H13742

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13742

LOCALITY

State(s):	Alaska
General Locality:	Norton Sound, AK
Sub-locality:	7 NM South of Golovnin Bay

2023

CHIEF OF PARTY
David Neff, C.H.

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13742**

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):	**Alaska**
General Locality:	**Norton Sound, AK**
Sub-Locality:	**7 NM South of Golovnin Bay**
Scale:	**40000**
Dates of Survey:	**08/31/2023 to 09/01/2023**
Instructions Dated:	**03/01/2023**
Project Number:	**OPR-R390-KR-23**
Field Unit:	**eTrac**
Chief of Party:	**David Neff, C.H.**
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:

All times are UTC. The purpose of this survey is to update existing NOS nautical charts. H13742 covers approximately 155 square nautical miles in Norton Sound, Alaska.

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in NAD83 UTM 3N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13742

Project: OPR-R390-KR-23

Locality: Norton Sound, AK

Sublocality: 7 NM South of Golovnin Bay

Scale: 1:40000

August 2023 - September 2023

eTrac

Chief of Party: David Neff, C.H.

A. Area Surveyed

eTrac conducted hydrographic survey operations in Nome, Alaska. H13742 covers approximately 155 square nautical miles of survey area. 166.60 linear nautical miles were acquired during the survey.

Survey was conducted within these limits between August 31, 2023 (DN243) and September 01, 2023 (DN244).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
64° 33' 42.95" N 164° 33' 55.68" W	64° 18' 42.88" N 163° 29' 18.35" W

Table 1: Survey Limits

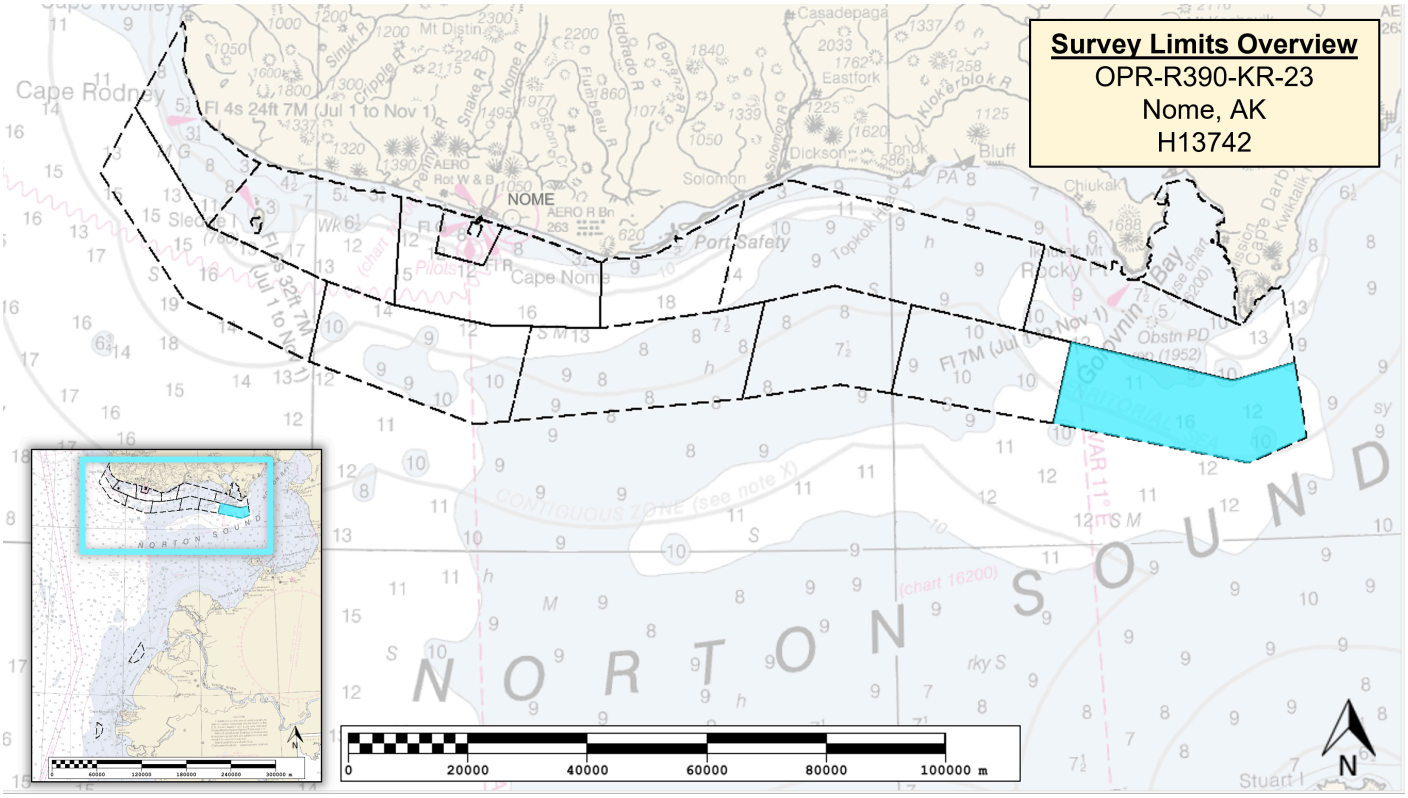


Figure 1: Survey Limits Overview (light blue area)

