# SEAFLOOR MAPPING OF LONG ISLAND SOUND -

# FINAL REPORT: PHASE I PILOT PROJECT APPENDICES

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STATE OF NEW YORK, DEPARTMENT OF ENVIRONMENTAL CONSERVATION, BUREAU OF MARINE RESOURCES;

CONNECTICUT SEA GRANT;

NEW YORK SEA GRANT;

AND

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGIONS 1 AND 2

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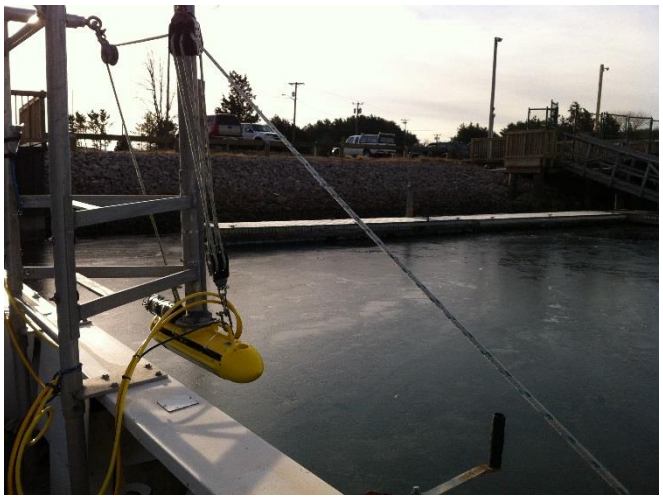
## Appendix 1: Addendum to Seafloor Topography and Acoustic Intensity – LISMARC Shallow Water Mapping

# Components for Long Island Sound Final Report

## Summary

Staff (E. Shumchenia and C.Heil) from the University of Rhode Island (URI) Graduate School of Oceanography's Environmental Mapping Laboratory transited from Allen Harbor in Narragansett Bay, RI to Pilot Project Area F in Long Island Sound near Stratford, CT on August 22, 2012. On the URI R/V Shanna Rose, we deployed a pole-mounted Teledyne Benthos C3D interferometric sonar and a towed CHIRPIII subbottom. Over the course of 2 survey days, we mapped 1.25 square miles surrounding Charles Island and within Bridgeport Harbor. The goal of the survey was to demonstrate shallow water mapping capabilities and techniques, as well as overlap into areas of deeper water that had been mapped at much lower resolutions previously. A ~2 - 3 meter tidal amplitude in this survey area was extremely advantageous for shallow water mapping. During high tide, we were able to survey areas on the NOAA chart around Charles Island marked as intertidal. Ironically, however, the pole-mounted C3D ran aground in Bridgeport Harbor on the deep side of a NOAA-charted 18-foot contour.

## Methods



The Teledyne Benthos C3D interferometric sonar system operated at 200 kHz, with vessel speed varying from 1 to 4 knots. Horizontal and vertical positional data were provided by a differential GPS and inertial motion unit (Applanix POS-MV). A CTD was fixed to the C3D polemount to obtain real-time temperature and salinity data for on-the-fly correction of signal travel time (sound velocity). A vessel and sensor diagram[1] and offsets[2] are provided with these deliverables. Interferometric data were acquired with Ocean Imaging Consultants (OIC) GeoDAS software in proprietary .oic format[3]. Subbottom data were acquired with SonarWizMap[4], using the GPS feed from the POS-MV, corrected with a layback value of 5 meters. A backup of the Hypack project file is available at the URI Environmental Mapping Laboratory[5]; the raw navigation file (.csv) for all survey transects is available as a part of these deliverables[6].

Interferometric data were processed using OIC Cleansweep version 3.4.27912. Side scan backscatter imagery was corrected using automated bottom tracking and manually-applied beam angle filters. Bathymetry was corrected for tide level using predicted tides available on www.tidesandcurrents.noaa.gov at the Bridgeport Harbor station[7]. Bathymetry data were filtered by depth and beam angle to reduce vertical scatter in the data. Both datasets were mosaicked at 0.5 meters. Side scan backscatter was exported in geotiff format[8], whereas bathymetry was exported in ASCII xyz format[9]. Bathymetry xyz files were brought into ArcGIS 9.3 and used to create a TIN (Triangular Irregular Network). The TIN was then converted to a raster with 0.5 meter resolution using the 3D Analyst toolbox. Rasters were exported as geotiffs[9].

## RESULTS

The bathymetry and sidescan sonar mosaics obtained in LIS are shown in Figures 1-4. The bathymetry mosaic from the Charles Island site is shown in figure 1. The sidescan sonar mosaic from the Charles Island site is shown in Figure 2. The side-scan sonar mosaic reveals heterogenous bottom types within the survey area including what appear to be sand waves. The bathymetry mosaic for the Bridgeport Harbor area is shown in Figure 3. The sidescan sonar mosaic from Bridgeport Harbor is shown in Figure 4. The sidescan mosaic reveals a heterogenous bottom within the survey area. Features include sand waves in the channel, a rocky bottom adjacent to Pleasure Beach, and numerous man-made structures/objects. Overall, the surveys were successful in identifying areas of different bottom types and features that could be used to obtain a representative suite of ground-truth samples for habitat characterization. In addition, the large tidal range in Long Island Sound allowed surveys into a water depth of approximately 1 foot.

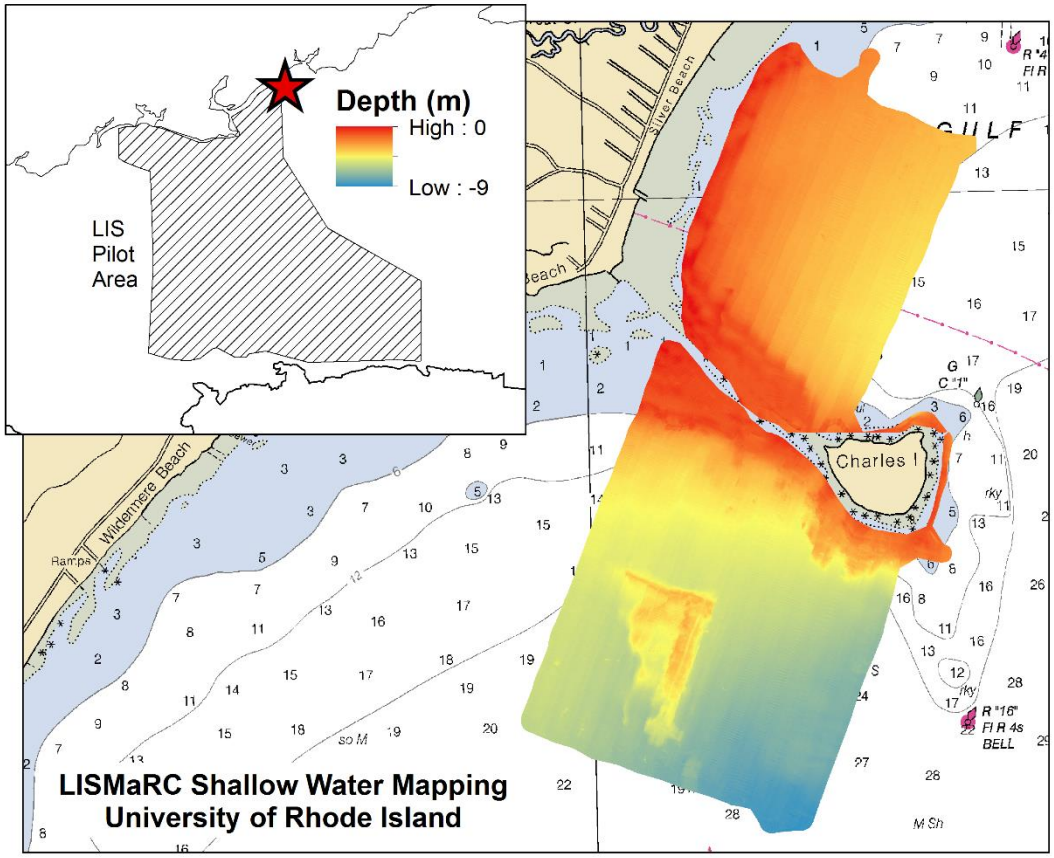



Figure 1. Bathymetry mosaic for Charles Island survey area.

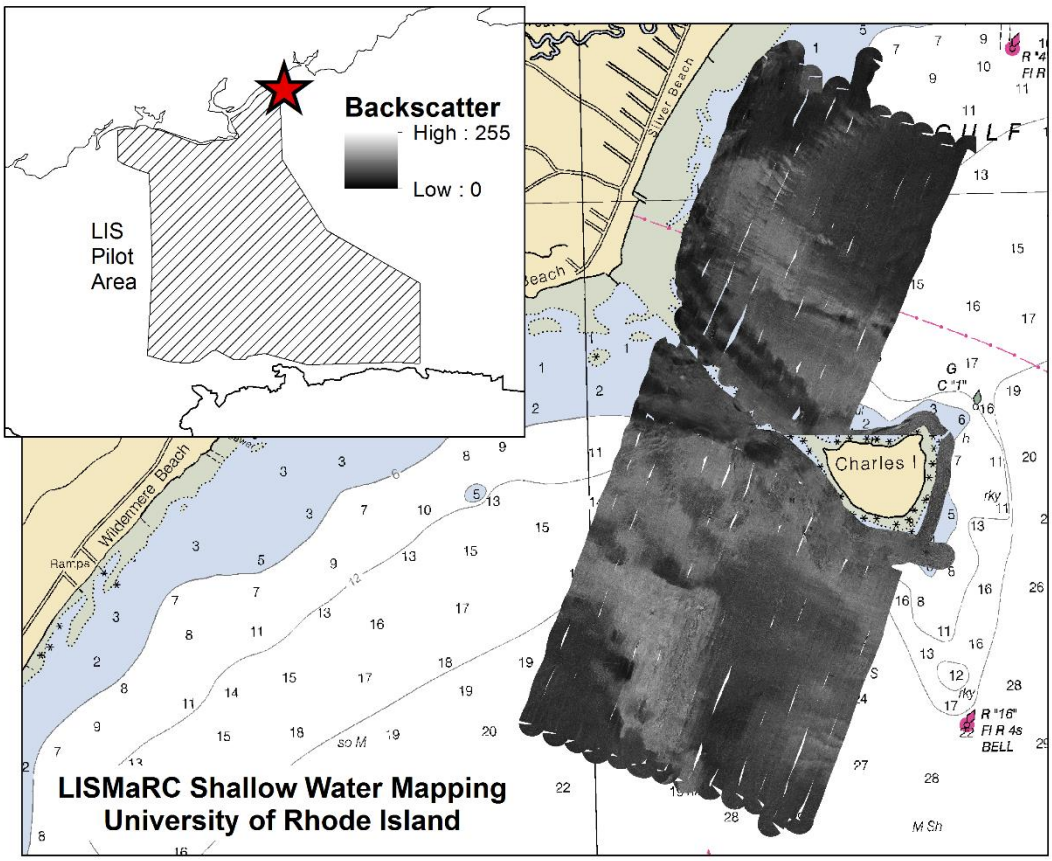



Figure 2. Sidescan sonar mosaic for Charles Island survey area.

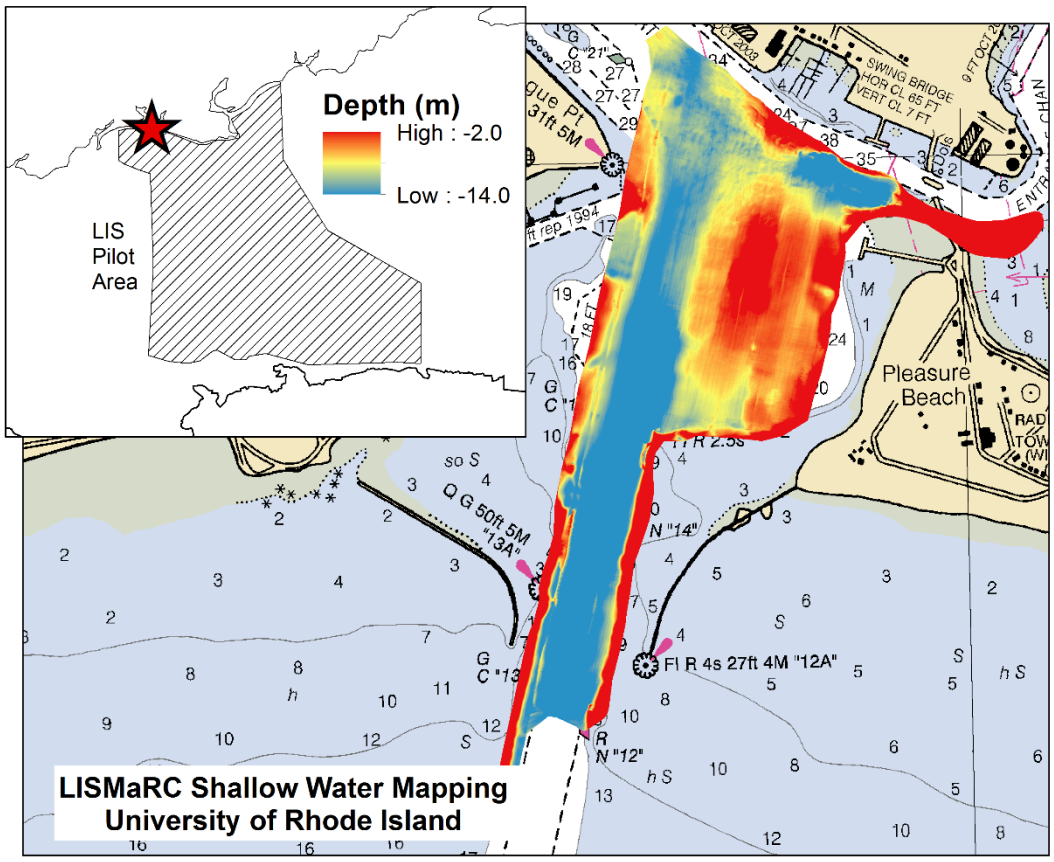



Figure 3. Bathymetry mosaic for Bridgeport Harbor survey area.

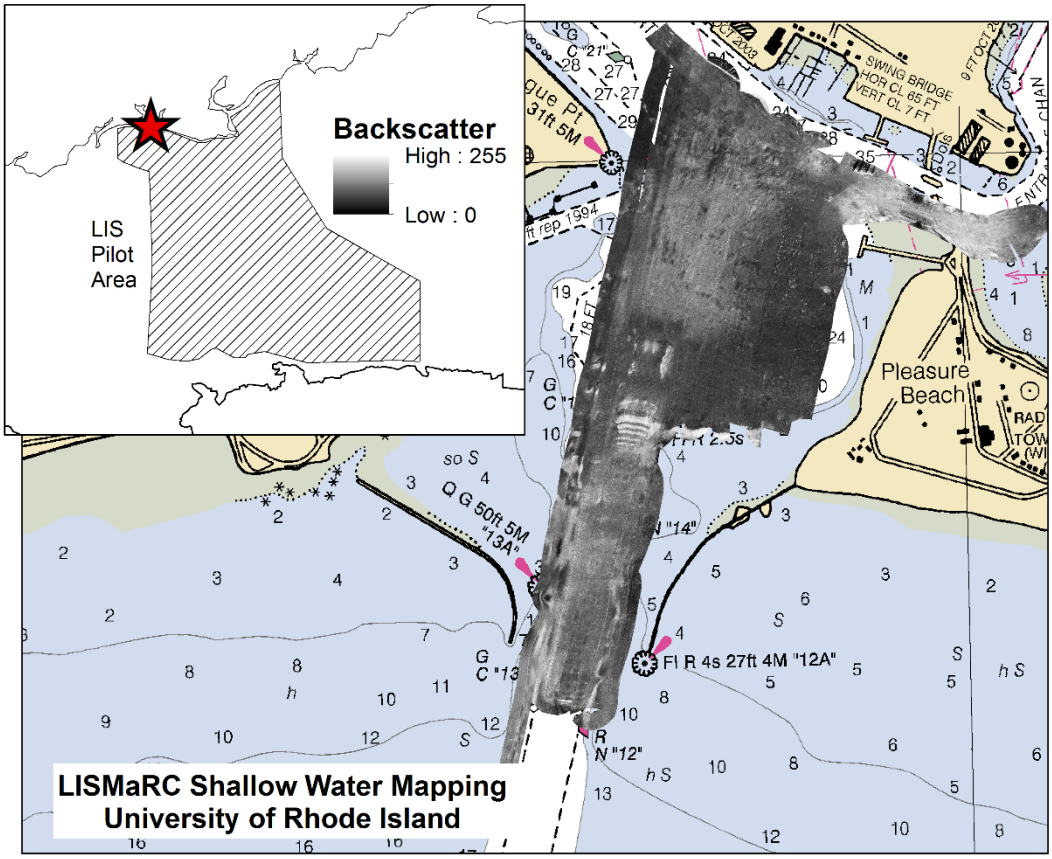



Figure 4. Sidescan sonar mosaic for Bridgeport Harbor survey area.

# Appendix 2:  Acoustic Survey Cruise Reports

**U.S. DEPARTMENT OF COMMERCE**
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

# Data Acquisition & Processing Report

*Type of Survey* *Multibeam and Side Scan Sonar*

*Project No.* *OPR-E350-TJ-12, OPR-B340-TJ-12, OPR-B363-TJ-12, OPR-B370-TJ-12 S-B935-TJ-12*

*Time Frame*: 02APR2012 – 08NOV2012

LOCALITY

*State* *Virginia, New York, Connecticut*

*General Locality* *Southern Chesapeake Bay, VA; Long Island Sound, NY; Block Island Sound, RI; Eastern Long Island Sound, CT, NY Harbor and Vicinity*

**2012**

**CHIEF OF PARTY**

*CDR Lawrence T. Krepp*
*National Oceanic and Atmospheric Administration*

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# A. EQUIPMENT

The methods and systems described in this report are used to meet Complete and Object detection coverage requirements and are in accordance with the Hydrographic Surveys Specifications and Deliverables Manual (2012), Hydrographic Survey Directives, and the Field Procedures Manual for Hydrographic Surveying (2012).

## THE SURVEY VESSELS

The platforms used for data collection were the *NOAA Ship Thomas Jefferson,* (Figure A-1), *Hydrographic Survey Launches 3101 and 3102* (Figure A-1). *Thomas Jefferson* acquired multibeam echosounder (MBES) data, Side Scan Sonar (SSS) imagery and sound velocity profile (SVP) data. The vessel is equipped with a DT Marine Products tow winch (Model 307EHLWR) for side scan deployment, a DT Marine Oceanographic winch for CTD and bottom sample deployment, and a Brooke Ocean Technology MVP 100 Moving Vessel Profiler (MVP). Launches *3101* and *3102* acquired multibeam echosounder (MBES) data, vertical beam echosounder (VBES) data, Side Scan Sonar (SSS) imagery and sound velocity profile (SVP) data. Table A-1 presents the vessel characteristics for all platforms.

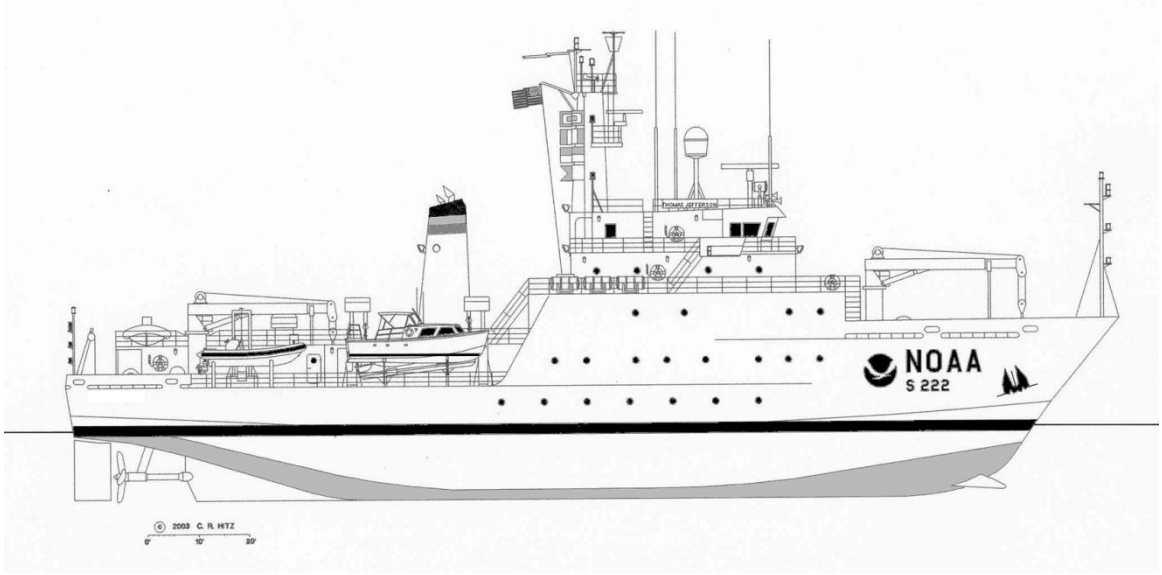


**Figure A-1. NOAA Ship *Thomas Jefferson.***



**Figure A-2. Hydrographic Survey Launch 3101/3102.**

| Vessel Name | LOA (Ft) | Beam (Ft) | Draft (Ft) | Survey Speed | Date of last Vessel Survey | Date of last Dynamic Draft Measurement |
|---|---|---|---|---|---|---|
| *NOAA Ship Thomas Jefferson* | 208’ | 45’ | 14.0’ | 5-10 kts | 3/10/2012 | 4/3/2012 |
| *HSL 3101* | 31’ | 10’8” | 5’2” | 4-12 kts | 1/20/2010 | 4/3/2012 |
| *HSL 3102* | 31’ | 10’8” | 5’2” | 4-12 kts | 1/20/2010 | 4/4/2012 |

**Table A-1. Survey Vessel Characteristics.**

## DATA ACQUISITION SYSTEMS

A complete listing of the data acquisition systems used for *OPR-E350-TJ-12, OPR-B340-TJ-12, OPR-B363-TJ-12, OPR-B370-TJ-12* are listed in the tables below:

**Hydrographic Hardware Inventory**
**Field Unit: Thomas Jefferson (S-222)**

| SONAR AND SOUNDING EQUIPMENT | | | |
|---|---|---|---|
| **Manufacturer** | **Model** | **Serial Number** | **CD # / ACM #** |
| Reson | 7P Processor | 50357 | CD0001044551 |
| | Lower Control Unit | 61206 | None |
| | 7125 Projector | 1908203 | None |
| | 7125 Reciever | 808042 | None |
| Klein | 5500 high speed high resolution side scan sonar towfish | 280 | None |
| | Top Side Processor Unit | 135 | CD0000825295 |
| **POSITIONING & ATTITUDE EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Trimble | DSM212L | 0220227516 | CD0000658032 |
| Trimble | DSM212L | 0220159716 | CD0000832703 |
| Applanix | POS/ MV | PCS - 2321 | CD0001472952 |
| Applanix | POS M/V | IMU - 146 | CD0001284522 |
| **SOUND SPEED MEASUREMENT EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Seabird | SBE 19 SVP | 192472-0285 | CD0001776086 |
| Applied Micro Stystems | Smart SV+T SSVS | 4823 | A011827 |
| Brooke Ocean Technology LTD | Sensor 1 | 5340 | None |
| | MVP PU | 10332 | CD0200825374 |
| | "Fish 1" | 10535 | None |
| | "Fish 2" | 10333 | None |
| | MVP Computer | 0127560 | None |
| | Sensor 2 | 4988 | None |
| | Deck Unit | 10332 | None |

**Table A-2 - *Thomas Jefferson* S222 Acquisition Systems.**

| Hydrographic Hardware Inventory | | | |
|---|---|---|---|
| **Field Unit: Launch 3101**<br>**Effective Date: October 22, 2012**<br>**Updated Through: October 22, 2012** | | | |
| **SONAR AND SOUNDING EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Reson | SeaBat 7125-SV TPU | 1812012 | None |
| | | 1812018 | CD0001527832 |
| | | 1812031 | CD0001529723 |
| | SeaBat 7125-SV X-Ducer | 2008044 | N/A |
| Klein | 5500 LW ss towfish | 319 | N/A |
| | Top Side Processor Unit | 135 | CD0000825295 |
| | | 136 | CD0000825297 |
| | | 137 | CD0000825292 |
| Odom | Echotrac CV-200 | 003260 | N/A |
| **POSITIONING & ATTITUDE EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Trimble | DSM212L | 0220243252 | CD0001606186 |
| Applanix | POS M/V | 2320 | CD0000825559 |
| | | IMU - 352 | none |
| **SOUND SPEED MEASUREMENT EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Seabird | SBE 19 Plus SVP | 19P33589-4486 | CD0001776087 |

**Table A-3- *HSL 3101* Acquisition Systems.**

| Hydrographic Hardware Inventory | | | |
|---|---|---|---|
| **Field Unit: Launch 3102**<br>**Effective Date: October 22, 2012**<br>**Updated Through: October 22, 2012** | | | |
| **SONAR AND SOUNDING EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Reson | SeaBat 7125-SV TPU | 1812012 | CD0001527832 |
| | | 1812018 | CD00016776100 |
| | | 1812031 | CD0001529723 |
| | SeaBat 7125-SV X-Ducer | 2008027 | N/A |
| Klein | 5500 LW ss towfish | 322 | N/A |
| | Top Side Processor Unit | 135 | CD0000825295 |
| | | 136 | CD0000825297 |
| | | 137 | CD0000825292 |
| Odom | Echotrac CV-200 | 002917 | N/A |
| **POSITIONING & ATTITUDE EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Trimble | DSM212L | 0220168291 | CD0000819685 |
| Applanix | POS/MV | 2562 | CD0000156714 |
| | | IMU - 356 | CD0001474855 |
| **SOUND SPEED MEASUREMENT EQUIPMENT** | | | |
| **Manufacturer** | **Model** | **Serial Number** | **CD Number** |
| Seabird | SBE 19 Plus SVP | 19P33589-4487 | CD0001776088 |

**Table A-4 *HSL 3102* Acquisition Systems.**

## A.1 ODOM Echotrac CV200

The Echotrac CV-200 is a dual-frequency digital recording echosounder system with a digital recorder. The systems high frequency setting is 200 kHz, low frequency is 24 kHz. It is hull-mounted on HSL *3101*and *3102*.

On Launches *3101* and *3102*, the transducer is mounted on the port side forward of the retractable arm that accommodates the RESON 7125-SV (Figure A-3). The installation of the Odom on Launch *3101, 3102* allows simultaneous acquisition of KLEIN 5000 side scan with general survey-grade bathymetry when the ODOM is operated in either low or high frequency mode.



**Figure A-3 - Odom Vertical Beam on *3101 / 3102.***

For the purposes of calculating total propagated error (TPU), the ODOM Echotrac CV-200 is assumed to be a single-frequency multibeam transducer with one beam. The maximum across-track and along-track beam angles are assumed to be identical at a value of 7.5°. The sonar is assumed to have a pulse length of 0.1 ms at 100 kHz and a ping rate of 20 Hz.

The ODOM Echotrac is used with side scan sonar to meet NOAA requirements for object detection.

Owing to its wide beamwidth, patch tests are not conducted to solve for mounting angle biases for ODOM Echotrac data. During typical acquisition conditions, the high-frequency beamwidth is wide enough to receive a primary-lobe hit at nadir regardless of vessel attitude. This breaks down, however, when the vessel pitches more than 3° or rolls more than 5°. Care is taken to avoid using the ODOM as the primary source of bathymetry in situations where the pitch or roll would cause attitude artifacts or side-lobe hits.

## A.2 RESON SeaBat 7125 Multibeam Echosounder

The RESON SeaBat 7125 system is a single-frequency, digital recording multibeam echosounder with a central frequency of 400 kHz. The RESON 7125 system aboard *Thomas Jefferson* is installed in a steel housing assembly with hydrodynamic shape mounted to a pylon extending from the starboard hull of the ship (Figure A-4).

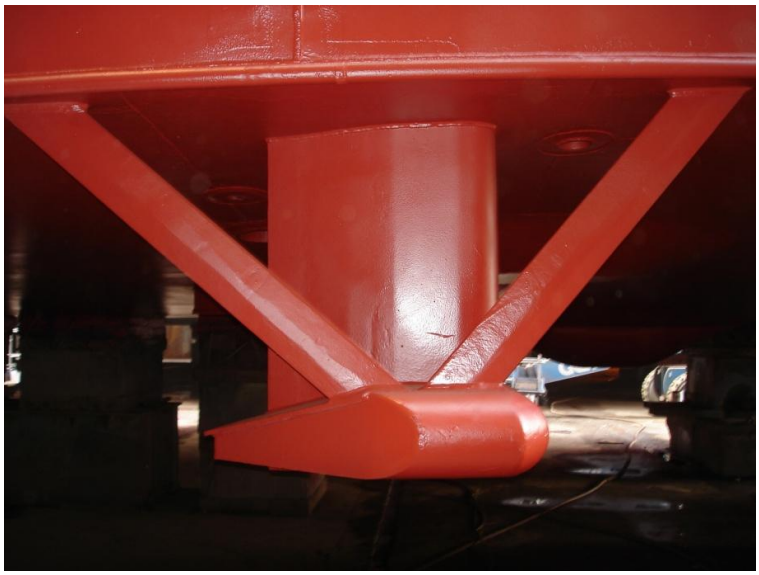

**Figure A-4. 7125 Housing on *Thomas Jefferson*.**

The RESON 7125 forms 256 beams and can be set to interpolate to 512 beams. The RESON 7125 can also be set to acquire equi-distant or equi-angular beam spacing. Each beam in the receive array has a 0.5° across-track resolution and 1° along-track resolution. The RESON 7125 has a maximum ping rate of 48 Hz and can achieve a full swath width to a depth of 75m. Standard operating procedure on *Thomas Jefferson* is to acquire 512 beam, equi-distant bathymetry.

The sonar contribution to the total propagated error is computed using parameters provided by the manufacturer and distributed with Caris HIPS.

The RESON 7125 performs active beam steering to correct for sound velocity at the transducer head using an Applied Microsystems LTD Sound Velocity and Temperature Smart Sensor. This sensor will be discussed in more detail in the Sound Velocity Equipment Section.

The user selectable range scale on the RESON 7125 was adjusted using the “autopilot” settings, or by hand.

## A.3 RESON SeaBat 7125-SV Multibeam Echosounder

The RESON 7125-SV system aboard Launches *3101, 3102* are installed on a RESON Seabat 7125 mounting bracket deployed on a retractable arm from the hull. (Figure A-5).



**Figure A-5. 7125-SV Housing on Launch *3101/3102.***

The RESON 7125-SV forms 256 beams and can be set to interpolate to 512 beams in the receive array and can be set to acquire equi-distant or equi-angular beam spacing. Standard operating procedure on *Thomas Jefferson* is to acquire 512 equi-distant bathymetry. The 400 kHz frequency has a 0.54° across-track resolution and 1° along-track resolution. The 200 kHz frequency has a 1.1° across-track resolution and 2.2° along-track resolution. The RESON 7125-SV has a maximum ping rate of 50 pings/s and can maintain a full swath width in depths of 1-75 m for the 400 kHz, and 1-150 m for the 200 kHz systems.

The sonar contribution to the total propagated error is computed using parameters provided by the manufacturer and distributed with Caris HIPS.

The RESON 7125-SV performs active beam steering to correct for sound velocity at the transducer head using a RESON Sound Velocity Probe (SVP) 70. This sensor will be discussed in more detail in the Sound Velocity Equipment Section.

The RESON 7125-SV can be configured for roll stabilization. In roll stabilized mode, the sonar can operate in environments with up to +/- 10 degrees of roll without degrading system performance. Standard operating procedure on HSL 3101 and 3102 is to acquire data in the roll stabilized mode.

The user selectable range scale on the RESON 7125-SV was adjusted using the "autopilot" settings, or by hand.

Notable RESON7125-SV equipment changes:

Over the course of the season, three different TPUs were used between HSL 3101 and HSL 3102 as breakdowns and maintenance occurred. Additionally, a receiver cable failed and was replaced. No patch test was performed after any of these replacements, since the transducers were never removed from their mountings.

## A.4 Variants of the Klein 5000 Side Scan Sonar

### Klein System 5000

The KLEIN 5000 high-speed, high-resolution side-scan sonar (SSS) system is a beam-forming acoustic imagery device with an operating frequency of 455 kHz and vertical beam angle of 40°. The KLEIN 5000 system consists of a KLEIN 5500 towfish, a Transceiver/Processing Unit (TPU), and a computer for user interface. Stern-towed units also include a tow cable telemetry assembly. There are two configurations for data acquisition using the KLEIN 5000 system: stern-towed and hull-mounted. S-222 uses exclusively towed SSS, HSL 3101 is hull mount configuration, HSL 3102 can be converted from hull-mounted to towed as required. HSL 3102 operated using only the hull mounted configuration for the 2012 field season.

The KLEIN 5000 system is distinct from other commercially-available side scan sonars in that it forms 5 simultaneous, dynamically-focused receiver beams per transducer face. This improves along-track resolution to approximately 20cm at the 100m range scale, even when acquiring data at up to 10 knots. Across-track resolution is typically 7.5cm at the 100m range scale. The achievable 20cm resolution meets the NOAA Hydrographic Surveys Specifications and Deliverables Manual (HSSDM) for object detection. Digital data from the KLEIN 5000 TPU is sent directly to the acquisition computer for display and logging by KLEIN SonarPro software. Raw digital side scan data from the KLEIN 5000 is collected in (SDF) and maintained full resolution, with no conversion or down sampling techniques applied.

Towfish positioning is provided by CARIS HIPS using cable out values recorded in the Sonar Pro SDF files. This program uses Payout and Towfish Depth to compute towfish positions. The tow fish position is calculated from the position of the tow point using the cable out value received by SonarPro from the cable payout meter, the towfish pressure depth (sent via a serial interface from the KLEIN 5000 TPU to the SonarPro software ), and the Course Made Good (CMG) of the vessel. This method assumes that the cable is in a straight line therefore no catenary algorithm is applied at the time of acquisition, but in processing, CARIS SIPS applies a 0.9 coefficient to account for the catenary.

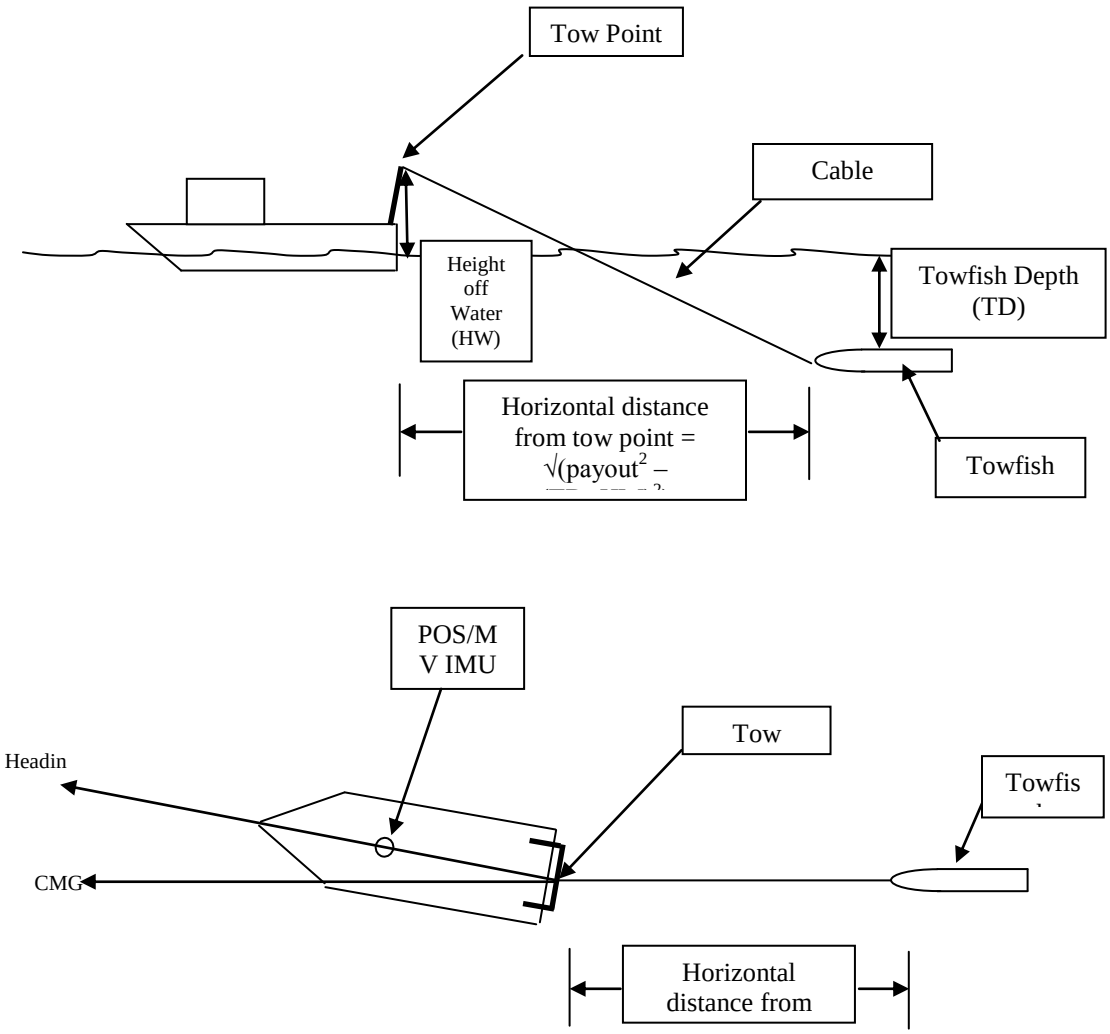


**Figure A-6. Towfish orientation and position description.**

When in the towed configuration, the north and east velocity vectors are filtered to calculate the ship's CMG. The CMG is used to determine the azimuth from the tow block to the side scan towfish. The position for the side scan towfish is computed based on the vessel's heading, the reference position (POS/MV IMU), the measured offsets (X, Y, and Z) to the tow point, height of the tow point above the water, Course Made Good and cable out. This calculated towfish position is sent to the sonar data collection system in the form of a GGA (NMEA-183, National Marine Electronics Association, Global Positioning System Fix Data String) message where it is merged with the sonar data file. Cable adjustments are made using a remote winch controller in acquisition in order to maintain acceptable towfish altitudes and sonar record quality. Changes to the amount of cable out are automatically saved to the SonarPro SDF.

Towfish altitude is maintained between 8% and 20% of the range scale in use (e.g. 4m-10m @ 50m range scale), when conditions permit. For equipment and personnel safety as well as safe vessel maneuverability, data may have been collected at towfish altitudes outside the 8% to 20% of the range over shoal areas and in the vicinity of charted

obstructions or wrecks. When the towfish altitude was either greater than 20% or less than 8%, periodic confidence checks on linear features (e.g. trawl scars) or geological features (e.g. sand waves or sediment boundaries) were made to verify the quality of the sonar data. Confidence checks ensured the ability to detect one-meter high objects across the full sonar record range.

Another feature that affects the towfish altitude is the use of a K-wing depressor. The K-wing depressor is attached directly to the towfish and serves to keep it below the vessel wake, even in shallower near shore waters at slower survey speeds. The use of the K-wing reduces the amount of cable payout, which in turn reduces the positioning error of the towfish. Another benefit to less cable out is increased maneuverability of the ship in shallow water. Less cable out reduces the need to recover cable prior to turning for the next survey line, permitting tighter turns and increased survey efficiency.

Side scan data file names are changed automatically every 15 minutes and manually at the completion of a survey line.

**Hull-Mounted Configuration**

Aboard both survey launches, the lightweight or heavyweight Klein 5500 towfish can be mounted to an aluminum sled using omega brackets (Figure A-7). Positioning of the hull mounted towfish is determined by entering the X,Y, Z position of the towfish as the tow point and a layback value of zero. Otherwise, the system is processed the same as the towed configuration.



**Figure A-7. Side Scan Hull Mounted on *3101 / 3102 (lightweight model shown).***

The hull-mounted configuration is normally used in depths of twenty meters or less, per the HSSDM. Aboard Launch *3101* and *3102*, sidescan may be collected concurrently with ODOM Echotrac CV-200 vertical beam bathymetry or RESON 7125 MBES.

Notable SSS equipment changes:

During the season, identical TPUs were swapped between platforms due to failures and platform acquisition requirements. The SSS fish data cable on HSL 3101 malfunctioned during the season and was replaced. Wet end hardware remained unchanged throughout these replacements.

## A.5 Manual Sounding Equipment

No manual sounding equipment was used for this project.

## A.6 Positioning and Orientation Equipment

Positioning for data acquired by the launches and the ship are achieved by writing differentially corrected GPS positions output from the POS/MV to the raw sonar data in real time. Upon conversion in CARIS, the positional information in the raw sonar data is used to create vessel track lines for the processed data. For projects OPR-B340-TJ-12 and OPR-B370-TJ-12, Ellipsoid Referenced Survey (ERS) methods were mandated.

