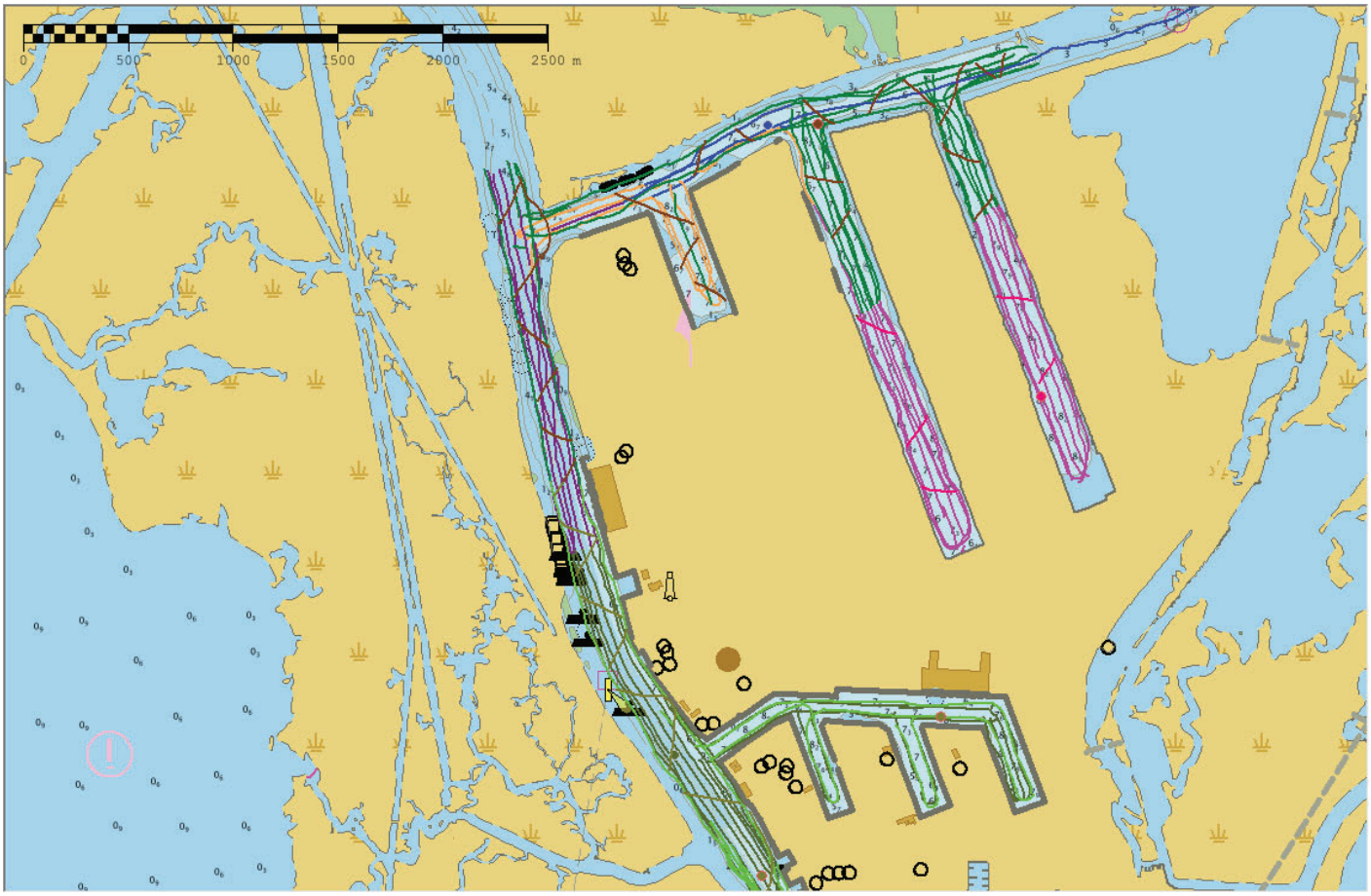


Figure 9: Tracklines symbolized by sound Velocity cast

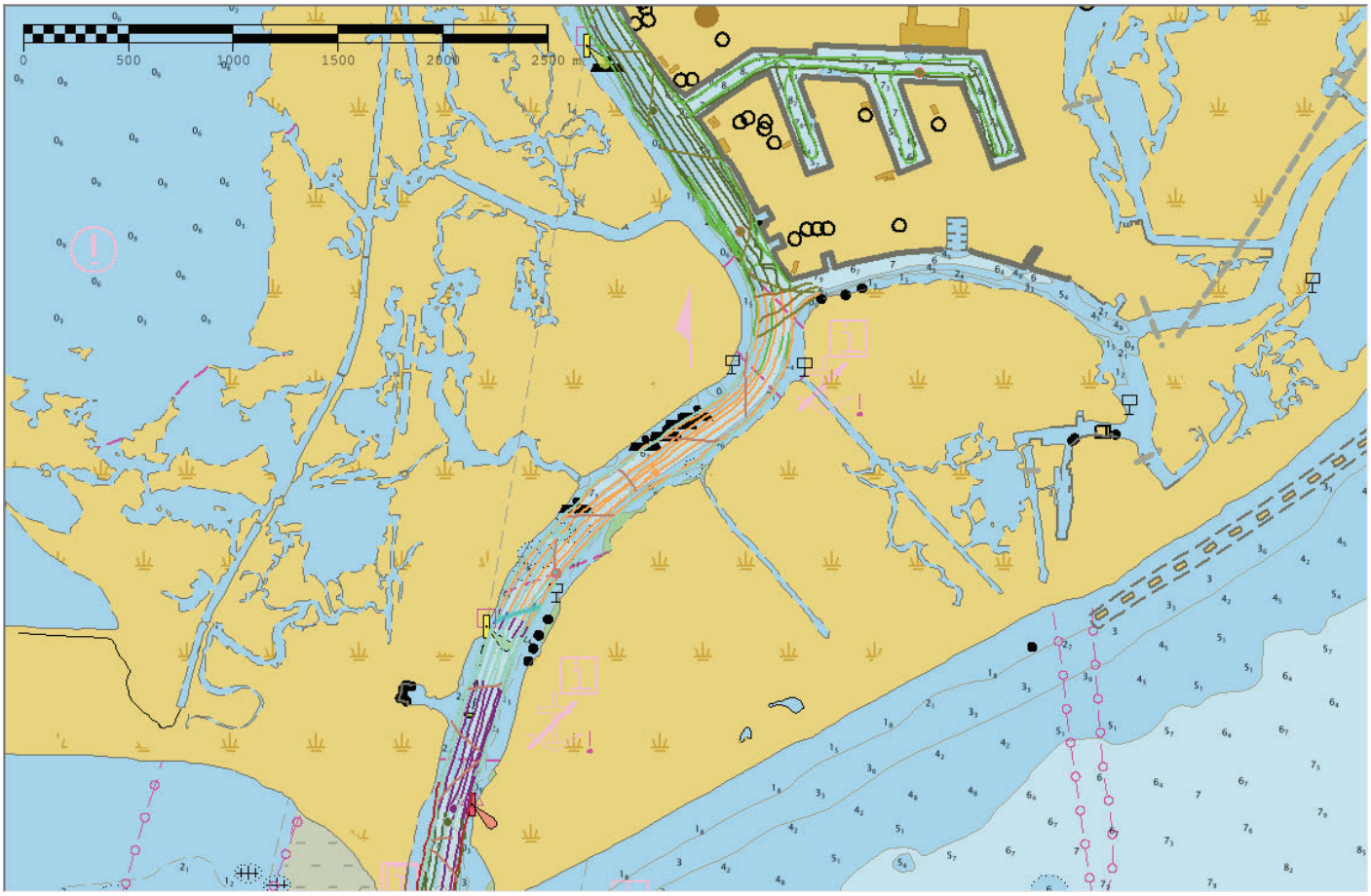


Figure 10: Tracklines symbolized by sound Velocity cast

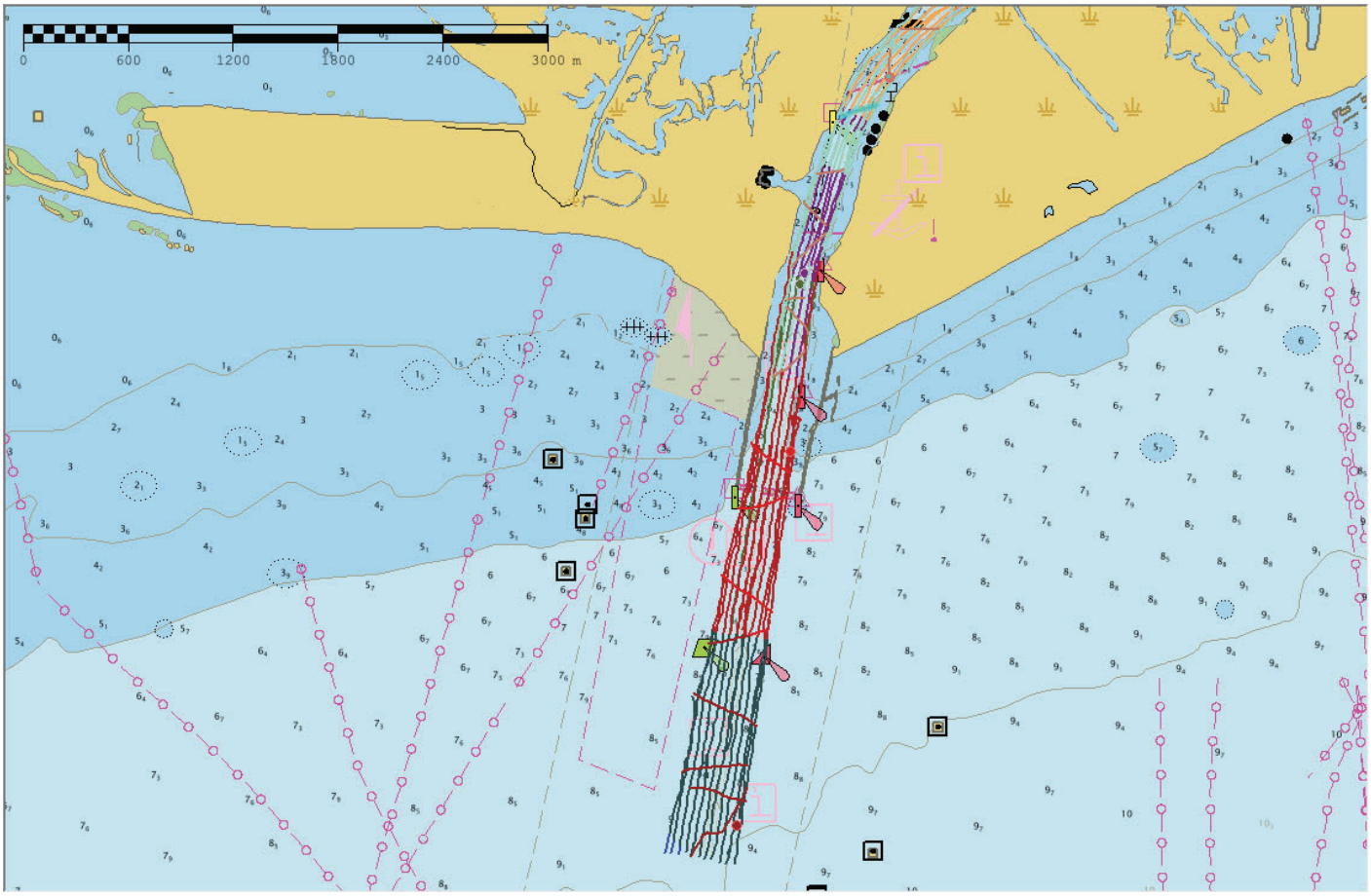


Figure 11: Tracklines symbolized by sound Velocity cast

B.2.8 Coverage Equipment and Methods

The survey was designed to collect Option B: 200% side scan sonar coverage using the Edgtech 4125 with concurrent multibeam bathymetry collection using the Kongsberg 2040c multibeam.

B.2.9 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature and the results are shown below. Density requirements for F00774 were achieved with at least 99% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3. The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep slopes and rocky areas where acoustic shadowing occurred, and at the edges of the survey limits.