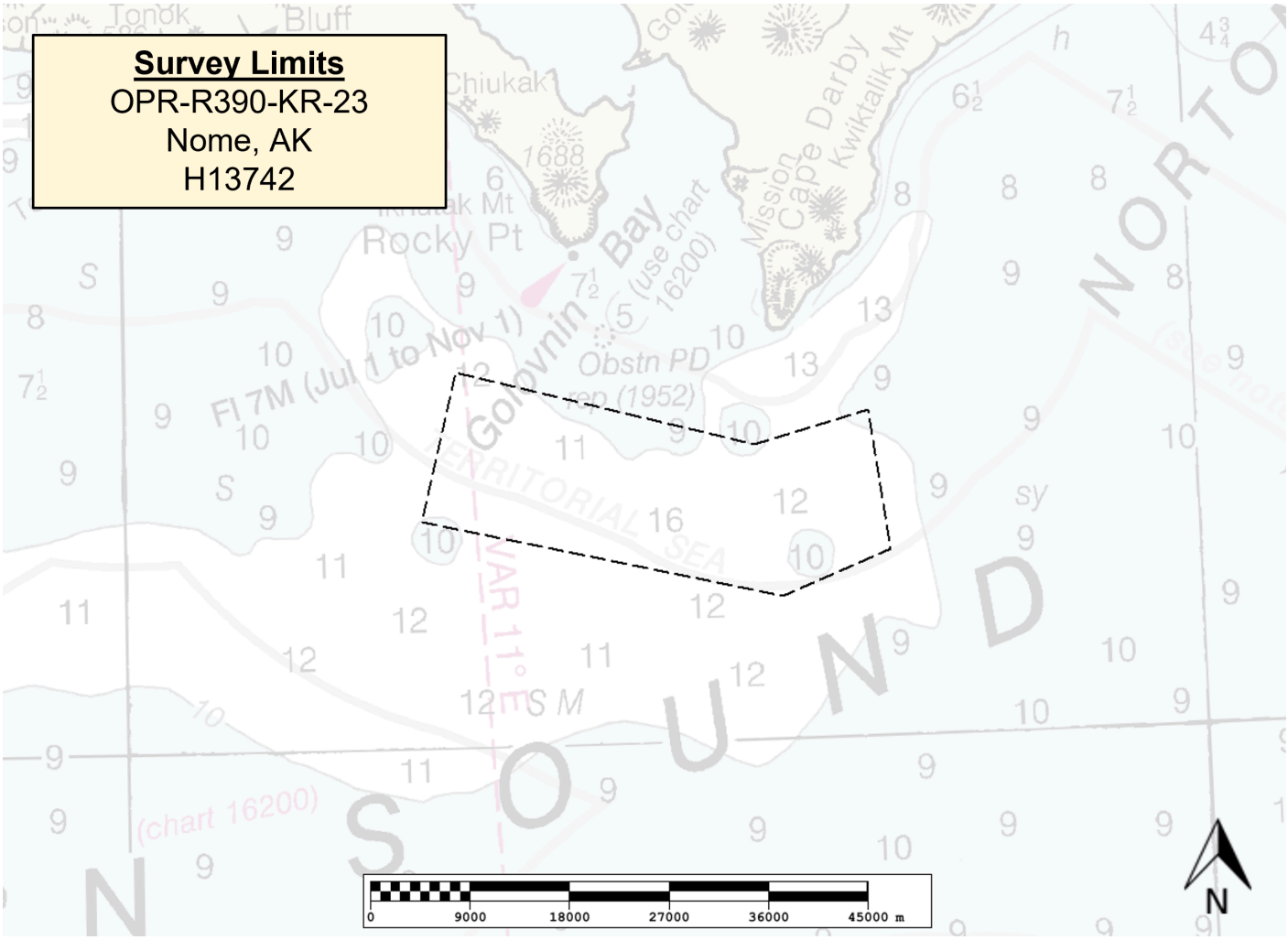


Figure 2: Survey Limits (black line)

All data were acquired in accordance with the requirements in the project instructions and specifications set forth in the Hydrographic Survey Specifications and Deliverables 2022 Edition (HSSD 2022).

A.2 Survey Purpose

The purpose of this survey is to update existing National Ocean Service (NOS) nautical charts.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey H13742 is accurate to International Hydrographic Organization (IHO) Order 1a as required per the HSSD 2022.

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 sheets 10, 11, 13 - 15	480m Set Line Spacing MBES in accordance with the requirements listed below and HSSD 2022.
All waters in survey area	Collect a minimum of 13,210 LNMs. All significant shoals or features found in waters less than 20m deep shall be developed to complete coverage standards, or a set line spacing density suitable to delineate the 5m depth contour as determined in consultation with the COR. If navigationally significant differences exist between charted and surveyed depths, contact the COR and summarize the findings. Denser set line spacing may be required following consultation with the COR.

Table 2: Survey Coverage

Note: H13742 was reordered to be the lowest priority sheet, and the survey area was not fully completed as the project wide assigned Linear Nautical Mileage was met. See Project Correspondence for reference.

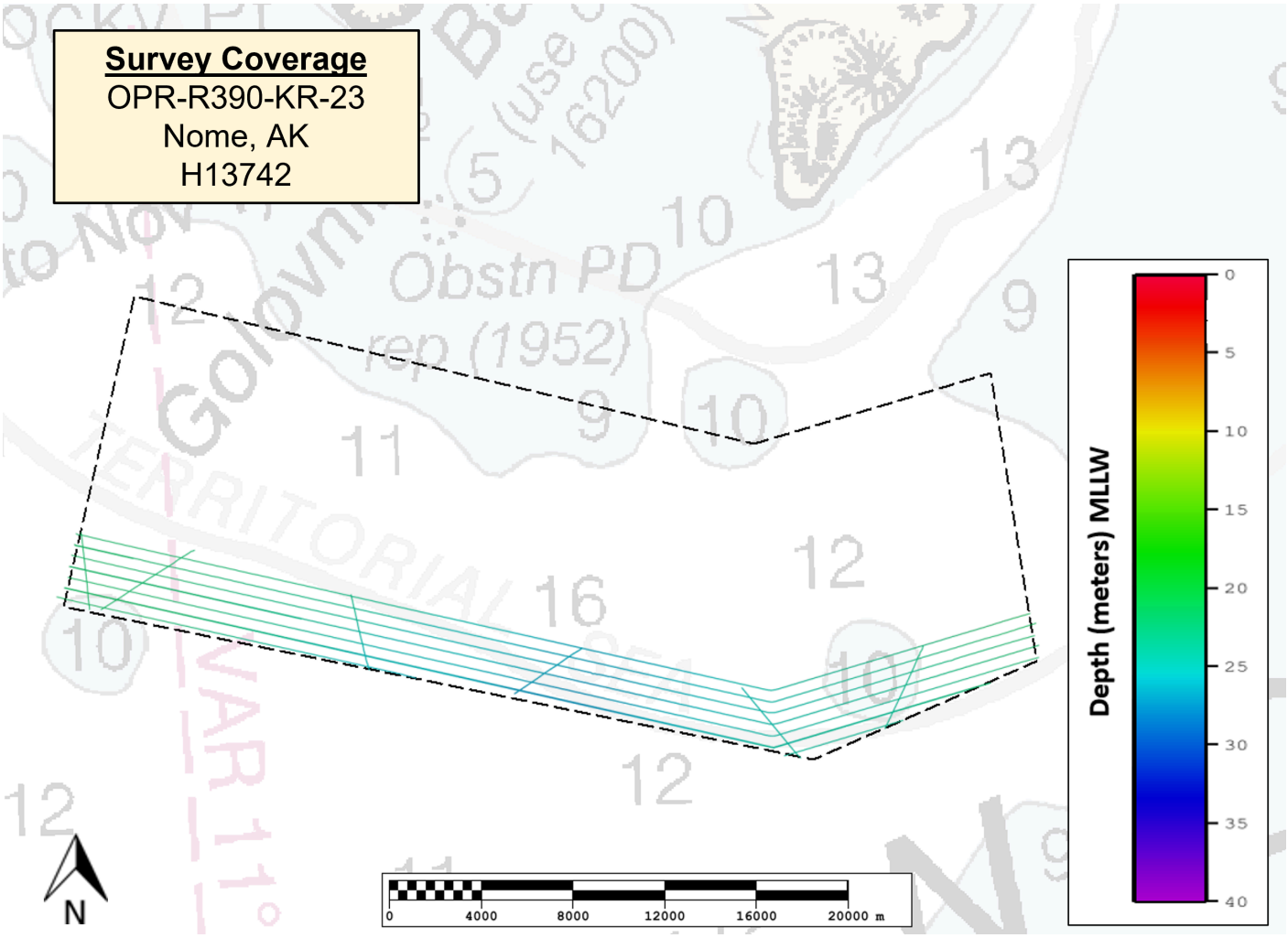


Figure 3: Survey Coverage

A.6 Survey Statistics

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

	HULL ID	*R/V Norseman II*	*ASV Quimby*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0
	MBES Mainscheme	124.44	29.56	154.0
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0	0.0
	SBES/MBES Crosslines	12.6	0.0	12.6
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				7
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				39.9

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/31/2023	243

Survey Dates	Day of the Year
09/01/2023	244

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	*R/V Norseman II*	*ASV Quimby*
LOA	35.0 meters	7.0 meters
Draft	4.0 meters	0.56 meters

Table 5: Vessels Used

The R/V Norseman II is a 35 meter steel research vessel that originally served as a Bering Sea commercial fishing vessel. It is equipped with a port custom over-the-side pole mount with secondary tie point.