When ERS are assigned, the additional positioning requirements involve logging full POSPac data from the POS/MV and utilizing POSPac MMS to derive Smoothed Best Estimate Trajectory (SBET) files. POSPac MMS requires ephemeris and clock data for the GPS constellation and data downloaded from Continually Operating Reference Stations (CORS) or other base stations to correct for atmospheric effects in the GPS data. SBET files are extremely accurate measurements of the 3-D position, speed, and motion of a vessel and can be used to apply higher quality navigation information to the processed data. Inertially Aided Post Processed Kinematic (IAPPK) navigation may be applied in CARIS during the SVP step in the processing workflow. For OPR-E350-TJ-12, OPR-B340-TJ-12, and OPR-B370-TJ-12, vertical and horizontal positioning was derived from IAPPK methods. IAPPK methods were not utilized for OPR-B363-TJ-12.

IAPPK methods are discussed in greater detail in Section C of this DAPR.

### Applanix POS/MV

A basic requirement of multibeam hydrography is accurate ship's position and attitude data during data acquisition. *THOMAS JEFFERSON* uses inertial positioning and orientation sensors and U.S. Coast Guard Differential GPS (DGPS) for a highly accurate blended position and orientation solution. Surveys covered by this DAPR were acquired within approximately 50 nautical miles of USCG differential beacons. Because of this relatively short distance to the differential beacons, horizontal positioning errors of 0.5m were used in Caris HVFs for all platforms during the surveys covered by this DAPR.

*THOMAS JEFFERSON*, HSL 3101, and HSL 3102 are each equipped with Trimble DSM212L DGPS receivers. The DSM212L includes a 12-channel GPS receiver capable of receiving external RTCM correctors from a shore-based reference station. The DSM212L receivers are used for differential correctors to position only and not for actual positioning.

Inertial position calculations on *THOMAS JEFFERSON, HSL 3101, and HSL 3102* are provided by an Applanix POS/MV Model 320 v.4. During the winter period, all three POS/MV systems were sent to the manufacturer where they were upgraded to firmware version 5.0.3 and internal logging capability was added. At the beginning of the season, both internal and Ethernet logging of the .pos file was used to verify the quality of internal logging. Based on our analysis, the quality of internal logging met or exceeded that of Ethernet logging and Ethernet logging was discontinued.

The POS/MV 320 system includes dual GPS antennas, an inertial measurement unit (IMU), and data processor (PCS). The IMU measures linear and angular accelerations corresponding to the major motions of the vessel (heave, pitch, roll, yaw) and inputs this data to the PCS, where it is combined with a GPS position determined by carrier-phase differential measurements to give the final position solution. The POS/MV position solution is not sensitive to short period noise, but its accuracy may decay rapidly over time.

According to the manufacturer's specifications, the inertial position/orientation solution has typical values of 0.02° true roll and pitch accuracy, 0.02° heading accuracy, 2m position accuracy, and 0.03 m/s velocity accuracy. These parameters are monitored in real time during acquisition using the POS/MV user interface software. These values were entered into the HVF and were used to compute the TPU of each sounding.

All acquisition platforms are equipped with Precise Timing, a multibeam sonar acquisition configuration which synchronizes all data to the same time. The timing message is generated by the POS/MV which is received by both the acquisition computer and the RESON TPU. Precise Timing reduces the variable effects of time latency and creates a single, measurable latency (usually zero seconds +/- 0.005 seconds). This is verified during patch tests.

All platforms utilize True Heave (a long-period recording of vessel heave used to detect longer period sea swells that may not be detected during short-period heave calculations) for a post processed heave solution.

IMU's for *Thomas Jefferson, 3101,* and *3102* were all sent to the manufacturer during the winter inport 2009-2010 for tumble testing and calibration. All IMUs passed tumble testing and calibration.

## A.7 Sound Velocity Profilers

A Brooke Ocean Technology Moving Vessel Profiler (MVP) with an Applied Microsystems Smart Sound Velocity and Pressure (SV&P) sensor or a Seabird Electronics SBE-19 CTD were used to collect sound speed profile (SSP) data from *Thomas Jefferson*. Seabird Electronics SBE-19 CTD+ units were used to collect sound speed profile (SSP) data from Launches 3101 and 3102. SSP data were obtained at intervals frequent enough to reduce sound speed errors. The frequency of casts is based on observed sound speed changes from previously collected profiles and time elapsed since the previous cast. Subsequent casts were made based on the observed trend of

sound speed changes. As the sound speed profiles change, cast frequency and location are modified accordingly. Confidence checks of the sound speed profile casts are conducted weekly by comparing simultaneous casts taken with all sound speed determining devices on the ship and each launch.

Sound speed data are included with the survey data in Section II of the Separates for each survey's Descriptive Report. Uncertainty values for sound speed are input into Caris by survey day for each platform during the TPU process. When CTDs are used, uncertainty values of 1m/s for each hour between successive casts is recommended to determine an appropriate uncertainty value. However, to be conservative, all CTD derived sound speeds are assigned an uncertainty of 4m/s even when acquired more frequently than every 4 hrs. An uncertainty value of 1m/s is used for all MVP casts even though MVP casts rarely exceed 1 hour between successive casts. Additionally, a surface sound speed uncertainty value of 0.2m is used for launches 3101 and 3102, as recommended in the 2012 FPM.

**Sea-Bird SBE19/19+ CTD Profilers**

*THOMAS JEFFERSON* and Survey Launches 3101 and 3102 acquire water column sound velocity data using Sea-Bird Electronics SeaCat SBE19 and SBE19+ Conductivity-Temperature-Depth (CTD) profilers. Temperature is measured directly. Salinity is calculated from measured electrical conductivity. Depth is calculated from strain gauge pressure.

*THOMAS JEFFERSON* is equipped with a SeaCat SBE19 CTD profiler with strain gauge pressure sensor. The SBE19 is capable of CTD profiling at depths from 0-3400m. Post calibration drift is expected to be 0.02 °C $yr^{-1}$, 0.012S $m^{-1}$ $yr^{-1}$, and 4.5 psia $yr^{-1}$ for temperature, conductivity, and pressure, respectively. The SBE19 is deployed by hand or using the DT Marine Oceanographic winch for ship based acquisition.

HSL 3101 and HSL 3102 are each equipped with a SeaCat SBE19+ CTD profiler with strain gauge pressure sensor. The SBE19+ has a specified post-calibration temperature accuracy of 0.0005S $m^{-1}$, and strain-gauge pressure accuracy of 0.35 psia. Post calibration drift is expected to be 0.002 °C $yr^{-1}$, 0.004S $m^{-1}$ $yr^{-1}$, and 0.168 psia $yr^{-1}$ for temperature, conductivity, and pressure, respectively. The SBE19+ is capable of CTD profiling at depths from 0-350m. The SBE19+ is deployed by hand from HSL 3101 and 3102.

All CTD instruments were returned to the manufacturer for calibration during December, 2011.

**Sea Surface Sound Velocimeters**

Unlike CTD profilers, surface sound velocimeter sensors (SSVS) calculate sound velocity in water using two-way travel time. The typical SSVS consists of a transducer and a reflector at a known distance from the transducer. A pulse of known frequency is emitted, reflects at the reflector surface a known distance from the transducer, and returns. The two-way travel time is measured, and sound velocity is derived. SSVS are

required for multibeam systems that perform active beam steering at the transducer head. The RESON 7125 and RESON 7125-SV systems both require SSVS data.

The AML Smart SV&T Probe is a real-time time-of-flight sound velocimeter and thermistor sensor. The manufacturer specified sound velocity accuracy is 0.02 m/s and temperature accuracy is 0.03 °C. Empirical observations of drift show a sound velocity drift of approximately 0.5 m/s/yr and temperature drift of approximately 0.05 °C/yr. Aboard *THOMAS JEFFERSON*, the AML Smart SV&T probe is mounted in an insulated sea chest in the sonar void. Sea surface temperature and sound velocity values are output in real time to the SIMRAD EM1002 and RESON 7125 systems at a rate of 10 Hz and are recorded in the raw Hypack .hsx files.

The surface sound speed uncertainty for the ship is based on historical analysis and the same values were used throughout the season. More details may be found in Section C of this DAPR.

**RESON Sound Velocity Probe 71 (SVP)**

The RESON SVP 71 is a real-time surface sound velocimeter. The manufacturer specified sound velocity accuracy is ±0.15 m/s at 0 – 50m. Surface sound velocity values are output to the RESON 7125-SV system at a rate of 20 Hz and lower. Data can be sent in real time to the RESON 7125-SV processor unit and are recorded in the raw Hypack .hsx files.

RESON SVP 71 was installed at the beginning of the 2011 field season on Launches *3101* and *3102*.

**ODOM Hydrographic Systems Digibar Pro**

The Digibar Pro is a real-time time-of-flight sea surface sound velocimeter. The manufacturer specified sound velocity accuracy is 0.3 m/s. Sea surface temperature and sound velocity values are output to the RESON 7125-SV system at a rate of 10 Hz. Data can be sent in real time to the RESON 7125-SV processor unit

The units were returned to the manufacturer and calibrated during the 2009-2010 inport period.

The Odom Digibar Pro is kept onboard Thomas Jefferson as a ready spare and was not utilized for any surveys covered by this DAPR.

**Brooke Ocean Technology Moving Vessel Profiler 100**

The Moving Vessel Profiler (MVP) (figure A-8) is a self-contained profiling system capable of sampling water column profiles to 100m depth. MVP-100 was mounted to the port quarter. The MVP consists of a computer-controlled high speed hydraulic winch, a

cable metering, over-boarding and docking system, a conductor cable and a streamlined free fall fish (FFF) housing an Applied Microsystems "time of flight" SV&P Smart Sensor (see SV&P below) . The system as configured aboard the *THOMAS JEFFERSON* collects vertical profiles of sound velocity data while the ship is underway at survey speed. The unit is located on the fantail and controlled remotely from the ship's acquisition room. When using MVP casts in conjunction with the RESON 7125 MBES, sound velocity data is processed using Pydro Velocipy software, then applied in CARIS HIPS during post processing.




**Figure A-8. MVP 100 on S-222**

Notable equipment changes: None

**AML – Sound Velocity & Pressure Smart Sensor (SV&P)**

The SV&P Smart Sensor is the main instrument housed on the MVP free fall fish; it is designed to directly measure sound velocity and pressure in water. Its small size, extremely fast response time and high sampling rate make the sensor ideal for fast profiles or tow speeds. The sensor has internal calibration coefficients and outputs real-time data to allow a "plug and play" environment.

The Applied Microsystems Smart SV&P Sensor was last calibrated by the manufacturer during December 2011.

## A.8 Bottom Samplers

Two types of bottom samplers are used aboard *THOMAS JEFFERSON* for analyzing bottom sediments.

The Khalisco Mud Snapper model 214WA100 may be deployed by one person by hand and is best used for shallow-water bottom samples acquired on the survey launches. (Figure A-9)

The Ponar Wildco model # 1728 sampler may be deployed by one person by hand and is sometimes used with the DT Marine Oceanographic winch for Ship based bottom sample acquisition. (Figure A-10)

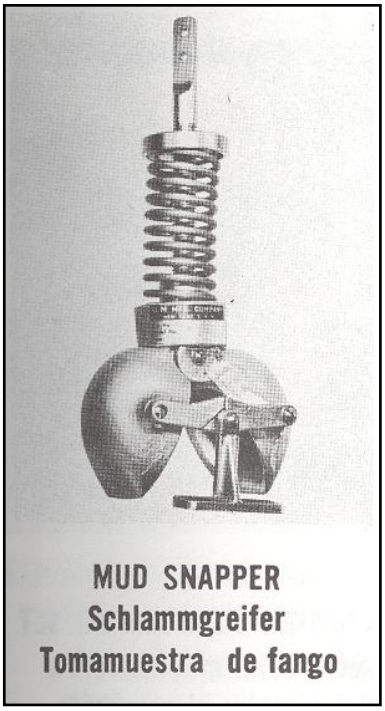


**Figure A-9. Khalisco Mud Snapper**



**Figure A-10. Ponar Grab Sampler**

## A.9 Software Systems

### Acquisition Software

Multibeam data were acquired using Hypack 2012 software running on acquisition computers with the Windows XP and Windows 7 operating system. Hypack is used to control real-time navigation, data time–tagging, and data logging. KLEIN 5000 side scan sonar data were acquired using KLEIN's SonarPro software running on acquisition computers with the Windows XP and Windows 7 operating system. Moving Vessel Profiler data were acquired using Brooke Ocean Technology MVP software running on a computer with the Windows XP operating system.

Data Processing: Post-acquisition multibeam processing was performed on board the *Thomas Jefferson* using processing computers with Windows XP and Windows 7 operating systems, which run CARIS HIPS&SIPS software. Side scan sonar data were reviewed for targets, side scan mosaics and contact generation in CARIS HIPS&SIPS software; Side-scan contacts were correlated with multibeam data in NOAA's Pydro software. CTD and MVP data were processed using NOAA Velocipy software. See Table A-5 below for software versions.

NOAA Ship Thomas Jefferson - Acquisition and Processing Software

| Acquisition Software | Date of Application | TJ | 3101 | 3102 |
|---|---|---|---|---|
| Hypack/Hysweep | Apr-12 | v2012 | v2012 | v2012 |
| SonarPro | Feb-10 | v11.2 | v11.2 | v11.2 |
| Velocipy | Oct-12 | V12.9 | V12.9 | v12.9 |
| Applanix MV POSView | Apr-12 | v5.1.0.2 | v5.1.0.2 | v5.1.0.2 |
| TSIP Talker | Aug-10 | v2.00 | v2.00 | v2.00 |
| MVP | Sep-09 | v.2.351 | | |

| Processing Software | Date of Application | Version |
|---|---|---|
| CARIS Hips and Sips | Sept-2012 | 7.1, SP2, HF 3 |
| CARIS Bathy Database | Oct-2012 | 4.0 |
| Windows 7 Pro 64-bit | Oct-2012 | SP1 |
| Pydro | Oct-2012 | 12.9 r3191 |

**Table A-5 – Acquisition and Processing Software versions and dates of application**

## CARIS HIPS AND SIPS Version 7.1 SP2, HF3

CARIS HIPS (Hydrographic Information Processing System) is used for all initial processing of multibeam and vertical beam echosounder bathymetry data, including tide, sound velocity, and vessel offset correction and data cleaning. CARIS HIPS uses statistical modeling to create Bathymetry with Associated Statistical Error (BASE) surfaces in one of three ways: swath-angle weighted grids, uncertainty-weighted grids, and Combined Uncertainty and Bathymetry Estimator (CUBE) algorithm grids. Creation of grids as bathymetric products is discussed in section B of this report.

CARIS SIPS (Side-scan Information Processing System) is used for all processing of side-scan sonar imagery, including cable layback correction, slant range correction, contact selection, towpoint entry, and mosaic generation.

## HSTP PYDRO Version 12.9

HSTP PYDRO is a program for the correlation and classification of side-scan sonar and multibeam bathymetry features and for the creation of preliminary smooth sheets. Multibeam features (designated soundings), side-scan sonar contacts, and detached positions are analyzed, grouped, and assigned S-57 classifications. High resolution BASE surface data is entered into the program and excessed to survey scale. The final product is a Preliminary Smooth Sheet file (PSS), which is delivered to the Atlantic Hydrographic Branch as part of the final submission package.

Pydro Versions 7.3 and later have functionality for TCARI installed. TCARI is described in detail in section C.2.1. The TCARI file for the area (when applicable) is received from NOS and loaded into Pydro along with the predicted, observed, or verified tide files for the corresponding stations. The use of TCARI is specified in the Project Instructions.

Pydro is also used for chart comparisons, generation of chartlets, generation of Danger to Navigation reports, generation of appendices to the Descriptive Report, compilation of survey statistics, and generation of standard NOAA forms such as the Descriptive Report cover sheet.

**HSTP VELOCIPY**

HSTP Velocipy is a program for the processing of sound velocity casts from Seabird CTDs and Moving Vessel Profiler systems. This program converts hexadecimal SeaCat data into ASCII conductivity-temperature-depth data, and then converts the ASCII data into a depth-binned sound velocity file that is compatible with CARIS HIPS/SIPS. Velocipy allows for batch processing of the numerous .calc files generated by the MVP during multibeam echosounder acquisition. The resulting .svp files are applied in CARIS HIPS during post-processing to correct for sound velocity variation within the water column. Velocipy is also used to check the accuracy of sound velocity casts and to archive sound velocity information for the National Oceanographic Data Center.

**CARIS Base Editor 4.0**

Base Editor is used for feature and AWOIS planning, feature de-conflicting, surface and sounding review, and chart comparison. This software is useful for visually analyzing a variety of data formats throughout each stage of the survey. Additionally, this software is used during survey content review meetings as one of the final data checks before surveys are submitted to the processing branch. During the 2012 season, most surveys primarily used Base Editor for feature management as opposed to Pydro.

# B. QUALITY CONTROL

## B.1 Acquisition Procedures

All platforms acquire hydrographic data according to the Project Instructions for each survey. The Project Instructions for a given survey specify the acquisition method to be used, the coverage required, and give the field unit discretion as to the best method to achieve that coverage.

The following survey types are used during field operations by *THOMAS JEFFERSON* in the 2012 Field Season:

- Complete MBES Coverage
- Object Detection SSS Coverage
- Object Detection MBES Coverage
- Concurrent Set Line Spacing MBES With Object Detection SSS
- Concurrent Set Line Spacing VBES With Object Detection SSS.

These coverage types are described in detail in the April 2012 Hydrographic Survey Specifications and Deliverables.

Line plans are designed by the field unit according to the coverage type specified in the Project Instructions. For complete coverage MBES surveys, lines are planned to acquire sufficient overlap to allow for a reasonable level of vessel deviation. Alternatively, MBES acquisition can be planned using a real time coverage matrix and polygon areas to achieve full bottom coverage. Line spacing for 100% SSS acquisition is established by multiplying the desired range scale, in meteres, by 1.6. For 200% SSS acquisition, line spacing is set to range scale multiplied by 0.8. Line planning and coverage type are discussed in detail in the Descriptive Report for each survey.

Crosslines are acquired as an additional confidence check for bathymetry. Crosslines provide a meaningful comparison between nadir beams and outer beams of mainscheme acquisition lines in the case of multibeam, and nadir to nadir for vertical beam lines. Crosslines are compared to the mainscheme lines using the standard deviation layer and hypothesis count layer of the grids in CARIS HIPS and Base Editor.

Acquisition speeds are adjusted to balance data quality, productivity, and energy efficiency. The Thomas Jefferson's bathymetric sonars typically produce densities above that which is required in Specs and Deliverables for "skunk striped" and complete coverage surveys at all survey speeds.

## B.2 Quality Management

A systematic approach to Quality Management has been instituted aboard the *THOMAS JEFFERSON*, starting well before the field season begins, through to the final packaging of Survey Deliverables and delivery to AHB.

Clear and concise communication is critical at all stages of the survey, and is established between all relevant parties[1] at the earliest stage of the process. Figure 1 represents the parties involved at all stages of the Quality Management process.

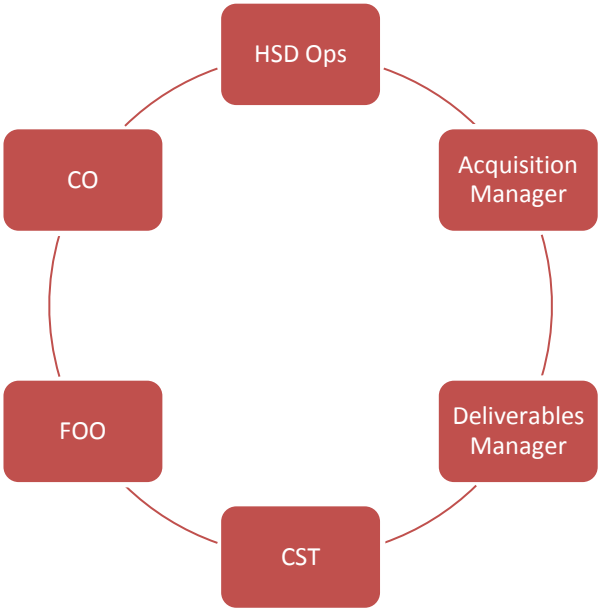


**Figure B-1: Quality management loop**

[1] Note on Personnel:
CO – Commanding Officer, FOO – Field Operations Officer, CST – Chief Survey Technician, HSD OPS – Hydrographic Surveys Division, Operations Branch

Below is a graphic showing the Quality review steps used aboard the *Thomas Jefferson*.

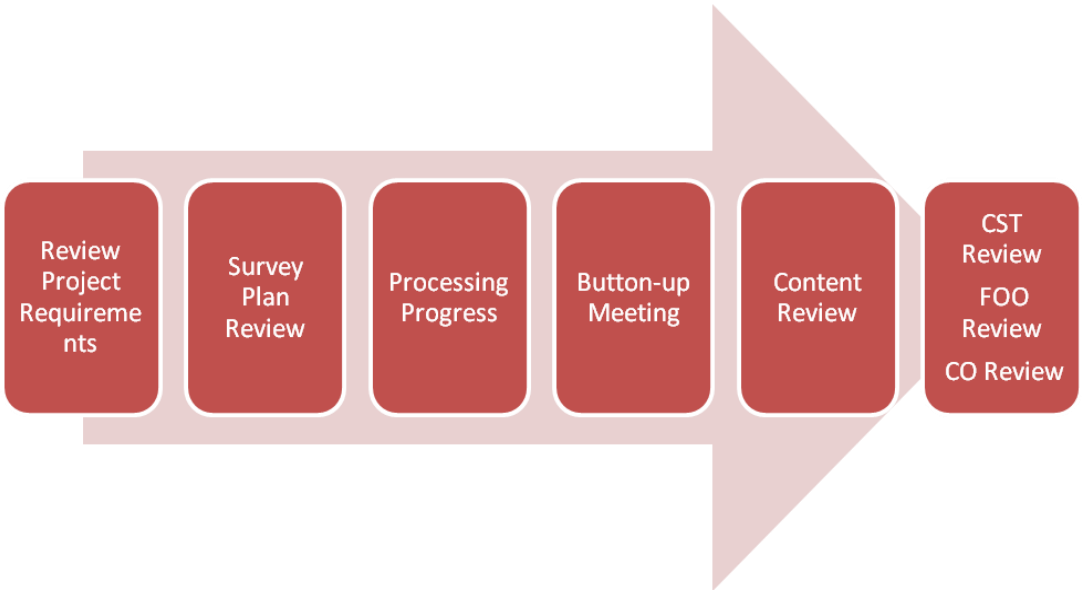


**Figure B-2: Quality Review Stages**

In the Review Project Requirements stage, the final project instructions are reviewed for specific criteria. Some of these are:

- Is the Survey fit for the Purpose?
- Are all charted features and AWOIS in the Composite Source File (CSF)?
- Are there any extraneous or unassigned features in CSF?
- Is the Survey a reasonable size?
- Are the resources available for the job?
- Do we have the right equipment, spares, qualified staff, OT, software and specs?
- Are there any special requirements from HSD OPS?

If any of these elements are found to be in question, dialogue is opened with HSD OPS, in order to resolve them. Once these questions have been answered, the Acquisition manager can prepare the survey plan. This would include the following requirements:

- Line plans/Polygons, Crossline plans, Bottom Sample plan
- Feature requirements as addressed in the Composite Source File (CSF) or ENC.
- Safety of Operations, i.e. where we can and cannot go.
- The plan's effectiveness and efficiency.
- Proper or maximum platform utilization.
- Survey Specific Sensor configurations, staffing plans, line plans, target files, etc.

All aspects of the survey plan are carefully reviewed by the CST, FOO and CO for any required changes initiated by the Acquisition manager before survey begins.

A weekly progress review of all planned and open surveys is conducted to evaluate and incorporate the following factors into the acquisition and deliverables schedule:

- Ship schedule (inports/transits)
- Completion rate, estimated survey end date
- Weather factors
- Equipment failures
- Processing backlog (if any)

The goal is to continuously manage multiple surveys and to establish a projected survey shipment date which accurately reflects all known factors. If processing is not keeping pace with acquisition, then additional resources can be deployed to reduce backlogs. This in turn allows for better quality assessment of collected data.

A Progress review of the survey occurs shortly before completion, with the following goals:

- Review remaining work
- Evaluate density coverage (5 Pings per grid node?)
- Confirm that all assigned features have coverage
- Prioritize remaining work for time remaining
- Adjust personnel and platform schedules as necessary
- Evaluate grids for systematic errors (Std Dev, Uncertainty)
- Review initial field sheet layout

After acquisition is complete and the Deliverables manager has applied final tides to all data, a Content Review is performed on the initial results of the survey, primarily surfaces and feature reports. Some of the particular items addressed are:

- Systematic errors evident in the child layers of the grids (Density, Std Dev, Hypothesis Count) that need to be addressed in the DR.
- Review feature report and advise changes or revisions.
- Consider any feature candidates for DtoN's.
- Determine any unusual acquisition or processing issues that need to be discussed in DR.

The final stage of the Quality Management system is a multiple review of the deliverables, by the CST, FOO and CO, each ensuring that all Specs have been met and that any revisions or changes identified in the Content Review have been made. These checks include:

- Examine finalized/thresholded grids for flyers or unresolved systematic issues. Are they discussed in the DR?
- Final check of feature report inclusions, relevance, S-57 attribution, image quality and general completeness.
- Vetting of the final DR. Does it reflect the Content Review discussion?

- Housekeeping – are all the ancillary reports, documents and data included and in the proper place?

### B.3 Data Management

A daily tracking of data has been developed to maintain data quality and integrity. Several forms identify and track the flow of data as it is collected and processed. These forms are presented in the Separates section under data acquisition and processing logs, included with the data for each survey.

During data collection, watch standers continuously monitor acquisition systems, checking for errors and alarms. Thresholds set in Hypack/Hysweep, POSPAC, RESON and SonarPro alert the watch stander by displaying alarm messages when error thresholds or tolerances are exceeded. These alarms, displayed as they occur, are reviewed and acknowledged on a case-by-case basis. Alarm conditions that may compromise survey data quality are corrected and then noted in acquisition log. Warning messages such as the temporary loss of differential GPS, excessive cross track error, or vessel speed approaching the maximum allowable survey speed are addressed by the watch stander and corrected before further data acquisition occurs.

Following data acquisition, initial processing begins. See figure B.3 for an example of the typical multibeam data processing procedures. The following checks are performed to insure proper data handling throughout the process:

- A one to one comparison of raw data to acquisition logs is performed.
- Correctors, including tide files, true heave, and SVP files are checked for completeness and accuracy.
- Application of all correctors is tracked by line and by application.

Figure B.3 shows the general processing flow for Multibeam data after collection.

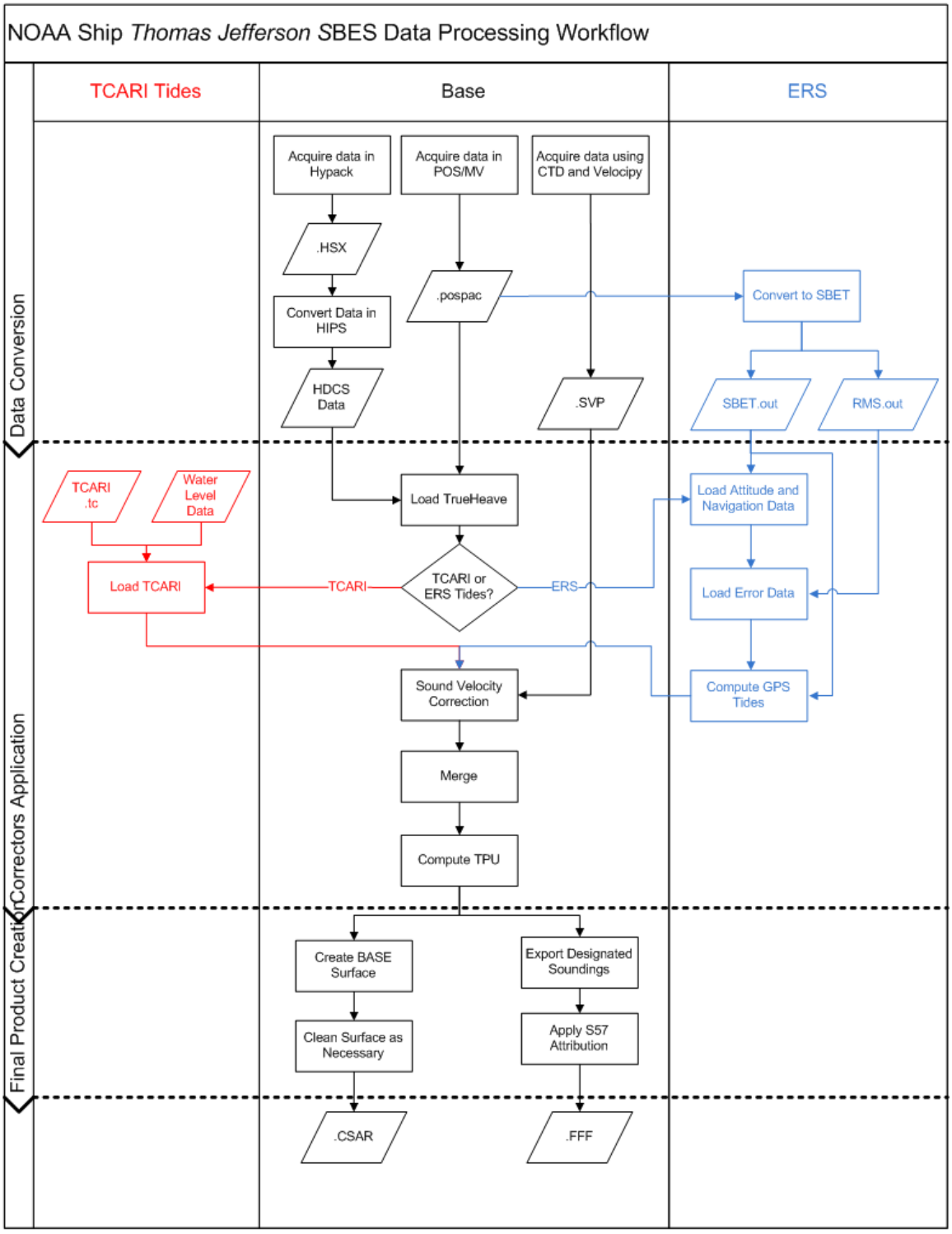


**Figure B-3: Data processing flow**

BASE surfaces are generated to ensure adequate data density, identify areas of high standard deviation and note any obvious problems with correctors.

Results of the processing are reviewed to determine adequacy of data and sounding correctors. Additional processing in preparation of data deliverables includes the following steps:

- Generation of side scan Contact Files and a Contact Plot
- Subset editing and review of multibeam data
- Application of verified tide correctors to multibeam data
- Application of true heave
- Cross line analysis of MBES data
- Cross line time series comparison between TCARI/Zone tides and ERS.
- Comparison with prior surveys
- Generation of shoal biased selected soundings at the scale of the survey
- Comparison with existing charts
- Quality control reviews of side scan data and contacts
- Final Coverage mosaic plots of side scan sonar data
- Correlation of side scan contacts with multibeam data
- Final quality control of all delivered data products

Processing and quality control procedures for multibeam and side scan data acquisition are described in detail below.

**B.4 Bathymetry**

Raw bathymetry data, (Hypack .hsx) are converted into CARIS HDCS data format upon completion of daily acquisition. Conversion parameters vary for each data format, and are stored in the LogFile of each HDCS processed line folder. After data conversion, attitude, and navigation are reviewed for outliers, and true heave, water level, and sound velocity are applied. Bathymetry lines are then merged. Following merge, Total Propagated Uncertainty (TPU) is calculated for each sounding. For a more detailed explanation of TPU calculation of multibeam and vertical beam echosounder data, refer to Section 4.2 of the 2012 NOAA Field Procedures Manuals.

Depending on acquisition type, MBES bathymetry may be processed using either an uncertainty-weighted navigation surface or a CUBE surface. Uncertainty-weighted BASE surfaces and CUBE surfaces are described in detail in the 2012 NOS Field Procedures Manual and the CARIS HIPS/SIPS Users Manual.

When the primary source of bathymetry for a survey area is a combination of VBES and MBES, a collection of finalized uncertainty-weighted mean bathymetric surfaces is generated as the product of the survey. CUBE is not permitted for this type of survey. When the primary source of bathymetry for this type of survey is set line spacing MBES data (also known as “skunk striped”), CUBE shall be used. The use of CUBE in this situation is required to guarantee proper nodal propagation distances as described in section 5.2.1, Gridded Data Specifications, of the 2012 HSSD. In most instances 95% of the nodes in a CUBE grid must contain a minimum of 5 soundings/node to adequately represent the seafloor depth in a given area.

When Complete or Object Detection (OD) MB is the primary source of bathymetry, data are processed using CUBE grids. The use of CUBE is mandatory to ensure compliance with the specification described in the paragraph above. Table 1 shows the required resolution in various survey depths.

**Object Detection Coverage**

| Depth Range (m) | Resolution (m) |
|---|---|
| 0-20 | 0.5 |
| 18-40 | 2 |

(Object Detection is rarely needed in depths greater than 30 meters).

**Complete Multibeam Coverage**

| Depth Range (m) | Resolution (m) |
|---|---|
| 0-20 | 1 |
| 18-40 | 2 |
| 35-80 | 4 |
| 75-160 | 8 |

**Table B-1. Multibeam resolution requirements by depth and coverage type**

Each resolution has its own CUBE parameter settings, and the hydrographer uses the appropriate resolution based CUBE parameters settings when computing each grid. CUBE parameters were distributed with the project instructions for each survey. CUBE parameters can be found in the 2012 Field Procedures Manual, Appendix 4.

## B.5 Error Modeling in CARIS HIPS

CARIS computes TPU based on both the static and dynamic measurements of the vessel and survey-specific information including tidal zoning uncertainty estimates and sound speed measurement uncertainties. Offset values are entered into the CARIS *.hvf file. During processing, the tidal zoning and speed of sound measurement errors are applied. Where TCARI tides are used, uncertainty is calculated and applied during application of TCARI tidal correctors to HDCS data.

Tidal Uncertainty
-For surveys in project B363, tidal zoning was used and an uncertainty value of 0.102 meters was applied.
-For surveys in project E350, TCARI tides were used and no uncertainty value was applied manually during processing.
-For surveys in projects B340 and B370, Vdatum was used and an uncertainty value of 0.102 meters was applied.

For most surveys, tidal zoning values are provided with the Water Level Instructions,

TPU parameters for tidal uncertainty are listed in each survey's Descriptive Report.

Sound Speed Uncertainty

TPU Parameters for sound speed uncertainties are documented in each survey's Descriptive Report.

Additional Uncertainties

Instrument-specific uncertainty values are obtained from either the CARIS TPU resource website or per HSD guidance. These uncertainty values are recorded in the Hips Vessel File (.hvf) for each vessel and sonar configuration. .hvf files used during the 2012 field season are included with as an attachment to this document in Appendix B.

**B.6 Bathymetry Analysis and Feature Classification**

Least depths of navigationally significant features are flagged as "designated soundings," which both identifies the object as a navigationally significant object for import into Pydro and forces the depth of the grid to match the least depth of the feature.

Following data cleaning in CARIS HIPS, Designated soundings and Side Scan contacts are inserted into a PYDRO Preliminary Smooth Sheet (PSS). DP and GP features are inserted using the "Generic Data Parser" tool. Images of contacts exported from CARIS are displayed in the Image Notebook Editor in PYDRO. Contacts are arranged by day and line and can be selected in the data "Tree" window. Information concerning a specific contact is reviewed in the Editor Notebook Window in PYDRO. This information includes contact positions; AWOIS item positions, contact cross references, and charting recommendations.

Contacts are classified according to type of contact (e.g. MBES, SSS, DP, etc), confidence, and proximity to other contacts. Although this will vary from survey to survey, the following general rules apply for classification of contacts:

- MBES contacts will be classified as primary contacts over SSS, DP, and GP contacts;
- If there are two or more MBES contacts for the same feature, the MBES contact of least depth is classified as the primary contact;
- If there is no bathymetry contact for a feature, then the SSS position will be classified as primary contact over DP and GP contacts;
- If there are two or more SSS contacts for the same feature, then the SSS contact that best represents the feature is classified as the primary contact;
- If there are no bathymetry or imagery contacts, then the DP contact that best represents the feature is classified as the primary contact.

Multiple representations of one distinct feature (e.g. contacts from two or more SSS lines on a known wreck) may be grouped. For a group of features, one representation is selected as the primary contact, and all others are selected as secondary contacts with respect to the primary contact.

Significant features are defined by the Hydrographic Survey Specifications and Deliverables as an object rising more than 1m above the seafloor in water depths of 0-20m, and an object rising 10% of depth above the seafloor in water depths greater than 20m. Either echosounder least depth or side-scan sonar acoustic shadow height may be used to determine height of an object off the water bottom.

Contacts appearing significant are further investigated with a MBES system capable of meeting NOAA object detection specifications. If there is no known least depth of good confidence on a significant feature, then the feature will be flagged as "Investigate." Features with such a tag must be further developed, in order of preference, with multibeam echosounder, diver least depth gauge, or vertical beam echosounder.

Any items that are to be addressed in the Feature Report (Appendix II) of the Descriptive Report are flagged as "Report". Examples of Report items include position of new or repositioned Aids to Navigation, permanent man-made features which do not pose a danger to surface navigation, or dynamic sedimentary bed forms which have not been previously noted on the chart. Items which have the "Report" flag set could also be further designated for inclusion in the Danger to Navigation Report by choosing the "DTON" flag. Dangers to Navigation are submitted to the Commanding Officer for review prior to submission to the Marine Charting Division (MCD).

After a feature is fully classified, primary features are flagged as "Resolved." If a primary feature is flagged "Resolved," then the secondary features correlated to that primary feature are automatically flagged "Resolved" and are given the same full classification as the primary feature.

**CARIS BathyDataBase**

For the 2012 field season, a new feature management procedure was implemented. This new procedure used BathyDataBase for all feature attribution, de-conflicting and reporting. Pydro was still used as an intermediary to extract designated soundings from bathymetry line data and place them in to a .000 file to be accessed from BathyDataBase.

## B.7 Imagery

Side scan sonar data are converted from *.sdf (Sonarpro raw format) to CARIS HDCS. Processing side scan data includes examining and editing fish height, vessel heading (gyro), and vessel navigation records. When side scan sonar is towed, fish navigation is recalculated using CARIS SIPS. Tow point offsets (C-frame and cable out), fish depth, fish attitude, and water depth are used to calculate horizontal layback.

After towfish navigation is recalculated, side scan imagery data are slant-range corrected to 0.1m with beam pattern correction. The slant-range corrected side scan imagery data are closely examined for any targets. Targets-of-interest are evaluated as potential contacts based upon apparent shadow height and appearance, particularly targets which do not appear to be natural in origin. Contacts are selected and saved to a contact file for each line of SSS data. Contact selection includes measuring apparent height and width, selecting contact position, and creating a contact snapshot (*.tif) image.

Side scan sonar coverage is determined by creating mosaics using Mosaic Editor in CARIS SIPS. Mosaic Editor uses the accurately modeled backscatter correction algorithms of the Geocoder engine to process source data. This processed imagery data is stored in SIPS as Georeferenced Backscatter Rasters, or GeoBaRs. GeoBaRs are the basis for all mosaics created in SIPS. From the GeoBaRs, mosaics are created which can be examined and edited in Mosaic Editor. Once imagery has been corrected, a full mosaic can be compiled from the data. If any deficiencies in the side scan sonar data are found, a holiday line file is created from the mosaics and additional lines of SSS are acquired.

### B.8 Survey Deliverables and Ancillary Product Generation

The ship's final bathymetric deliverables to the Atlantic Hydrographic Branch are a collection of BASE surfaces, the final feature file (FFF) .000, including S-57 feature classifications, the Descriptive Report, and side scan sonar mosaics (when applicable). The resolution of surfaces varies according to acquisition type specified in the Project Instructions.

## C. Corrections to Echo Soundings

### C.1 Sound Velocity

Sound speed data acquired by the surface sound velocity sensors on *THOMAS JEFFERSON* and *HSL 3101/3102* are recorded in the raw Hypack .hsx files and are used to calculate transmit and receive angles for the ray tracing algorithm. The surface sound velocity sensors are discussed in Section A and will not be discussed further in this section.

### CTD Profiles

Sound velocity profiles for the *THOMAS JEFFERSON* and for Launches *3101* and *3102* are processed using the program HSTP Velocipy version 12.9 which generates sound velocity profiles for CARIS HIPS. Sound velocity correctors are applied to MBES and VBES soundings in CARIS HIPS during post processing only.