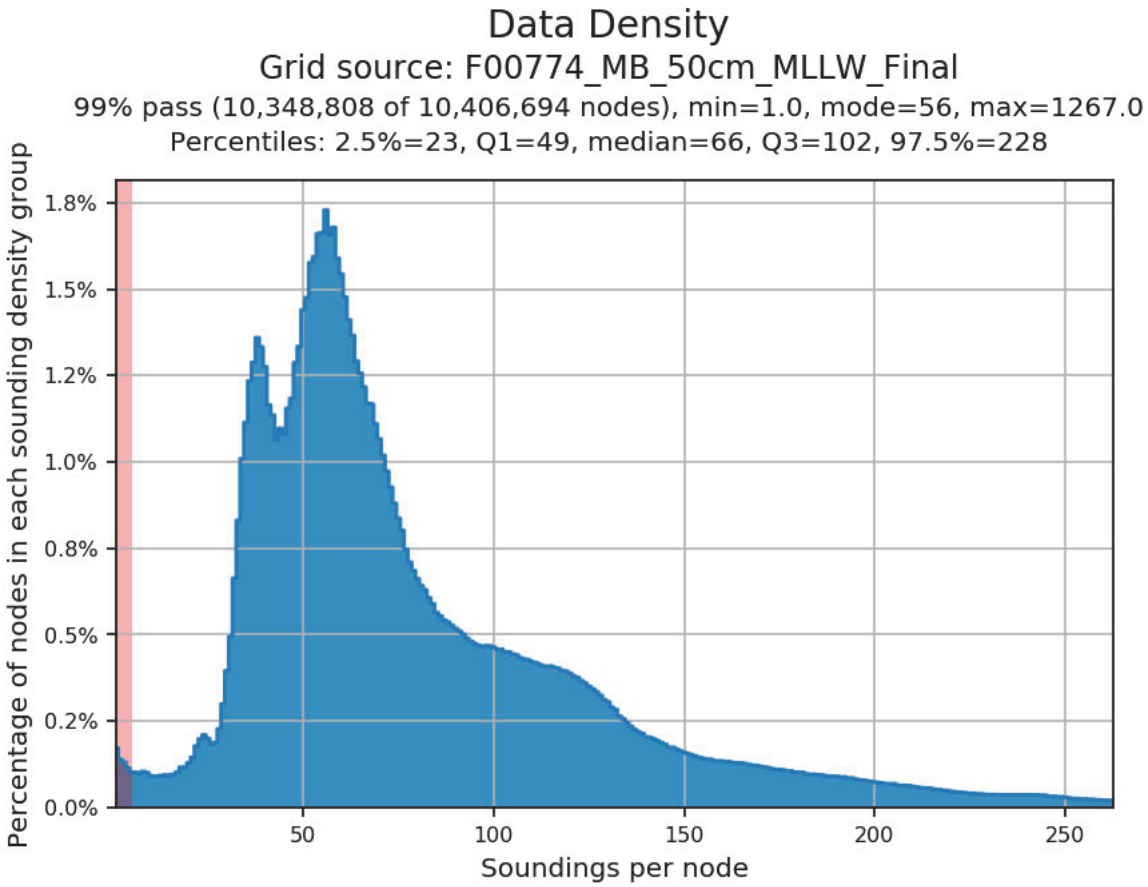


Figure 12: Data Density

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

Backscatter was acquired but not processed. All equipment and survey methods were used as detailed in the DAPR.

B.5 Data Processing

B.5.1 Primary Data Processing Software

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

B.5.2 Surfaces

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

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
F00774_MB_50cm_MLLW_Final	CARIS Raster Surface (CUBE)	0.5 meters	1.4 meters - 13.3 meters	NOAA_0.5m	Concurrent MBES
F00774_SSSAB_50cm_400kHz_1of2	SSS Mosaic	0.5 meters	-	NOAA_0.5m	200% SSS
F00774_SSSAB_50cm_400kHz_2of2	SSS Mosaic	0.5 meters	-	NOAA_0.5m	200% SSS
F00774_MB_50cm_MLLW	CARIS Raster Surface (CUBE)	0.5 meters	1.4 meters - 13.3 meters	NOAA_0.5m	Concurrent MBES

Table 9: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for F00774. The surfaces have been reviewed where noisy data, or "fliers," are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed. Flier Finder, part of the QC Tools package within HydrOffice, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was

run iteratively until all remaining flagged fliers were deemed to be valid aspects of the steep slopes and dynamic nature of the seafloor.

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.

Traditional Methods Used:

- TCARI

There was no Water Level file associated with this survey.

File Name	Status
K920NRT12019.tc	Preliminary

Table 10: Tide Correctors (.zdf or .tc)

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via ERZT	F00774_NAD83_ERZT_MLLW.csar

Table 11: 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 15.

The following PPK methods were used for horizontal control:

- RTX

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

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between a CARIS HIPS and SIPS sounding set created from a finalized surface and all coincident ENCs listed in section D.1.1 using Pydro's CA Tools. In general, the surveyed soundings agreed with the majority of charted depths. No significant differences were found.

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
US5LA26M	1:10000	37	12/10/2020	12/10/2020

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

Some minimal shoaling was flagged and evident after a chart comparison. It is our determination that is does not present a danger to navigation, but should be noted for future examination.