ASV Quimby is a 7 meter Wave Adaptive Modular Vessel (WAM-V) which is an innovative class of watercraft using unique suspension technology to radically improve seagoing capabilities. ASV Quimby is equipped with a custom sonar mount.

B.1.2 Equipment

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

Manufacturer	Model	Type
R2Sonic	2024	MBES
R2Sonic	2022	MBES
AML Oceanographic	MicroX SV	Sound Speed System
AML Oceanographic	BaseX2	Sound Speed System
AML Oceanographic	MVP-X	Sound Speed System
Applanix	POS MV WaveMaster	Positioning and Attitude System
R2Sonic	I2NS	Positioning and Attitude System

Table 6: Major Systems Used

R/V Norseman II utilized a single head R2Sonic 2024 MBES, an AML Micro.X for the surface sound speed system, an AML/eTrac MVP-X for the sound speed system, an AML Base.X2 as a spare for the sound speed system, and an Applanix POS MV WaveMaster for the positioning and attitude system.

ASV Quimby utilized a single head R2Sonic 2022 MBES, an AML Micro.X for the surface sound speed system, and a R2Sonic I2NS for the positioning and attitude system.

B.2 Quality Control

B.2.1 Crosslines

A beam-to-beam statistical analysis was performed using the Cross Check tool in Qimera. A 4 meter Combined Uncertainty and Bathymetric Estimator (CUBE) weighted dynamic surface was created incorporating only the mainscheme lines and excluded crosslines. The Cross Check tool was used to perform the beam-by-beam comparison of the crossline data to the mainscheme surface. Comparisons showed excellent agreement, well above 95% of the allowable TVU.

Note: This surface was created for QC only and is not submitted as a surface deliverable.

Below is a histogram of the crossline comparison statistics showing IHO Order 1a compliance per beam.

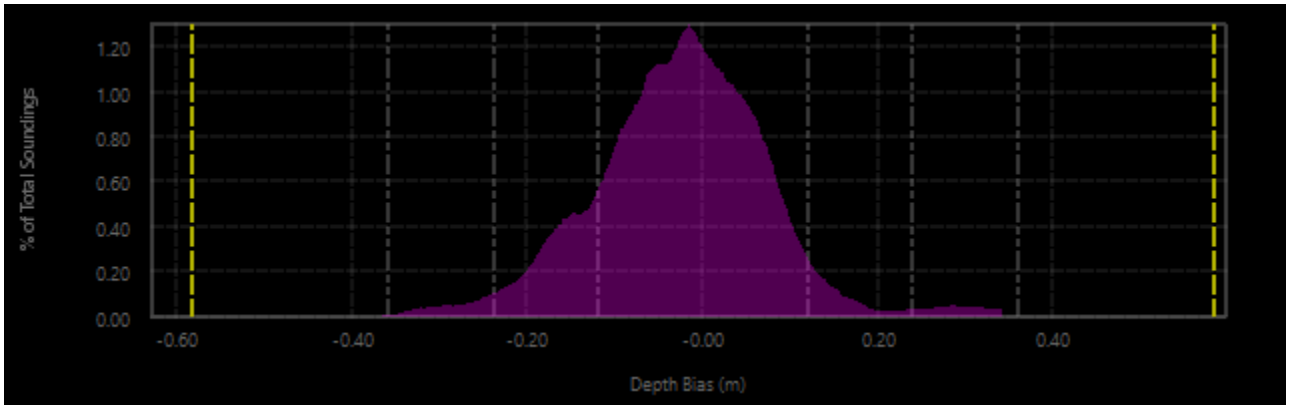


Figure 4: H13742 Crossline Comparison

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0.13 meters	N/A

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
R.V Norseman	0.05 meters/second	N/A	N/A	0.2 meters/second
ASV Quimby	0.05 meters/second	N/A	N/A	0.2 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

The standard deviation uncertainty and the total vertical uncertainty (TVU) layers of the Dynamic Surface were utilized during data processing to search for features, water column noise, and systematic errors.

IHO Order 1a uncertainty specification was met by 99% of the nodes.

In Qimera versions beginning in 2.5.1 and beyond, the user has the ability to export the Dynamic Surface to a Bathymetric Attributed Grid (BAG) with the TVU layer.

Using this BAG, the percentage of nodes that fell within the TVU specification for each Dynamic Surface was calculated using the NOAA QC tools program.These results are shown in an image below. The TVU was also reviewed using the Colormap Range in the Qimera TVU surface layer. This image is also included below.

Set Line Spacing Coverage MBES (Finalized 4m CUBE weighted Dynamic Surface) = 100% of nodes are within the allowable TVU.