The speed of sound through water is determined by a minimum of one cast per week (although one per day is usually acquired) for VBES acquisition and one cast every three to four hours of MBES acquisition, in accordance with the NOS Hydrographic Surveys Specifications and Deliverables (HSSD). Casts are conducted more frequently when changing survey areas, or when environmental conditions such as changes in weather,

tide, current, or significant spatial and/or temporal variation in the speed of sound is observed in the survey area that would warrant additional sound velocity profiles.

The sound velocity casts are extended automatically and applied to all bathymetric data in CARIS HIPS during post processing.

**Brooke Ocean MVP**

The SV data acquired by the MVP is transmitted to a raw SV file folder, where the hydrographer conducts a basic check of the data for correct day number, sound velocity data, and file format/integrity. The SV cast may also be graphically viewed and compared with other casts using the Sound Velocity vs. Depth graph in the MVP controller software.

Like CTD casts, MVP casts are processed and/or extended for use in CARIS HIPS using HSTP Velocipy.

## C.2 Water Level Correctors

Zoned Tides

Soundings are initially reduced to Mean Lower-Low Water (MLLW) using preliminary (observed) water level data. Data may be obtained from the primary tide gauge through the Center for Operational Oceanographic Products and Services (CO-OPS) website. Observed water level files are converted to CARIS tide files (.tid) and/or text files and applied to all sounding data using either discrete tide zoning in CARIS HIPS or the TCARI module in Pydro. The type of water level correction used in a survey is specified in the Water Level Instructions, provided by CO-OPS.

When discrete tide zoning is specified in the Tide Note, THOMAS JEFFERSON personnel use verified water levels and final tide zoning from the Zone Definition File (ZDF) provided by CO-OPS for hydrographic product generation.

TCARI

Tidal Constituents and Residuals Interpolator (TCARI) grid files, when applicable, are submitted to THOMAS JEFFERSON as part of the Project Instruction package. A TCARI grid is computed using the shoreline, a limiting boundary, and the positions of two or more water level gauges. Harmonic constants, residual water levels, and gauge weights are interpolated for each grid point, using the data from the water level gauges as control points. Water level corrections are applied in Pydro using the TCARI tools found in Pydro. When using TCARI for datum reduction, water level corrections are not applied to echosounder data in CARIS. Following TCARI water level correction in Pydro, data is merged and processed as described in Section B.

Ellipsoid Referenced Surveys and VDATUM

ERS methods were required for all surveys in projects B340 and B370. For these surveys, processed SBETs, as described in Section A of this DAPR, are applied in CARIS Hips and Sips. First, the smoothed attitude and navigation are loaded by using the "Process-Load Attitude/Navigation data" option. Next, the error data is loaded by using the "Process-Load Error data" option. Once these steps have been completed successfully, the TPU must be recomputed and "Error Data" must be checked instead of "Vessel Settings". Following TPU computations, GPS Tide must be computed. This is accomplished by selecting the "Process-Compute GPS Tide" option and loading the .csv separation model. This separation model is either included with the project instructions, or generated by the field unit by utilizing the VDATUM tool built into Pydro. Once created, the .csv file contains a node by node offset between the ellipsoid and MLLW. If no model is applied, and the height offset is left at 0.0, then all soundings remain referenced to the ellipsoid. However, since the current guidance from the Office of Coast Survey is to reduce all soundings to MLLW, a .csv model shall be used when computing GPS Tide. The final step is to Merge the data and apply the GPS Tide computed in the previous step.

## C.3 Multibeam Calibration Procedures

Heave, pitch, roll, yaw, and navigation latency biases for each vessel are corrected during a multibeam bias calibration test (patch test). MBES vessel offsets, dynamic draft correctors, and system bias values are contained in HIPS Vessel Files (HVFs). These offsets and biases are applied to the sounding data during processing in CARIS HIPS. A Patch Test or verification of certain biases is typically performed at the start of each field season and re-verified for each project before acquiring MBES data in the new survey area. Calibration reports are generated for initial calibrations at the beginning of the field season, but reports are not necessarily generated for each project when values are re-verified. Small changes in the roll bias are common, but also are not necessarily documented by official reports. Changes in .HVFs not accompanied by full calibration reports are instead documented in the comments column of the HVF entry by the date in which the change took effect. HVF files are submitted with this document under Appendix B.

## C.4 Vessel Offsets, Static Draft, and Dynamic Draft Correctors

A partial re-survey of *THOMAS JEFFERSON* vessel offsets was conducted on 10 March 2005 by NGS personnel, and no physical changes in offsets have occurred since then.

| Coordinate (direction) | NGS Values |
|---|---|
| X (fore and aft) | -10.282 |
| Y (port and starboard) | 1.356 |
| Z (vertical) | -22.320 |

**Table C-1. IMU to Primary GPS antenna offsets for *Thomas Jefferson***

Preliminary static draft measurements are made at the beginning of each leg and weekly thereafter. Static draft for *THOMAS JEFFERSON* is measured using a sight tube located in lower survey stores in the vicinity of frame 33. Additional static draft measurements are made as needed with changing conditions, such as changes in the ship's ballasting or loading. Lower survey stores is not vented to the atmosphere, and as a result, air pressure inside the ship can introduce an error in static draft measurements. As a result, a value of 0.1m was entered into the CARIS HVF as the uncertainty for static draft for the ship.

3101
Vessel offset measurements were made on *HSL 3101* on January 13, 2010 by NGS personnel. The NGS survey measured from established benchmarks on the vessel back to the reference point, in this case, the cross hairs on top of the IMU. From the surveyed benchmarks, the new RESON 7125SV, SSVS, and Odom CV200 installation offsets were measured using a steel tape. The Klein 5000 side scan was surveyed in a similar manner and offsets for the "heavy weight" and "light weight" systems were recorded.

Static draft measurements for HSL 3101 and HSL 3102 are determined using a sight tube to measure the waterline with respect to the reference point on the top of the IMU. These measurements are made during each patch test.

3102
Vessel offset measurements were also made on *HSL 3102* on January 13, 2010 by NGS personnel. The NGS survey measured from established benchmarks on the vessel back to the reference point on top of the IMU in the same manner as the survey of HSL 3101. From the surveyed benchmarks, the new RESON 7125SV, SSVS, and Odom CV200 installation offsets were measured using a steel tape. The Klein 5000 side scan was surveyed in a similar manner and offsets for the "heavy weight" and "light weight" systems were recorded.

**Dynamic Draft**

The *Thomas Jefferson* utilized an Elipsoid Referenced Survey (ERS) method for measuring dynamic draft for the ship, HSL 3101, and HSL 3102. This method has been termed Ellipsoid Referenced Dynamic Draft Measurement (ERDDM). Post-processed Smoothed Best Estimate Trajectory (SBET) altitude heights with respect to the ellipsoid were created in POSPac MMS 6.0 and used to measure dynamic draft.

The ERDDM was conducted by acquiring POSPac data while acquiring survey lines for the Echosounder method. The Echosounder method was modified slightly to provide additional drift values to isolate the effects of tide. This was achieved by going all stop at the end of each line and drifting dead in the water for 1 – 3 minutes. These all stop values provided visual break points for reference in the continuous POSPac data that was logged for the duration of survey operations for the day. During the ERDDM for HSL 3101, at rest periods were not acquired at the end of some of the lines. In these instances, vessel heading was used for visual break points in the POSPac data.

POSPac data was processed in POSPac MMS 5.3 and an SBET file was created. The vessel speed and the altitude plots were examined and data corresponding to the lines described in the Echosounder method above were exported into a spreadsheet and analyzed. The average vessel speed for each line and the average difference between at speed altitudes and at rest altitudes were computed and used to create a dynamic draft table.

APPROVAL SHEET

This Data Acquisition and Processing Report is respectfully submitted for the following projects:

**OPR-E350-TJ-12, Southern Chesapeake Bay, VA**
**OPR-B340-TJ-12, Long Island Sound, NY**
**OPR-B370-TJ-12, Eastern Long Island Sound, NY**
**OPR-B363-TJ-12, Block Island Sound, RI**
**S-B935-TJ-12, NY Harbor and Vicinity Response**

As Chief of Party, I have ensured that standard field surveying and processing procedures were adhered to during these projects in accordance with the Hydrographic Surveys Specifications and Deliverables (**4/2012**), Hydrographic Survey Technical Directives **HTD 2012-5**, and the Field Procedures Manual for Hydrographic Surveying (**4/2012**,).

I acknowledge that all of the information contained in this report is complete and accurate to the best of my knowledge.

This DAPR applies to all surveys completed in 2012 for the projects listed above.

Approved and Forwarded:

| | |
|---|---|
| LT William G. Winner, NOAA<br>Field Operations Officer | CDR Lawrence T. Krepp, NOAA<br>Commanding Officer |

# Multibeam Echosounder Calibration

**Field Unit: NOAA Ship THOMAS JEFFERSON**

**Date of Test: 3 Apr 2012**

**Calibrating Hydrographer(s): LT Winner**

## MULTIBEAM SYSTEM INFORMATION

**Multibeam Echosounder System: Reson 7125 SV1 400 kHz 512 beams**

**System Location: 3101**

**Sonar Serial Number: Rx: 1409071; Tx 400: 2308097; Tx 200: 4408356**

**Processing Unit Serial Number: 1812018**

**Date of Most Recent EED / Factory Checkout:**

## VESSEL INFORMATION

**Sonar Mounting Configuration:** hull-mounted

**Date of Current Vessel Offset Measurement / Verification:**

**Description of Positioning System:** POS/MV version 4 w/ Precise Timing

**Date of Most Recent Positioning System Calibration:**

## TEST INFORMATION

**Test Date(s) / DN(s): 3 Apr 2012; 094**

**System Operator(s): HST Glomb**

**Wind / Seas / Sky:**

**Locality:** Chesapeake Bay

**Sub-Locality:** Cape Charles

**Bottom Type:** sandy

**Approximate Average Water Depth:** 13 meters

## DATA ACQUISITION INFORMATION

| Line Number | Heading | Speed |
|---|---|---|
| 400_1706 | 0 | 4 |
| 400_1711 | 180 | 4.4 |
| 401_1715 | 0 | 4 |
| 401_1719 | 180 | 4.3 |
| 402_1723 | 0 | 4.1 |
| 402_1728 | 180 | 4.3 |
| 403_1735 | 270 | 2.2 |
| 403_1741 | 270 | 4.2 |

## TEST RESULTS

**Navigation Timing Error: 0.00**

**Pitch Timing Error:0.00**

**Roll Timing Error: 0.00**

**Pitch Bias: 1.33**

**Roll Bias: -0.44**

**Heading Bias: 0.97**

**Resulting CARIS HIPS HVF File Name: TJ_3101_Reson7125_400kHz**

## NARRATIVE

Values match closesly with last year's values. Yaw lines did not overlap the object, so other lines had to be used.

# Multibeam Echosounder Calibration

**Field Unit: NOAA Ship THOMAS JEFFERSON**

**Date of Test: 4 Apr 2012**

**Calibrating Hydrographer(s): LT Winner**

## MULTIBEAM SYSTEM INFORMATION

**Multibeam Echosounder System: 7125 SV1 400 kHz 512 beams**

**System Location: 3102**

**Sonar Serial Number: Rx: 0309006; Tx 400: 2208005; Tx 200: 2909185**

**Processing Unit Serial Number: 1812012**

**Date of Most Recent EED / Factory Checkout:**

## VESSEL INFORMATION

**Sonar Mounting Configuration:** hull-mounted

**Date of Current Vessel Offset Measurement / Verification: Jan 2011**

**Description of Positioning System:** POS/MV version 4 w/ Precise Timing

**Date of Most Recent Positioning System Calibration:**

## TEST INFORMATION

**Test Date(s) / DN(s): 4 APR 2012; 095**

**System Operator(s): HST Glomb**

**Wind / Seas / Sky:**

**Locality:** Chesapeake Bay

**Sub-Locality:** Cape Charles

**Bottom Type:** sandy

**Approximate Average Water Depth: 13** meters

## DATA ACQUISITION INFORMATION

| Line Number | Heading | Speed |
|---|---|---|
| 400_1320 | 180 | 4.2 |
| 400_1324 | 0 | 4.2 |
| 401_1327 | 180 | 4.2 |
| 401_1330 | 0 | 4.3 |
| 402_1334 | 180 | 4.1 |
| 402_1338 | 0 | 4.5 |
| 403_1344 | 270 | 2.4 |
| 403_1349 | 270 | 4.7 |

## TEST RESULTS

**Navigation Timing Error: 0.00**

**Pitch Timing Error:0.00**

**Roll Timing Error: 0.00**

**Pitch Bias: 0.37**

**Roll Bias: -0.94**

**Heading Bias: -1.4**

**Resulting CARIS HIPS HVF File Name: TJ_3102_Reson7125_400kHz.hvf**

## NARRATIVE

Values match closesly with last year's values. Yaw lines did not overlap the object, so other lines had to be used.

**SEA-BIRD ELECTRONICS, INC.**
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

# *Temperature Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19 | **Serial Number:** | 192472-0285 |

***Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

Date: 12/14/2011 Drift since last cal: -0.00095 Degrees Celsius/year

Comments:

**'CALIBRATION AFTER REPAIR'** ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

**SEA-BIRD ELECTRONICS, INC.**
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# *Conductivity Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19 | **Serial Number:** | 192472-0285 |

***Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

**Date:** 12/14/2011 **Drift since last cal:** -0.00120 **PSU/month***

**Comments:**

**'CALIBRATION AFTER CLEANING & REPLATINIZING'** ☐ Performed ☑ Not Performed

**Date:** **Drift since Last cal:** **PSU/month***

**Comments:**

****Measured at 3.0 S/m***

***Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.***

CTD - 0285, S222


# Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 0285
CALIBRATION DATE: 14-Dec-11

SBE19 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.12500315e-003
h = 5.75194956e-004
i = -1.00004252e-006
j = -3.14777854e-006
f0 = 1000.0

IPTS-68 COEFFICIENTS

a = 3.64764105e-003
b = 5.70460005e-004
c = 6.87852369e-006
d = -3.14771798e-006
f0 = 2297.577

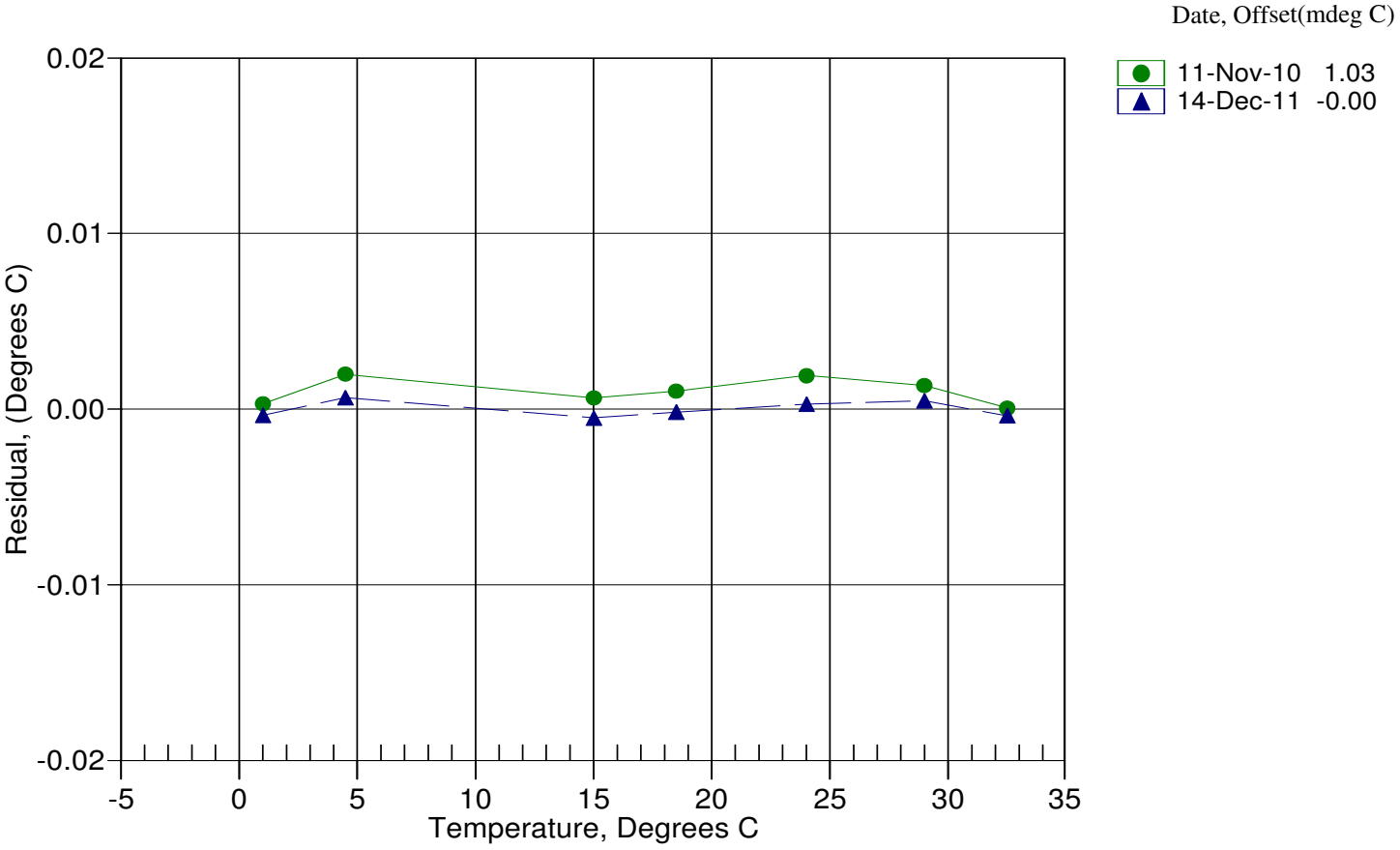
| BATH TEMP (ITS-90) | INSTRUMENT FREQ (Hz) | INST TEMP (ITS-90) | RESIDUAL (ITS-90) |
|---|---|---|---|
| 0.9999 | 2297.577 | 0.9995 | -0.00036 |
| 4.5000 | 2490.753 | 4.5007 | 0.00065 |
| 15.0000 | 3139.098 | 14.9995 | -0.00049 |
| 18.5000 | 3379.524 | 18.4998 | -0.00017 |
| 23.9999 | 3783.259 | 24.0002 | 0.00027 |
| 29.0000 | 4178.885 | 29.0005 | 0.00047 |
| 32.5000 | 4472.560 | 32.4996 | -0.00038 |

Temperature ITS-90 = $1/\{g + h[ln(f_0/f)] + i[ln^2(f_0/f)] + j[ln^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 = $1/\{a + b[ln(f_0/f)] + c[ln^2(f_0/f)] + d[ln^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: $T_{68}$ is assumed to be 1.00024 * $T_{90}$ (-2 to 35 °C)

Residual = instrument temperature - bath temperature



CTD - 0285, S222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Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 0285
CALIBRATION DATE: 03-Jan-12

SBE19 PRESSURE CALIBRATION DATA
5000 psia S/N 133807 TCV: -121

QUADRATIC COEFFICIENTS:

PA0 = 2.491586e+003
PA1 = -6.501956e-001
PA2 = -5.844651e-008

STRAIGHT LINE FIT:

M = -6.502140e-001
B = 2.491225e+003

| PRESSURE PSIA | INST OUTPUT(N) | COMPUTED PSIA | ERROR %FS | LINEAR PSIA | ERROR %FS |
|---|---|---|---|---|---|
| 14.75 | 3806.0 | 16.09 | 0.03 | 16.51 | 0.04 |
| 1115.01 | 2118.0 | 1114.21 | -0.02 | 1114.07 | -0.02 |
| 2115.18 | 582.0 | 2113.15 | -0.04 | 2112.80 | -0.05 |
| 3115.20 | -960.0 | 3115.72 | 0.01 | 3115.43 | 0.00 |
| 4115.23 | -2498.0 | 4115.41 | 0.00 | 4115.46 | 0.00 |
| 5065.23 | -3958.0 | 5064.14 | -0.02 | 5064.77 | -0.01 |
| 4115.21 | -2499.0 | 4116.06 | 0.02 | 4116.11 | 0.02 |
| 3115.17 | -962.0 | 3117.02 | 0.04 | 3116.73 | 0.03 |
| 2115.17 | 580.0 | 2114.45 | -0.01 | 2114.10 | -0.02 |
| 1115.03 | 2116.0 | 1115.51 | 0.01 | 1115.37 | 0.01 |
| 14.75 | 3809.0 | 14.14 | -0.01 | 14.56 | -0.00 |

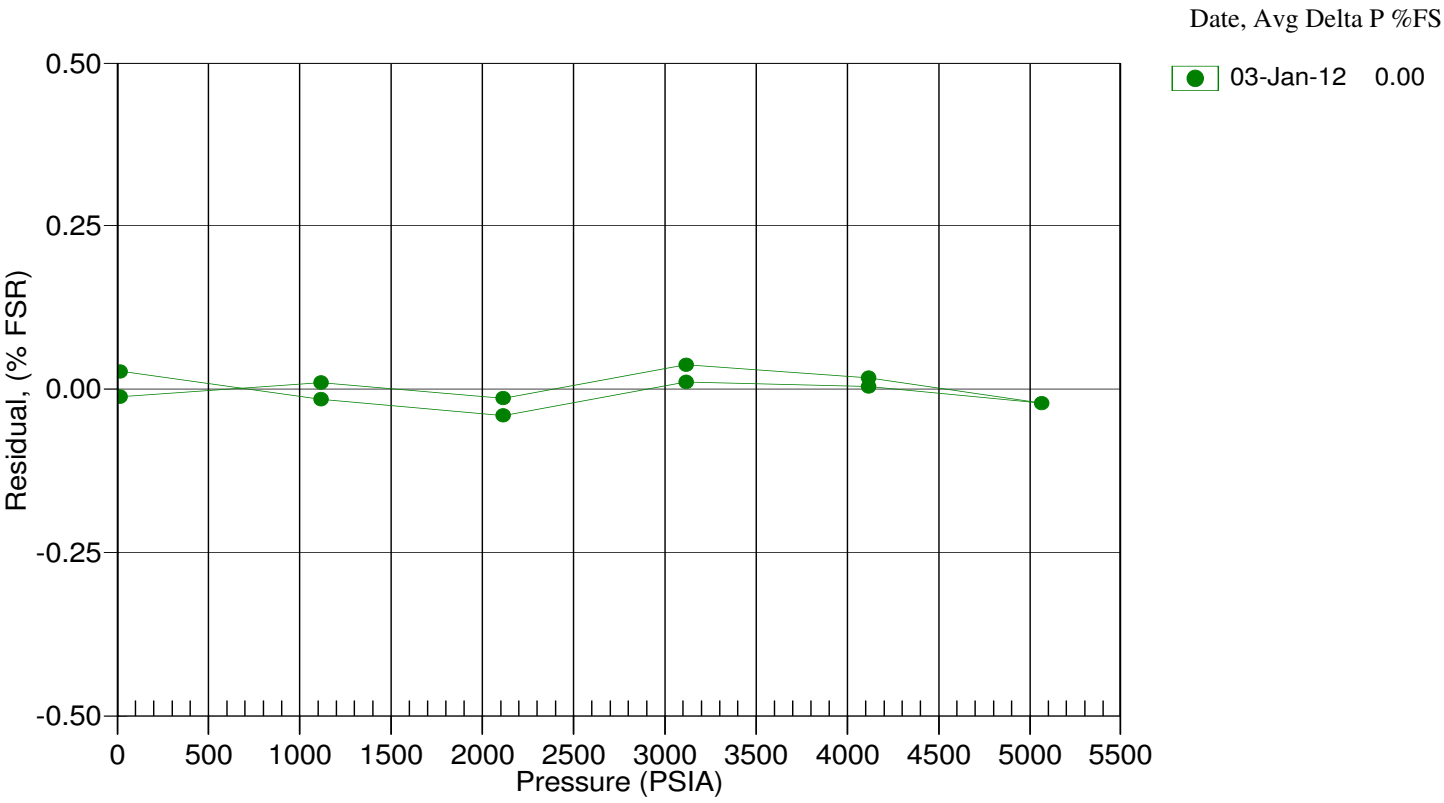
Straight Line Fit:

Pressure (psia) = M * N + B (N = binary output)

Quadratic Fit:

pressure (psia) = PA0 + PA1 * N + PA2 * $N^2$

Residual = (instrument pressure - true pressure) * 100 / Full Scale Range



CTD - 0285, S222


# Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 0285
CALIBRATION DATE: 14-Dec-11

SBE19 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Seimens/meter

GHIJ COEFFICIENTS

```
g = -4.08457931e+000
h =  4.87502825e-001
i =  1.10067345e-003
j = -1.77211107e-005
CPcor = -9.5700e-008 (nominal)
CTcor =  3.2500e-006 (nominal)
```

ABCDM COEFFICIENTS

```
a =  7.52840059e-003
b =  4.77680955e-001
c = -4.07135887e+000
d = -9.32378835e-005
m =  2.4
CPcor = -9.5700e-008 (nominal)
```

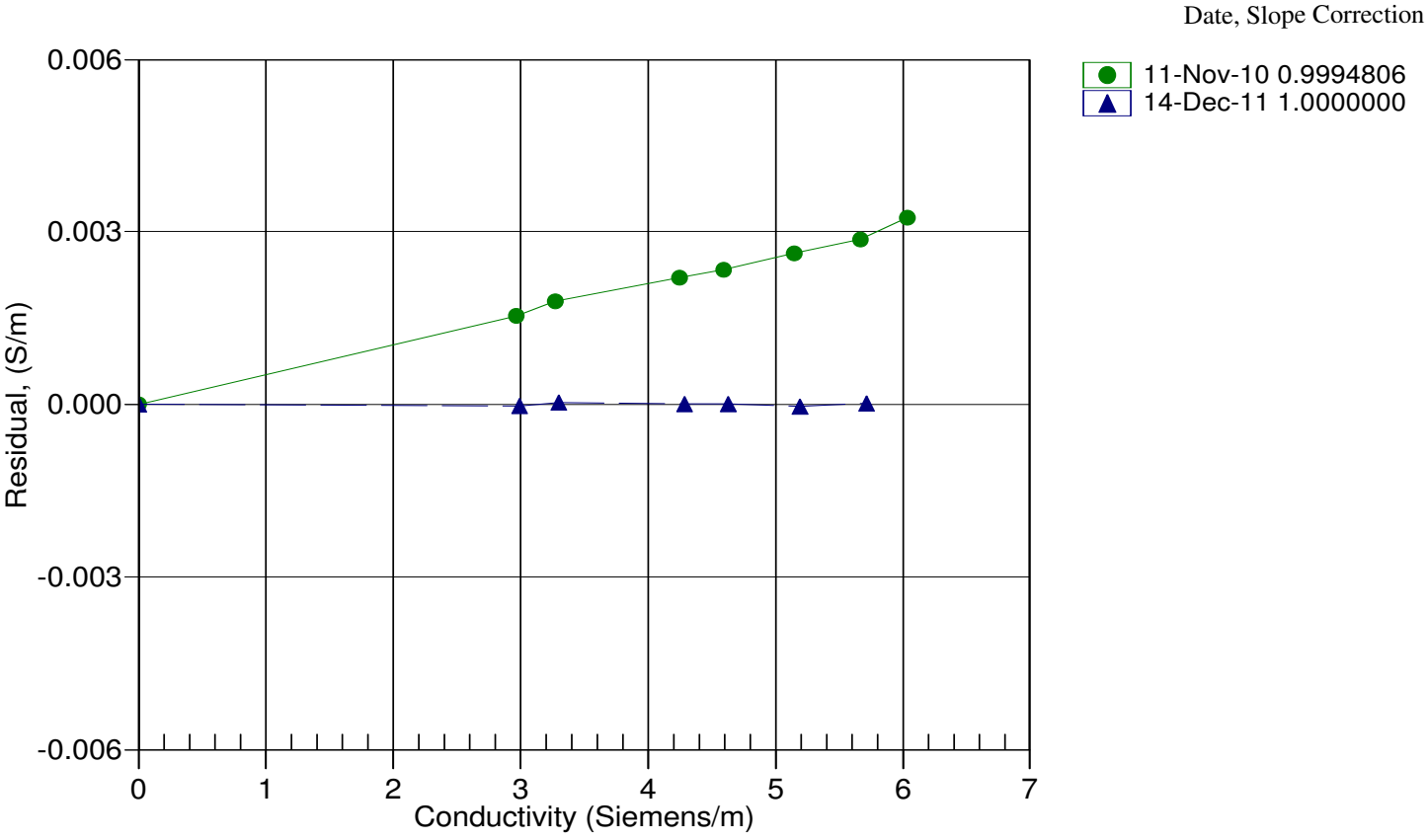
| BATH TEMP (ITS-90) | BATH SAL (PSU) | BATH COND (Siemens/m) | INST FREO (kHz) | INST COND (Siemens/m) | RESIDUAL (Siemens/m) |
|---|---|---|---|---|---|
| 22.0000 | 0.0000 | 0.00000 | 2.88563 | 0.00000 | 0.00000 |
| 0.9999 | 34.9717 | 2.98797 | 8.28002 | 2.98794 | -0.00003 |
| 4.5000 | 34.9512 | 3.29619 | 8.64513 | 3.29622 | 0.00003 |
| 15.0000 | 34.9072 | 4.28158 | 9.71912 | 4.28159 | 0.00001 |
| 18.5000 | 34.8971 | 4.62793 | 10.06899 | 4.62793 | 0.00001 |
| 23.9999 | 34.8858 | 5.18781 | 10.60972 | 5.18777 | -0.00004 |
| 29.0000 | 34.8780 | 5.71128 | 11.09115 | 5.71130 | 0.00002 |

Conductivity = $(g + hf^2 + if^3 + jf^4) / 10(1 + \delta t + \varepsilon p)$ Siemens/meter

Conductivity = $(af^m + bf^2 + c + dt) / [10 (1 + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; $\delta$ = CTcor; $\varepsilon$ = CPcor;

Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



**SEA-BIRD ELECTRONICS, INC.**
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

# *Temperature Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19Plus | **Serial Number:** | 19P33589-4486 |

***Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

**Date:** 12/14/2011 **Drift since last cal:** -0.00030 **Degrees Celsius/year**

**Comments:**

**'CALIBRATION AFTER REPAIR'** ☐ Performed ☑ Not Performed

**Date:** **Drift since Last cal:** **Degrees Celsius/year**

**Comments:**

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# *Conductivity Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19Plus | **Serial Number:** | 19P33589-4486 |

***Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

**Date:** 12/14/2011 **Drift since last cal:** -0.00020 **PSU/month***

**Comments:**

**'CALIBRATION AFTER CLEANING & REPLATINIZING'** ☐ Performed ☑ Not Performed

**Date:** **Drift since Last cal:** **PSU/month***

**Comments:**

****Measured at 3.0 S/m***

***Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.***

CTD - 4486, HSL 3101


# Sea-Bird Electronics, Inc.

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Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 4486
CALIBRATION DATE: 14-Dec-11

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.275141e-003
a1 = 2.593836e-004
a2 = 3.412295e-007
a3 = 1.367993e-007

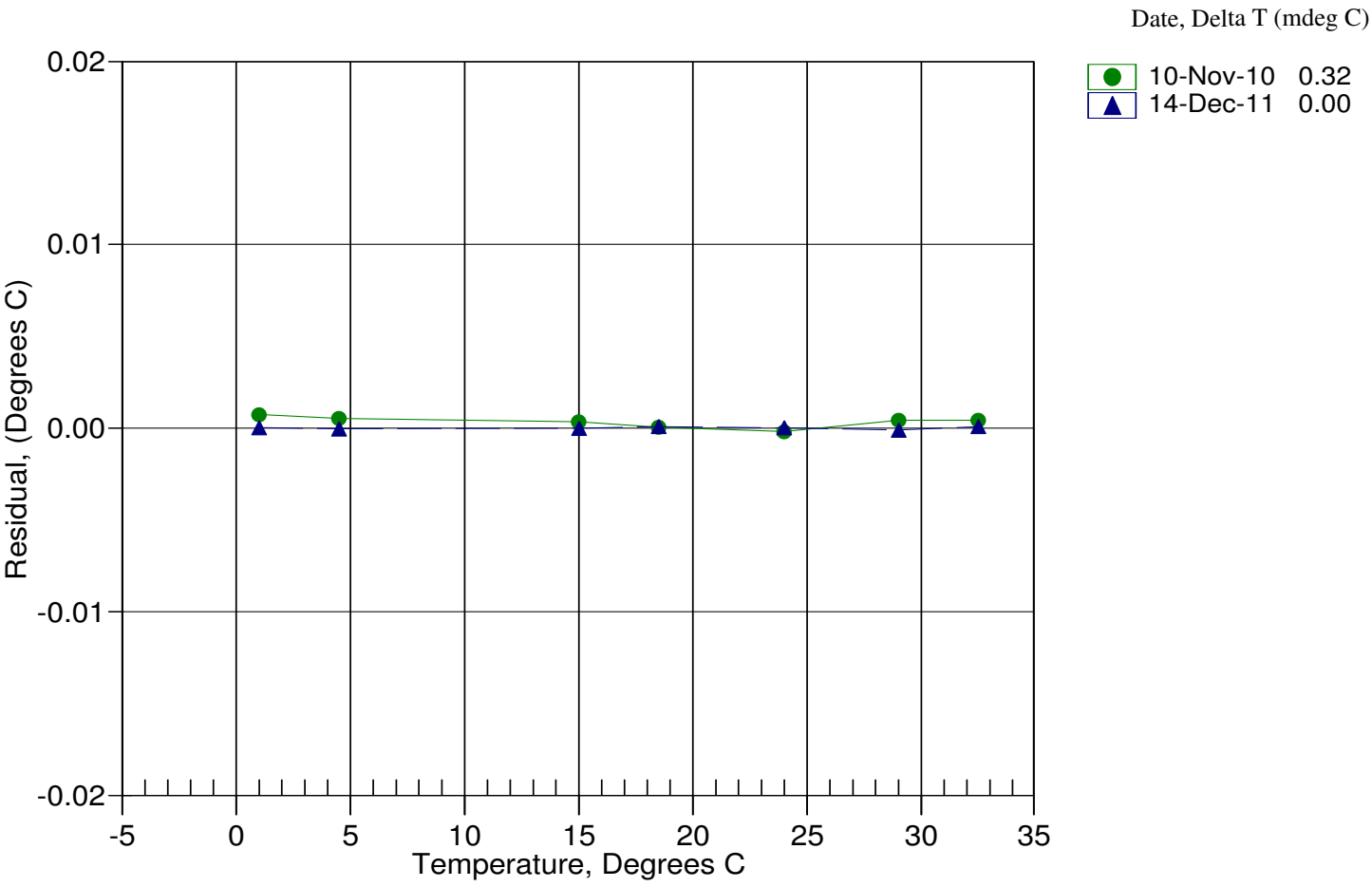
| BATH TEMP (ITS-90) | INSTRUMENT OUTPUT(n) | INST TEMP (ITS-90) | RESIDUAL (ITS-90) |
|---|---|---|---|
| 0.9999 | 604355.583 | 0.9999 | 0.0000 |
| 4.5000 | 535781.867 | 4.5000 | -0.0000 |
| 15.0000 | 366318.467 | 15.0000 | -0.0000 |
| 18.5000 | 320996.770 | 18.5001 | 0.0001 |
| 23.9999 | 259598.117 | 23.9999 | 0.0000 |
| 29.0000 | 212961.533 | 28.9999 | -0.0001 |
| 32.5000 | 184834.656 | 32.5001 | 0.0001 |

MV = (n - 524288) / 1.6e+007

R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)

Temperature ITS-90 = $1/\{a0 + a1[ln(R)] + a2[ln^2(R)] + a3[ln^3(R)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature



CTD - 4486, HSL 3101


# Sea-Bird Electronics, Inc.

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Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 4486
CALIBRATION DATE: 09-Dec-11

SBE19plus PRESSURE CALIBRATION DATA
508 psia S/N 2799

COEFFICIENTS:

| | | | |
|---|---|---|---|
| PA0 = | 2.017286e-002 | PTCA0 = | 5.246207e+005 |
| PA1 = | 1.549533e-003 | PTCA1 = | 2.799682e+000 |
| PA2 = | 7.596469e-012 | PTCA2 = | -1.050025e-001 |
| PTEMPA0 = | -7.556904e+001 | PTCB0 = | 2.468737e+001 |
| PTEMPA1 = | 4.833845e+001 | PTCB1 = | -7.250000e-004 |
| PTEMPA2 = | -2.487770e-001 | PTCB2 = | 0.000000e+000 |

PRESSURE SPAN CALIBRATION

| PRESSURE PSIA | INST OUTPUT | THERMISTOR OUTPUT | COMPUTED PRESSURE | ERROR %FSR |
|---|---|---|---|---|
| 14.72 | 534117.0 | 2.0 | 14.73 | 0.00 |
| 104.99 | 592298.0 | 2.0 | 104.97 | -0.00 |
| 204.97 | 656708.0 | 2.0 | 204.94 | -0.01 |
| 304.96 | 721100.0 | 2.0 | 304.94 | -0.00 |
| 404.97 | 785446.0 | 2.0 | 404.94 | -0.01 |
| 504.96 | 849768.0 | 2.0 | 504.96 | -0.00 |
| 404.97 | 785478.0 | 2.0 | 404.99 | 0.00 |
| 304.97 | 721144.0 | 2.0 | 305.01 | 0.01 |
| 204.99 | 656749.0 | 2.0 | 205.01 | 0.00 |
| 105.03 | 592333.0 | 2.0 | 105.03 | -0.00 |
| 14.71 | 534112.0 | 2.0 | 14.72 | 0.00 |

THERMAL CORRECTION

| TEMP ITS90 | THERMISTOR OUTPUT | INST OUTPUT |
|---|---|---|
| 32.50 | 2.26 | 534254.28 |
| 29.00 | 2.19 | 534271.06 |
| 24.00 | 2.08 | 534281.78 |
| 18.50 | 1.97 | 534291.91 |
| 15.00 | 1.89 | 534293.49 |
| 4.50 | 1.67 | 534285.87 |
| 1.00 | 1.60 | 534278.85 |

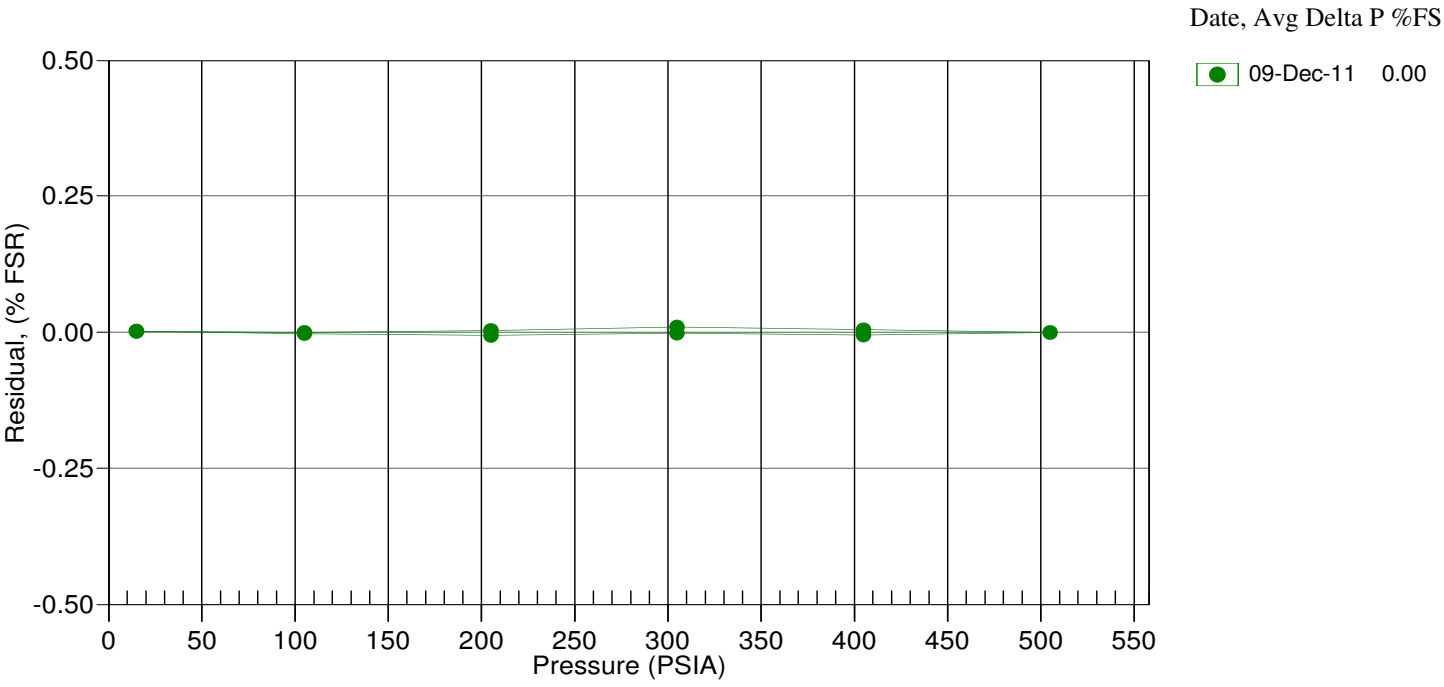
| TEMP(ITS90) | SPAN(mV) |
|---|---|
| -5.00 | 24.69 |
| 35.00 | 24.66 |

y = thermistor output; $t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

x = pressure output - $PTCA0 - PTCA1 * t - PTCA2 * t^2$

$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$

pressure (psia) = $PA0 + PA1 * n + PA2 * n^2$



CTD - 4486, HSL 3101


# Sea-Bird Electronics, Inc.

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SENSOR SERIAL NUMBER: 4486
CALIBRATION DATE: 14-Dec-11