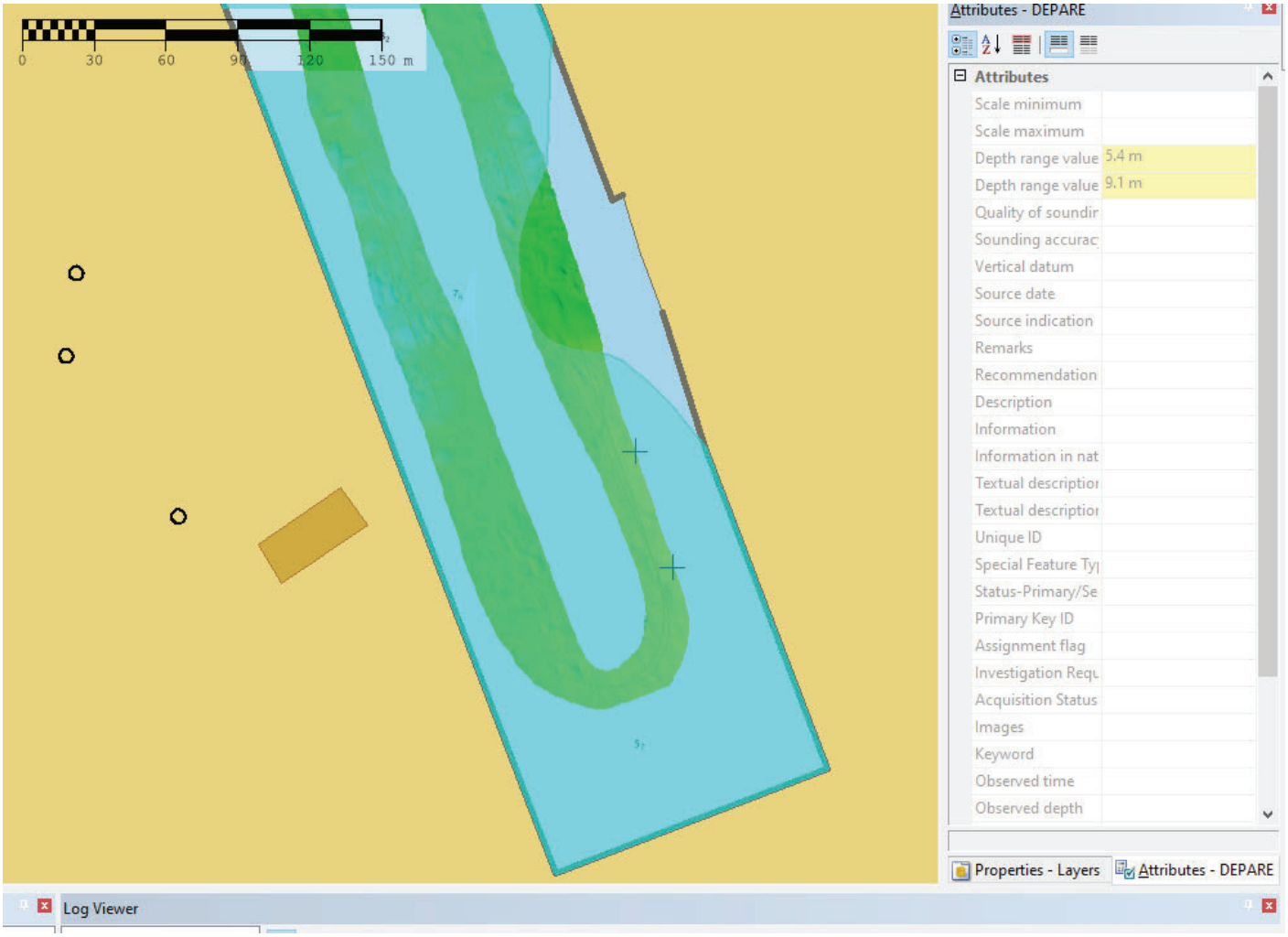