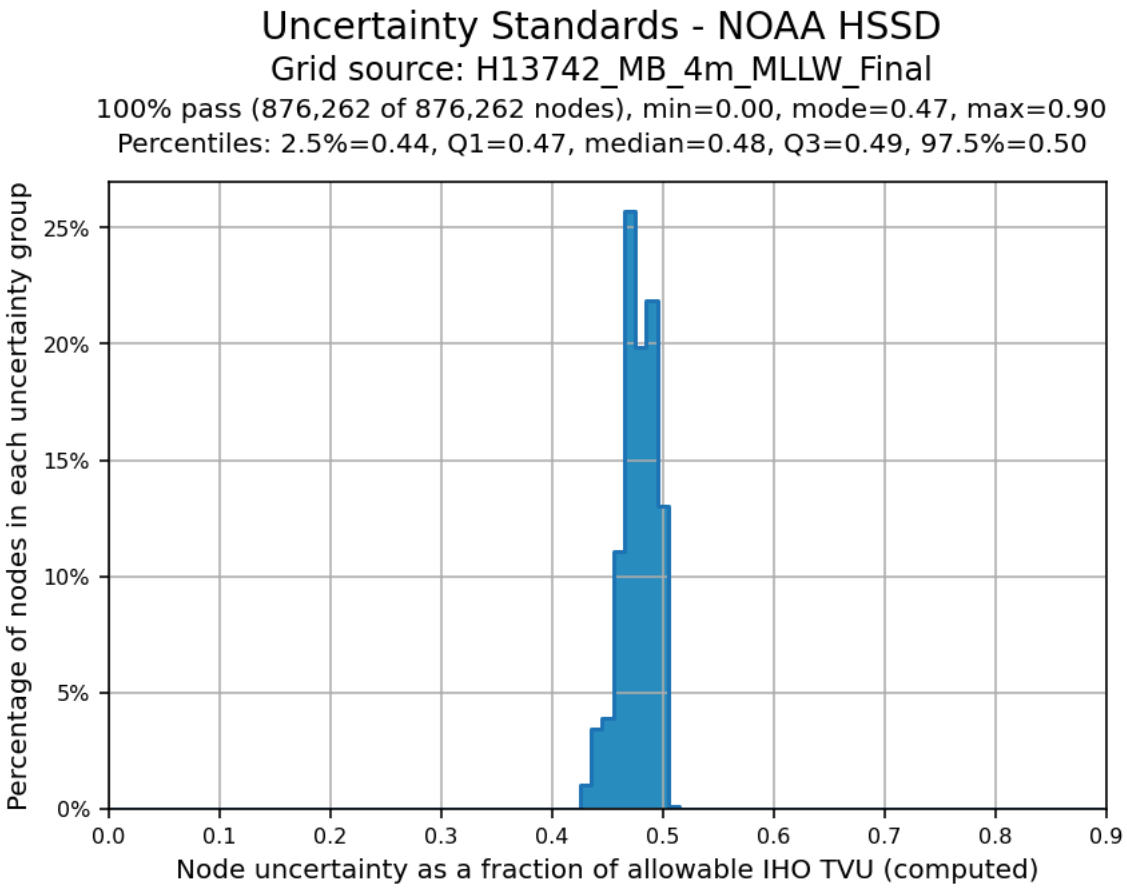


Figure 5: H13742 Finalized 4m MBES TVU Statistics

B.2.3 Junctions

Depth differences between junctioning surveys were evaluated using the JunctionTrac program, developed in-house by eTrac. For each junction, each CUBE weighted dynamic surface's nodes were exported to an ASCII CSV file where the fields were (Easting, Northing, Depth) for each node. A 4 meter difference surface between the junctioning datasets was also created and exported to an ASCII CSV file where the fields were (Easting, Northing, Diff) for each node. The three ASCII CSV files were then loaded into the JunctionTrac program and junction statistics were computed. A file was also created in this process to locate

any nodes from the difference surface that exceed the allowable TVU, which was imported into Qimera and any identified points from JunctionTrac were analyzed.

Note: the difference surfaces were created for comparison efforts only and are not submitted as surface deliverables.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13743	1:40000	2023	eTrac	W

Table 9: Junctioning Surveys

H13743

The junction comparison was performed using all overlapping data between H13742 and H13743. Below is a histogram of junction comparison statistics showing the difference between the junctioning surfaces and allowable TVU as well as difference statistics. 100% of nodes were within allowable TVU.

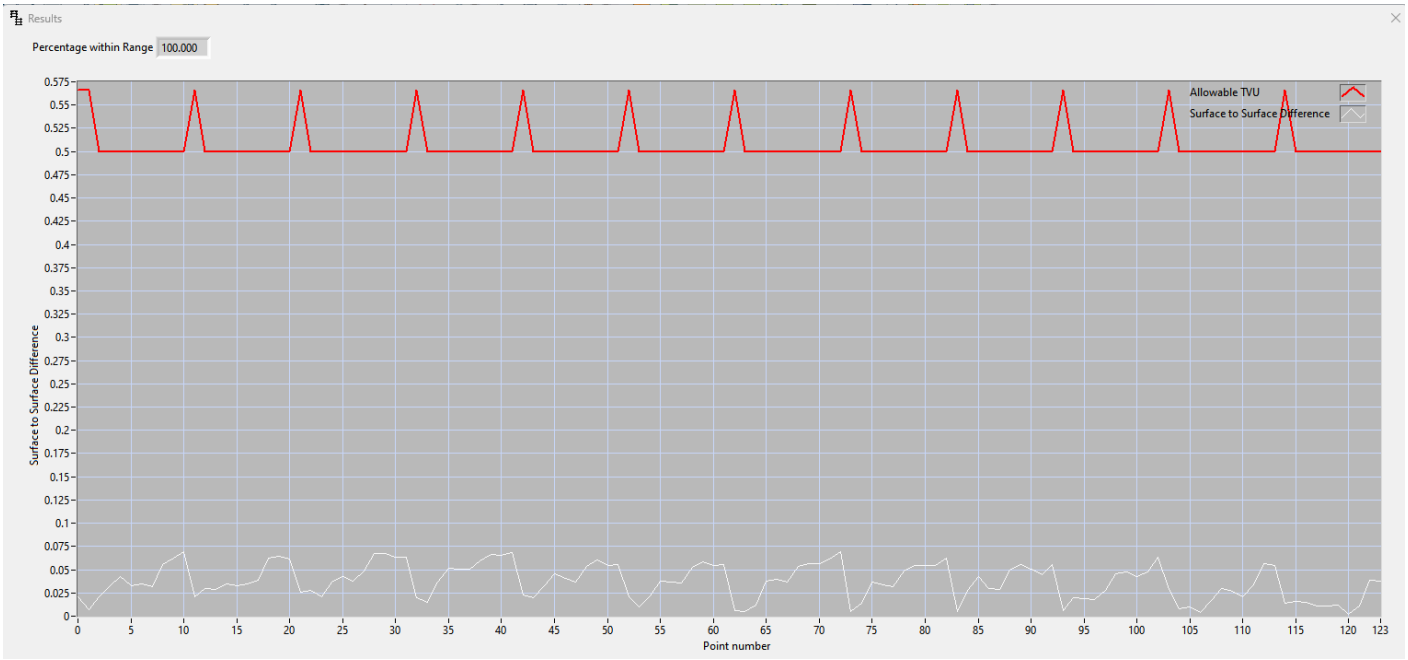
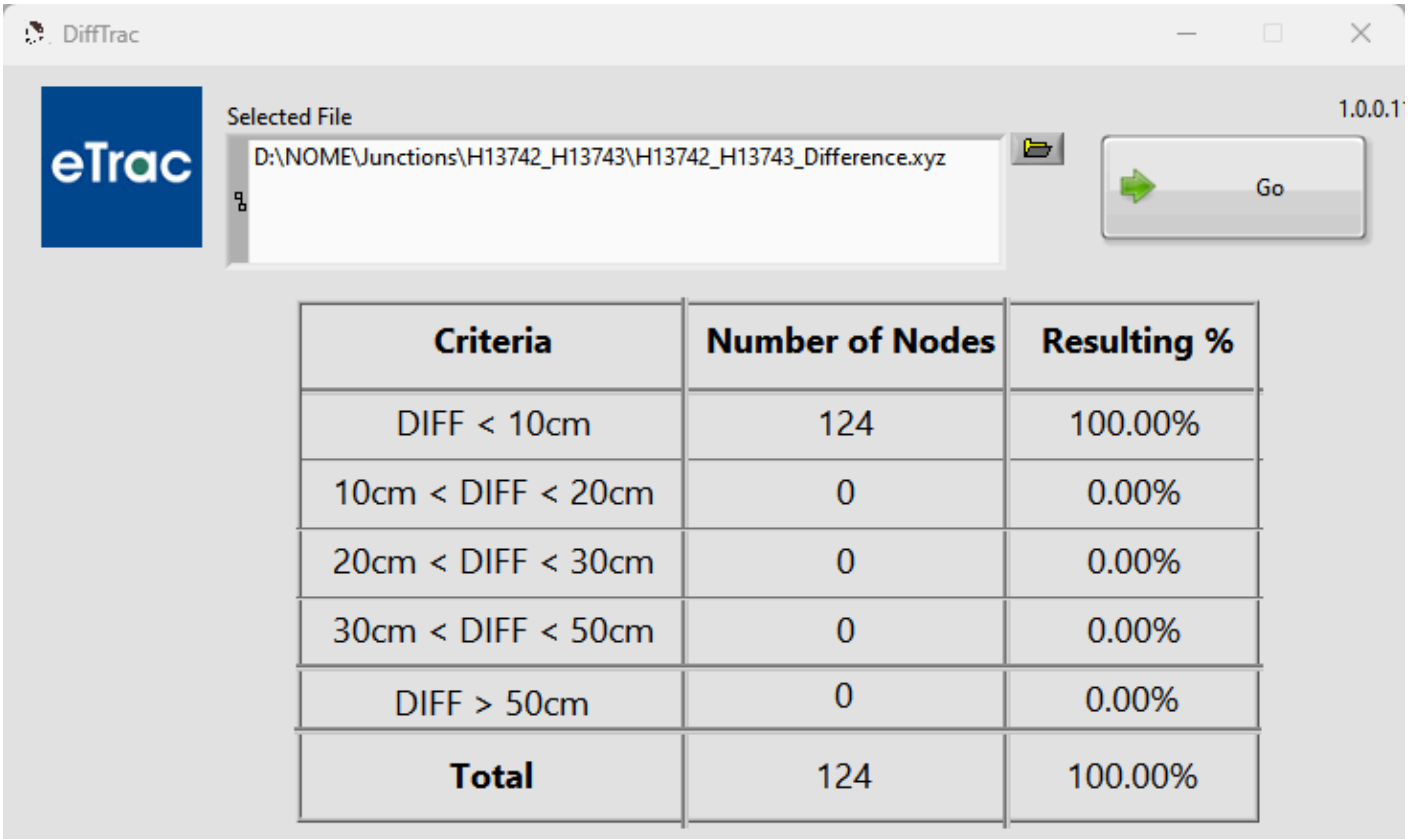