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.029827e+000
h =  1.436052e-001
i = -2.467991e-004
j =  3.934339e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

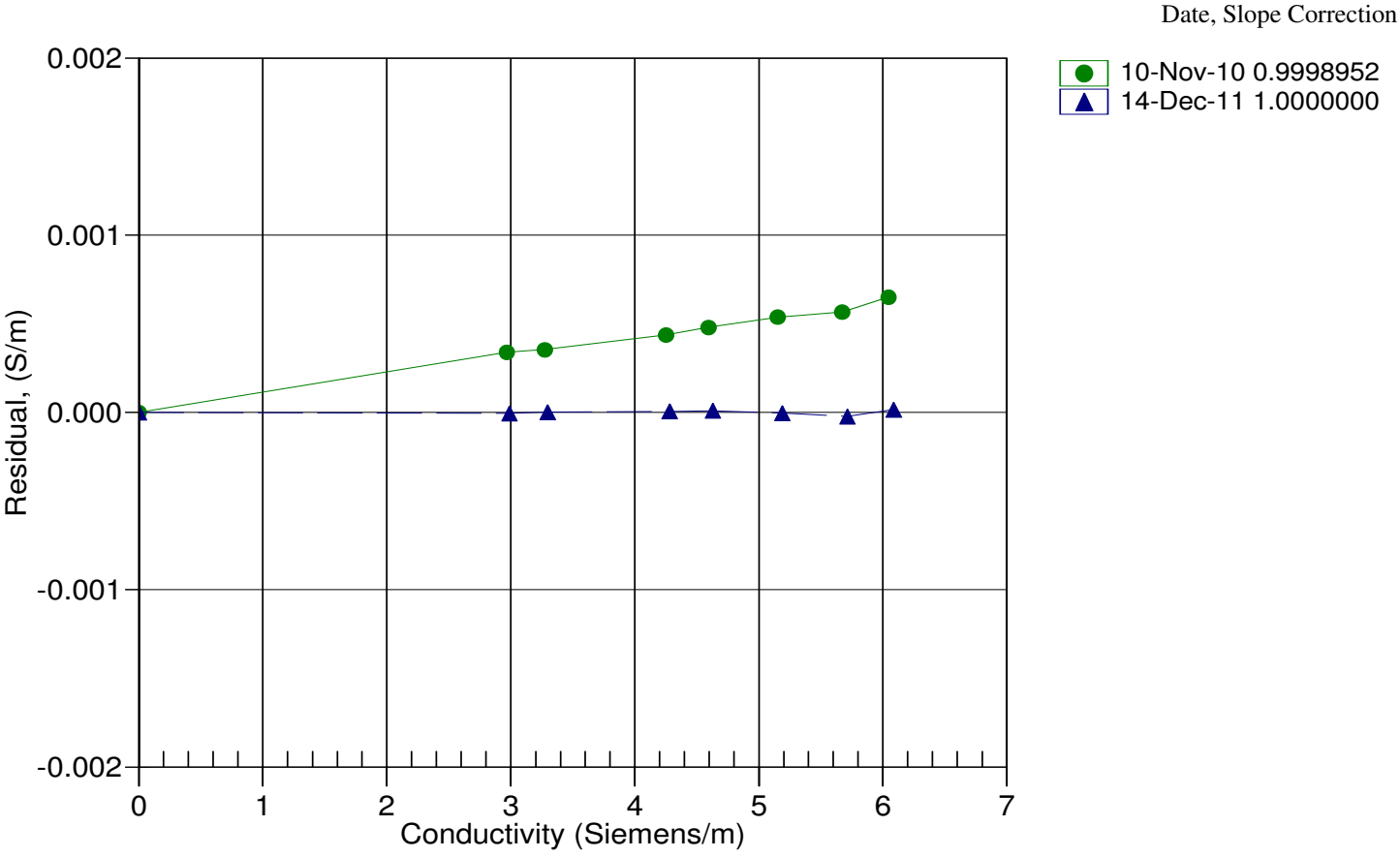
| BATH TEMP (ITS-90) | BATH SAL (PSU) | BATH COND (Siemens/m) | INST FREQ (Hz) | INST COND (Siemens/m) | RESIDUAL (Siemens/m) |
|---|---|---|---|---|---|
| 22.0000 | 0.0000 | 0.00000 | 2681.46 | 0.0000 | 0.00000 |
| 0.9999 | 34.9717 | 2.98797 | 5293.19 | 2.9880 | -0.00001 |
| 4.5000 | 34.9512 | 3.29619 | 5491.83 | 3.2962 | 0.00000 |
| 15.0000 | 34.9072 | 4.28158 | 6082.71 | 4.2816 | 0.00000 |
| 18.5000 | 34.8971 | 4.62793 | 6276.92 | 4.6279 | 0.00001 |
| 23.9999 | 34.8858 | 5.18781 | 6578.43 | 5.1878 | -0.00000 |
| 29.0000 | 34.8780 | 5.71128 | 6847.99 | 5.7113 | -0.00002 |
| 32.5000 | 34.8714 | 6.08451 | 7033.70 | 6.0845 | 0.00002 |

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; $\delta$ = CTcor; $\varepsilon$ = CPcor;

Residual = instrument conductivity - bath conductivity



**SEA-BIRD ELECTRONICS, INC.**
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

# *Temperature Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19Plus | **Serial Number:** | 19P33589-4487 |

***Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

Date: 12/14/2011 Drift since last cal: -0.00007 Degrees Celsius/year

Comments:

**'CALIBRATION AFTER REPAIR'** ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

**SEA-BIRD ELECTRONICS, INC.**
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# *Conductivity Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/14/2011 |
| **Model Number:** | SBE 19Plus | **Serial Number:** | 19P33589-4487 |

***Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

**Date:** 12/14/2011 **Drift since last cal:** +0.00020 **PSU/month***

**Comments:**

**'CALIBRATION AFTER CLEANING & REPLATINIZING'** ☐ Performed ☑ Not Performed

**Date:** **Drift since Last cal:** **PSU/month***

**Comments:**

****Measured at 3.0 S/m***

***Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.***

CTD - 4487, HSL 3102


# Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com


SENSOR SERIAL NUMBER: 4487
CALIBRATION DATE: 14-Dec-11

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.208646e-003
a1 = 2.630433e-004
a2 = -2.424026e-007
a3 = 1.540871e-007

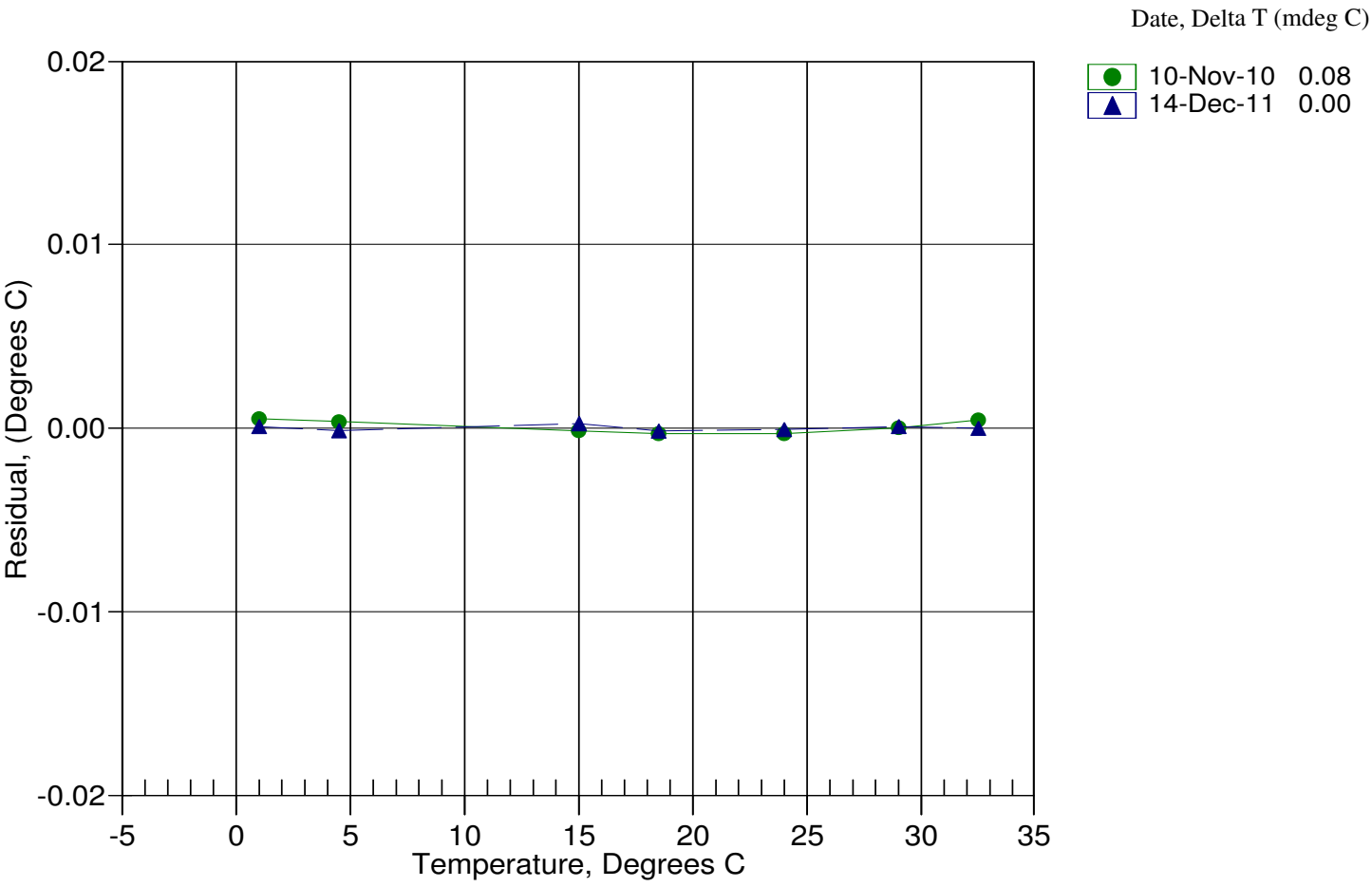
| BATH TEMP (ITS-90) | INSTRUMENT OUTPUT(n) | INST TEMP (ITS-90) | RESIDUAL (ITS-90) |
|---|---|---|---|
| 0.9999 | 713466.450 | 1.0000 | 0.0001 |
| 4.5000 | 638149.217 | 4.4999 | -0.0001 |
| 15.0000 | 447157.683 | 15.0002 | 0.0002 |
| 18.5000 | 394891.918 | 18.4998 | -0.0002 |
| 23.9999 | 323255.083 | 23.9998 | -0.0001 |
| 29.0000 | 268206.167 | 29.0001 | 0.0001 |
| 32.5000 | 234744.033 | 32.5000 | -0.0000 |

MV = (n - 524288) / 1.6e+007

R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)

Temperature ITS-90 = $1/\{a0 + a1[ln(R)] + a2[ln^2(R)] + a3[ln^3(R)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature



CTD - 4487, HSL 3102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SENSOR SERIAL NUMBER: 4487
CALIBRATION DATE: 09-Dec-11

SBE19plus PRESSURE CALIBRATION DATA
508 psia S/N 2837

COEFFICIENTS:

| | | | |
|---|---|---|---|
| PA0 = | 8.061338e-002 | PTCA0 = | 5.243986e+005 |
| PA1 = | 1.555712e-003 | PTCA1 = | 4.572438e+000 |
| PA2 = | 7.319688e-012 | PTCA2 = | -1.008803e-001 |
| PTEMPA0 = | -7.398211e+001 | PTCB0 = | 2.498675e+001 |
| PTEMPA1 = | 4.843255e+001 | PTCB1 = | -5.000000e-005 |
| PTEMPA2 = | -1.939711e-001 | PTCB2 = | 0.000000e+000 |

PRESSURE SPAN CALIBRATION

| PRESSURE PSIA | INST OUTPUT | THERMISTOR OUTPUT | COMPUTED PRESSURE | ERROR %FSR |
|---|---|---|---|---|
| 14.72 | 533864.0 | 2.0 | 14.73 | 0.00 |
| 104.99 | 591849.0 | 2.0 | 104.97 | -0.00 |
| 204.97 | 656050.0 | 2.0 | 204.95 | -0.01 |
| 304.96 | 720229.0 | 2.0 | 304.95 | -0.00 |
| 404.97 | 784363.0 | 2.0 | 404.94 | -0.01 |
| 504.96 | 848475.0 | 2.0 | 504.96 | -0.00 |
| 404.97 | 784393.0 | 2.0 | 404.99 | 0.00 |
| 304.97 | 720262.0 | 2.0 | 305.00 | 0.01 |
| 204.99 | 656089.0 | 2.0 | 205.01 | 0.00 |
| 105.03 | 591885.0 | 2.0 | 105.03 | -0.00 |
| 14.71 | 533861.0 | 2.0 | 14.72 | 0.00 |

THERMAL CORRECTION

| TEMP ITS90 | THERMISTOR OUTPUT | INST OUTPUT |
|---|---|---|
| 32.50 | 2.22 | 534013.67 |
| 29.00 | 2.15 | 534019.36 |
| 24.00 | 2.04 | 534020.95 |
| 18.50 | 1.92 | 534022.77 |
| 15.00 | 1.85 | 534017.41 |
| 4.50 | 1.63 | 533989.33 |
| 1.00 | 1.56 | 533975.94 |

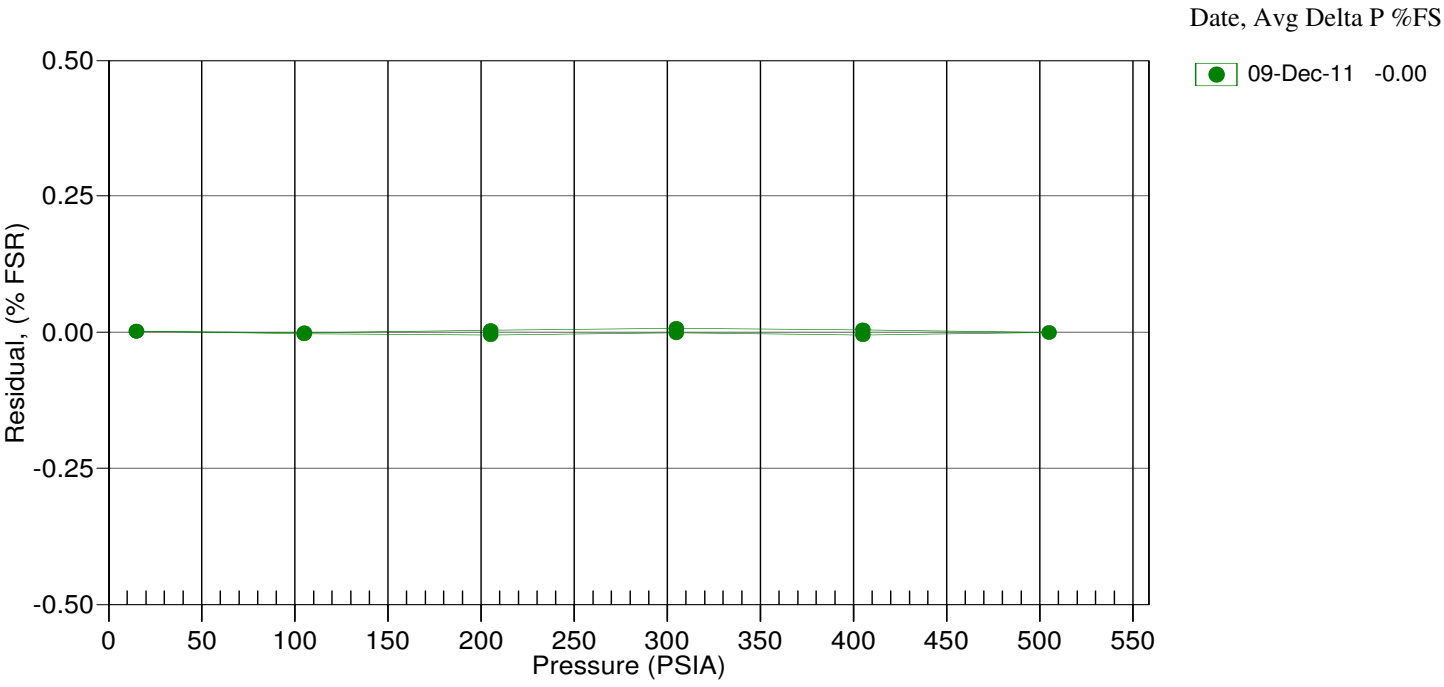
| TEMP(ITS90) | SPAN(mV) |
|---|---|
| -5.00 | 24.99 |
| 35.00 | 24.98 |

y = thermistor output; $t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

x = pressure output - $PTCA0 - PTCA1 * t - PTCA2 * t^2$

$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$

pressure (psia) = $PA0 + PA1 * n + PA2 * n^2$



CTD - 4487, HSL 3102


# Sea-Bird Electronics, Inc.

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SENSOR SERIAL NUMBER: 4487
CALIBRATION DATE: 14-Dec-11

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.021817e+000
h =  1.396141e-001
i = -2.206344e-004
j =  3.674517e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

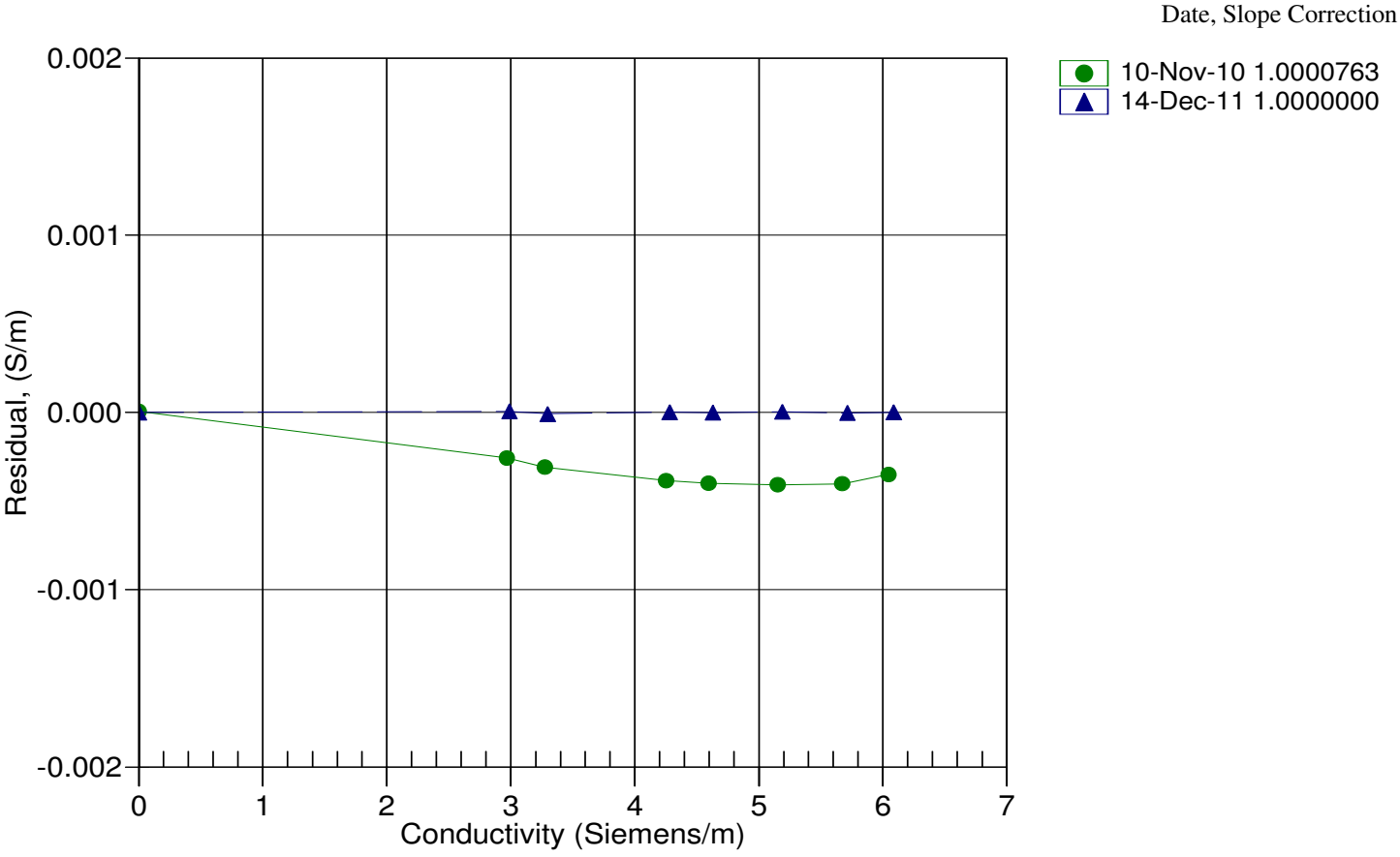
| BATH TEMP (ITS-90) | BATH SAL (PSU) | BATH COND (Siemens/m) | INST FREQ (Hz) | INST COND (Siemens/m) | RESIDUAL (Siemens/m) |
|---|---|---|---|---|---|
| 22.0000 | 0.0000 | 0.00000 | 2708.52 | 0.0000 | 0.00000 |
| 0.9999 | 34.9717 | 2.98797 | 5361.59 | 2.9880 | 0.00001 |
| 4.5000 | 34.9512 | 3.29619 | 5563.14 | 3.2962 | -0.00001 |
| 15.0000 | 34.9072 | 4.28158 | 6162.62 | 4.2816 | 0.00000 |
| 18.5000 | 34.8971 | 4.62793 | 6359.62 | 4.6279 | -0.00000 |
| 23.9999 | 34.8858 | 5.18781 | 6665.47 | 5.1878 | 0.00000 |
| 29.0000 | 34.8780 | 5.71128 | 6938.89 | 5.7113 | -0.00000 |
| 32.5000 | 34.8714 | 6.08451 | 7127.23 | 6.0845 | 0.00000 |

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; $\delta$ = CTcor; $\varepsilon$ = CPcor;

Residual = instrument conductivity - bath conductivity



**SEA-BIRD ELECTRONICS, INC.**
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

# *Temperature Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/20/2011 |
| **Model Number** | SBE 19Plus | **Serial Number:** | 19P60744-6667 |

***Temperature sensors are normally calibrated 'as received', without adjustments, allowing a determination sensor drift. If the calibration identifies a problem, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing coefficients to convert sensor frequency to temperature. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'offset' allows a small correction for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

Date: 12/17/2011 Drift since last cal: +0.00019 Degrees Celsius/year

Comments:

**'CALIBRATION AFTER REPAIR'** ☐ Performed ☑ Not Performed

Date: Drift since Last cal: Degrees Celsius/year

Comments:

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# *Conductivity Calibration Report*

| | | | |
|---|---|---|---|
| **Customer:** | Atlantic Marine Center | | |
| **Job Number:** | 66950 | **Date of Report:** | 12/20/2011 |
| **Model Number** | SBE 19Plus | **Serial Number:** | 19P60744-6667 |

***Conductivity sensors are normally calibrated 'as received', without cleaning or adjustments, allowing a determination of sensor drift. If the calibration identifies a problem or indicates cell cleaning is necessary, then a second calibration is performed after work is completed. The 'as received' calibration is not performed if the sensor is damaged or non-functional, or by customer request.***

***An 'as received' calibration certificate is provided, listing the coefficients used to convert sensor frequency to conductivity. Users must choose whether the 'as received' calibration or the previous calibration better represents the sensor condition during deployment. In SEASOFT enter the chosen coefficients. The coefficient 'slope' allows small corrections for drift between calibrations (consult the SEASOFT manual). Calibration coefficients obtained after a repair or cleaning apply only to subsequent data.***

**'AS RECEIVED CALIBRATION'** ☑ Performed ☐ Not Performed

**Date:** 12/17/2011 **Drift since last cal:** -0.00040 **PSU/month***

**Comments:**

**'CALIBRATION AFTER CLEANING & REPLATINIZING'** ☐ Performed ☑ Not Performed

**Date:** **Drift since Last cal:** **PSU/month***

**Comments:**

****Measured at 3.0 S/m***

***Cell cleaning and electrode replatinizing tend to 'reset' the conductivity sensor to its original condition. Lack of drift in post-cleaning-calibration indicates geometric stability of the cell and electrical stability of the sensor circuit.***

CTD - 6667, S222 (Spare)


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SENSOR SERIAL NUMBER: 6667
CALIBRATION DATE: 17-Dec-11

SBE19plus TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.246547e-003
a1 = 2.596044e-004
a2 = -1.637414e-007
a3 = 1.445447e-007

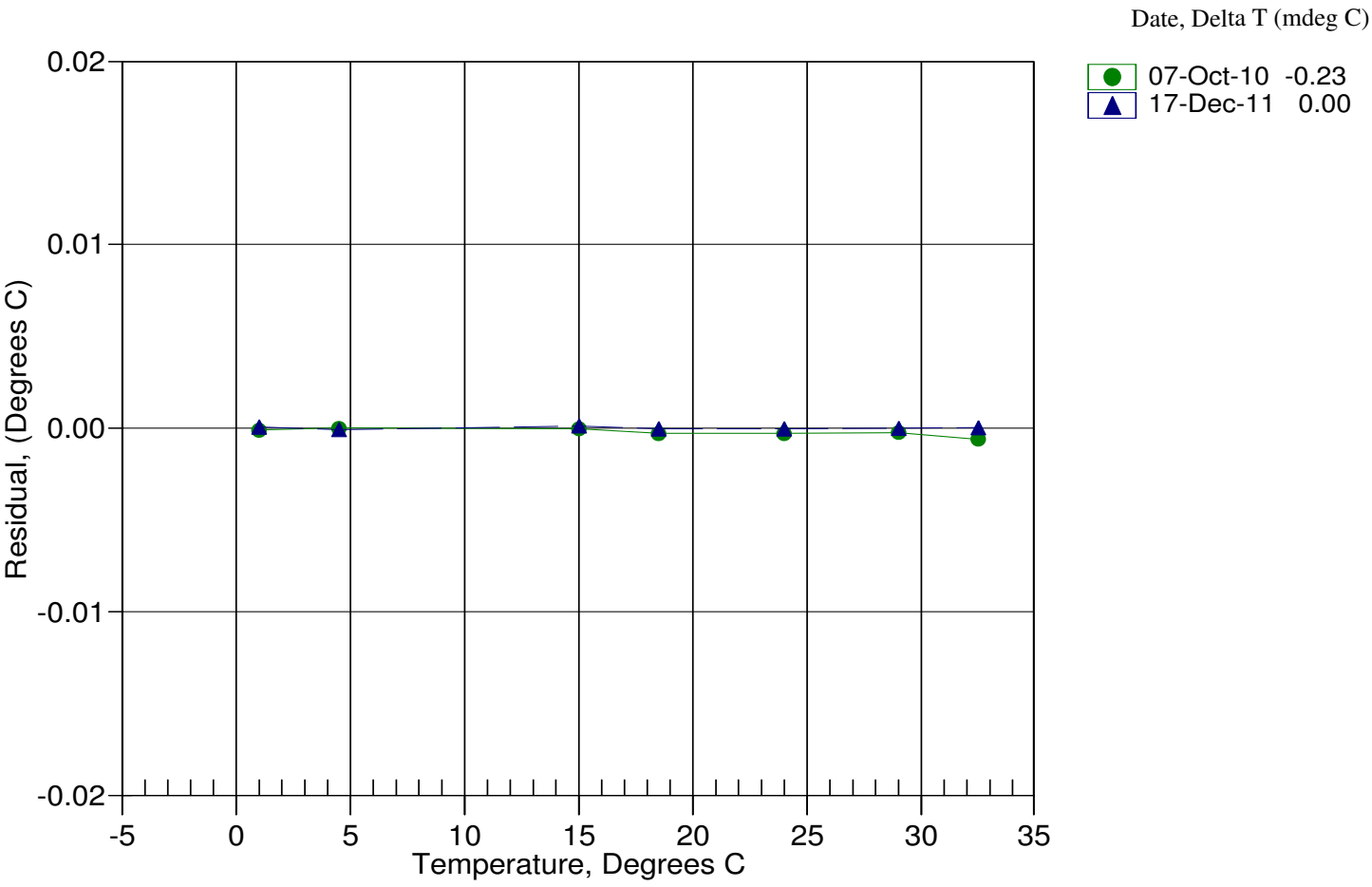
| BATH TEMP (ITS-90) | INSTRUMENT OUTPUT(n) | INST TEMP (ITS-90) | RESIDUAL (ITS-90) |
|---|---|---|---|
| 1.0000 | 702135.237 | 1.0000 | 0.0000 |
| 4.5000 | 626313.390 | 4.4999 | -0.0001 |
| 15.0000 | 435058.390 | 15.0001 | 0.0001 |
| 18.5000 | 383024.458 | 18.5000 | -0.0000 |
| 24.0000 | 311973.034 | 24.0000 | -0.0000 |
| 29.0000 | 257611.085 | 29.0000 | -0.0000 |
| 32.5000 | 224677.186 | 32.5000 | 0.0000 |

MV = (n - 524288) / 1.6e+007

R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)

Temperature ITS-90 = $1/\{a0 + a1[ln(R)] + a2[ln^2(R)] + a3[ln^3(R)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 6667
CALIBRATION DATE: 16-Dec-11

SBE19plus PRESSURE CALIBRATION DATA
870 psia S/N 3182130

COEFFICIENTS:

| | | | |
|---|---|---|---|
| PA0 = | 1.879247e+000 | PTCA0 = | 5.246270e+005 |
| PA1 = | 2.627187e-003 | PTCA1 = | 5.088441e+001 |
| PA2 = | 2.286017e-011 | PTCA2 = | -8.235602e-001 |
| PTEMPA0 = | -6.545655e+001 | PTCB0 = | 2.523813e+001 |
| PTEMPA1 = | 5.168516e+001 | PTCB1 = | -9.750000e-004 |
| PTEMPA2 = | -2.587175e-001 | PTCB2 = | 0.000000e+000 |

PRESSURE SPAN CALIBRATION

| PRESSURE PSIA | INST OUTPUT | THERMISTOR OUTPUT | COMPUTED PRESSURE | ERROR %FSR |
|---|---|---|---|---|
| 14.84 | 530261.0 | 1.7 | 14.83 | -0.00 |
| 180.11 | 593057.0 | 1.7 | 180.04 | -0.01 |
| 360.09 | 661395.0 | 1.7 | 360.04 | -0.01 |
| 540.09 | 729655.0 | 1.7 | 540.05 | -0.00 |
| 720.08 | 797831.0 | 1.7 | 720.06 | -0.00 |
| 875.05 | 856461.0 | 1.7 | 875.03 | -0.00 |
| 720.09 | 797862.0 | 1.7 | 720.14 | 0.01 |
| 540.12 | 729700.0 | 1.7 | 540.17 | 0.01 |
| 360.13 | 661450.0 | 1.7 | 360.18 | 0.01 |
| 180.16 | 593116.0 | 1.7 | 180.19 | 0.00 |
| 14.84 | 530287.0 | 1.7 | 14.88 | 0.00 |

THERMAL CORRECTION

| TEMP ITS90 | THERMISTOR OUTPUT | INST OUTPUT |
|---|---|---|
| 32.50 | 1.91 | 530505.78 |
| 29.00 | 1.84 | 530493.60 |
| 24.00 | 1.75 | 530456.86 |
| 18.50 | 1.64 | 530377.95 |
| 15.00 | 1.57 | 530299.18 |
| 4.50 | 1.36 | 529927.18 |
| 1.00 | 1.29 | 529765.53 |

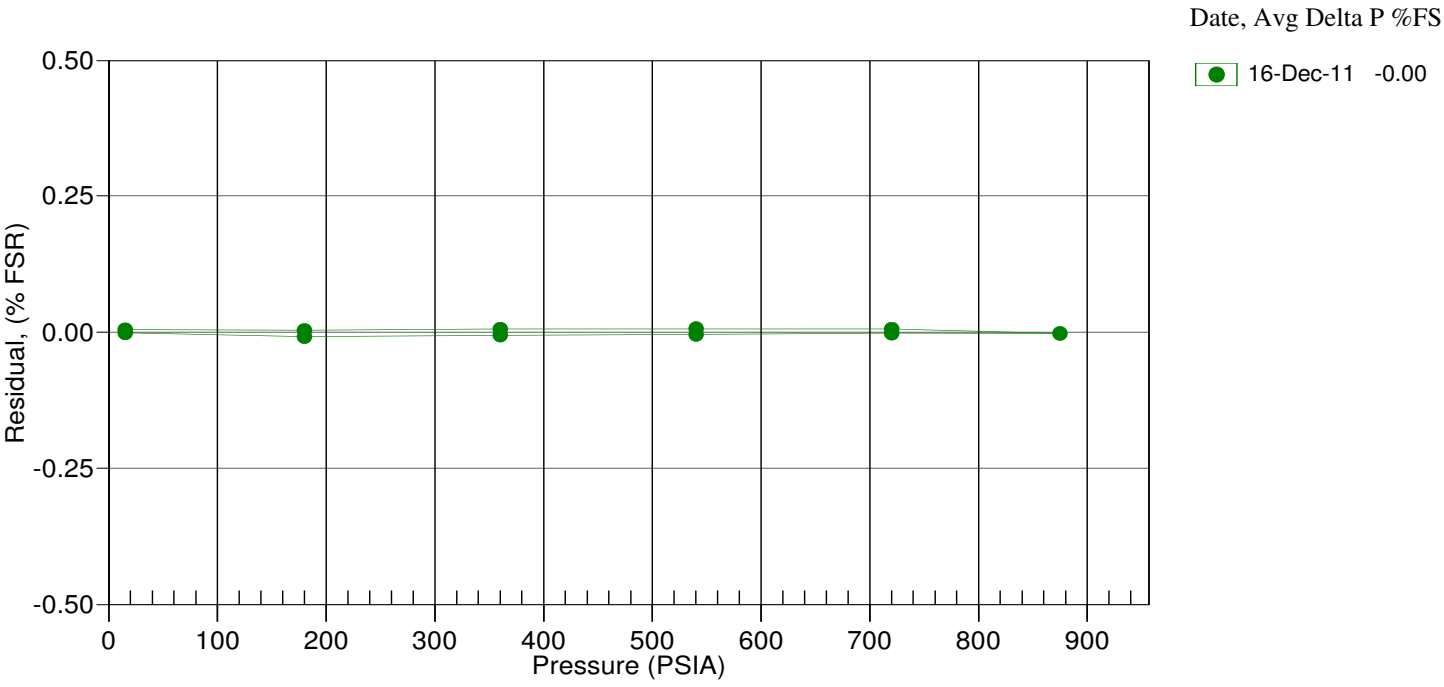
| TEMP(ITS90) | SPAN(mV) |
|---|---|
| -5.00 | 25.24 |
| 35.00 | 25.20 |

y = thermistor output; $t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

x = pressure output - $PTCA0 - PTCA1 * t - PTCA2 * t^2$

$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$

pressure (psia) = $PA0 + PA1 * n + PA2 * n^2$



CTD - 6667, S222 (Spare)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SENSOR SERIAL NUMBER: 6667
CALIBRATION DATE: 17-Dec-11

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.025366e+000
h =  1.349556e-001
i = -1.862922e-004
j =  3.127232e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

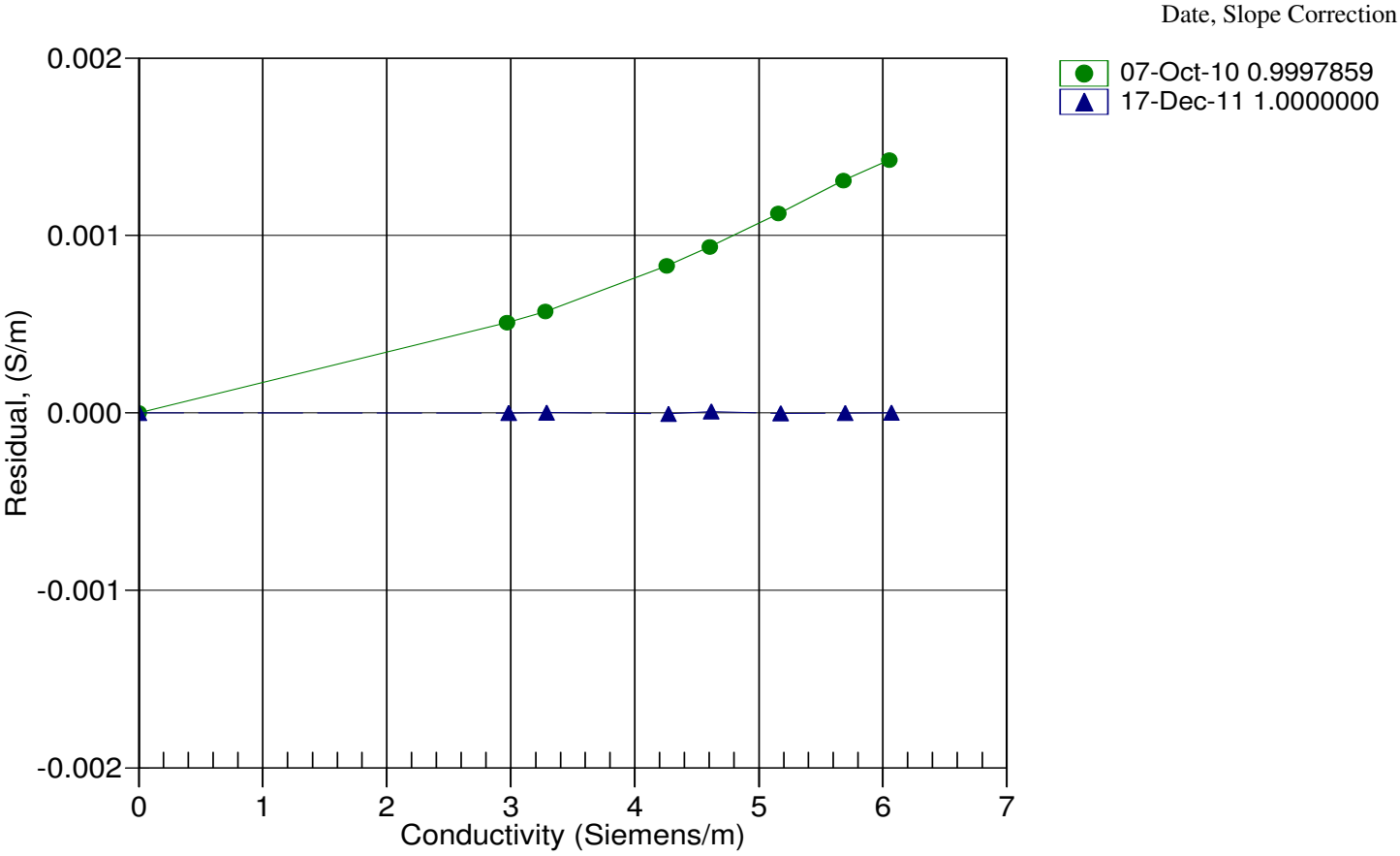
| BATH TEMP (ITS-90) | BATH SAL (PSU) | BATH COND (Siemens/m) | INST FREQ (Hz) | INST COND (Siemens/m) | RESIDUAL (Siemens/m) |
|---|---|---|---|---|---|
| 22.0000 | 0.0000 | 0.00000 | 2759.23 | 0.0000 | 0.00000 |
| 1.0000 | 34.8691 | 2.98005 | 5449.64 | 2.9800 | -0.00000 |
| 4.5000 | 34.8488 | 3.28749 | 5654.26 | 3.2875 | 0.00000 |
| 15.0000 | 34.8046 | 4.27033 | 6262.94 | 4.2703 | -0.00001 |
| 18.5000 | 34.7944 | 4.61578 | 6463.01 | 4.6158 | 0.00001 |
| 24.0000 | 34.7824 | 5.17414 | 6773.59 | 5.1741 | -0.00000 |
| 29.0000 | 34.7727 | 5.69598 | 7051.19 | 5.6960 | -0.00000 |
| 32.5000 | 34.7626 | 6.06768 | 7242.24 | 6.0677 | 0.00000 |