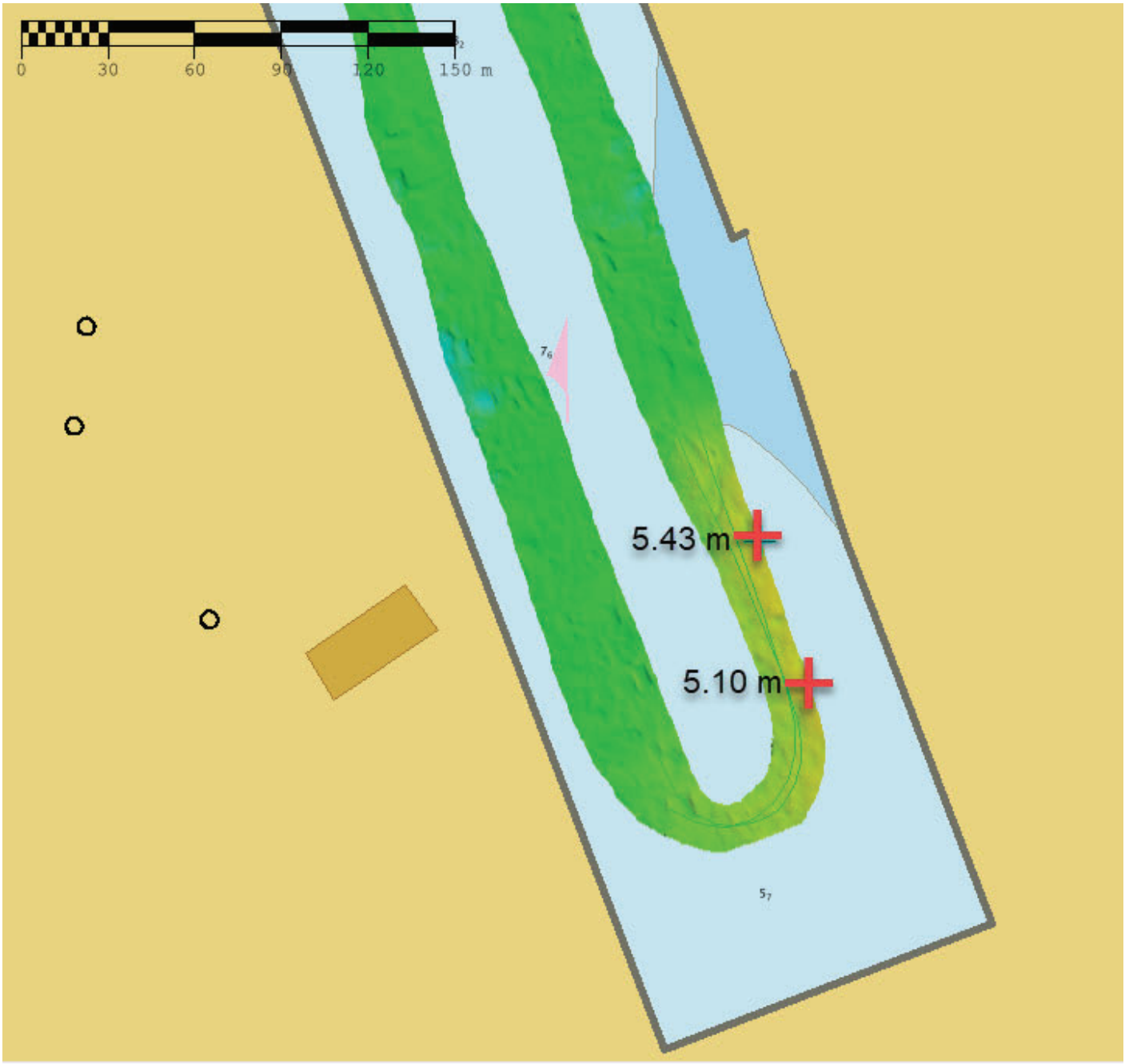