Figure 6: H13742 - H13743 Junction Comparison



Criteria	Number of Nodes	Resulting %
DIFF < 10cm	124	100.00%
10cm < DIFF < 20cm	0	0.00%
20cm < DIFF < 30cm	0	0.00%
30cm < DIFF < 50cm	0	0.00%
DIFF > 50cm	0	0.00%
Total	124	100.00%

Figure 7: H13742 - H13743 Difference Statistics

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: SVP casts were generally taken every 2 hours. Occasionally casts would exceed a 2 hour frequency, however would never exceed a 4 hour frequency.

On R/V Norseman, casts were applied in QPS Qinsy acquisition software at the time of the cast. Casts taken on R/V Norseman II were shared with ASV Quimby and applied in QPS Qinsy at the same time. Surface sound velocity measured at 1Hz was compared to surface velocity from the sound velocity profile in real-time. If the surface velocity comparison was in excess of 2 m/s at any time during survey operations, a new cast was taken.

Surface sound speeds were compared in real-time and profile to profile for each cast on the vessel. Additionally, the processor reviewed profiles in Qimera to remove spurious readings within a cast, compare day-to-day casts, and to check distribution over the surveyed area, in order to better understand trends for efficient acquisition planning.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Data Density Evaluation

In order to determine if the density of the data met the specified 5 soundings per node, data density was evaluated using DensityTrac in the AmiTrac program, developed in-house by eTrac. Each finalized CUBE weighted dynamic surface's nodes were exported to a BBH file. The BBH file was then loaded into the DensityTrac program and density statistics were computed.

For H13742 the following percentages represent the results of the density query:

Set Line Spacing Coverage MBES (Finalized 4m CUBE weighted Dynamic Surface) = 98.84% of nodes are composed from at least 5 soundings.

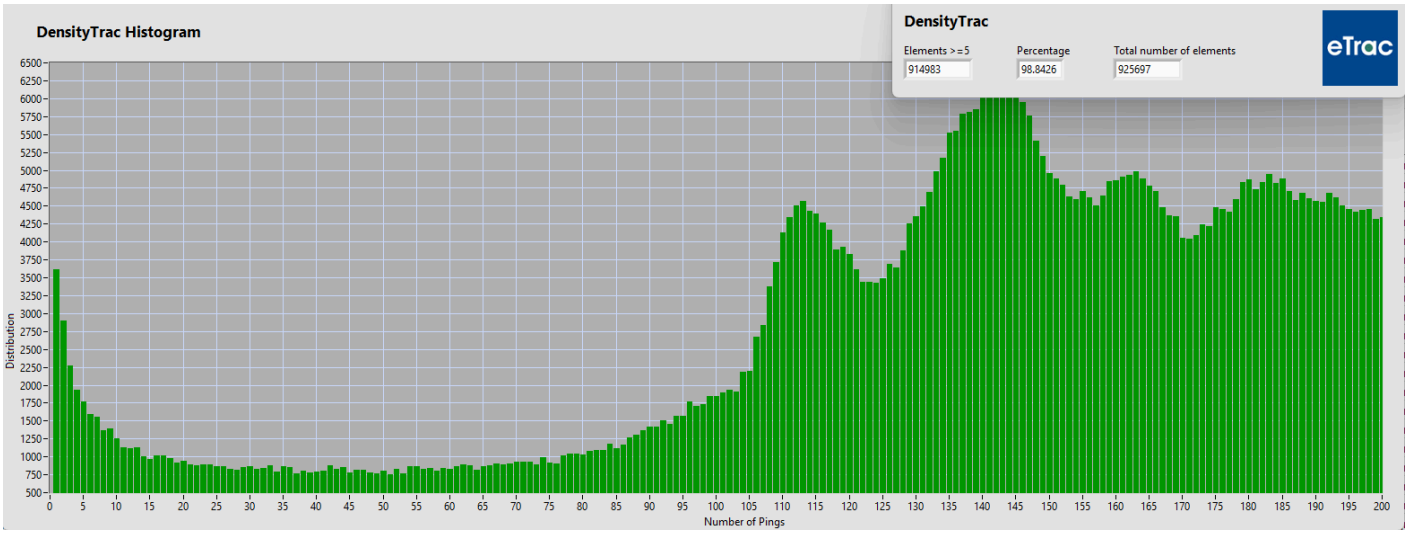


Figure 8: H13742 Finalized 4m Set Line Spacing MBES Density Distribution

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 data were collected throughout the survey and are retained in the raw DB files. Every effort was made in the field to collect quality backscatter data while maintaining the primary mandate of high quality bathymetric data. eTrac verified coverage and general quality of the backscatter data collected daily. A beam intensity window was monitored in Qinsy during acquisition to ensure backscatter data collection. Raw backscatter data were viewed in QPS FMGeocoder (FMGT) to further confirm collection criteria had been met. After MBES data was fully processed and cleaned in Qimera, GSF files were exported and brought into FMGT and processed into backscatter mosaics. Shown below is an example of the raw backscatter mosaic from H13742 DN243 TO DN244 (R/V Norseman II).

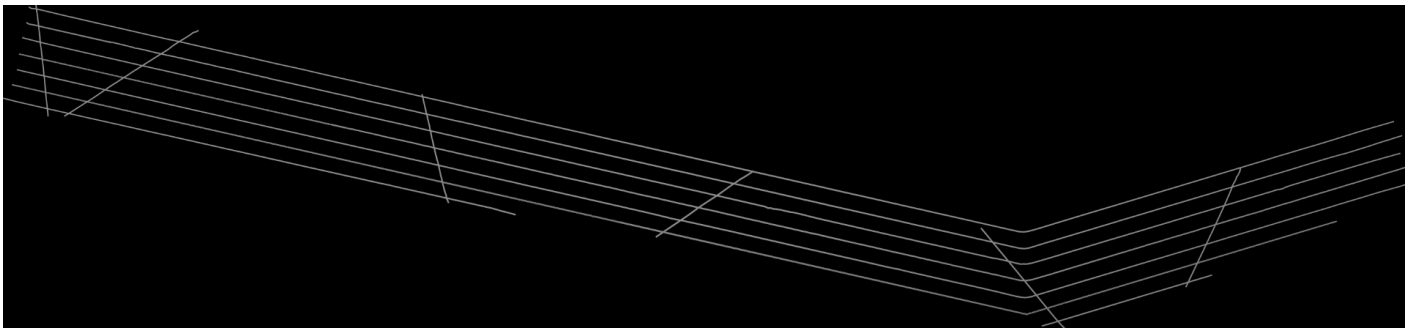


Figure 9: Raw Backscatter from R/V Norseman (DN243 to DN244)

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following Feature Object Catalog was used: NOAA Profile Version 2022.