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C)]; p = pressure[decibars]; $\delta$ = CTcor; $\varepsilon$ = CPcor;

Residual = instrument conductivity - bath conductivity



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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 004823 |
| Asset Product Type: | Smart SV&T |
| Calibration Type: | Temperature |
| Calibration Range: | 0 to +45 Deg C |
| Calibration RMS Error: | .005 |
| Calibration ID: | 004823 999999 T12501 271211 215522 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | -4.619904E+1 | Coefficient G: | 0.000000E+0 |
| Coefficient B: | 2.879730E-3 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | -4.674987E-8 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | 4.785235E-13 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | 0.000000E+0 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 0.000000E+0 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 27/12/2011

Certified By:

AML Oceanographic

Robert Haydock
President, AML Oceanographic

AML Oceanographic certifies that the asset described above has been calibrated or recalibrated with equipment referenced to traceable standards. Please note that Xchange™ sensor-heads may be installed on assets other than the one listed above; this calibration certificate will still be valid when used on other such assets. If this instrument or sensor has been recalibrated, please be sure to update your records. Please also ensure that you update the instrument's coefficient values in any post-processing software that you use, if necessary. Older generation instruments may require configuration files, which are available for download at our Customer Centre at www.AMLoceanographic.com/support

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 004823 |
| Asset Product Type: | Smart SV&T |
| Calibration Type: | Sound Velocity |
| Calibration Range: | 1400 to 1550 m/s |
| Calibration RMS Error: | .0207 |
| Calibration ID: | 004823 999999 139875 271211 215522 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | 1.524980E+3 | Coefficient G: | 0.000000E+0 |
| Coefficient B: | -1.067510E+2 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | 8.551027E+0 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | -8.853014E-1 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | 0.000000E+0 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 0.000000E+0 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 27/12/2011

Certified By:

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Robert Haydock

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 005649 |
| Asset Product Type: | Smart SV&T Instrument, 500m Housing |
| Calibration Type: | Temperature |
| Calibration Range: | 0 to +45 Deg C |
| Calibration RMS Error: | .0003 |
| Calibration ID: | 005649 002099 400180 291211 162040 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | -1.681698E+1 | Coefficient G: | 1.479443E-28 |
| Coefficient B: | 1.539978E-3 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | -2.610716E-8 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | 4.938888E-13 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | -4.346158E-18 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 8.910081E-24 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 29/12/2011

Certified By:

AML Oceanographic

Robert Haydock

President, AML Oceanographic

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 005649 |
| Asset Product Type: | Smart SV&T Instrument, 500m Housing |
| Calibration Type: | Sound Velocity |
| Calibration Range: | 1400 to 1600 m/s |
| Calibration RMS Error: | .0144 |
| Calibration ID: | 005649 002051 200506 271211 215522 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | 7.232283E-4 | Coefficient G: | 0.000000E+0 |
| Coefficient B: | -7.385191E-5 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | 6.647626E-7 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | -5.091818E-7 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | 0.000000E+0 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 0.000000E+0 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 27/12/2011

Certified By:

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 007591 |
| Asset Product Type: | Micro SV&P for Brooke MVP - |
| Calibration Type: | Sound Velocity |
| Calibration Range: | 1400 to 1600 m/s |
| Calibration RMS Error: | .0112 |
| Calibration ID: | 007591 131945 135084 081211 094606 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | 7.186194E-4 | Coefficient G: | 0.000000E+0 |
| Coefficient B: | -7.417913E-5 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | 1.163344E-6 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | -7.809832E-7 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | 0.000000E+0 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 0.000000E+0 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 8/12/2011

Certified By:

AML Oceanographic

Robert Haydock

President, AML Oceanographic

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 007591 |
| Asset Product Type: | Micro SV&P for Brooke MVP - |
| Calibration Type: | Pressure |
| Calibration Range: | 1000 dBar |
| Calibration RMS Error: | .0488 |
| Calibration ID: | 007591 129146 0TE599 291211 154038 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | -2.575685E+3 | Coefficient G: | 8.071607E-10 |
| Coefficient B: | 1.820538E-1 | Coefficient H: | -5.916234E-15 |
| Coefficient C: | -4.133096E-6 | Coefficient I: | -1.762695E-5 |
| Coefficient D: | 2.932489E-11 | Coefficient J: | 1.123850E-9 |
| Coefficient E: | 5.711699E-1 | Coefficient K: | -2.388330E-14 |
| Coefficient F: | -3.660197E-5 | Coefficient L: | 1.691618E-19 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 29/12/2011

Certified By:

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Robert Haydock

President, AML Oceanographic

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MVP, S222

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 005340 |
| Asset Product Type: | Smart SV&P for Brooke MVP - |
| Calibration Type: | Sound Velocity |
| Calibration Range: | 1400 to 1550 m/s |
| Calibration RMS Error: | .0162 |
| Calibration ID: | 005340 999999 201222 071211 215548 |
| Installed On: | |

---

| | | | |
|---|---|---|---|
| Coefficient A: | 1.523393E+3 | Coefficient G: | 0.000000E+0 |
| Coefficient B: | -1.069210E+2 | Coefficient H: | 0.000000E+0 |
| Coefficient C: | 8.466070E+0 | Coefficient I: | 0.000000E+0 |
| Coefficient D: | -7.911434E-1 | Coefficient J: | 0.000000E+0 |
| Coefficient E: | 0.000000E+0 | Coefficient K: | 0.000000E+0 |
| Coefficient F: | 0.000000E+0 | Coefficient L: | 0.000000E+0 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 7/12/2011

Certified By:




Robert Haydock

President, AML Oceanographic

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# Certificate of Calibration

| | |
|---|---|
| Customer: | NOAA - Marine Operations Center Atlantic |
| Asset Serial Number: | 005340 |
| Asset Product Type: | Smart SV&P for Brooke MVP - |
| Calibration Type: | Pressure |
| Calibration Range: | 1000 dBar |
| Calibration RMS Error: | .0293 |
| Calibration ID: | 005340 999999 0ZE092 281211 133158 |
| Installed On: | |

| | | | |
|---|---|---|---|
| Coefficient A: | -1.918390E+3 | Coefficient G: | -9.419392E-7 |
| Coefficient B: | -1.399663E+0 | Coefficient H: | 1.044152E-8 |
| Coefficient C: | 2.217375E-2 | Coefficient I: | 1.180306E-8 |
| Coefficient D: | -1.520440E-4 | Coefficient J: | -1.508418E-10 |
| Coefficient E: | 5.850883E-2 | Coefficient K: | 8.793572E-12 |
| Coefficient F: | 4.658058E-5 | Coefficient L: | -1.896560E-13 |
| | | Coefficient M: | 0.000000E+0 |

Calibration Date (dd/mm/yyyy): 28/12/2011

Certified By:

AML Oceanographic

Robert Haydock
President, AML Oceanographic

AML Oceanographic certifies that the asset described above has been calibrated or recalibrated with equipment referenced to traceable standards. Please note that Xchange™ sensor-heads may be installed on assets other than the one listed above; this calibration certificate will still be valid when used on other such assets. If this instrument or sensor has been recalibrated, please be sure to update your records. Please also ensure that you update the instrument's coefficient values in any post-processing software that you use, if necessary. Older generation instruments may require configuration files, which are available for download at our Customer Centre at www.AMLoceanographic.com/support

AML Oceanographic
2071 Malaview Avenue, Sidney B.C. V8L 5X6 CANADA
T: +1-250-656-0771 F: +1-250-655-3655 Email: service@AMLoceanographic.com

# SVP Test and Calibration certificate

| | |
|---|---|
| SVP Type : | SVP70 |
| SVP Serial No. | 2011275 |

Date of issue : 29-09-2011

| | |
|---|---|
| Temperature Calibration : | Hart 1504 s/n A6B554 & Thermistor s/n 3014 |
| Point 1: | 4.6 ℃ |
| Point 2: | 16.6 ℃ |
| Point 3: | 25.5 ℃ |
| Pressure Calibration : | Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03) |
| Point 1: | 0 Bar |
| Point 2: | 299.7 Bar |
| Point 3: | 600.4 Bar |

| | RMS Speed of Sound Errors |
|---|---|
| Temperature Validation : | 0.0029 m/s |
| Pressure Validation : | 0.0710 m/s |

Calibration & Final Function Test : Sign : _____

QA Signature : Inits : _____

2011.09.29

RESON A/S, Fabriksvangen 13, DK-3550 Slangerup
Fax: +45 4738 0066, Phone: +45 4738 0022

RESON

# SVP Test and Calibration certificate

| | |
|---|---|
| SVP Type : | SVP71 |
| SVP Serial No. | 4211067 |

| | |
|---|---|
| Date of issue : | 22-02-2012 |

| | |
|---|---|
| Temperature Calibration : | Hart 1504 s/n A6B554 & Thermistor s/n 3014 |
| Point 1: | 4.6 °C |
| Point 2: | 16.5 °C |
| Point 3: | 25.5 °C |
| Pressure Calibration : | Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03) |
| Point 1: | 0 Bar |
| Point 2: | 103.3 Bar |
| Point 3: | 204.2 Bar |

| | RMS Speed of Sound Errors |
|---|---|
| Temperature Validation : | 0.0156 m/s |
| Pressure Validation : | 0.0241 m/s |

Calibration & Final Function Test : Sign : Find Petersen

QA Signature : Inits : Oskar

2012. 02. 23

RESON

RESON A/S, Fabriksvangen 13, DK-3550 Slangerup
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RESON

# SVP Test and Calibration certificate

| | |
|---|---|
| SVP Type : | SVP71 |
| SVP Serial No. | 4211065 |

Date of issue : 21-02-2012

| | |
|---|---|
| Temperature Calibration : | Hart 1504 s/n A6B554 & Thermistor s/n 3014 |
| Point 1: | 4.6 °C |
| Point 2: | 16.5 °C |
| Point 3: | 25.5 °C |
| Pressure Calibration : | Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03) |
| Point 1: | 0 Bar |
| Point 2: | 102.5 Bar |
| Point 3: | 203.9 Bar |

| | RMS Speed of Sound Errors |
|---|---|
| Temperature Validation : | 0.0231 m/s |
| Pressure Validation : | 0.0713 m/s |

Calibration & Final Function Test : Sign : Find Petersen

QA Signature : Inits : Osb

2012-02-23

RESON

RESON A/S, Fabriksvangen 13, DK-3550 Slangerup
Fax: +45 4738 0066, Phone: +45 4738 0022

# SVP Test and Calibration certificate

| | |
|---|---|
| SVP Type : | SVP71 |
| SVP Serial No. | 0710064 |

Date of issue : 14-09-2011

| | |
|---|---|
| Temperature Calibration : | Hart 1504 s/n A6B554 & Thermistor s/n 3014 |
| Point 1: | 4.6 °C |
| Point 2: | 16.6 °C |
| Point 3: | 25.5 °C |
| Pressure Calibration : | Custom Built Tank (TestUnit ASF150 Ser# 41-10-0007-R03) |
| Point 1: | 0 Bar |
| Point 2: | 101.4 Bar |
| Point 3: | 204.1 Bar |

| | RMS Speed of Sound Errors |
|---|---|
| Temperature Validation : | 0.0185 m/s |
| Pressure Validation : | 0.0766 m/s |

Calibration & Final Function Test : Sign : Finn Petersen

QA Signature : Inits : 2011.09.14

RESON A/S, Fabriksvangen 13, DK-3550 Slangerup
Fax: +45 4738 0066, Phone: +45 4738 0022

H12488

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable Area |
| Registry Number: | H12488 |

## LOCALITY

| | |
|---|---|
| State(s): | New York |
| General Locality: | Long Island Sound |
| Sub-locality: | East of Nissequuge River to Crane Neck Point NY. |

**2012**

CHIEF OF PARTY
CDR. Lawerence T. Krepp, NOAA

LIBRARY & ARCHIVES

Date:

| U.S. DEPARTMENT OF COMMERCE<br>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | REGISTRY NUMBER: |
|---|---|
| **HYDROGRAPHIC TITLE SHEET** | **H12488** |

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): | **New York** |
| General Locality: | **Long Island Sound** |
| Sub-Locality: | **East of Nissequuge River to Crane Neck Point NY.** |
| Scale: | **10000** |
| Dates of Survey: | **06/24/2012 to 08/02/2012** |
| Instructions Dated: | **05/08/2012** |
| Project Number: | **OPR-B340-TJ-12** |
| Field Unit: | **NOAA Ship *Thomas Jefferson*** |
| Chief of Party: | **CDR. Lawerence T. Krepp, NOAA** |
| Soundings by: | **RESON 7125 Multibeam Echo Sounder** |
| Imagery by: | **RESON 7125 Backscatter KLEIN 5000 Side Scan Sonar** |
| Verification by: | **Atlantic Hydrographic Branch** |
| Soundings Acquired in: | **meters at Mean Lower Low Water** |

Remarks:

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**Descriptive Report to Accompany Survey H12488**

Project: OPR-B340-TJ-12

Locality: Long Island Sound

Sublocality: East of Nissequuge River to Crane Neck Point NY.

Scale: 1:10000

June 2012 - August 2012

**NOAA Ship *Thomas Jefferson***

Chief of Party: CDR. Lawerence T. Krepp, NOAA

# A. Area Surveyed

Area surveyed was east of Nissequogue River to Crane Neck Point New York. Crane Neck is a pennisula that extends out northwest into Long Island Sound. The submerged extension of the point continues with sandwaves and rocks that are susceptible to shoaling. On the south side of this survey is the approach to Stony Brook Harbor. It has considerable recreational and fishing charter enterprises.

## A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit | Southeast Limit |
|---|---|
| 41° 1" 35' N<br>73° 12" 54' W | 40° 54" 29' N<br>73° 8" 36' W |

*Table 1: Survey Limits*

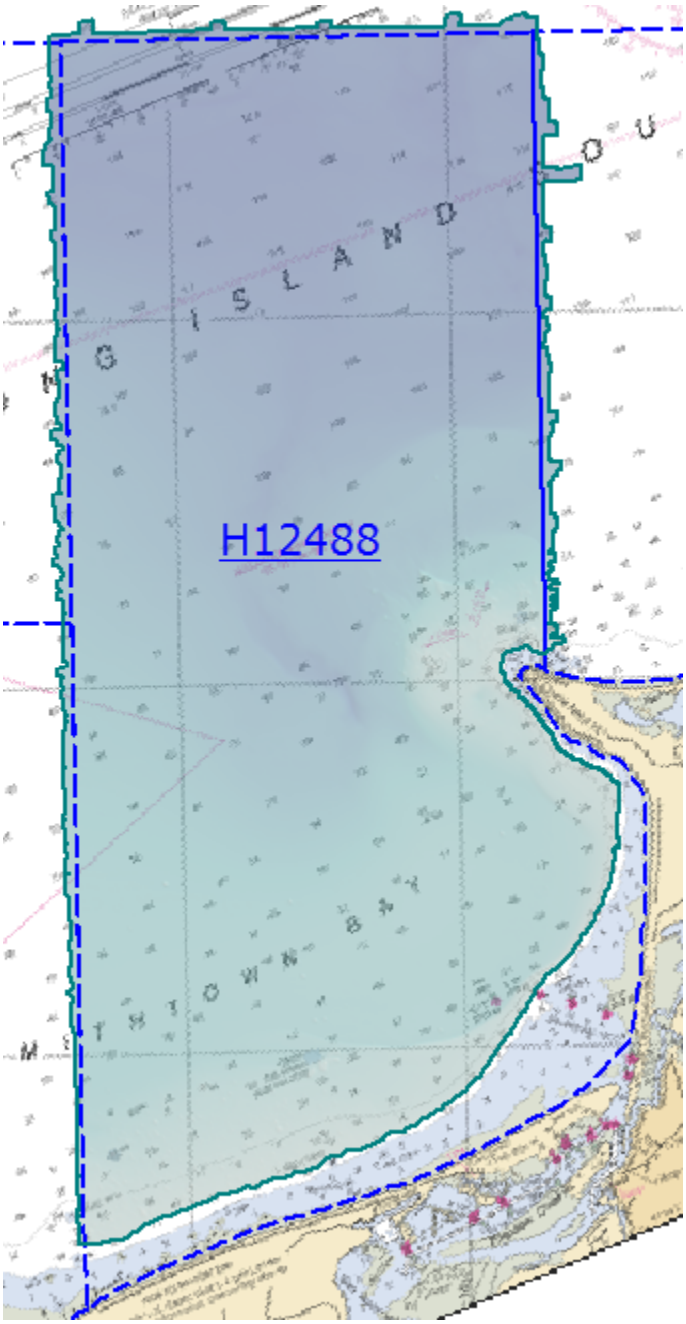


*Figure 1: Limit to 4m Curve*

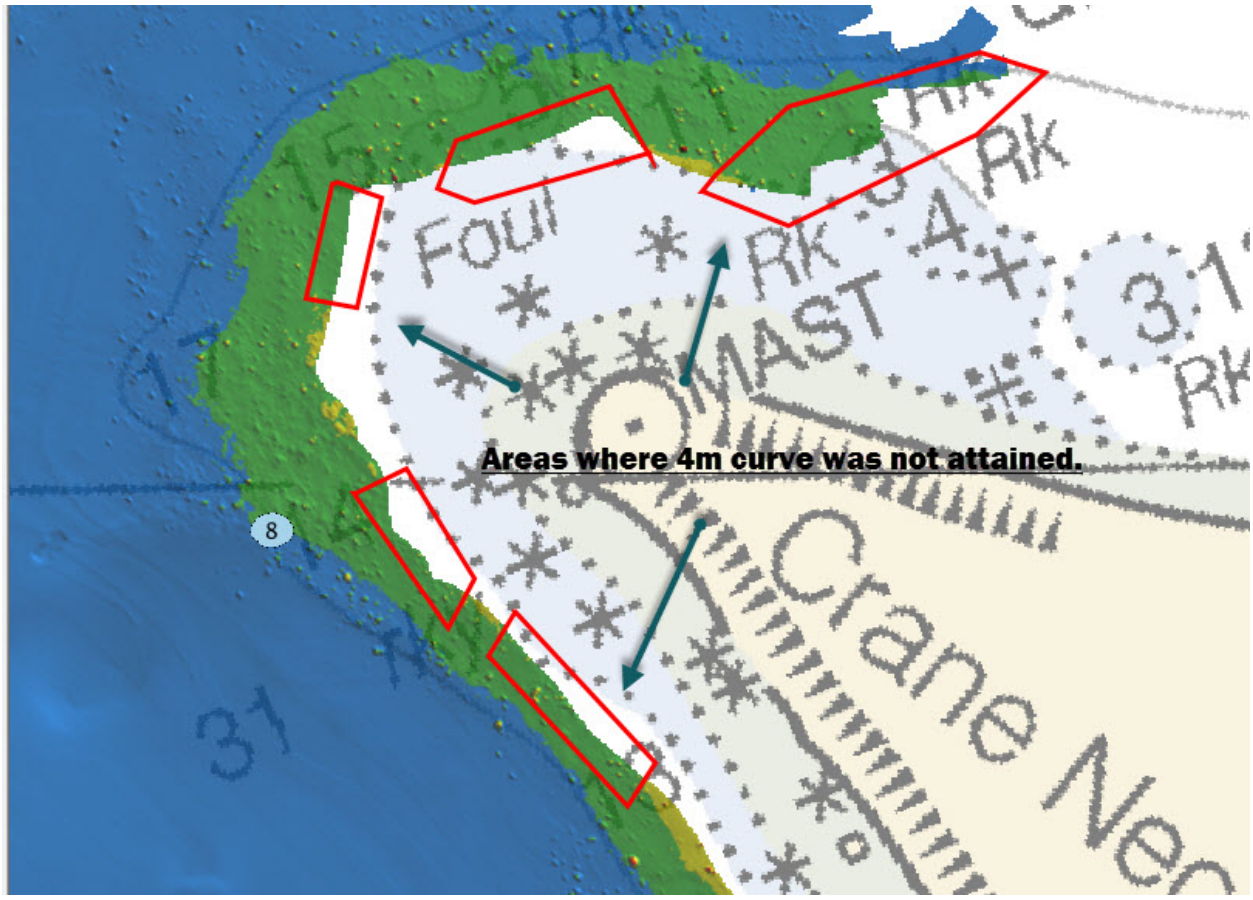


*Figure 2: Exception to 4m curve. Green to Yellow denotes 4m curve is obtained*

The survey limits, as depicted in the project instructions project reference file, extend all the way to the shoreline. The coverage requirement for multibeam is to the NALL line or 4m curve. With the exception of foul areas, complete MBES coverage was achieved as per project instructions. These areas are generally located very near shore, subject to dangerous wave action, and judged to be navigationally insignificant. In Fig 4 the dashed line indicates the sheet limit, the solid line displays the limits of survey. Fig. 4 is a close up of missed areas.

## A.2 Survey Purpose

This project is being conducted in support of NOAA's Office of Coast Survey to provide contemporary hydrographic data in order to update the nautical charting products and reduce the survey backlog within the area. In addition, data from this project will support the Long Island Sound Sea floor Mapping Initiative for the States of Connecticut and New York. This project also responds to the Coast Guard proposal to establish six anchorage grounds in Long Island Sound to increase safety for vessels through enhanced voyage planning and also by clearly indicating the location of anchorage grounds for ships proceeding to ports in New York. The USCG is requesting that NOAA confirm that their underwater surveys of Long Island Sound did not detect any wrecks at all in the locations being proposed for the anchorage areas. Data acquired for this project will be used by partners for species and habitat identification, infrastructure projects,

ocean mapping, coastal hazards and geology. Partners include the US Environmental Protection Agency, Connecticut Department of Environmental Protection, the University of Connecticut Marine Science Department, New York Department of Environmental Quality, and other organizations.This project will cover approximately 206 SNM of which 165 SNM are critical survey areas as designated in the NOAA Hydrographic Survey Priorities, 2010 edition.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12488 met complete multibeam coverage requirements. Ninety five percent of the survey met the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSDM (Figure 2 and 3.). Most areas that did not meet the requirement were from acoustic shadows.

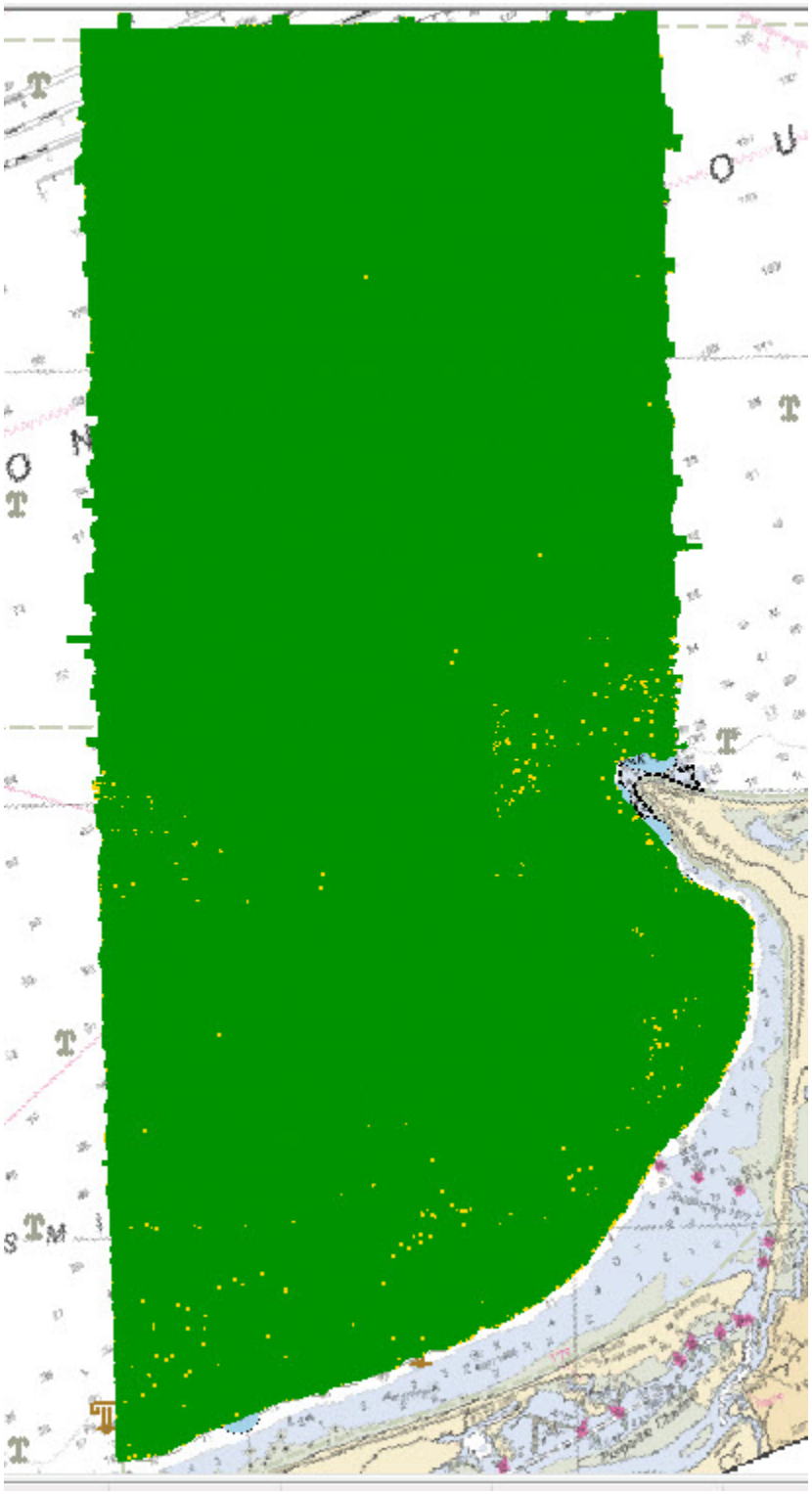

*Figure 3: Total Coverage by Density Limit. Yellow indicates less than 5 pings per node*

| Field Sheets | Resolution | Depth Range ( 2012 Spec) | Num Nodes | Fewer than 5 per node | Percent of nodes greater than 5 per node |
|---|---|---|---|---|---|
| FS1_50cm | 0.5m | 0-20 | 91,142,588 | 488,245 | 99.46% |
| FS1_2m | 2.0m | 18-40 | 2,201,619 | 118 | 99.99% |
| FS2_50cm | 0.5m | 0-20 | 1,148,586 | 56,381 | 95.09% |
| FS2_2m | 2.0m | 18-40 | 6,832,658 | 1875 | 99.97% |
| | | Total | 101,325,451 | 546,619 | 99.46% |

*Figure 4: H12488 Density Summary Table*

## A.4 Survey Coverage

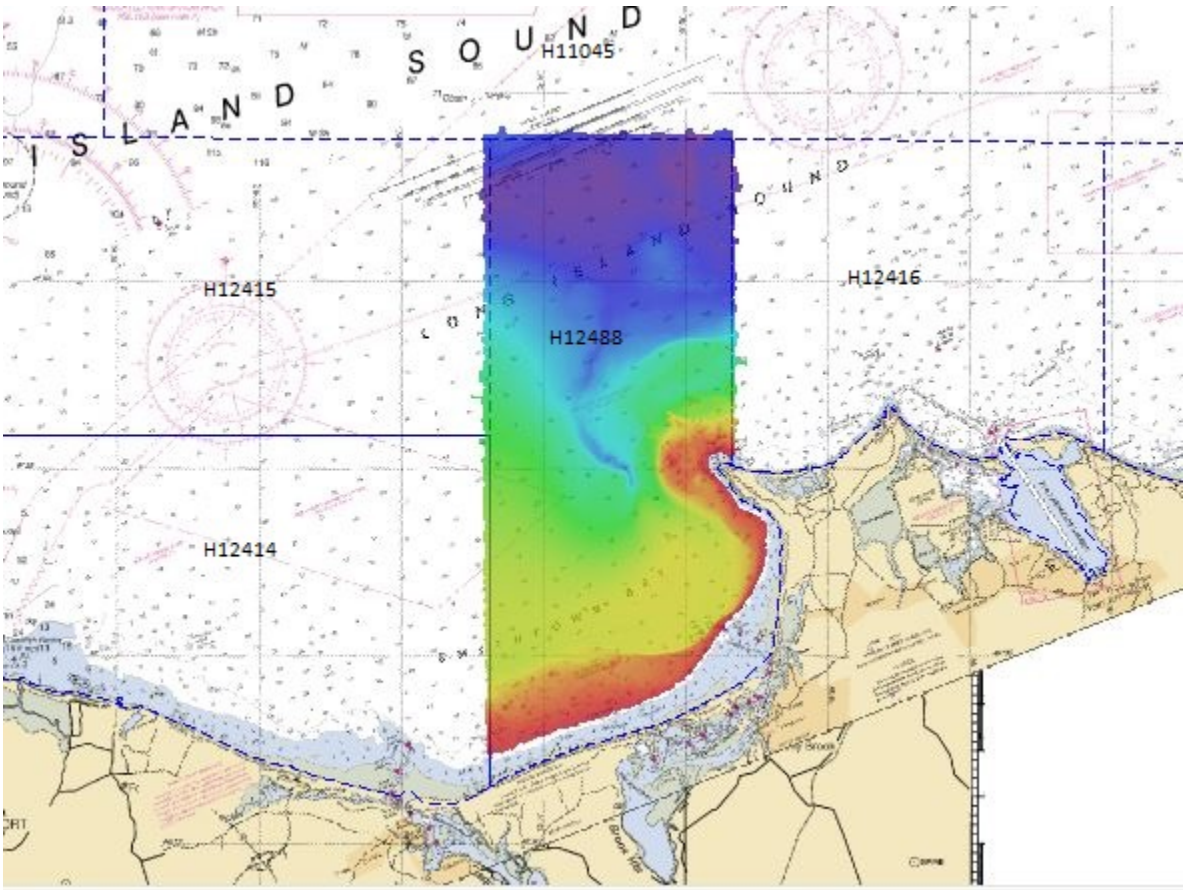


*Figure 5: Survey Coverage Limit with contemporary adjoining Surveys*

With the exception of Holidays and Density loss, over 95% of the survey adhered to the Project Instructions. Holidays that exceeded the 3 node specification were observed and noted in the image below. Some were of considerable length but usually not more than 2-3 nodes wide. There is a slight difference in the grid

cell coverage depending on whether TCARI or GPS Tide is used. This may explain timeliness in accessing holiday plans prior to leaving the area. See Fig. 6

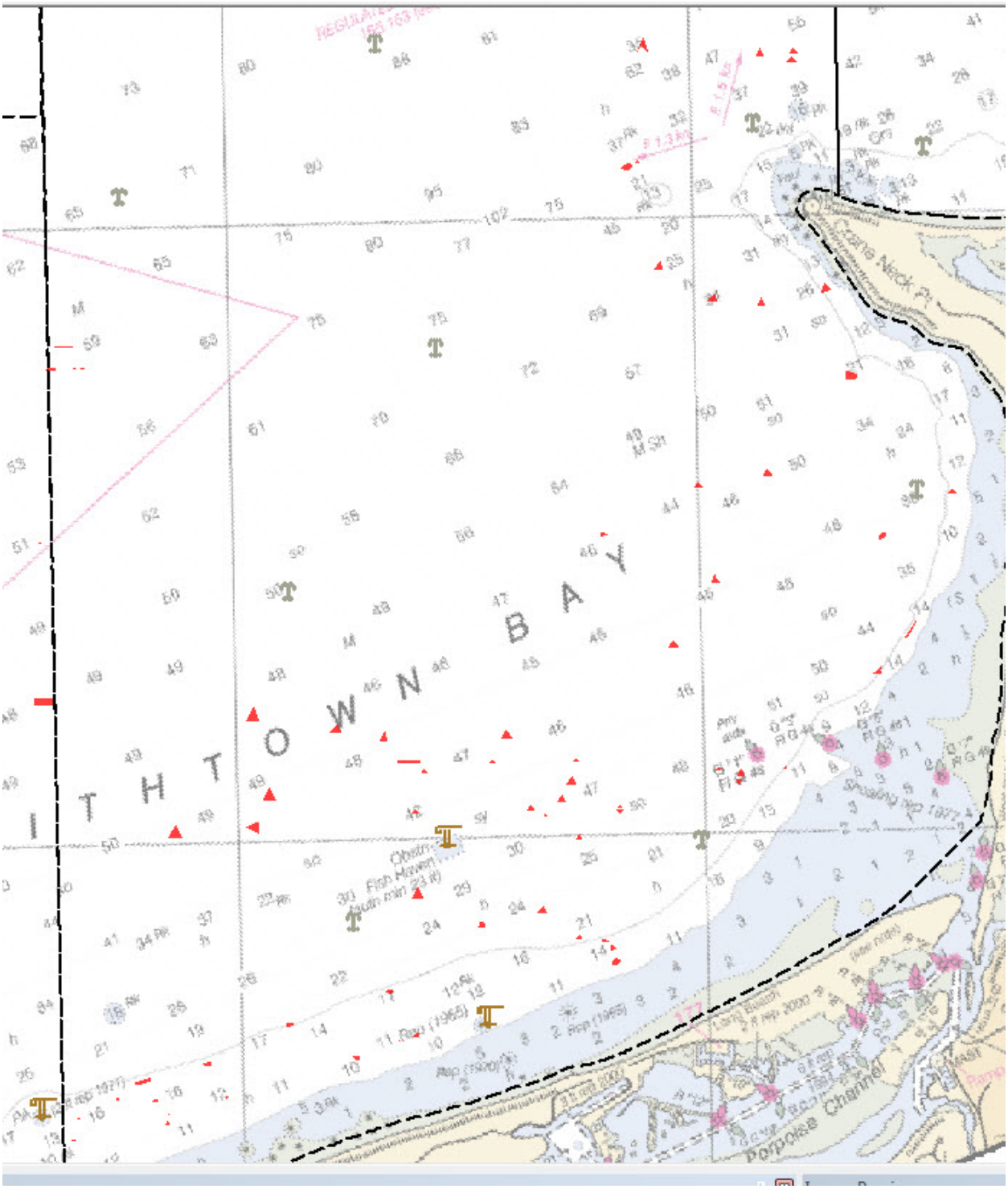


*Figure 6: Areas of Holidays that exceed 3 consecutive pings.*

## A.5 Survey Statistics

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

| | Vessel | ***S222*** | ***3101*** | ***3102*** | ***Total*** |
|---|---|---|---|---|---|
| **LNM** | **SBES Mainscheme** | 0 | 0 | 0 | 0 |
| | **MBES Mainscheme** | 430.73 | 106.93 | 223.76 | 761.42 |
| | **Lidar Mainscheme** | 0 | 0 | 0 | 0 |
| | **SSS Mainscheme** | 0 | 13.9 | 13.5 | 27.4 |
| | **SBES/MBES Combo Mainscheme** | 0 | 0 | 0 | 0 |
| | **SBES/SSS Combo Mainscheme** | 0 | 0 | 0 | 0 |
| | **MBES/SSS Combo Mainscheme** | 0 | 0.0 | 0 | 0 |
| | **SBES/MBES Combo Crosslines** | 22.41 | 22.79 | 21.43 | 66.63 |
| | **Lidar Crosslines** | 0 | 0 | 0 | 0 |
| **Number of Bottom Samples** | | | | | 0 |
| **Number AWOIS Items Investigated** | | | | | 4 |
| **Number Maritime Boundary Points Investigated** | | | | | 0 |
| **Number of DPs** | | | | | 2 |
| **Number of Items Items Investigated by Dive Ops** | | | | | 0 |
| **Total Number of SNM** | | | | | 16.6 |

*Table 2: Hydrographic Survey Statistics*

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

| Survey Dates | Julian Day Number |
|---|---|
| 06/24/2012 | 176 |
| 06/25/2012 | 177 |
| 06/26/2012 | 178 |
| 06/27/2012 | 179 |
| 06/28/2012 | 180 |
| 06/29/2012 | 181 |
| 06/30/2012 | 182 |
| 07/26/2012 | 208 |
| 07/27/2012 | 209 |
| 07/28/2012 | 210 |
| 07/29/2012 | 211 |
| 07/30/2012 | 212 |
| 08/02/2012 | 215 |

*Table 3: Dates of Hydrography*

Launches performed SSS only for Recon purposes.

# 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 | *S222* | *3101* | *3102* |
|---|---|---|---|
| **LOA** | 208 feet | 31 feet | 31 feet |
| **Draft** | 15 feet | 3.5 feet | 3.5 feet |

*Table 4: Vessels Used*

### B.1.2 Equipment

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

| Manufacturer | Model | Type |
|---|---|---|
| RESON | 7125 SV and 7125 ROV | MBES |
| KLEIN | 5000 V1 | SSS |
| APPLANIX | POS/MV | Attitude System |
| TRIMBLE | REC DSM212L | Positioning System |
| Rolls Royce | MVP | Sound Speed System |
| Seabird | SBE 19plus | Conductivity, Temperature, and Depth Sensor |
| Applied Micro System | Smart SV+T, Micro SV&P | Sound Speed System |
| RESON | SVP71 | Sound Speed System |

*Table 5: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 9% of mainscheme acquisition.

The percentage of cross lines were  9% of the main scheme and exceeded the requirement for 100% object detection coverage. SSS was run only for reconnaissance and was not used to establish object detection requirements. A difference grid was made to access cross line to main scheme parity. Of the crossings 99% percent were less than  +/- 0.3meters. Figures 7 and 8 show the cross line overlay on the main scheme lines. The boundary outlines the XL coverage. Statistics can be found in Separates IV.