Figure 13: Depth Range of 5.4 to 9.1 meters, described on ENC US5LA26M



Coordinates

	Latitude	Longitude	Z (m)
1	29.119252N	090.206566W	0.0

Figure 14: Soft mud shoaling evident in area.

D.1.3 Charted Features

Charted features exist for this survey, but were not all investigated. There were no feature investigation requirements for this project.

D.1.4 Uncharted Features

Uncharted features exist for this survey, but were not documented in a Final Feature File. There were no feature investigation requirements for this project.

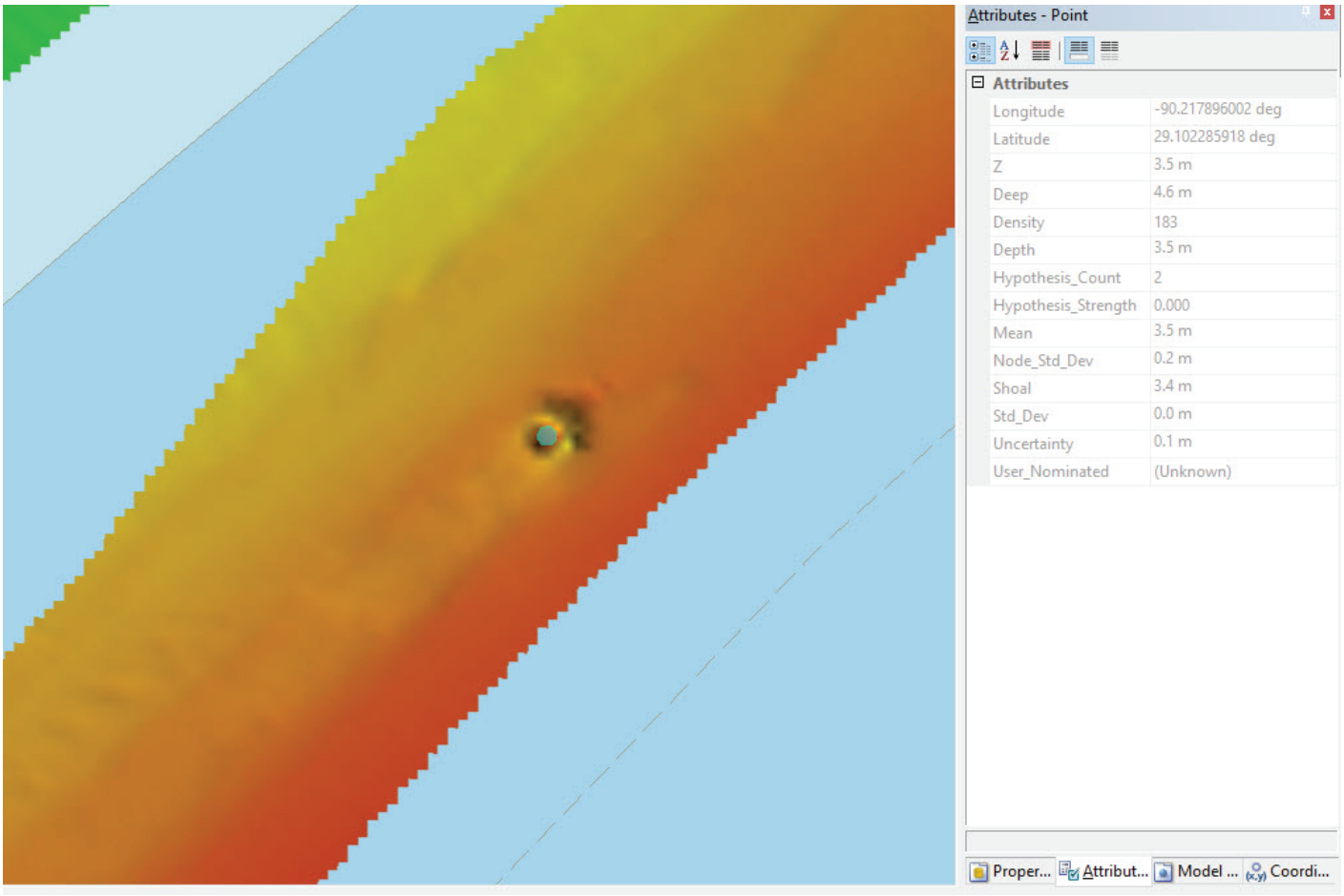


Figure 15: Possible new feature evident in bathymetry

D.1.5 Channels

In general, the surveyed depths meet or exceed the controlling depths, tabulated depths, and reported depths of all maintained channels in the survey area.