Feature Object Catalog, NOAA Profile Version 2022 was used only in CARIS. Qimera was used as the primary processing software.

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
H13742_MB_4m_MLLW_Final	BAG	4 meters	19.73 meters - 27.98 meters	NOAA_4m	MBES Set Line Spacing
H13742_MBAB_2m_NO_400kHz_1of2	MB Backscatter Mosaic	2 meters	-	N/A	MBES Set Line Spacing
H13742_MBAB_2m_QU_400kHz_2of2	MB Backscatter Mosaic	2 meters	-	N/A	MBES Set Line Spacing

Table 10: Submitted Surfaces

A 4m surface is provided meeting Set Line Spacing MBES with backscatter specifications for H13742.

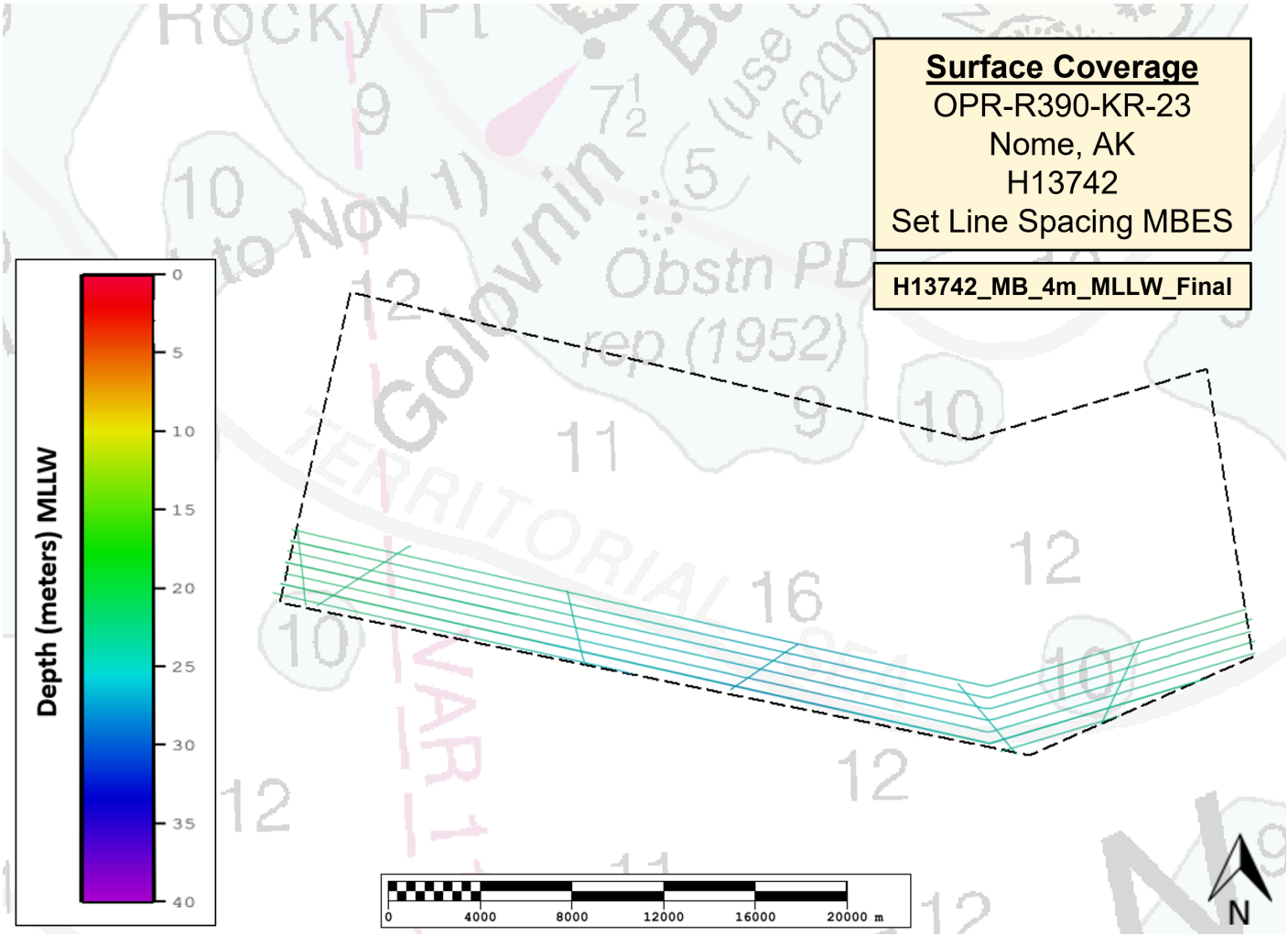


Figure 10: H13742 Finalized 4m CUBE weighted Dynamic Surface Coverage

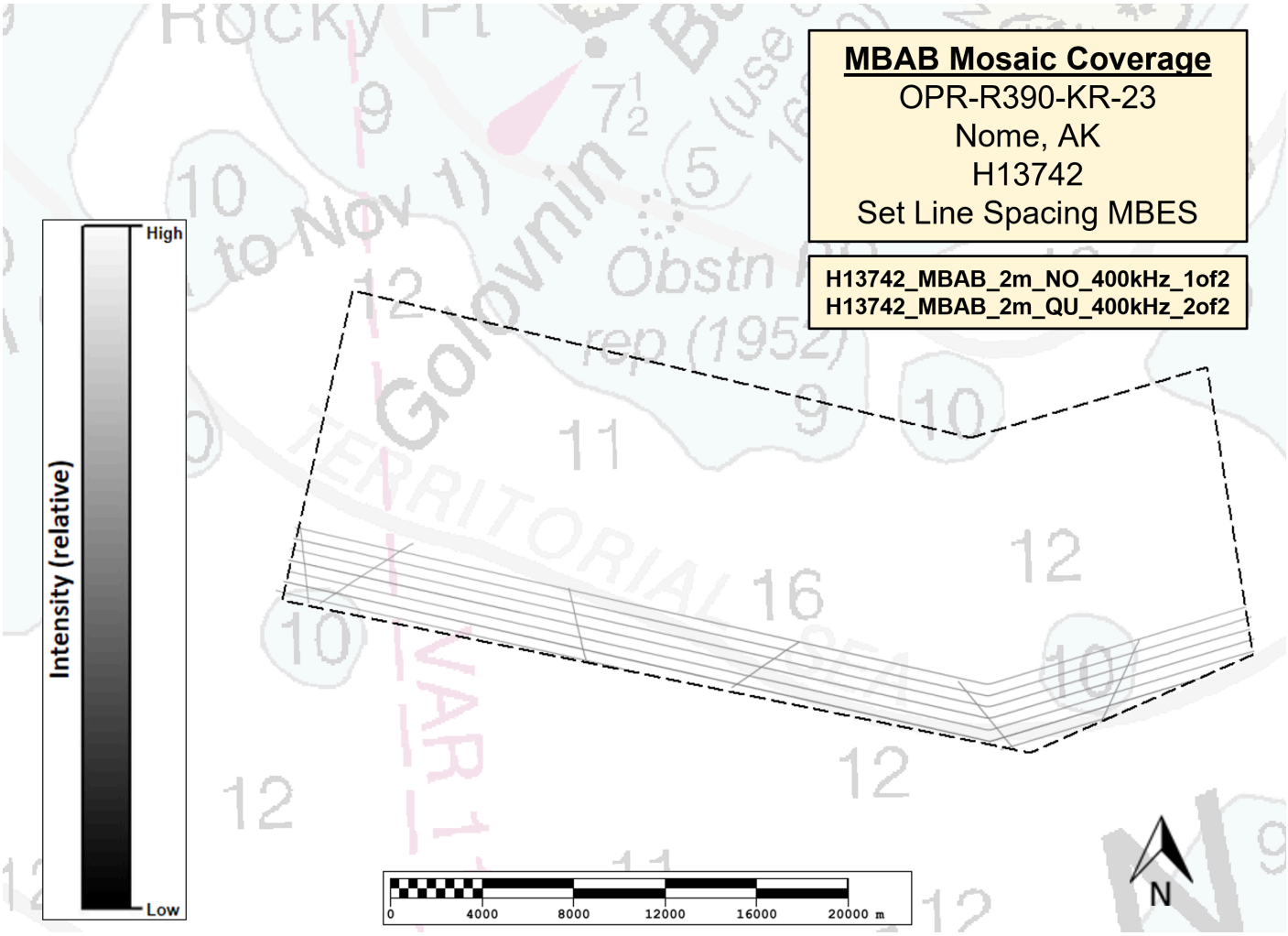


Figure 11: H13742 Finalized 2m MBAB Mosaic Coverage

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR and 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-R390-KR-23_Nome_CapeWoolleyToGolovin_AK_ERTDM_2023_NAD83-MLLW.qgfvom

Table 11: ERS method and SEP file

In order to reference soundings to Mean Lower Low Water Datum, a separation model was provided by NOAA and was applied to the Qinsy DB files via a .qgfvom separation file in the acquisition software.

During HDR This file OPR-R390-KR-23_Nome_ToGolovin_AK_ERTDM_2023_NAD83-MLLW.csar was used to create the Ellipsoid surface.

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 3.

The following PPK methods were used for horizontal control:

- RTX

Applanix PosPac MMS was utilized to post process real time positioning data utilizing Trimble's PP-RTX implementation of Trimble CenterPoint RTX to create a Smoothed Best Estimate of Trajectory (SBET).

RTK