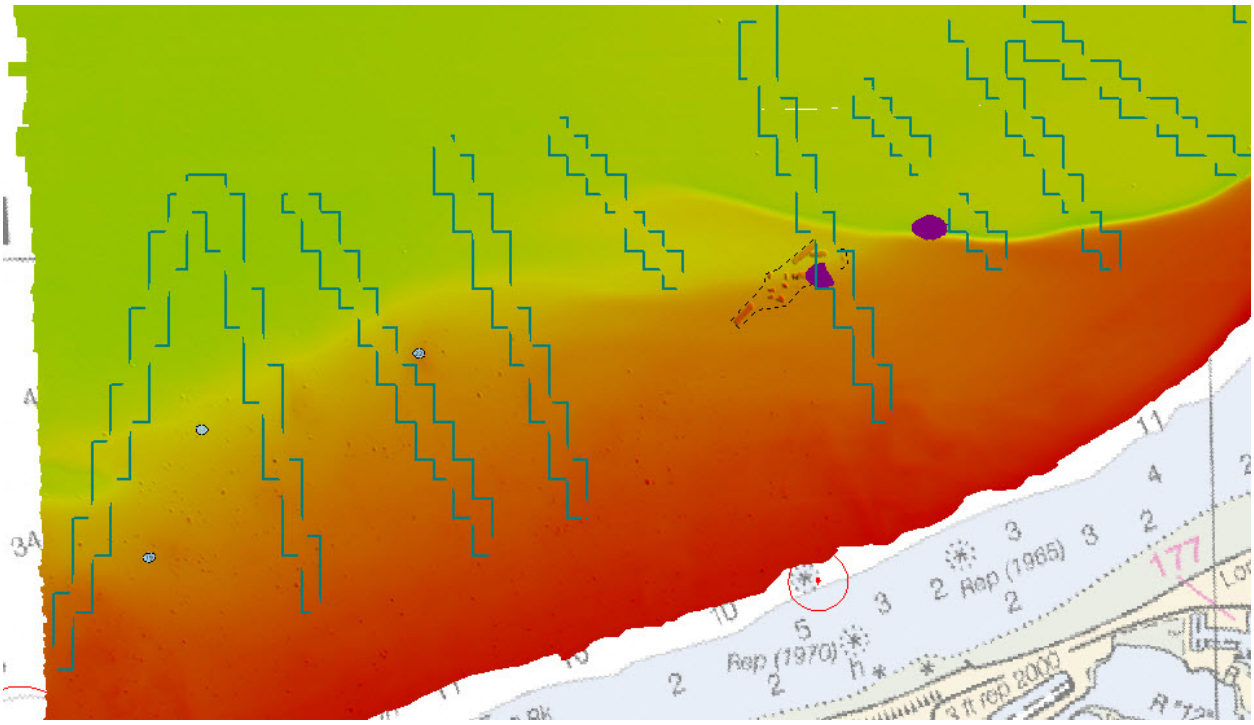


*Figure 7: XL South. Orientations highlighted to show XL parity to MS*

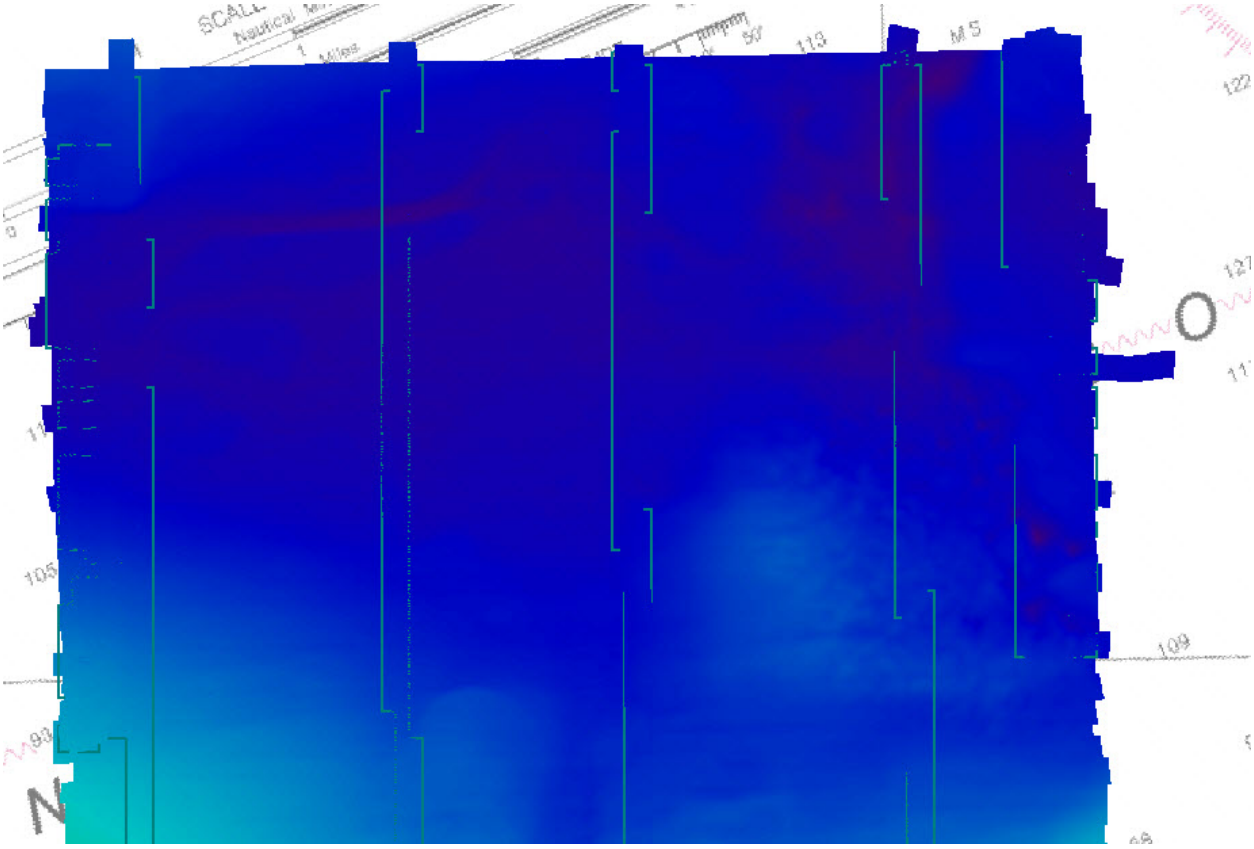

*Figure 8: XL North. Orientations highlighted to show XL parity to MS*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Measured | Zoning |
|---|---|
| 0 meters | 0 meters |
| 0.102 meters | 0 meters |

*Table 6: Survey Specific Tide TPU Values*

| Hull ID | Measured - CTD | Measured - MVP | Surface |
|---|---|---|---|
| 3101 ,3102, S222 | 4.0 meters/second | 0 meters/second | 0.2 meters/second |
| S222 | 4.0 meters/second | 1.0 meters/second | 0.2 meters/second |

*Table 7: Survey Specific Sound Speed TPU Values*

Two values for Tide uncertainty were used for this project. One is derived from Tidal Constituent And Residual Interpolation (TCARI), and the other Ellipsoidally Referenced Survey (ERS) and referred to as GPS Tide. A value of 0.102 was determined for GPS Tide. Two methods of sound velocity were also used derived from Conductivity Temperature and Density(CTD) and a Moving Vessel Profiler(MVP). The ship was the only platform that could use either CTD or MVP of which the MVP was the preferred method.

The NOAA uncertainty standards are based on IHO S-44 standards for hydrographic surveys. The TVU QC layer compares the estimated uncertainty of the depth estimate to the allowable uncertainty of the depth estimate node by node.The method used was the ratio method which visualizes the ratio of the uncertainty at a node to the maximum allowed IHO uncertainty for each node via a computed layer in CARIS. This TVU QC layer scales with depth and demonstrates what fraction of the total allowable error budget is consumed by the estimated uncertainty.

Four finalized surfaces were examined, H12488_FS1_50cm_MLLW, H12488_FS1_2m_MLLW, H12488_FS2_50cm_MLLW, H12488_FS2_2m_MLLW. Values from the ratio which require further examination are from -1.0 to -100. All the surfaces passed with 99.9% confidence. Most values were either on features or outliers of insignifcant value. Results can be found in Separates IV.

### B.2.3 Junctions

There were three contemporary surveys that junction H12488. H12414 to the southwest, H12415 to the northwest, and H12416 to the east. The survey H11045 2003 by Rude was on the north side but no data was available. No other junction surveys provided intersected this survey. A difference surface was created between adjoining grids and results obtained from the statistic tool. All the junctions attained 99.8% agreement at less than +/- 0.3m. . Results can be found in Separates IV.

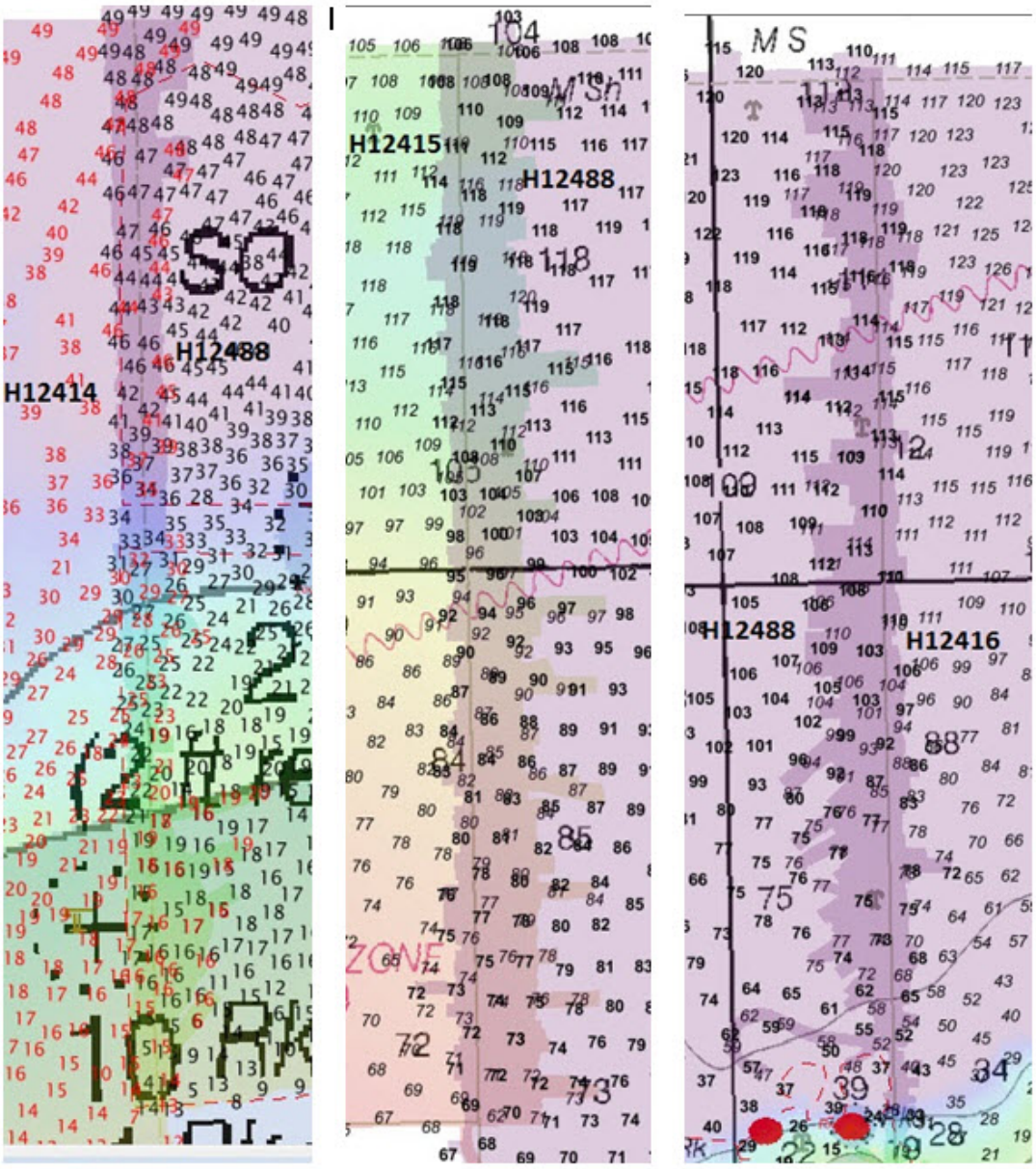


*Figure 9: Contemporary Junctions with Surveys H12414, H12415, H12416*

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: CTD Casts were taken every 3 to 4 hours throughout the day. MVP Casts averaged every 30 minutes depending on safe deployment or traffic.

Efforts to minimize sound velocity issues included frequent of casts based on time and location. While in acquisition, values in excess of 3 meters/sec while on line were monitored and decisions for casts determined on that basis.

In addition a Sound Speed Comparison Tool script developed by Matt Wilson was used on ship data. This tool will retroactively plot the real-time sound speed input to a multibeam echo sounder (SSP) versus the sound speed at the commensurate water level taken from the Moving Vessel Profiler (MVP). Out of 1007 MVP profiles for the ship, 13 comparisons failed the 2m/sec criteria on ship data. The 2m/sec criteria was chosen because the tool can better access the data then by monitoring it in acquistion. On inspection of the most excessive of the comparisons, data was either rejected completely or rejected to a reduced swath width(outside beams). Most excesses were within IHO specification for differences in depth caused by excess velocity error. The sample refers to a high reading from the results that occurred on S222 data DN181 at 2100. On inspection in subset editor the data was in fact within specification. The mean difference and standard deviation between surface and cast measurements was (m/s)=0.611, +/-0.927. See Fig. 11 and Separates H12488_Soundspeed_comarisons_All.txt for a list of times that were in excess.

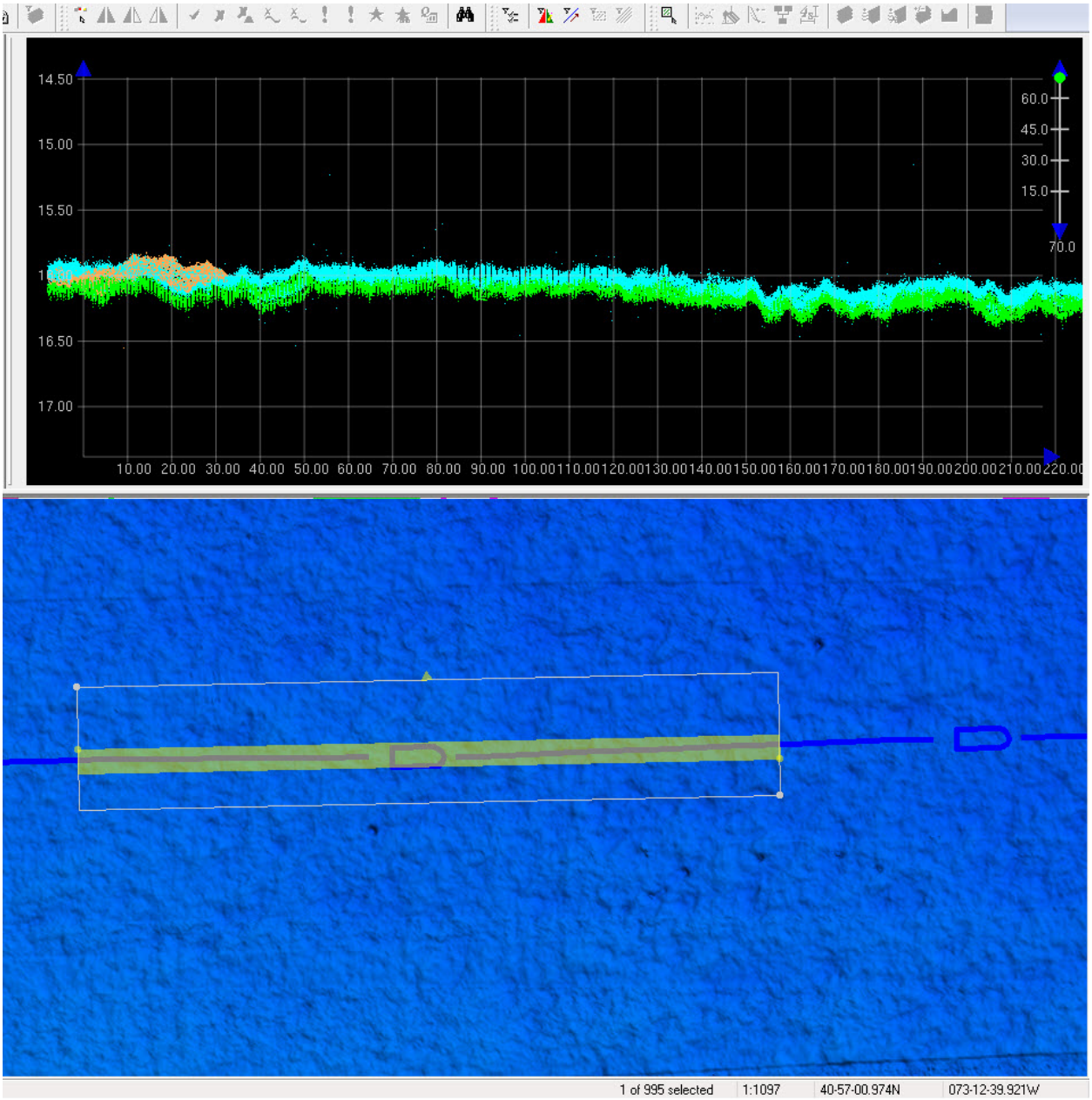


*Figure 10: S222 DN181. Data Flagged by SSP tool in excess. Several lines are shown in addition to the line in error. All the lines have depths well within range.*

### 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

Backscatter was logged as a s7k file and submitted to the IOCM processing center and/or directly to NGDC, and is not included with the data submitted to the Branch.

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAA Profile V_5_3

The NOAAProfileField Version 5.3.2 was used for CARIS/HIPS and Bathy Data Base(BDB)

### 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 |
|---|---|---|---|---|---|
| H12488_FS1_50cm_MLLW_Final | CUBE | 0.5 meters | 0 meters - 20 meters | NOAA_0.5m | Object Detection |
| H12488_FS1_2m_MLLW_Final | CUBE | 2.0 meters | 18 meters - 40 meters | NOAA_2m | Complete MBES |
| H12488_FS2_50cm_MLLW_Final | CUBE | 0.5 meters | 0 meters - 20 meters | NOAA_0.5m | Object Detection |
| H12488_FS2_2m_MLLW_Final | CUBE | 2 feet | 18 meters - | NOAA_2m | Complete MBES |

| Surface Name | Surface Type | Resolution | Depth Range | Surface Parameter | Purpose |
|---|---|---|---|---|---|
| | | | 40 meters | | |

*Table 8: Submitted Surfaces*

# C. Vertical and Horizontal Control

The Hydrographer has no additional comments.

## C.1 Vertical Control

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

Standard Vertical Control Methods Used:

TCARI

| File Name | Status |
|---|---|
| 8516945.tid | Final Approved |
| 8467150.tid | Verified Observed |
| 8465705.tid | Verified Observed |

*Table 9: Water Level Files (.tid)*

| File Name | Status |
|---|---|
| B340TJ2012_Rev.tc | Final |

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

A request for final approved tides was sent to N/OPS1 on 08/10/2012. The final tide note was received on 10/10/2012.

Non-Standard Vertical Control Methods Used:

VDatum

Ellipsoid to Chart Datum Separation File:

The separation model for H12488 is 2012_B340_VDatum_Ellip_MLLW.txt and can be found in the GNSS, SBET directory.

## C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM 18.

There were two differential beacons Moriches and Sandy Hook. Moriches was the beacon of choice and used predominantly on H12488.

The following DGPS Stations were used for horizontal control:

| DGPS Stations |
|---|
| Moriches, NY 293 KHZ |
| Sandy Hook, NJ 286 KHZ |

*Table 11: USCG DGPS Stations*

## C.3 Additional Horizontal or Vertical Control Issues

### 3.3.1 GPS Tides and TCARI Application

The majority of this survey was processed with IAPPK ellipsoid heights, reduced to MLLW via a VDatum seperation file. Some lines after processing with GPS Tides, produced depths inconsistant with the rest of the mainschem multibeam and failed IHO specifications. The possible causes for those failures ranged from incomplete POSPAC data, operator error, system failure and anomalies due to satellite interference. Uncertainty and standard deviation layers of the grids were the best indication of major discrepancies. When alternative methods of processing in the POSPac MMS software failed, those lines were then processed

using TCARI. If a small section of GPS Tide/Altitude was observed, that area was smoothed in the attitude editor. Care must be taken during application of correctors so the smoothing is not over written. A list of lines using TCARI can be found in Separates, I_Acquisition_&_Processing_Logs, Processing_Logs, H12488_SBET_QC_Log.xlsx. Examples of the anomalies are listed below.

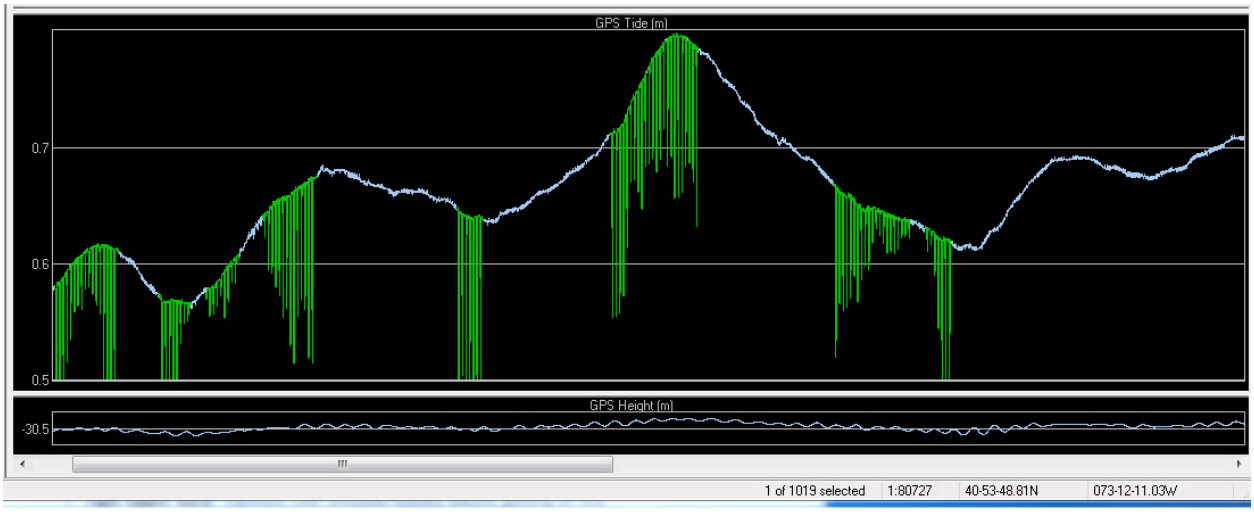


*Figure 11: Altitude Anomaly as viewed in Attitude Editor (GPS Tide). The green is displaying unsusal GPS Tide levels.*

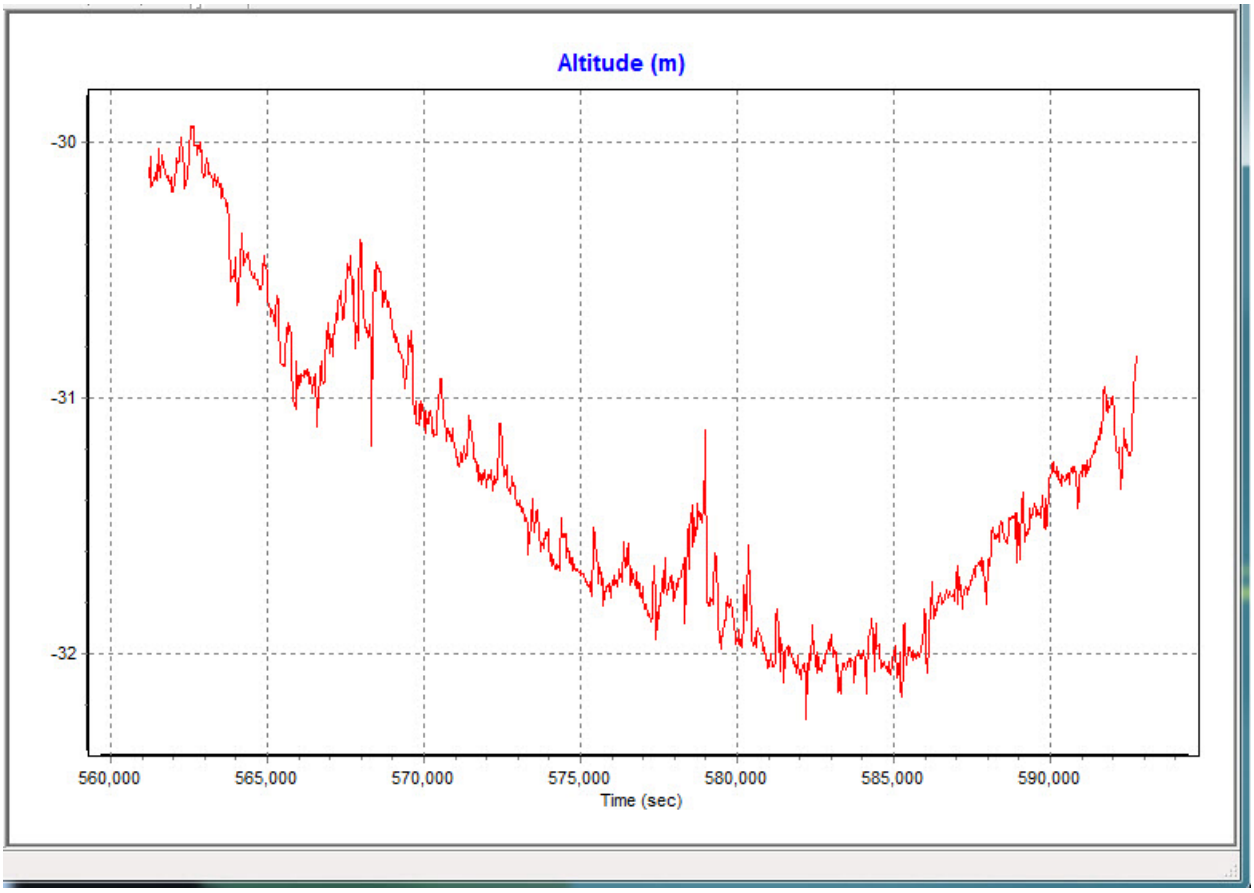


*Figure 12: Altitude Anomaly POS/PAC MMS Altitude PLot*

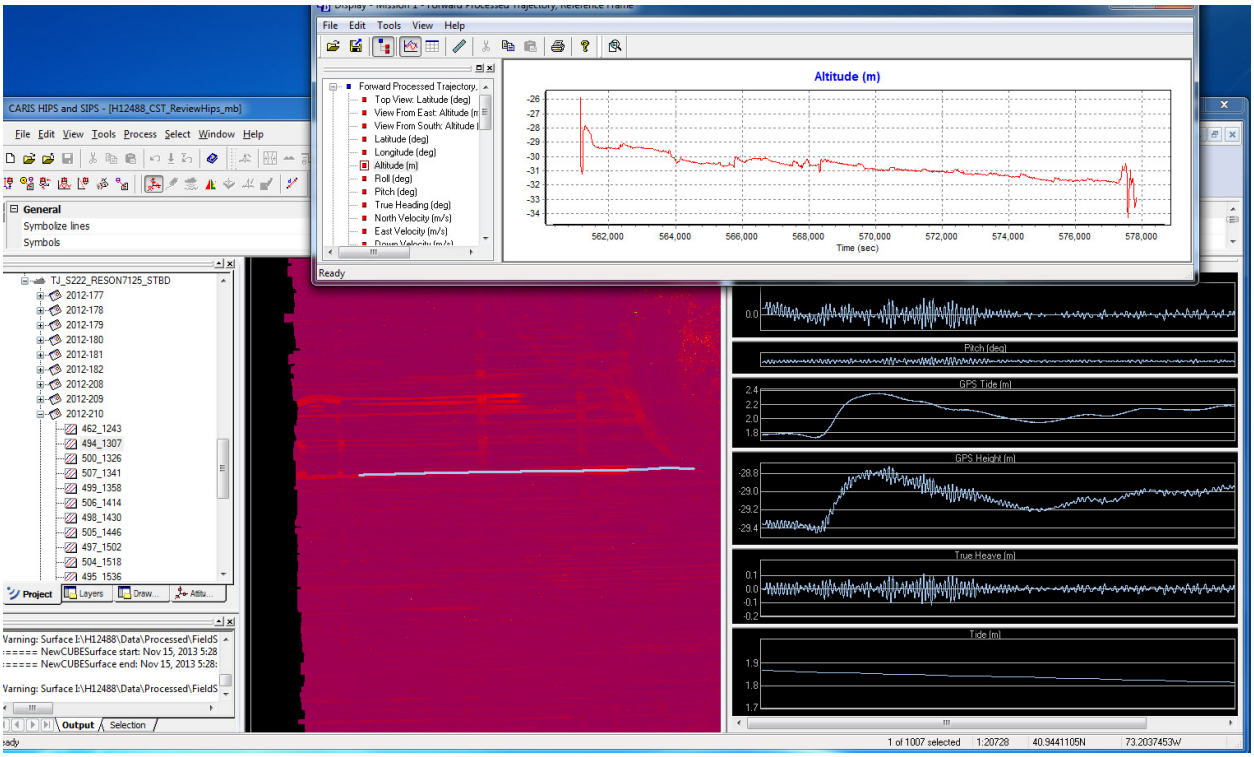


*Figure 13: Altitude Anomaly as viewed in Attitude Editor. This compares GPS Tide and Height to TCARI Tide.*

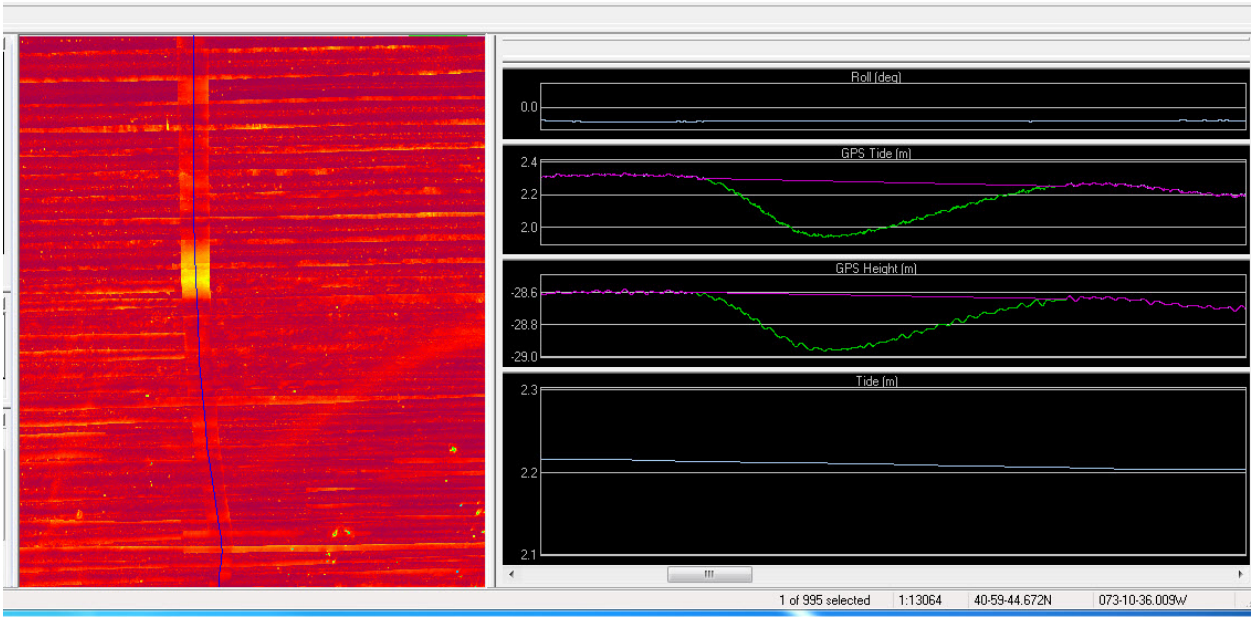


*Figure 14: Altitude Anomaly as viewed in Attitude Editor as seen by isolated yellow rectangle. This also compares GPS Tide and Height to TCARI Tide. In this case Graph shows how smoothing is applied.*

### 3.3.2 Attitude Anomaly

All the platforms experienced various attitude problems at one time or another.Uncertainty and standard deviation layers of the grids were also the best indication of major discrepancies. In cases where appropriate, data was either filtered to 45 degrees or deleted in subset editor. The types of attitude error observed could be heave, roll, or cocked pings. Examples are listed below. Although within specification, there was a slight Attitude error observed on both launches covering days 178 and 179 from west part of the sheet to crane neck. It can be seen as a wavy line when the grid is placed in high exaggeration. The weather was wind northeast at 10 to 15kts with 2ft chop. The majority of the anomaly was within the 8-14 meter curve, and due to possible dynamic sea conditions.

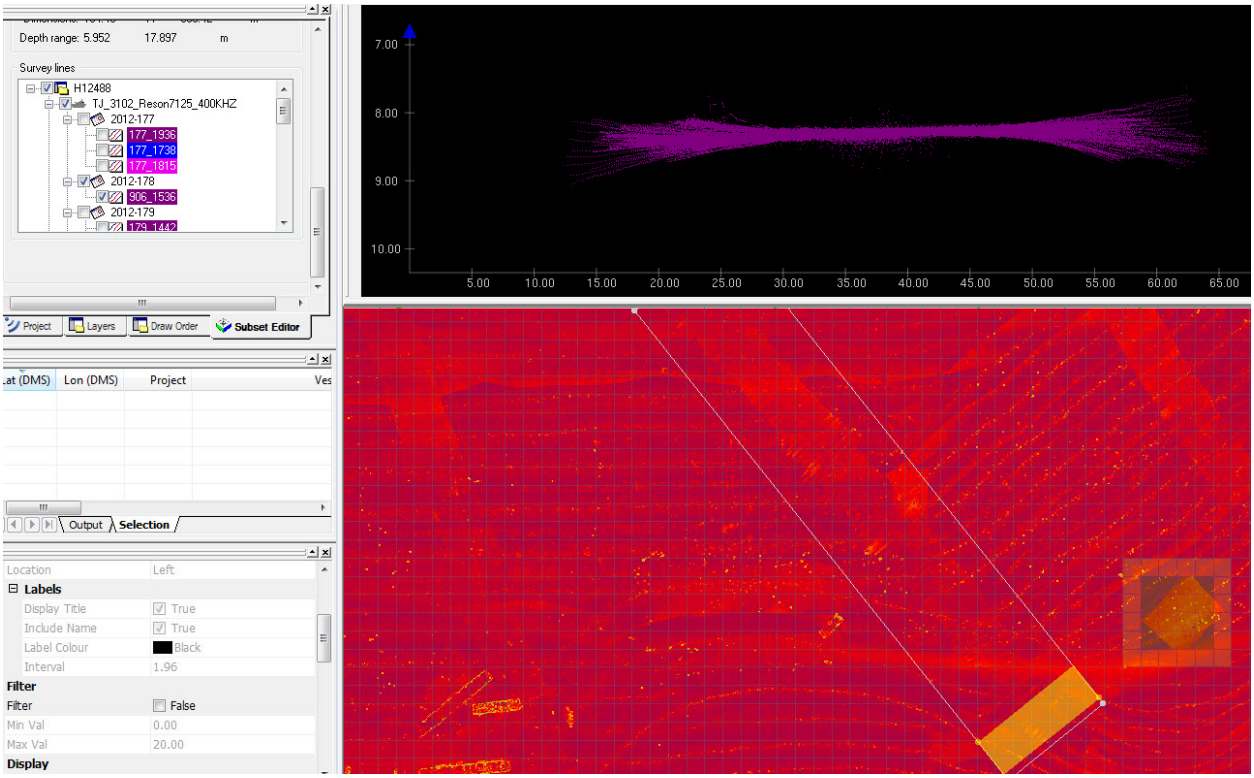


*Figure 15: Attitude Anomaly XL 3102 Possible timing*

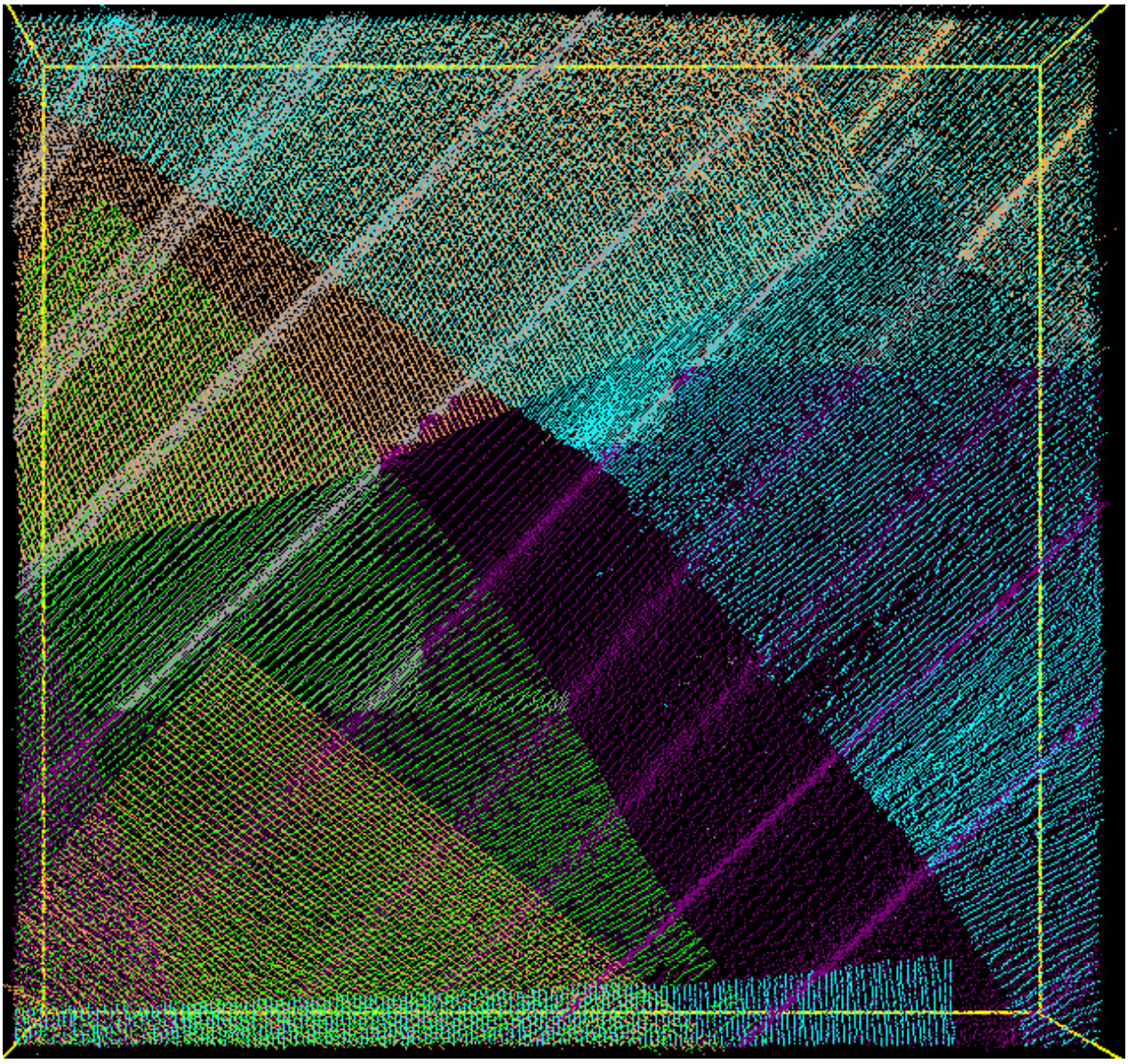

*Figure 16: Attitude Anomaly Heave Artifact*

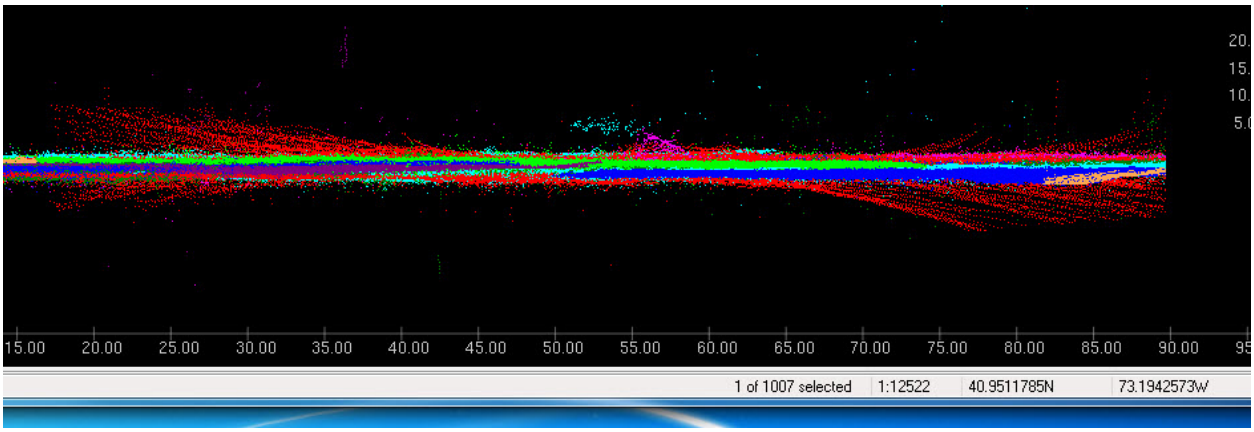


*Figure 17: Attitude Anomaly 3101 DN 178 cocked Pings*

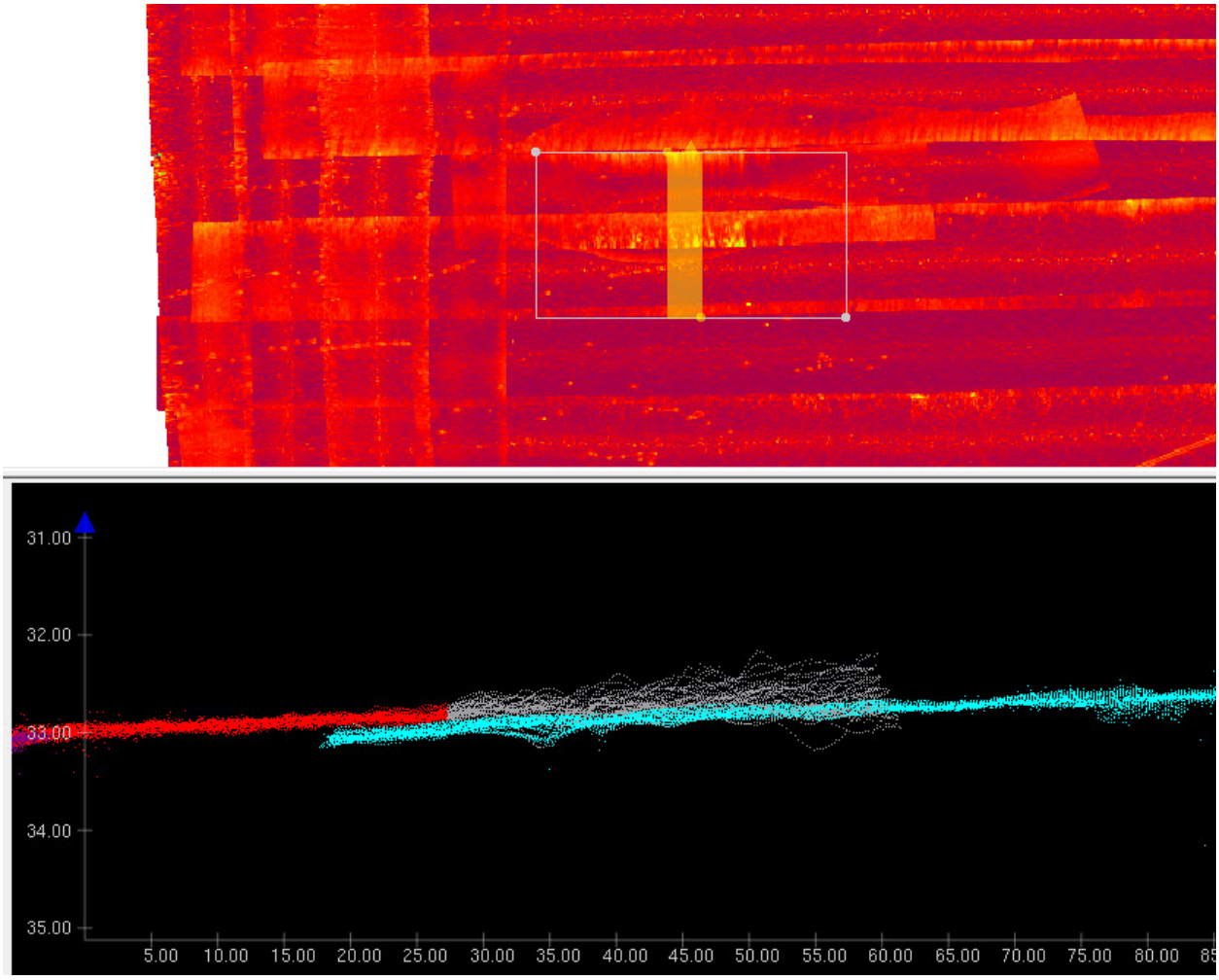


*Figure 18: Attitude Anomaly outerbeam flareup*

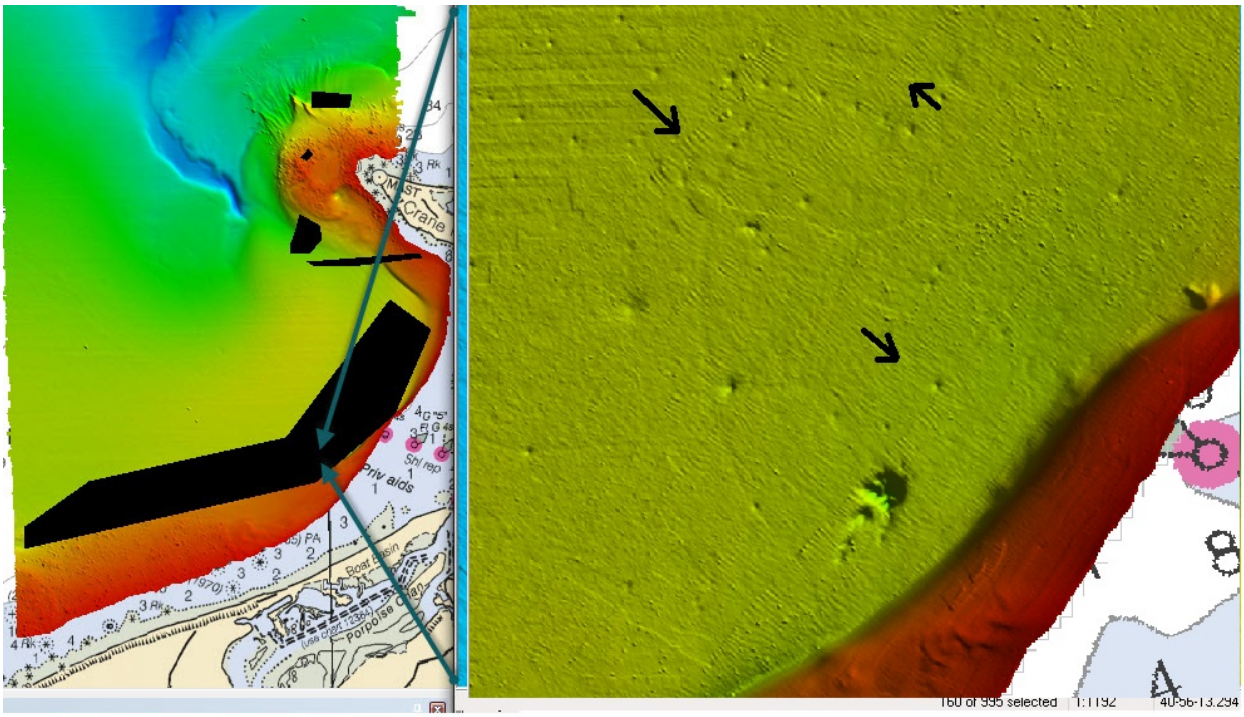

*Figure 19: Attitude_Anomaly days 178- 179 timing*

### 3.3.3 Side Scan Bleed Over

Some Dual MB/SSS was acquired simultaneously for near shore reconnaissance. The Reson 7125 MB and the Klein5000 SSS both have a frequency of 455khz. The triggering is set up in such a way that a pulse of SSS triggers the multibeam with minute delay so that for the most part there is no cross talk between the two sonars. The range of the SSS is much greater than the multibeam dependent on depth. The greater range of the SSS can cause the return to take a longer period of time between pulses. The multibeam may pick up what is known as a second sweep return. These were scanned in subset and where observed rejected.