D.2 Additional Results

D.2.1 Aids to Navigation

No aids to navigation were reported to the U. S. Coast Guard.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

No bottom samples were required for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

The survey area has several deep scours along the shallows that are the result of prop wash from large work boats and tugs within the port and about the service docks. Many of the vessels in this area will drive into the soft mud shallows instead of anchoring and will then back out under increased power causing temporary wash-outs and drag marks.

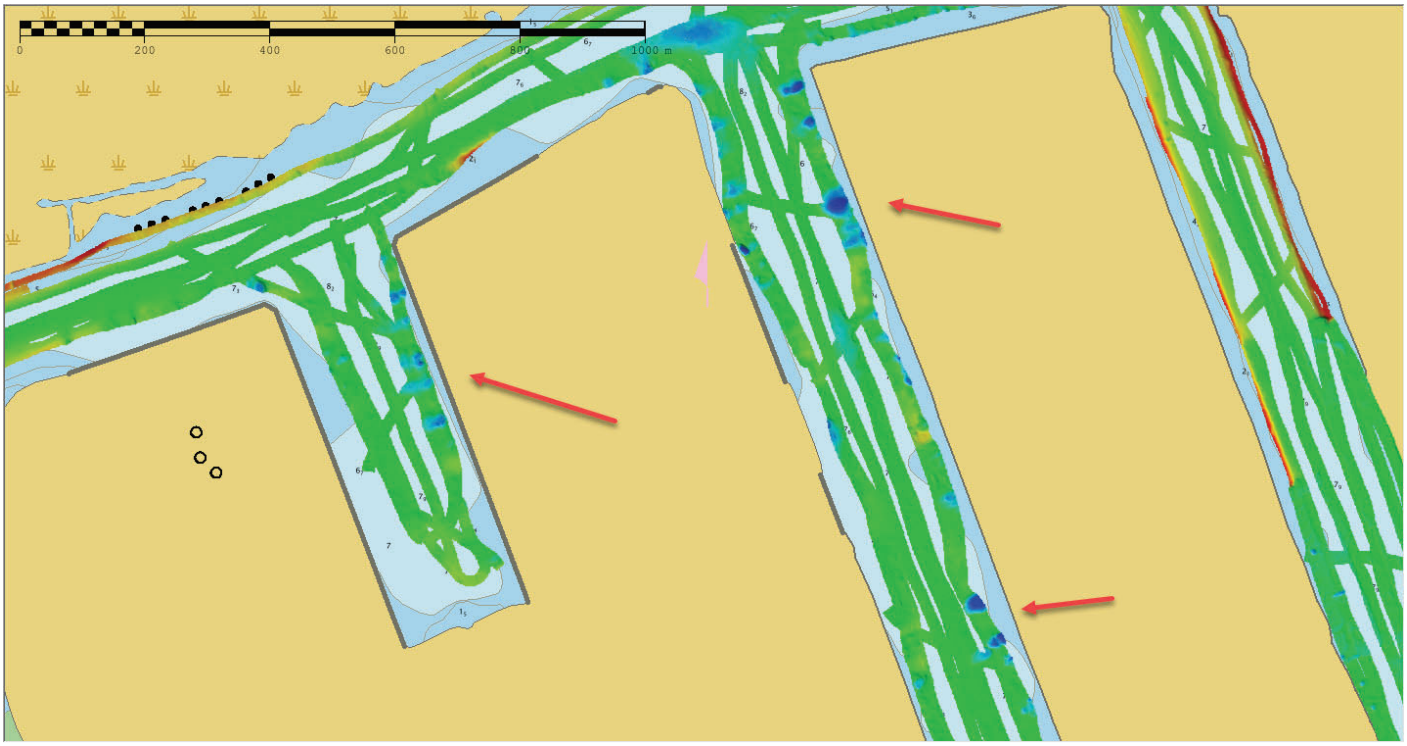


Figure 16: Scours from prop-wash

D.2.9 Construction and Dredging

An area was recently dredged within the channel approaching the port.