GNSS satellite corrections were received on each vessel using the G4+ carrier signal from the Marinestar Global Correction System maintained by Fugro.

D. Results and Recommendations

D.1 Chart Comparison

A chart comparison was conducted for H13742 using Pydro CA tools, Qimera, and Caris HIPS and SIPS. Survey data were compared against the largest scale ENC to accomplish the chart comparison. The largest scale ENC does not cover the entire survey boundary so two other charts were used to complete the chart comparison. Details of the ENCs used are listed below.

US4AK6QR, scale: 80000, edition: 1, update application date: 01/17/2023, issue date: 01/17/2023

US3AK83M, scale: 300000, edition: 12.2, update application date: 12/06/2022, issue date: 12/06/2022

US3AK80M, scale: 400000, edition:12.2, update application date: 12/06/2022, issue date: 12/06/2022

Throughout survey operations sounding comparisons between the charted depths and the surveyed depths were analyzed to identify depth discrepancies. Using 4 meter CUBE weighted Dynamic surfaces, soundings were generated in the "Sounding Selection" tab of Pydro CA tools. Soundings were displayed against the charted soundings and a visual comparison was made in Caris HIPS and SIPS. Additionally, potential DtoNs and discrepancies were generated using the "DTM vs Chart" tab of Pydro CA tools. The results were displayed through CA tools and investigated in CARIS HIPS and SIPS and Qimera.

An overview image of the generated soundings on each chart is included below.

Results of the chart comparison are included in the following sections.

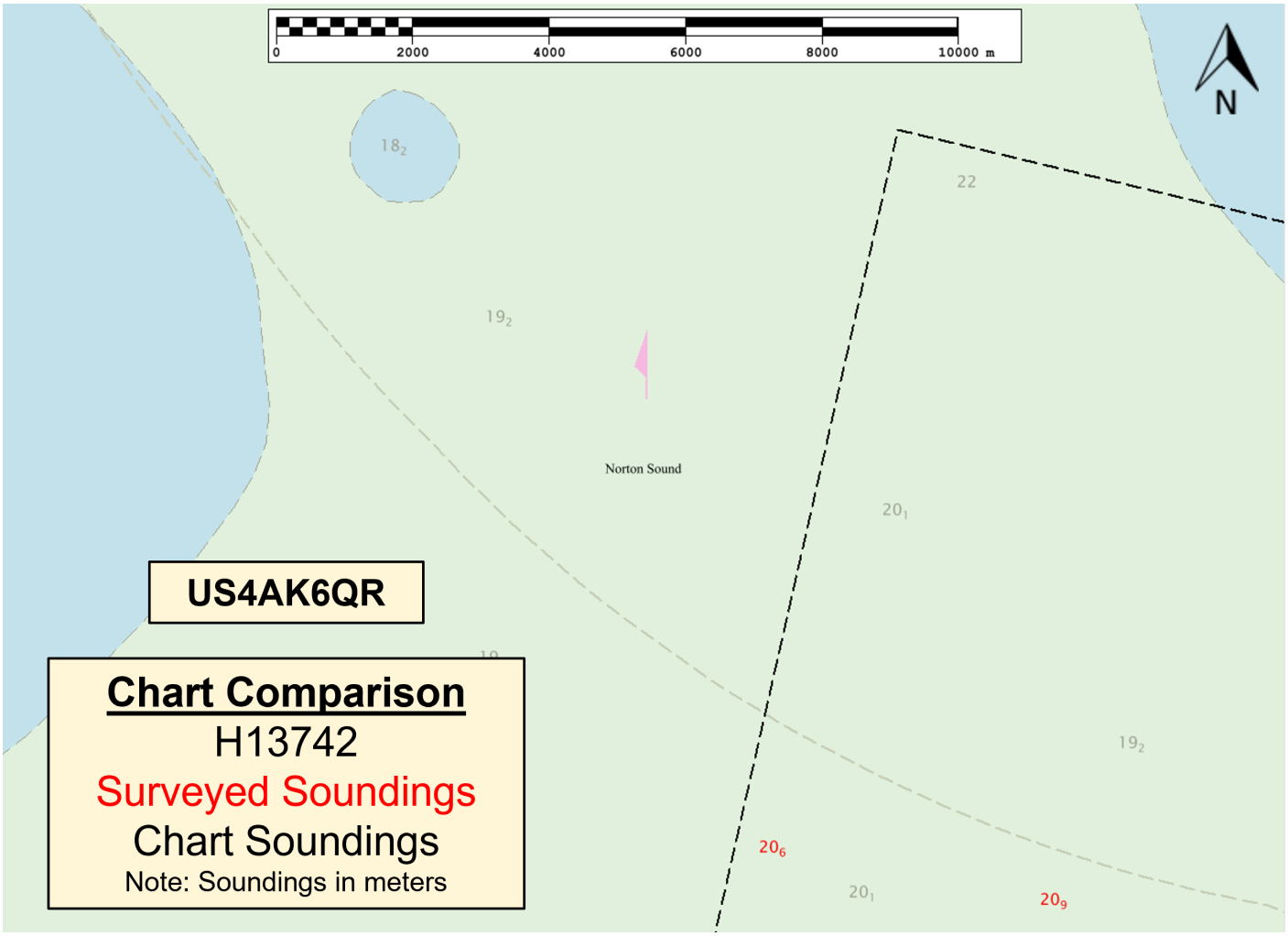


Figure 12: Generated Soundings used for Chart Comparison (US4AK6QR)