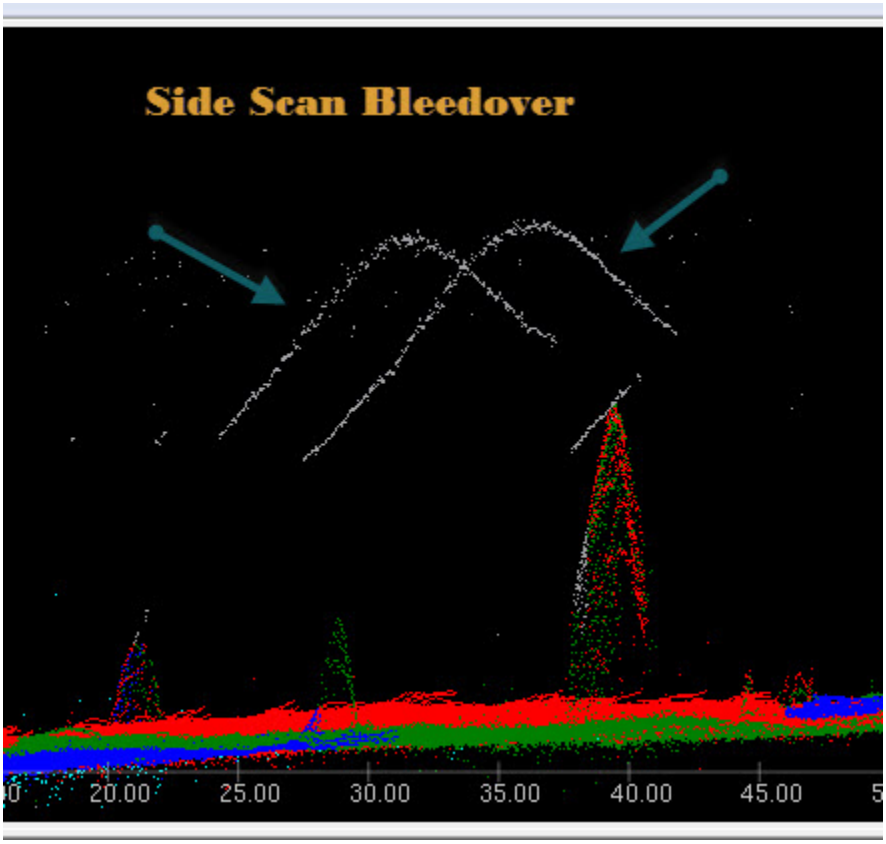


*Figure 20: SSS Bleedover or crosstalk*

### 3.3.4 Sound Speed and Refraction

Occasional errors due to sound speed or refraction were seen in outside beams. Where the observed surface exceeded specification the outside beams were deleted. In most cases the grid honored the surface.

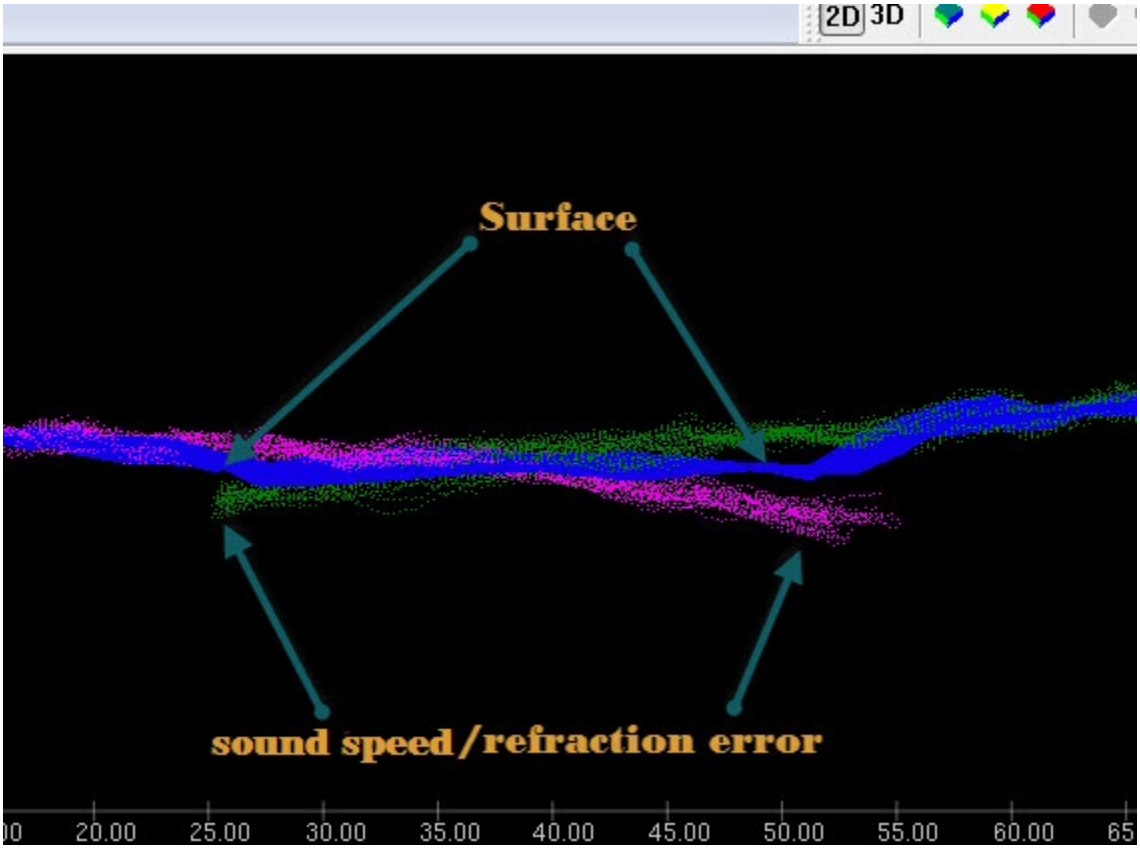


*Figure 21: Sound Speed/Refraction of outside beams*

# D. Results and Recommendations

## D.1 Chart Comparison

A difference grid was made from surveyed soundings to ENC depths. In addition a lattice and a overlay of ENC and Raster chart of Surveyed sounding was made noting differences.There was remarkable parity between ENC, charted, and surveyed soundings. Dangers to Navigation were sent on the most significant features.

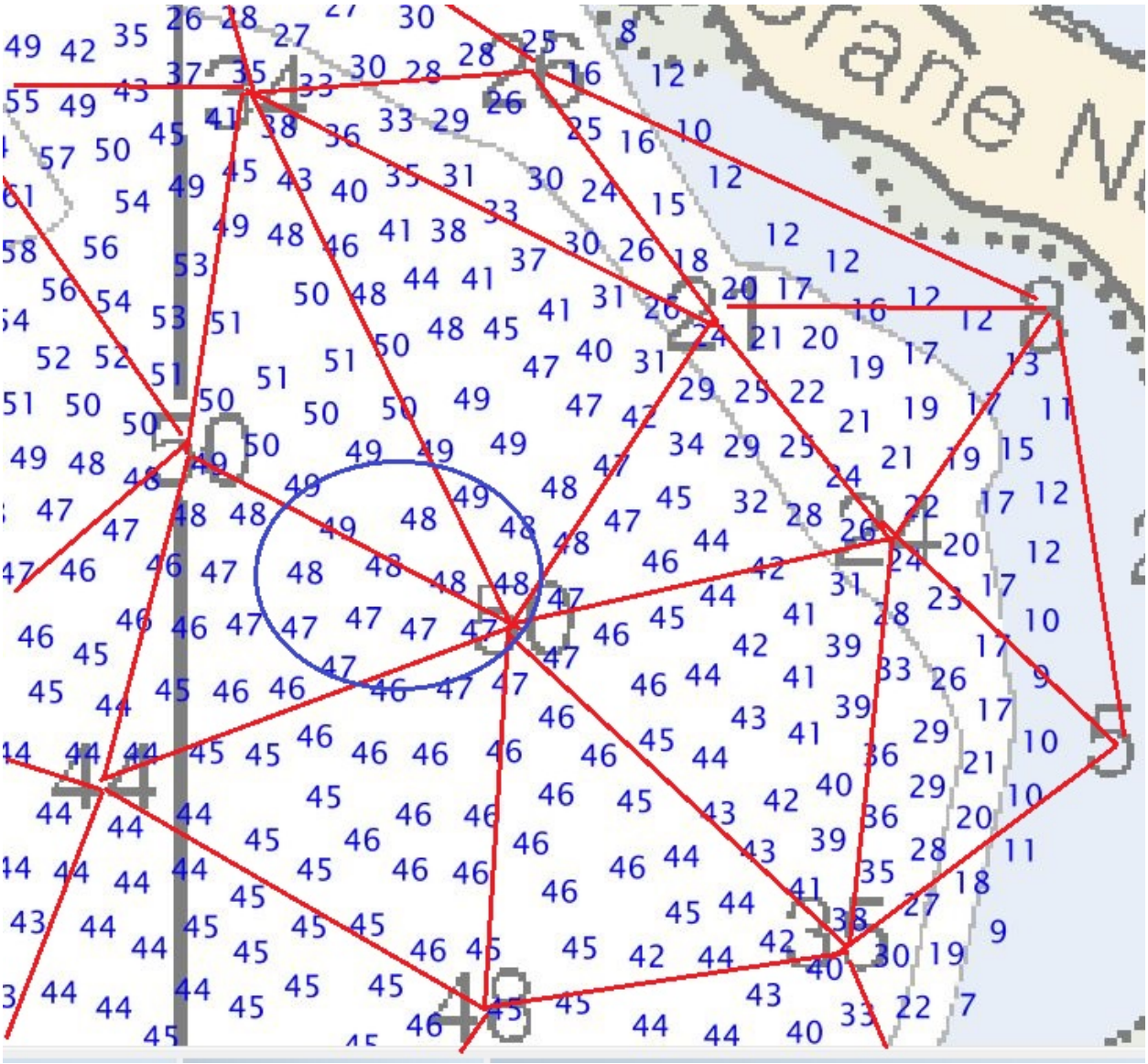

*Figure 22: Example of Lattice Inspection*

### D.1.1 Raster Charts

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

| Chart | Scale | Edition | Edition Date | LNM Date | NM Date |
|---|---|---|---|---|---|
| 12363 | 1:80000 | 41 | 02/2010 | 04/27/2013 | 04/27/2013 |
| 12364 | 1:40000 | 39 | 09/2012 | 05/04/2013 | 05/04/2013 |

*Table 12: Largest Scale Raster Charts*

12363

Chart 12363 varied slightly in positions due to its smaller scale. The chart was comparable to the larger scale chart. See 12364 for details.

12364

Two detached positions were taken on verifying buoy positions. G "1" Fl G 4s was located on station at 40-56-14.892N 073-09-46.098W it is a Coast Guard maintained buoy. Chart 12363 has the Private Aids text in an acceptable location. The chart 12364_21 has a "Priv aids" text over the G"1" buoy which is false. The private aids begin at G"3 and continue as private aids into Porpoise Channel. The text should be moved to reflect those ATON's. Buoy G"3" was not found on station but is in place at a different location. The private aids are maintained by the Town of Smithtown as reported by the Harbor Master. The buoys are seasonal and are periodically moved for best water. For exact locations contact the Smith Town Harbor Master, Pat Gilligan at 361 360 7643.

The Fish Haven appears to be charted inappropriately as no soundings or features were comparable to the prescribed depth and were actually deeper. The AWOIS list description of the Fish Haven is fairly accurate in describing the items located south of the Fish Haven in the new Wreck area.

New Rocks and Wrecks as well as evidence of shoaling were found in the south west section and Crane Neck. Fig 24 and 25 show examples of charted differences.

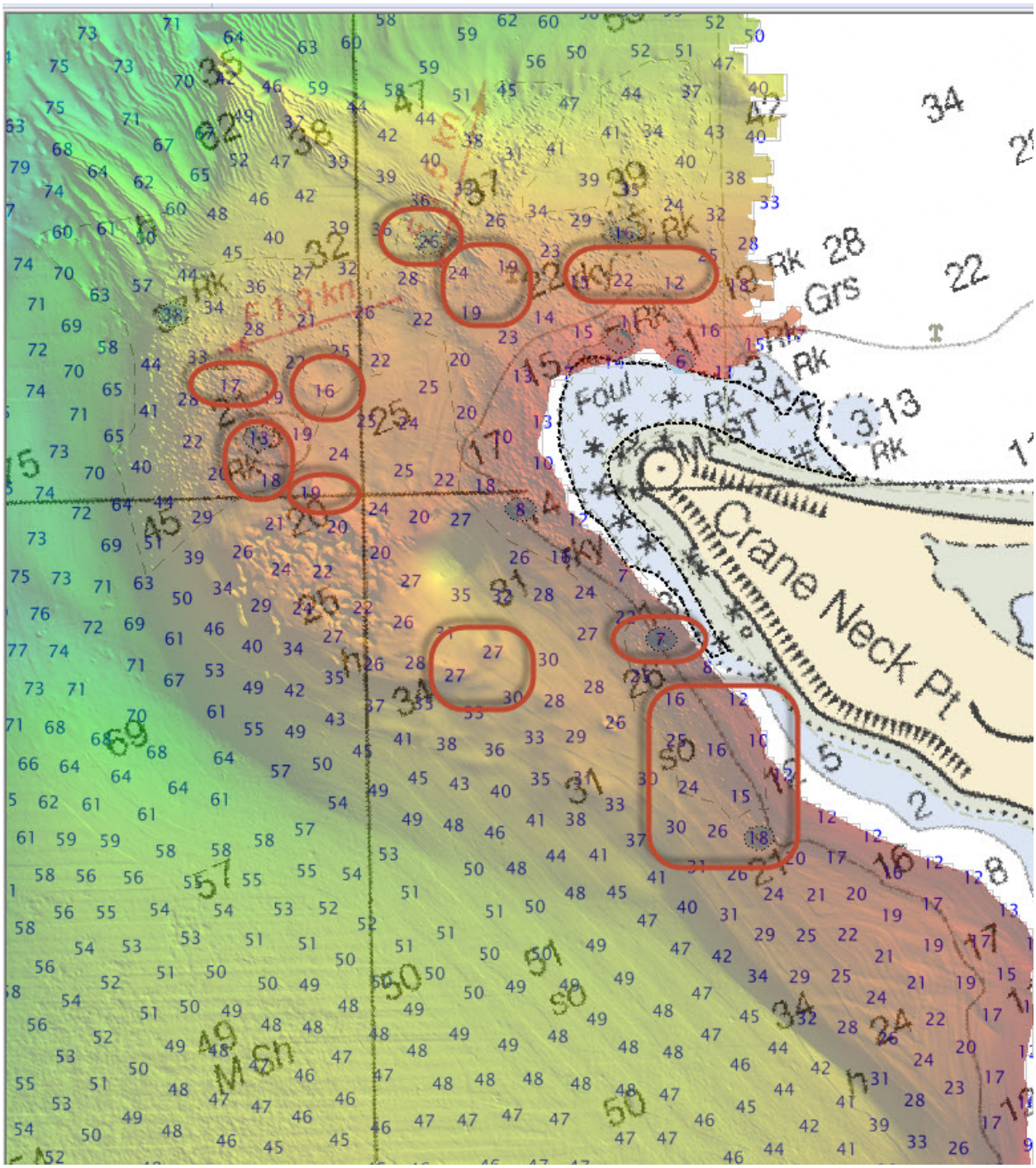


*Figure 23: Crane Neck*

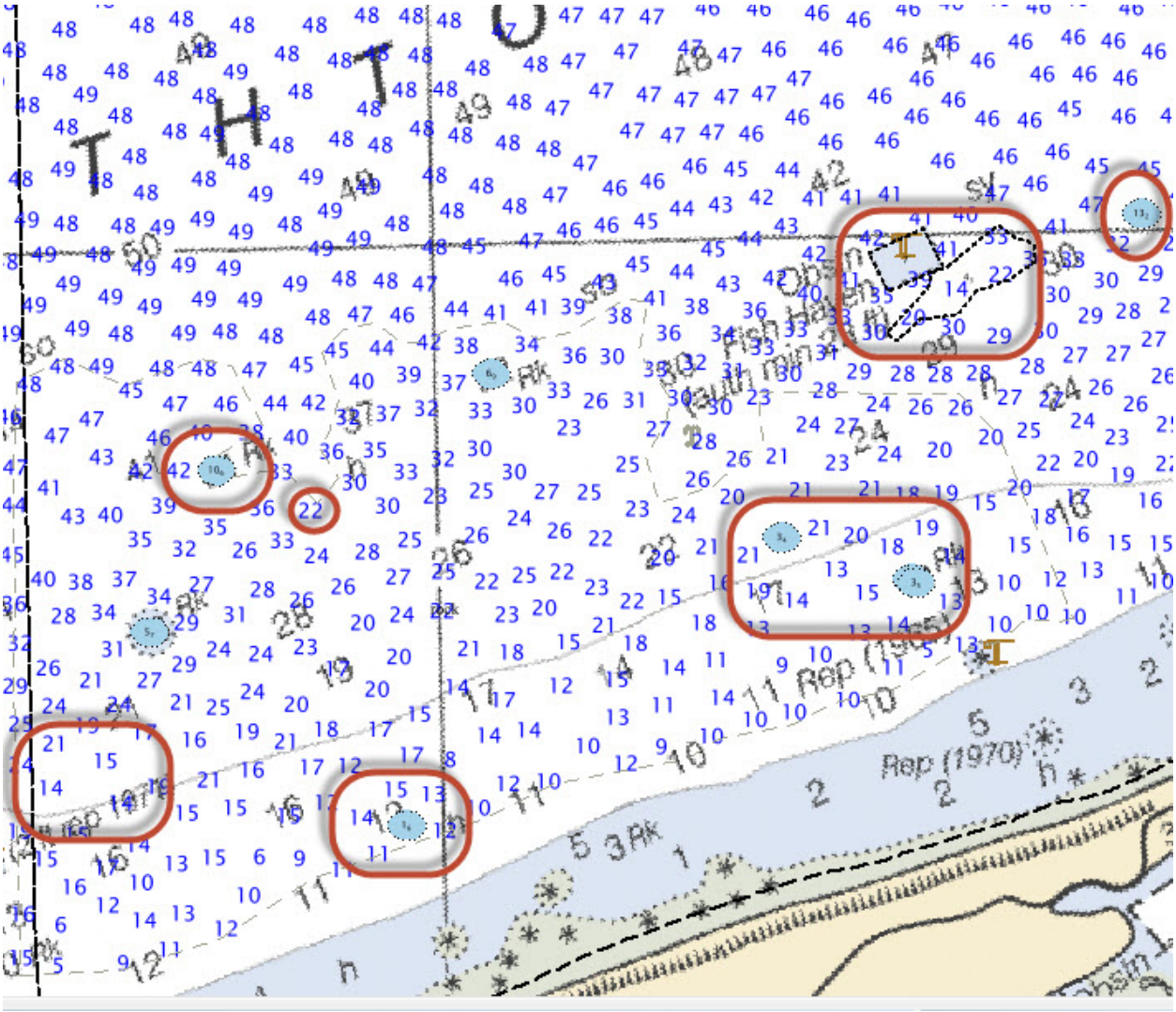


*Figure 24: South west*

### D.1.2 Electronic Navigational Charts

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

| ENC | Scale | Edition | Update Application Date | Issue Date | Preliminary? |
|---|---|---|---|---|---|
| US5CN10M | 1:40000 | 2 | 02/14/2011 | 02/14/2012 | NO |
| US4NY13M | 1:80000 | 13 | 06/23/2013 | 02/07/2012 | NO |

*Table 13: Largest Scale ENCs*

US5CN10M

This ENC is similar to US4NY13M but has sparser sounding. Results were of a similar nature.

US4NY13M

Overall, The results general shifts in positioning of shoals and deeps between charted soundings. Of the surveyed soundings 70% were within 1 foot, 25% of the soundings were shoal and 5% were deep. The majority of shoal sounding occurred near rock strewn areas near Crane Neck and southwest corner. Uncharted rocks and wrecks were found especially south of the charted fish haven. In Fig. 26, green displays comparable surveyed soundings (-0.6 to 06m). Yellow and red are surveyed soundings shoal of the ENC(-0.6 to -1.0m). Blue and Purple deeper than ENC(0.6 to 1.0m). The northwest corner has a huge difference because of the sparseness of depths from the ENC. The southwest corner and Crane Neck have big differences deepening in large areas but shoaling up on new rocks and the tops of sand waves. There is a circular pattern of change with the locus at Crane Neck. For results See Separates IV.

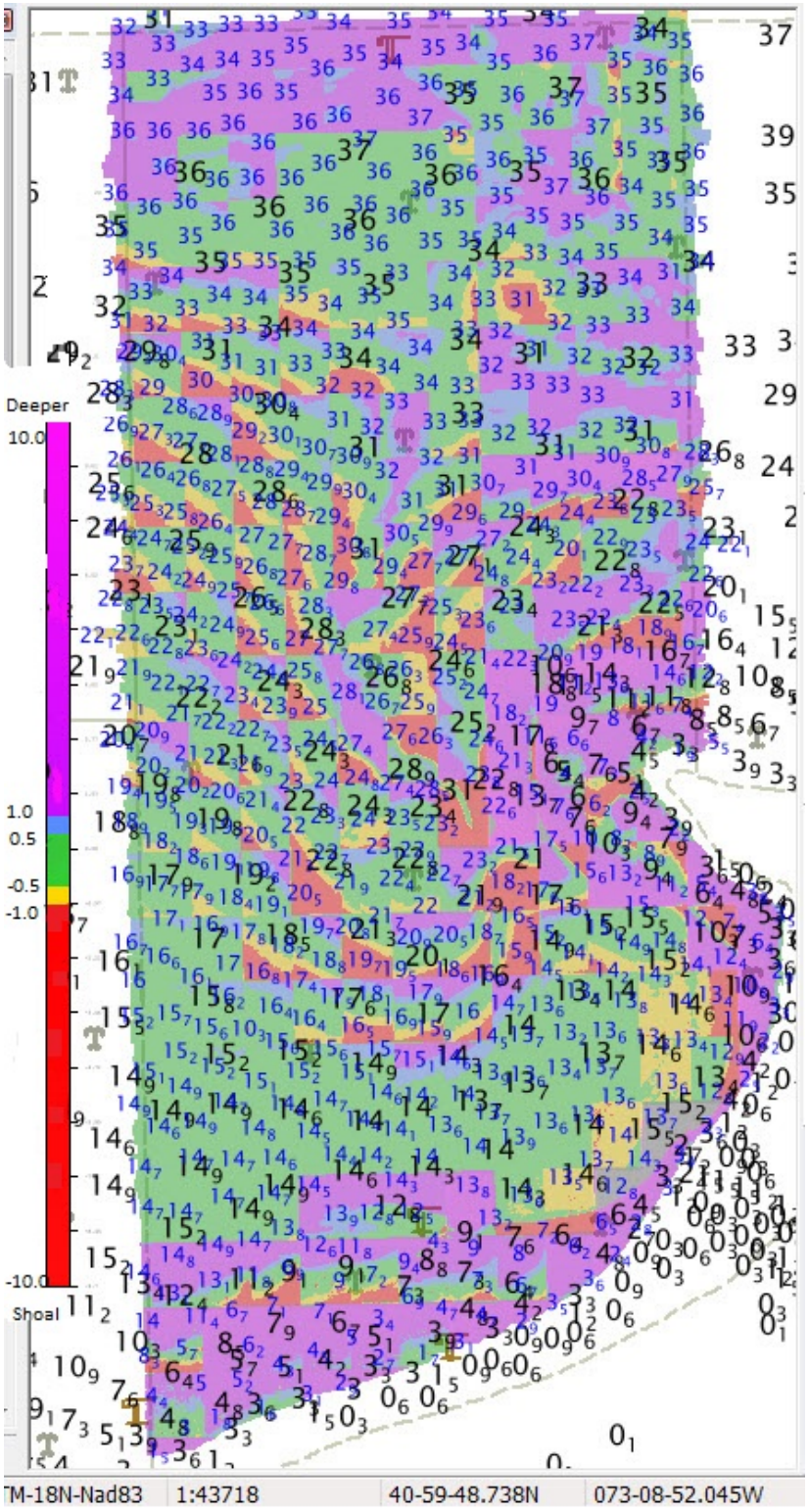


*Figure 25: H12488_to ENC Difference (Red Shoa)l to (Purple Deep)*

### D.1.3 AWOIS Items

Four AWOIS items exist for this survey and are described in the Final Feature File.

### D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

### D.1.5 Charted Features

There are 15 charted features that fell within the survey limits. Some Charted features were not investigated. These were inside the NALL line or 4m curve. A portion of the 2 ft Rep, AWOIS 14973 radius, on the west side of the sheet was disproved. Further information can be found on survey H12414.

### D.1.6 Uncharted Features

The most significant item on this survey is a group of wrecks and obstructions that appear to have sunk as a fish haven.The current charted fish haven just north of the area and appears to have been miss-positioned. The fish haven is free of any obstructions and the authorized minimum depth does not correlate to any surveyed sounding. The soundings inside the obstruction area do have correlation, as well as the AWOIS description of the items found.

### D.1.7 Dangers to Navigation

Danger to Navigation Reports are included in Appendix II of this report.

### D.1.8 Shoal and Hazardous Features

Shoal areas exist near Crane Neck Point and the south west section of H12488. New Rock and a Wreck area were found and are described in the Final Feature File.

### D.1.9 Channels

The Northport Anchorage Area intersects a part of this survey. No features or depths found in this area pose a danger. No channels exist for this survey. There are no precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

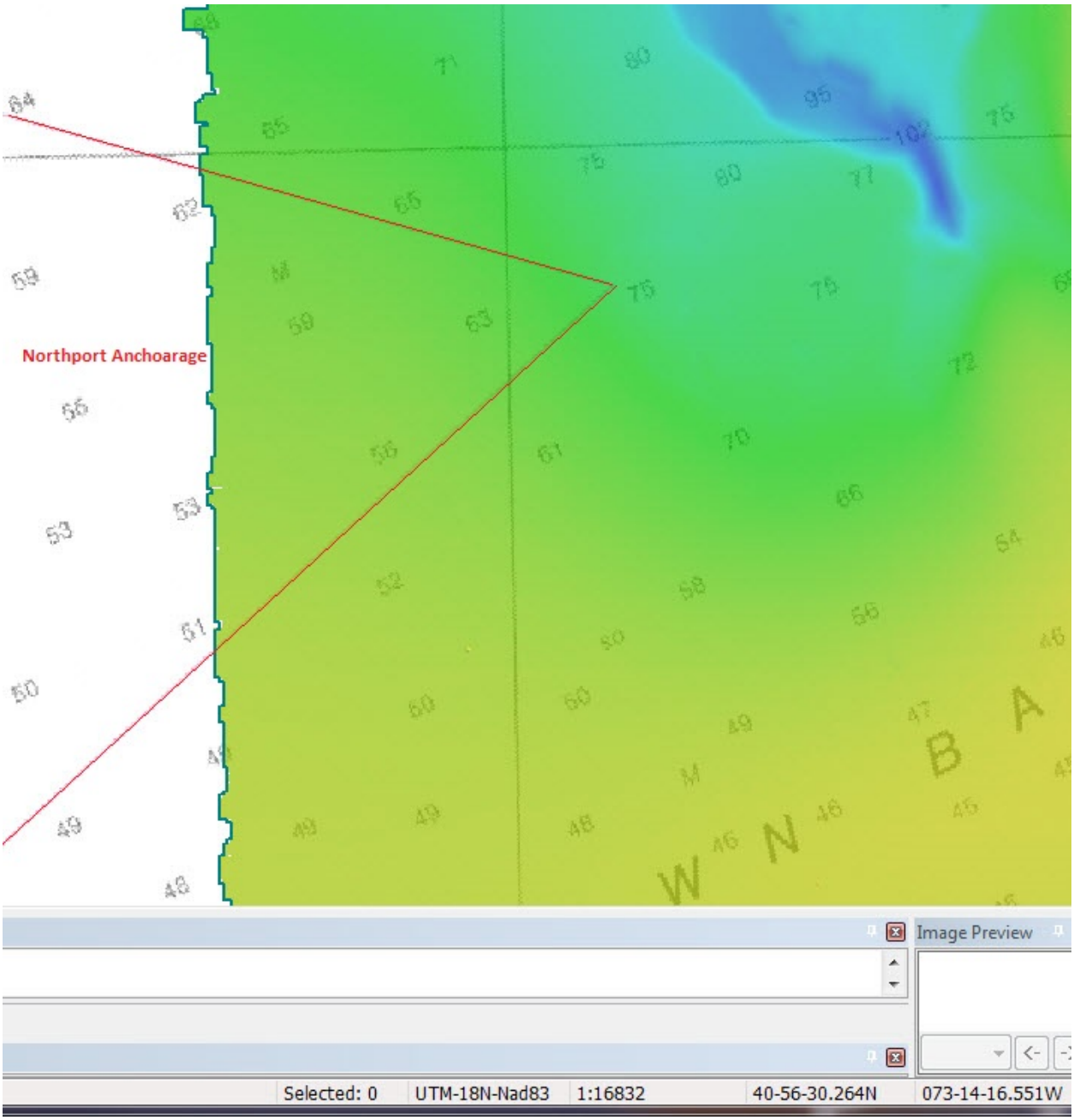


*Figure 26: Northport Anchorage*

### D.1.10 Bottom Samples

No bottom samples were required for this survey.

## D.2 Additional Results

### D.2.1 Shoreline

Shoreline was assigned in the Hydrographic Survey Project Instructions but was inside the NALL line and was not investigated.

### D.2.2 Prior Surveys

There are three prior surveys that intersect with H12488. All three were completed in 1967. The comparison was made in feet by comparing rasters, no digital data was available. The greatest shoaling appears to occur in the southwest corner of H12488 and near Crane Neck Point, both are have considerable rocks and boulders and sand waves. Differences range from 3-15 ft depending on whether new rock features and sand waves were discovered. The deeper areas (45-100ft) have difference+/- 2-3 ft no visible trends.