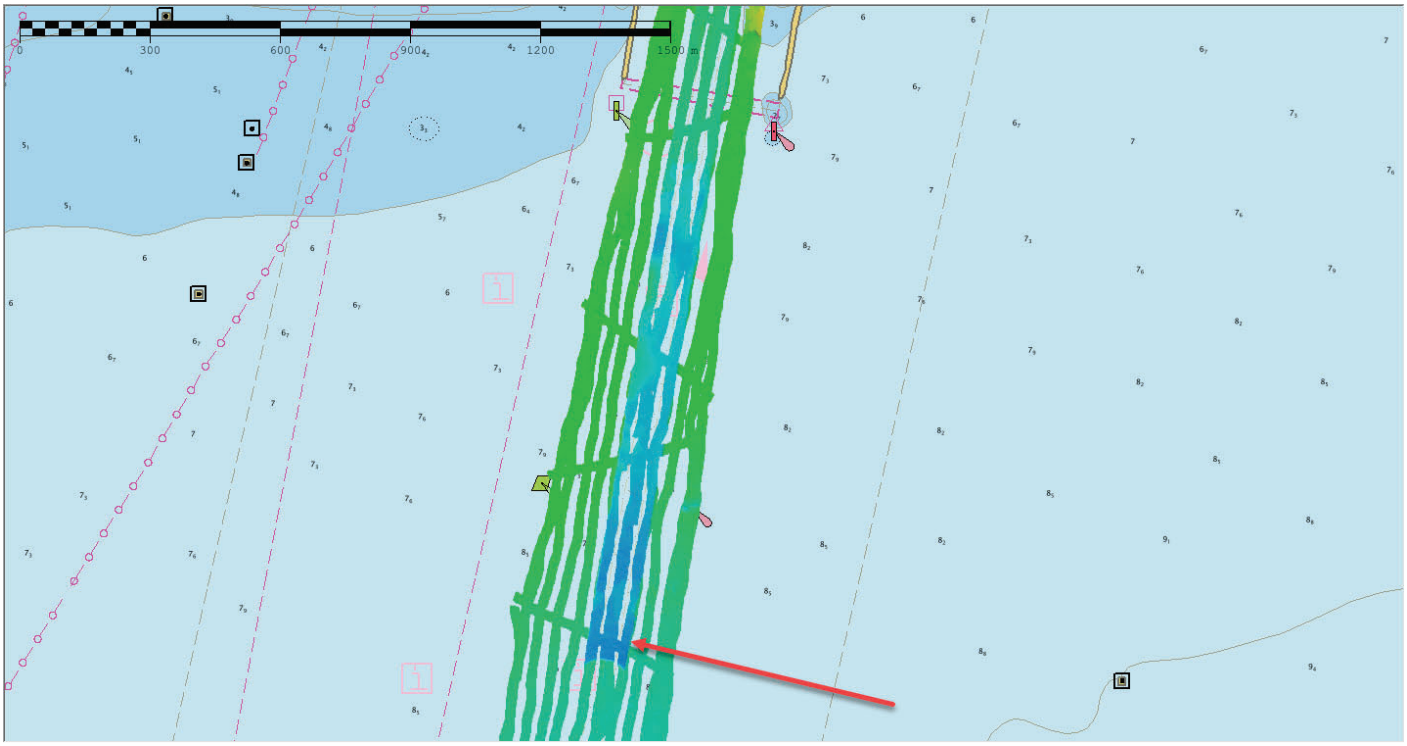


Figure 17: Dredge area evident in the MB derived CUBE surface from F00774

D.2.10 New Survey Recommendations

We recommend that shoaling within the construction canals be investigated for further development and a shallow water survey system be deployed for further feature development along the shoreline -possibly a shallow autonomous system.

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Joshua Bergeron	Sheet Manager	04/07/2021	BERGERON.JOSHUA.STEPHAN.1239796180 Digitally signed by BERGERON.JOSHUA.STEPHAN.1239796180 Date: 2021.04.13 13:53:13 -05'00'
LT John Kidd	Chief of Party	04/07/2021	Digitally signed by KIDD.JOHN.RYAN.1401688524 Date: 2021.04.13 13:56:37 -05'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
PHB	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
PPK	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File

APPROVAL PAGE

F00774

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: 

James Miller
Acting Chief, Pacific Hydrographic Branch