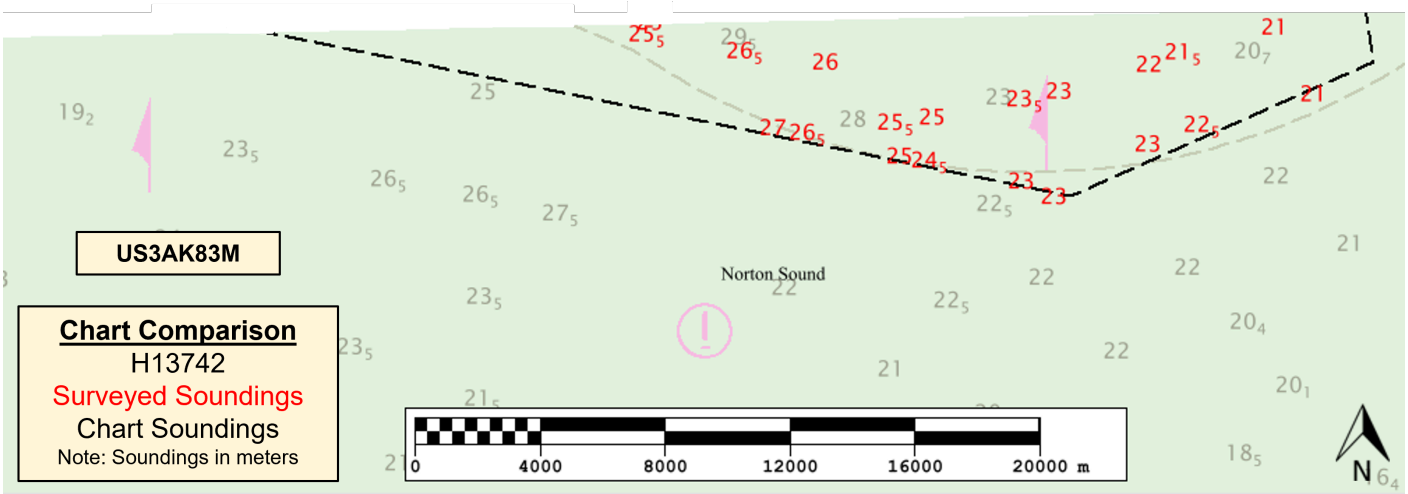


Figure 13: Generated Soundings used for Chart Comparison (US3AK83M)

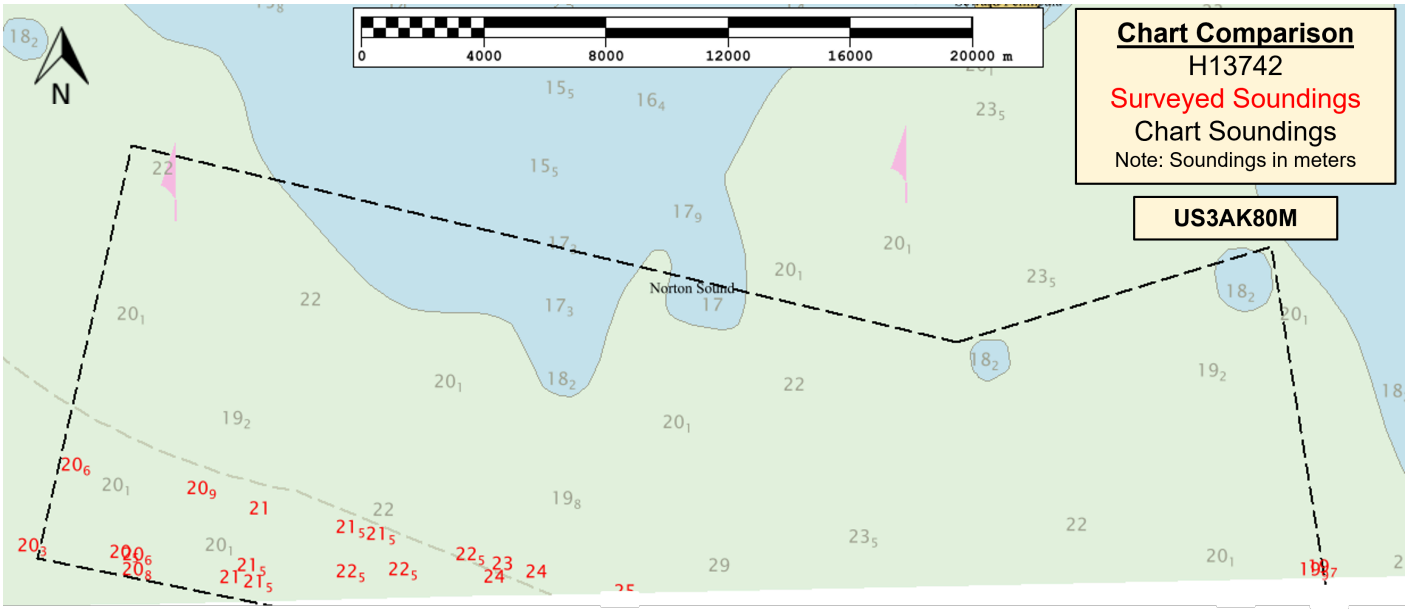


Figure 14: Generated Soundings used for Chart Comparison (US3AK80M)

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
US4AK6QR	1:80000	1	01/17/2023	01/17/2023
US3AK83M	1:300000	12	12/06/2022	12/06/2022
US3AK80M	1:400000	12	12/06/2022	12/06/2022

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Channels

No channels exist within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

No Aids to navigation (AtoNs) exist for this survey.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

7 bottom samples were obtained in accordance with section 7.1 of the HSSD 2022 in areas designated by the field through discussions with our COR. Detailed information and images of the bottom samples are located in the Final Feature File (FFF). Each bottom sample has been given a unique identifier in the "userid" field of the .000 S-57 file (format MX).

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

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

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

D.2.10 New Survey Recommendations

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

D.2.11 ENC Scale Recommendations

No new ENC scales are recommended for this area.

E. Approval Sheet

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

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

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

Approver Name	Approver Title	Approval Date	Signature
David Neff, C.H.	Chief of Party	12/04/2023	David Neff, CH Digitally signed by David Neff, CH DN: C=US, E=dave.neff@woolpert.com, O="eTrac, A Woolpert Company", OU="eTrac, A Woolpert Company", CN="David Neff, CH" Date: 2023.12.04 21:47:55-08'00'

F. Table of Acronyms

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

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

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