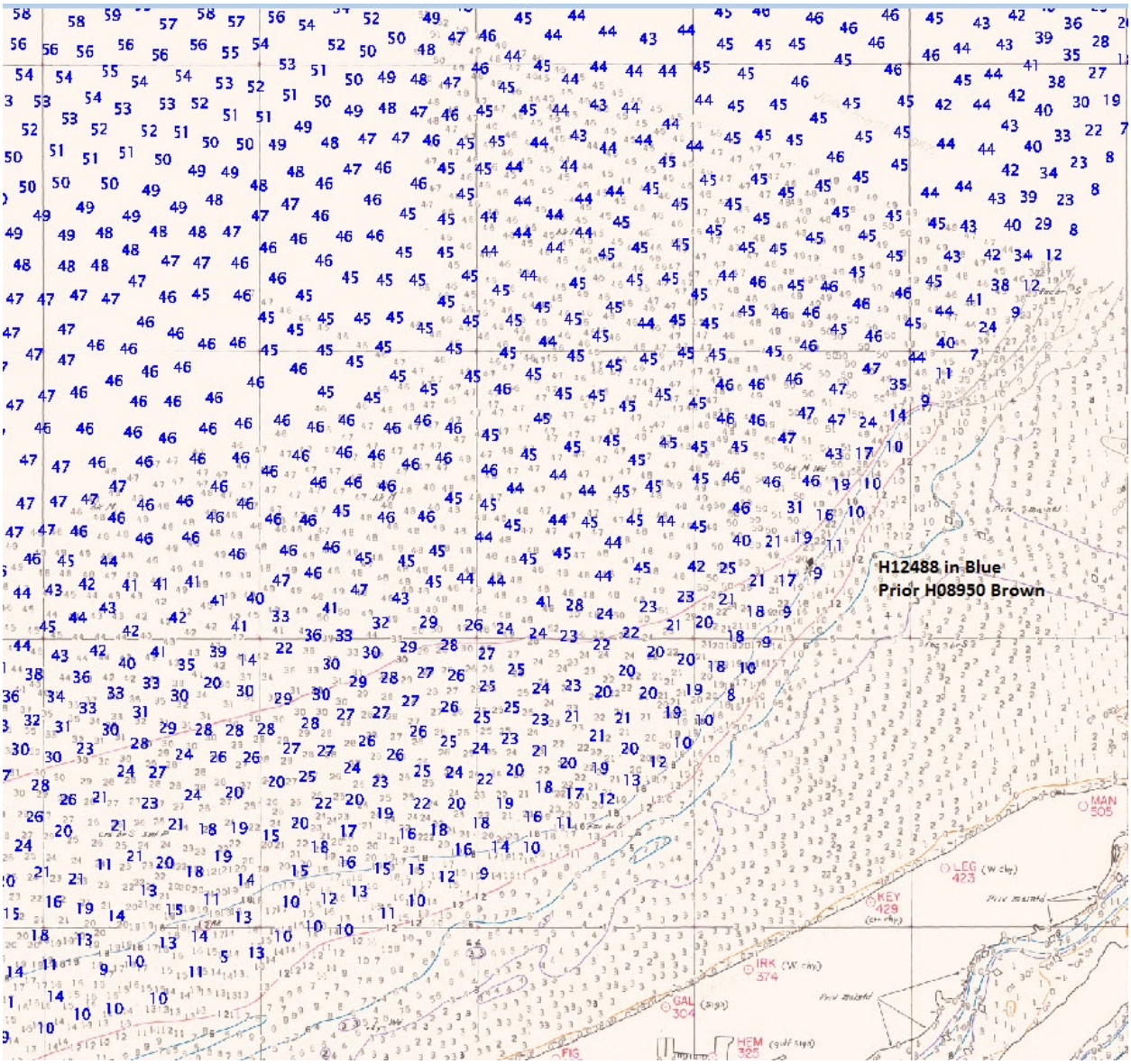


*Figure 27: H08950_E*

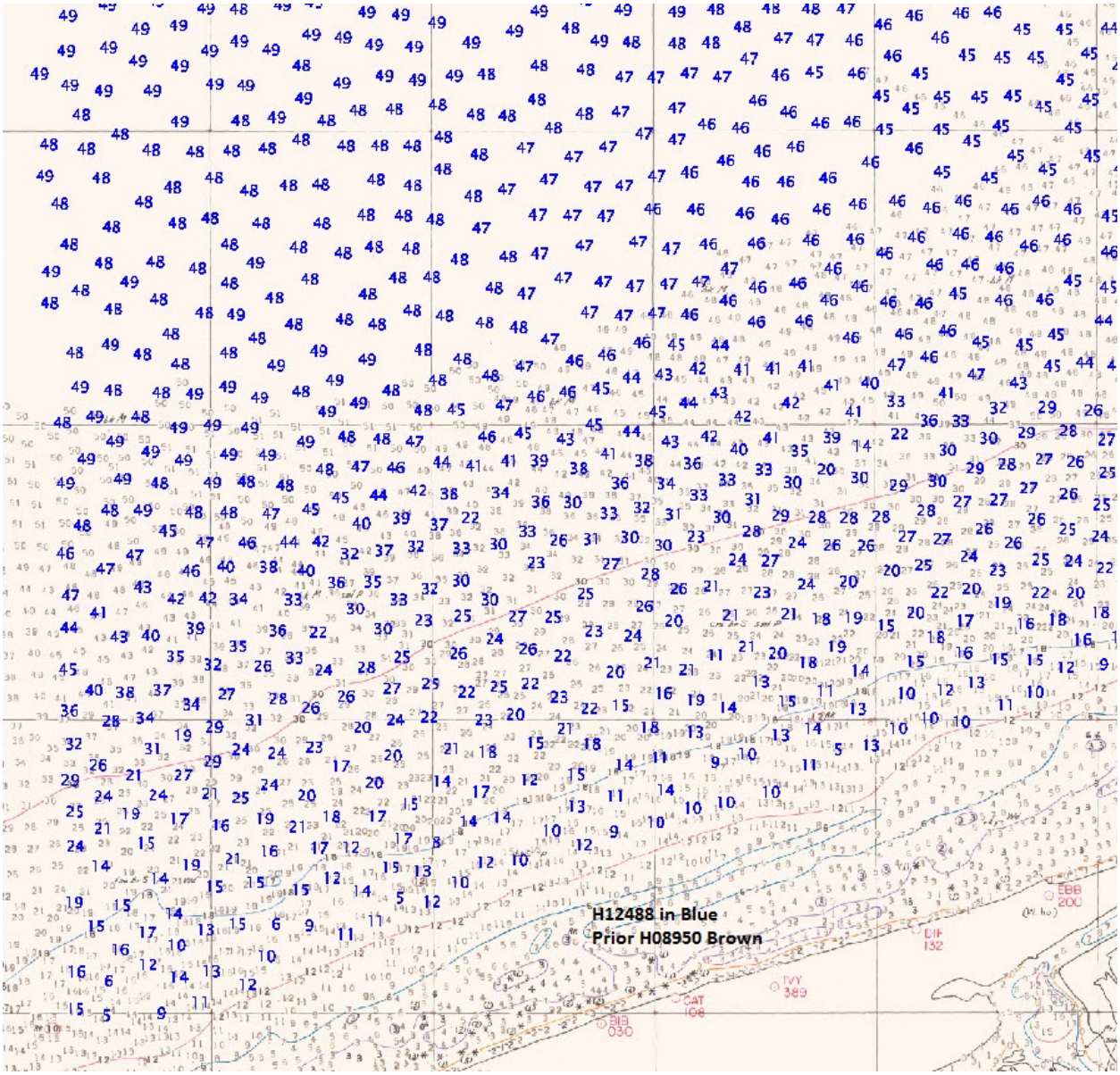


*Figure 28: H08950_W*

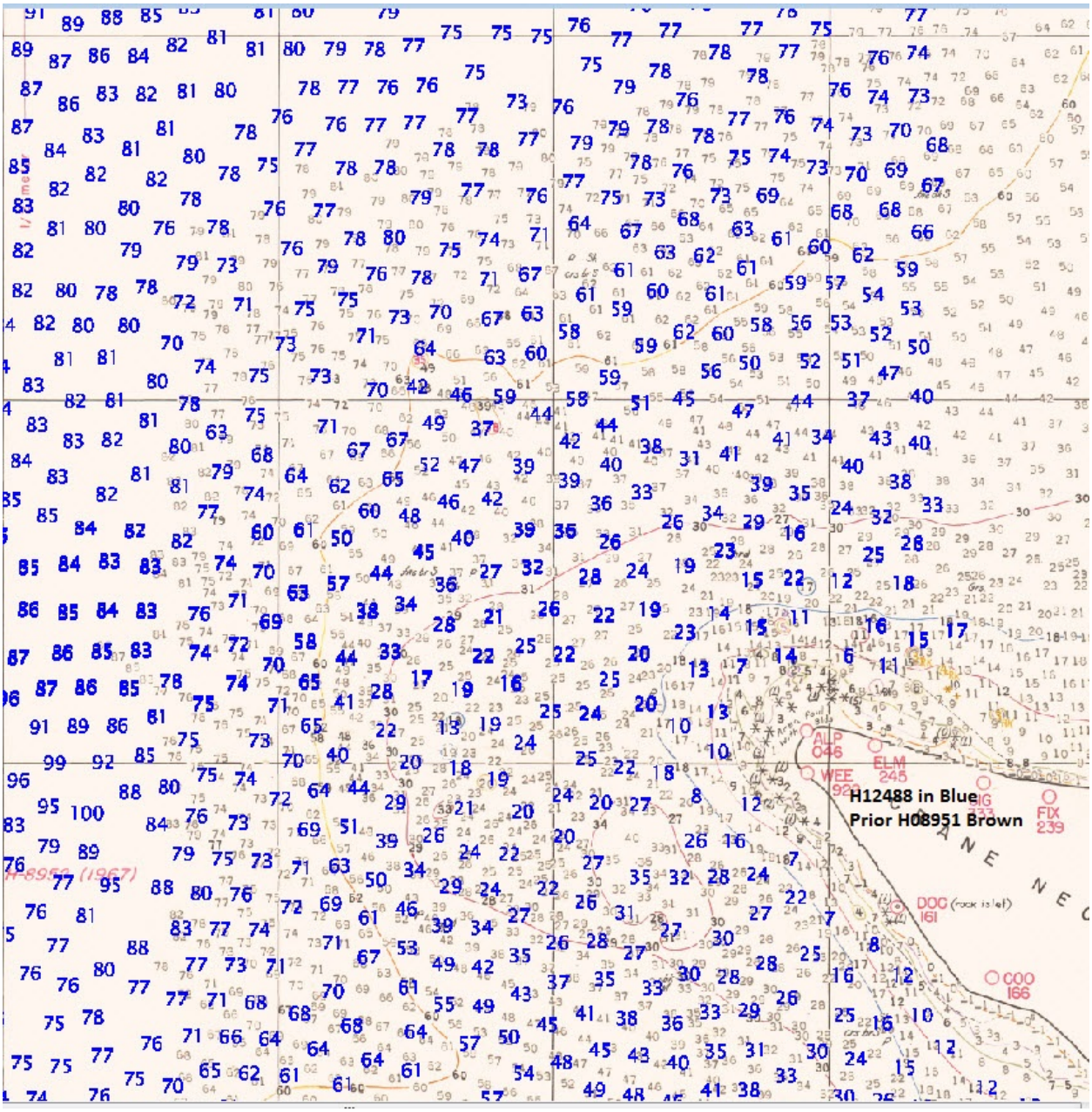


*Figure 29: H08951_N*

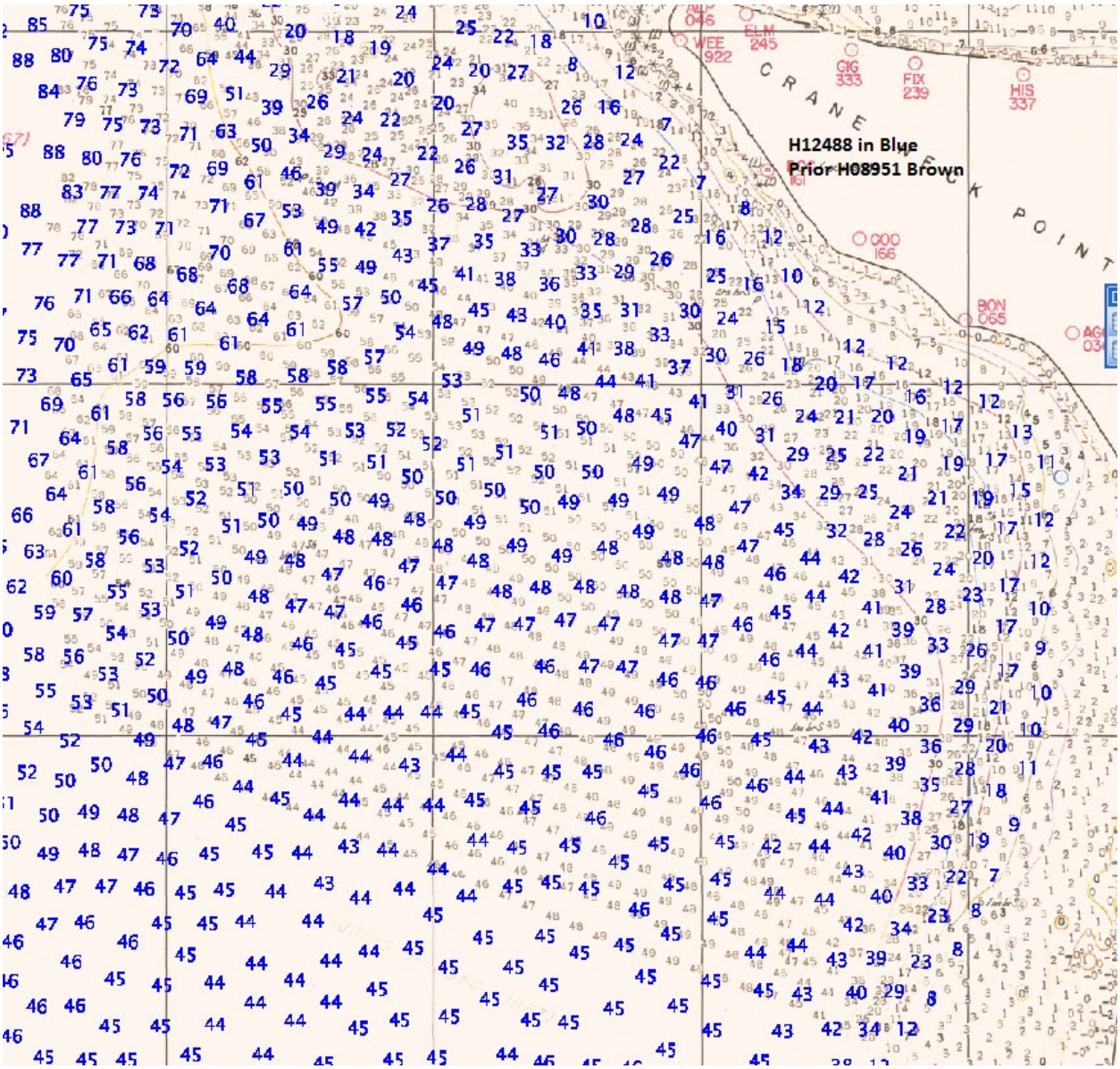


*Figure 30: H08951_S*




*Figure 31: H08952_N*

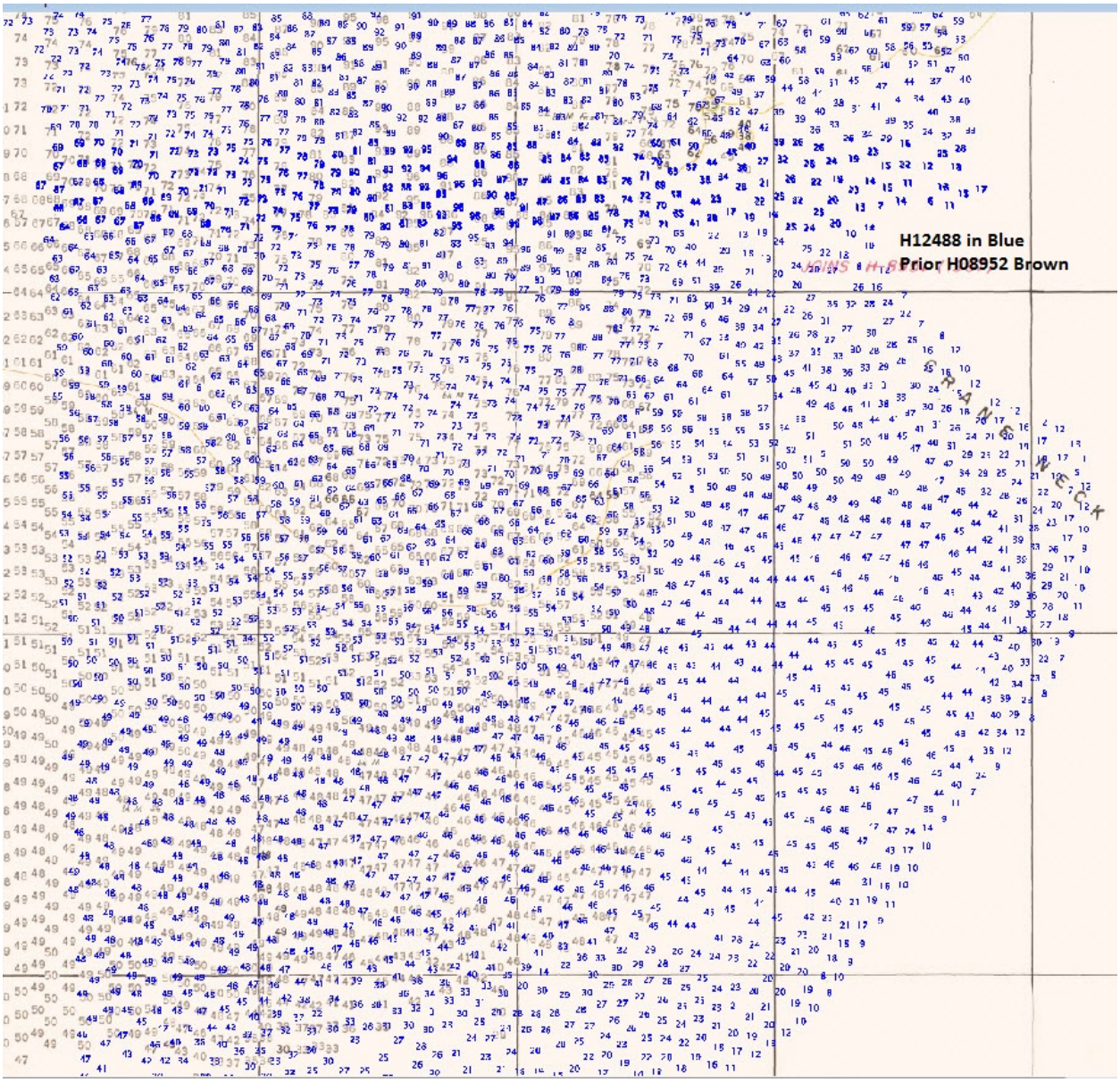


*Figure 32: H08952_S*

### D.2.3 Aids to Navigation

### D.2.4 Overhead Features

No overhead features exist for this survey.

### D.2.5 Submarine Features

One cable line crosses the north portion of H12488.

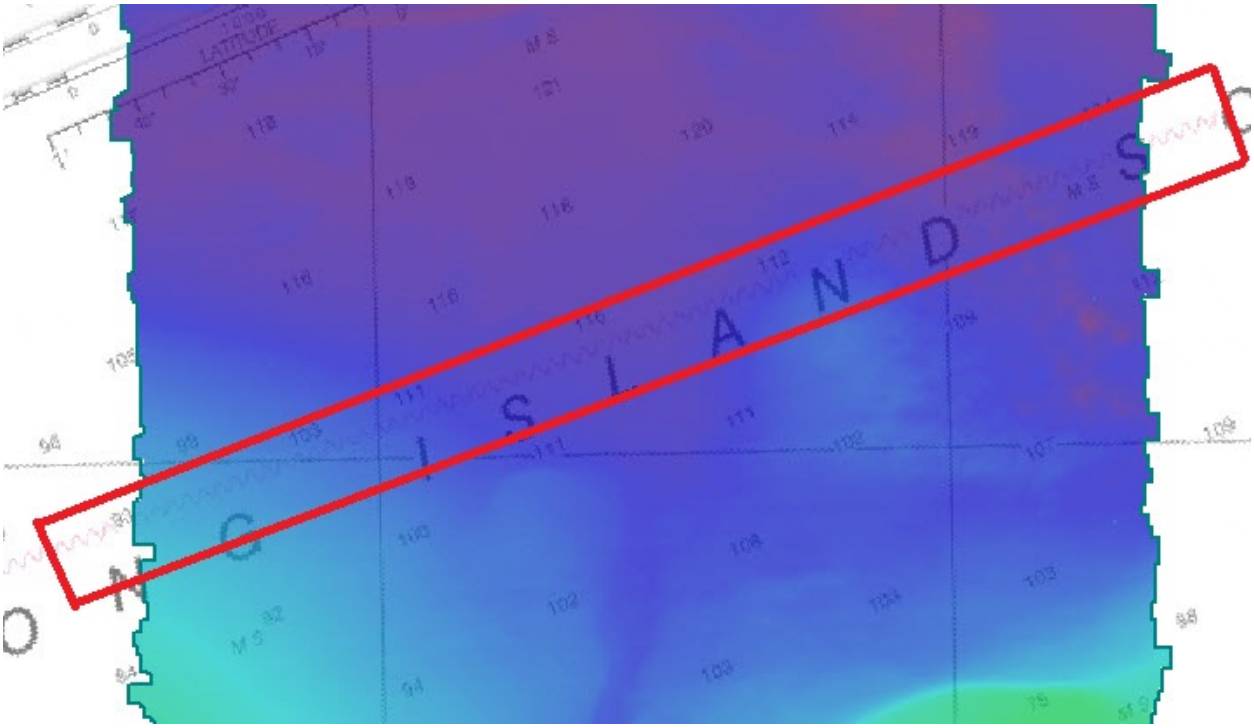


*Figure 33: Under Water Cable*

### D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

### D.2.7 Platforms

No platforms exist for this survey.

### D.2.8 Significant Features

Two buoys were encountered and are mentioned in the chart comparison.

### 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 New Inset Recommendations

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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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 |
|---|---|---|---|
| James Crocker<br>CDR, NOAA | Commanding Officer | 02/13/2014 | |
| Megan Guberski LT, NOAA | Field Operations Officer | 02/13/2014 | |
| Peter Lewit | Chief Hydrographic Survey Technician | 02/13/2014 | |

# 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** | Continually Operating Reference Staiton |
| **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 |
| **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 |
| **HSSD** | Hydrographic Survey Specifications and Deliverables |

| Acronym | Definition |
|---|---|
| **HSTP** | Hydrographic Systems Technology Programs |
| **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** | Local Notice to Mariners |
| **LNM** | Linear Nautical Miles |
| **MCD** | Marine Chart Division |
| **MHW** | Mean High Water |
| **MLLW** | Mean Lower Low Water |
| **NAD 83** | North American Datum of 1983 |
| **NAIP** | National Agriculture and Imagery Program |
| **NALL** | Navigable Area Limit Line |
| **NM** | 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 |
| **PST** | Physical Science Technician |
| **RNC** | Raster Navigational Chart |
| **RTK** | Real Time Kinematic |
| **SBES** | Singlebeam Echosounder |
| **SBET** | Smooth Best Estimate and Trajectory |
| **SNM** | Square Nautical Miles |
| **SSS** | Side Scan Sonar |
| **ST** | Survey Technician |
| **SVP** | Sound Velocity Profiler |
| **TCARI** | Tidal Constituent And Residual Interpolation |
| **TPU** | Total Porpagated Error |
| **TPU** | Topside Processing Unit |
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United Stated Coast Guard |
| **UTM** | Universal Transverse Mercator |
| **XO** | Executive Officer |
| **ZDA** | Global Positiong System timing message |
| **ZDF** | Zone Definition File |

H12417

NOAA Form 76-35A

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable AreaSupport USCG |
| Registry Number: | H12417 |

## LOCALITY

| | |
|---|---|
| State: | New York |
| General Locality: | Long Island Sound |
| Sub-locality: | Mt. Misery Pt. to Sound Beach, NY |

**2012**

CHIEF OF PARTY
CDR Lawrence T. Krepp

LIBRARY & ARCHIVES

Date:

| NOAA FORM 77-28 (11-72) | U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | REGISTRY NUMBER: |
|---|---|---|
| **HYDROGRAPHIC TITLE SHEET** | | **H12417** |

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: | **New York** |
| General Locality: | **Long Island Sound** |
| Sub-Locality: | **Mt. Misery Pt. to Sound Beach, NY** |
| Scale: | **5000** |
| Dates of Survey: | **05/19/2012 to 06/23/2012** |
| Instructions Dated: | **05/20/2012** |
| Project Number: | **OPR-B340-TJ-12** |
| Field Unit: | **NOAA Ship *Thomas Jefferson*** |
| Chief of Party: | **CDR Lawrence T. Krepp** |
| Soundings by: | **Multibeam Echo Sounder** |
| Imagery by: | **Multibeam Echo Sounder Backscatter** |
| Verification by: | **Atlantic Hydrographic Branch** |
| Soundings Acquired in: | **meters at Mean Lower Low Water** |
| H-Cell Compilation Units: | ***meters at Mean Lower Low Water*** |

Remarks:

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# Descriptive Report to Accompany Survey H12417

Project: OPR-B340-TJ-12

Locality: Long Island Sound

Sublocality: Mt. Misery Pt. to Sound Beach, NY

Scale: 1:5000

May 2012 - June 2012

**NOAA Ship *Thomas Jefferson***

Chief of Party: CDR Lawrence T. Krepp

# A. Area Surveyed

Survey sheet area is in the vicinity of Mt. Misery Point, NY.

## A.1 Survey Limits

Data was acquired within the following survey limits:

| Northeast Limit | Southwest Limit |
|---|---|
| 41.025 N<br>72.9421666667 W | 40.967 N<br>73.0708333333 W |

*Table 1: Survey Limits*

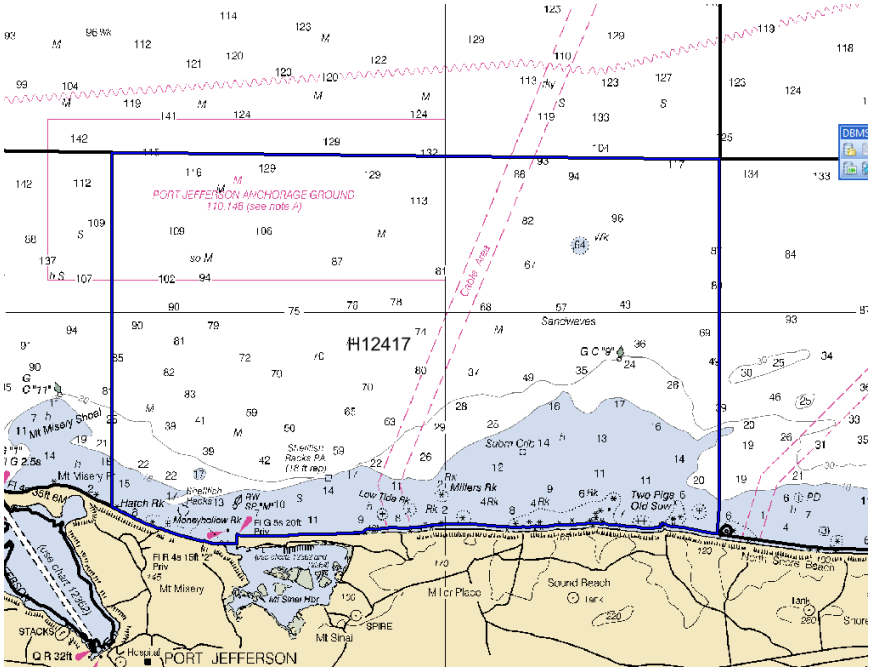


*Figure 1: Survey limits for H12417*

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

## A.2 Survey Purpose

The purpose of this survey is to support safe navigation by updating nautical charting products with contemporary hydrographic data. Additionally, data acquired by this survey will support the Long Island Seafloor Mapping Initiative for the states of Connecticut and New York. Finally, this project will assist the Coast Guard in establishing new achorage grounds in Long Island Sound.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

This hydrographic survey was completed as specified by Hydrographic Survey Letter Instructions OPR-B340-TJ-12, dated 24th April, 2012. No additional work is needed to complete this survey. No changes significant to navigation have been noted and it is recommended that this survey receive normal processing priority.

## A.4 Survey Coverage

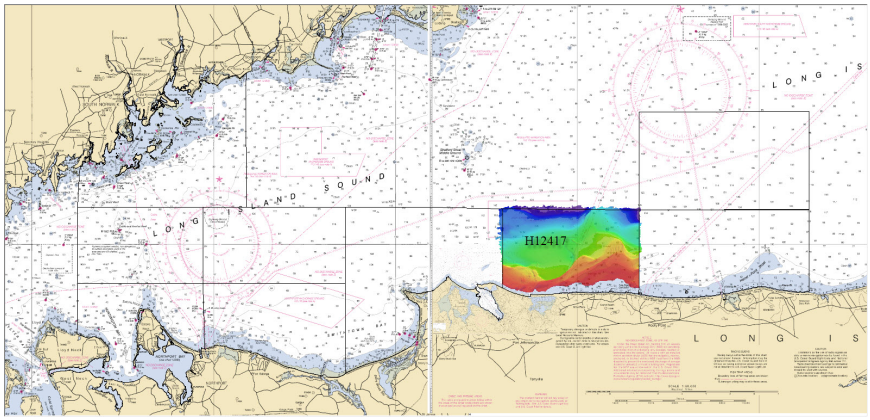


*Figure 2: H12417 survey coverage.*

In six areas, no longer than 165 meters across, the 4 meter nearshore limit of hydrography was not met due to launch safety concerns.

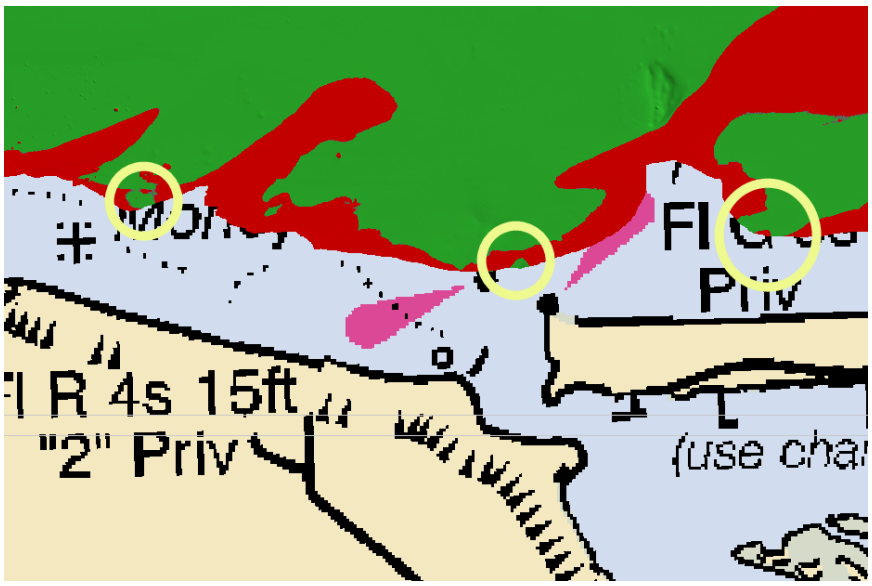


*Figure 3: Circled locations indicate areas where the 4m limit was not reached on the western portion of the sheet.*

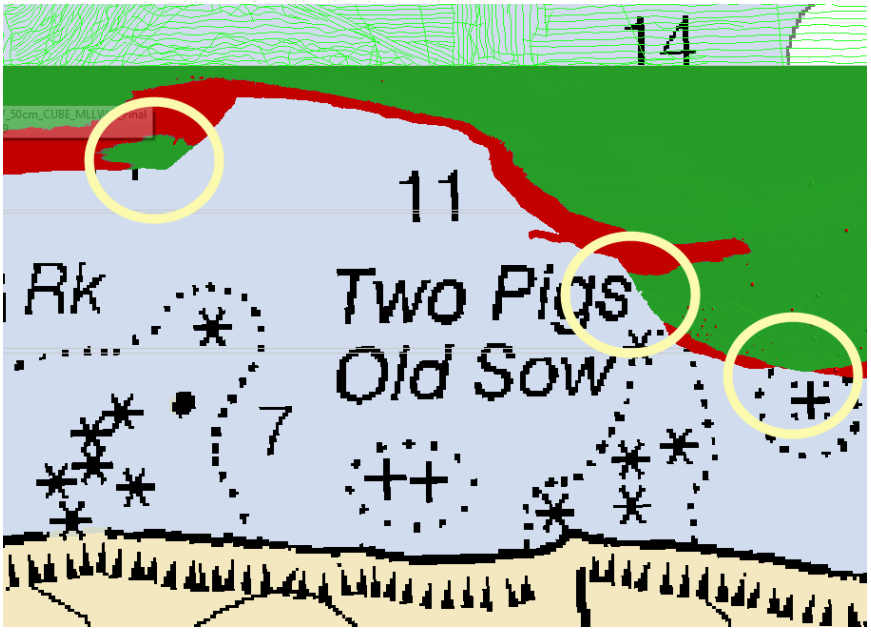


*Figure 4: Circled locations indicate areas where the 4m limit was not reached on the eastern portion of the sheet.*

## A.5 Survey Statistics

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

| | HULL ID | *S222* | *3101* | *3102* | *Total* |
|---|---|---|---|---|---|
| LNM | **SBES Mainscheme** | 0 | 0 | 0 | 0 |
| | **MBES Mainscheme** | 386.78 | 494.52 | 189.38 | 1070.68 |
| | **Lidar Mainscheme** | 0 | 0 | 0 | 0 |
| | **SSS Mainscheme** | 0 | 0 | 0 | 0 |
| | **SBES/MBES Combo Mainscheme** | 0 | 0 | 0 | 0 |
| | **SBES/SSS Combo Mainscheme** | 0 | 0 | 0 | 0 |
| | **MBES/SSS Combo Mainscheme** | 0 | 0 | 0 | 0 |
| | **SBES/MBES Combo Crosslines** | 17.59 | 26.73 | 0 | 44.32 |
| | **Lidar Crosslines** | 0 | 0 | 0 | 0 |
| **Number of Bottom Samples** | | | | | 0 |
| **Number of DPs** | | | | | 0 |
| **Number of Items Items Investigated by Dive Ops** | | | | | 0 |
| **Total Number of SNM** | | | | | 19.06 |

*Table 2: Hydrographic Survey Statistics*

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

| ***Survey Dates*** |
|---|
| 05/19/2012 |
| 05/20/2012 |
| 05/22/2012 |
| 05/23/2012 |
| 05/24/2012 |
| 05/30/2012 |
| 05/31/2012 |
| 06/01/2012 |
| 06/02/2012 |
| 06/03/2012 |
| 06/04/2012 |
| 06/05/2012 |
| 06/06/2012 |
| 06/07/2012 |
| 06/08/2012 |
| 06/11/2012 |
| 06/12/2012 |
| 06/23/2012 |

*Table 3: Dates of Hydrography*

## A.6 Shoreline

Shoreline was investigated in accordance with the Project Instructions and the HSSD.

## A.7 Bottom Samples

Updated bottom sample locations were provided after the project instructions were given. There were no bottom samples included within the sheet limits for H12417 in the revised files.

# 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** | ***3102*** | ***3101*** | ***S222*** |
|---|---|---|---|
| **LOA** | 31 feet | 31 feet | 210 feet |
| **Draft** | 3 feet | 3 feet | 14 feet |

*Table 4: Vessels Used*

### B.1.2 Equipment

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

| **Manufacturer** | **Model** | **Type** |
|---|---|---|
| Reson | 7125 ROV | MBES |
| Reson | 7125 SV1 | MBES |
| Applanix | POSMV | Positioning and Attitude System |
| Seabird | Seacat19+ | Conductivity, Temperature and Depth Sensor |
| Brooke Ocean | MVP100 | Sound Speed System |

*Table 5: Major Systems Used*

Data were acquired by NOAA Ship Thomas Jefferson, launch 3101 and launch 3102. NOAA Ship Thomas Jefferson, launch 3101 and launch 3102 acquired Reson 7125 multibeam echo sounder (MBES) soundings and sound velocity profiles. Vessel configurations, equipment operation and data acquisition and processing were consistent with specifications described in the DAPR.

## B.2 Quality Control

### B.2.1 Crosslines

Crossline comparison was conducted using the difference surface method in CARIS BathyDataBASE. Crosslines agreed very well with main scheme bathymetry, in most cases less than 10cm of difference was noticed. Computed statistics from the difference surface: mean: 0.02m, stdev: 0.19m. A maximum difference of 0.8m occurred in a small area where shifting sand waves were present. Nearby charted "Sandwaves" should be retained.

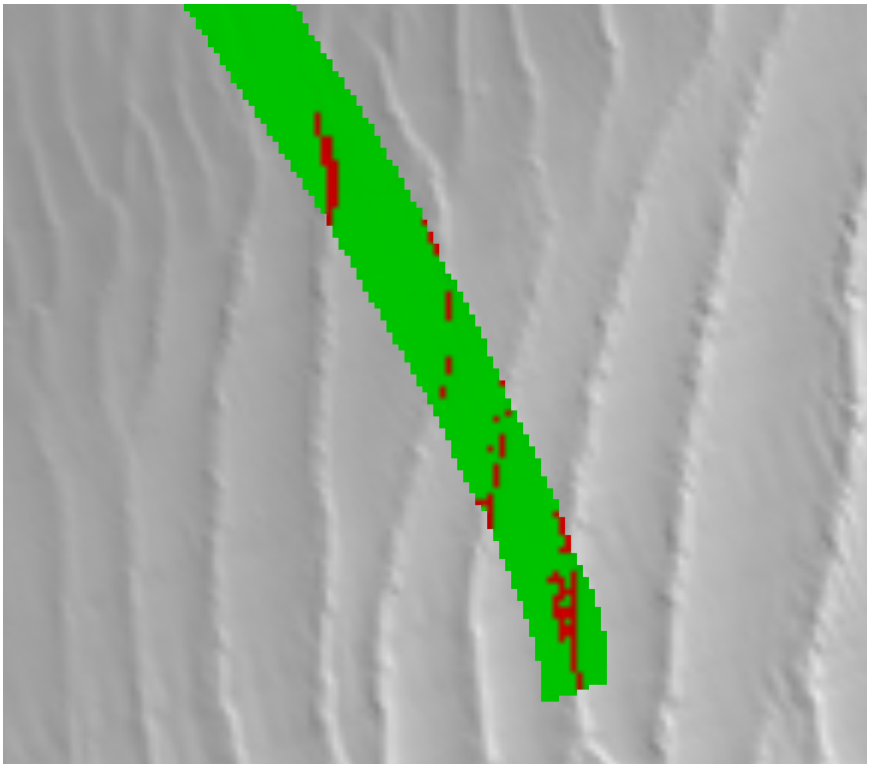

*Figure 5: Red bands illustrate greater than 0.25m of difference between crossline and mainscheme in the area with the most prevalent sand wave movement.*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Measured | Zoning |
|---|---|
| 0meters | 0.102meters |
| 0meters | 0meters |

*Table 6: Survey Specific Tide TPU Values*

| Hull ID | Measured - CTD | Measured - MVP | Surface |
|---|---|---|---|
| S222 | N/A meters/second | 1meters/second | 0.2meters/second |
| 3101 | 4meters/second | N/A meters/second | 0.2meters/second |
| 3102 | 4meters/second | N/A meters/second | 0.2meters/second |

*Table 7: Survey Specific Sound Speed TPU Values*

Data were initially processed to the ellipsoid using POSPac MMS Smoothed Best Estimate of Trajectories (SBET). These SBETs include horizontal and vertical error data and this data is included in the TPU computations. The tidal uncertainty values in the top row represent the uncertainties in the VDATUM solution for the area. All lines with GPS tides applied utilized tidal values in the top line.

CO-OPS provided tide uncertainty values for the TCARI surface and the VDATUM solution that is part of the Total Propagated Uncertainty (TPU) calculation. TPU is calculated and written to each line's HDCS file (CARIS processed data format). When surfaces are created, an uncertainty child layer is created. This child layer represents the amount of uncertainty for individual nodes in the surface based on a combination of a priori values from equipment vendors, values determined from environmental observation in the field, and from automated empirical analysis of data in real-time. Once all investigated features have been reviewed and least depths have been designated, surfaces are finalized. In finalization, the standard deviation for each node in the surface is multiplied by 1.96 to provide the 95% (2-sigma) confidence value for the node. This 2-sigma standard deviation is compared to the computed Total Vertical Uncertainty (TVU) for each node. The larger of the two values is retained as the finalized Uncertainty for each node. Uncertainty is reported in meters. IHO has established allowable TVU values for each order of survey. This survey meets IHO Order I TVU requirements in 100% of nodes in the final surface. All lines with TCARI as the final tidal corrector utilized the tidal uncertainty values in the second line in the table above.

### B.2.3 Junctions

H12417 junctions with three surveys and sounding agreement is within 2 feet.

The following junctions were made with this survey:

| Registry Number | Scale | Year | Field Unit | Relative Location |
|---|---|---|---|---|
| H12416 | 1:5000 | 2012 | NOAA Ship THOMAS JEFFERSON | W |
| H12437 | 1:40000 | 2012 | NOAA Ship THOMAS JEFFERSON | E |
| H11044 | 1:20000 | 2001 | NOAA Ship RUDE | N |

*Table 8: Junctioning Surveys*

H12416

Processing of H12416 had not been completed at the time this DR was written. A difference surface was created using a preliminary surface from H12416 and the combined surface. The mean difference was 1.8cm with a standard deviation of 11.7cm.

H12437

Sounding layers from H12437 and H12417 were compared using CARIS BathyDataBase and had a mean difference of 1.2cm with a standard deviation of 11cm.

H11044

No bathymetric data was provided for H11044. H12417 was compared to H11044 by performing a comparison between raster chart 12362 and a sounding layer generated by a combined 4 meter BASE surface from H12417. Compared soundings ranged from 96 feet to 132 feet and agreed to within 2 feet.

### 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

#### B.2.5.1None Exist

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

### B.2.6 Factors Affecting Soundings

#### B.2.6.1 Shifting Sand Waves

Within H12417, an area in the southwestern portion of the sheet displayed significant sand wave patterns that appeared to shift during subsequent days of data acquisition. This is visible in the 50cm BASE surface as shown below.

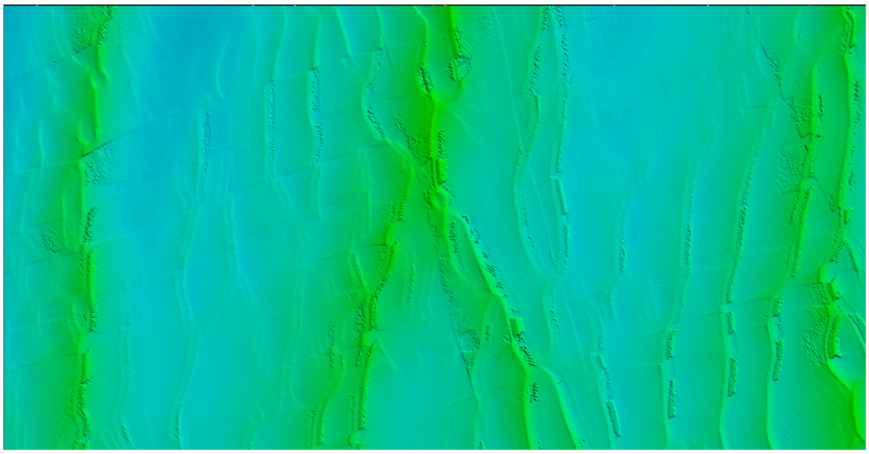

*Figure 3: Shifting sand waves present in portion of H12417.*

### B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: S-222 conducts Moving Vessel Profiler casts approximately every 20 minutes. The launches conduct CTD casts approximately once every two hours. All sound velocity correctors were applied to the data using the "nearest in time" option in CARIS HIPS/SIPS.

Throughout the data acquisition phase of H12417, sound velocity profiles were inspected and trends noted. These trends showed a well mixed water column with little variation in sound velocity throughout the day. The inshore area was divided into rectangular polygons designed to be completed every two hours. This allowed for one CTD cast to be taken per polygon.

### B.2.8 Coverage Equipment and Methods

99.47% of nodes in H12417 contained 5 or more soundings.

## B.3 Echo Sounding Corrections

### B.3.1 Corrections to Echo Soundings

HDCS sounding data were reduced to mean lower low water (MLLW) primarily with a VDATUM solution. Several lines were processed to TCARI when issues with ERS processing did not allow for an SBET solution. See the Vertical and Horizontal Control Section for more information.

### B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

### B.3.3 Trueheave Application

On DN153, lines 153_1708, 153_1716, 153_1723, a gap in POS/MV data acquisition occurred. Trueheave was not applied to these lines, but conditions were calm and the affected lines were compared to adjacent lines with Trueheave applied and found to agree well. The hydrographer recommends that the lines be treated normally in further processing and sounding selection.

## B.4 Backscatter

Backscatter was logged as a 7k file and submitted to the IOCM processing center and/or directly to NGDC, and is not included with the data submitted to the Branch.

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAAProfileField.xml v. 5.2

### B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

| Surface Name | Surface Type | Resolution | Depth Range | Surface Parameter | Purpose |
|---|---|---|---|---|---|
| H12417_50cm_CUBE_MLLW | CUBE | 0.5 meters | 1.31 meters - 20 meters | NOAA_0.5m | Complete MBES |
| H12417_2m_CUBE_MLLW | CUBE | 2 meters | 18 meters - 40 meters | NOAA_2m | Complete MBES |
| H12417_4m_CUBE_MLLW | CUBE | 4 meters | 35 meters - 42.35 meters | NOAA_4m | Complete MBES |
| H12417_4m_CUBE_MLLW_ Combined_Final | CUBE | 4 meters | 1.31 meters - 42.35 meters | NOAA_32m | Complete MBES |

*Table 9: CARIS Surfaces*

The final submitted surfaces is a combined surface of the first three submitted surfaces. It was combined using the FPM recommended combine rules in CARIS BathyDataBASE.

# C. Vertical and Horizontal Control

As per FPM section 5.2.3.2.3, no HVCR was filed as horizontal or vertical control stations were not established by the field party for this survey. A summary of horizontal and vertical control for this survey follows.

## C.1 Vertical Control

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

Standard Vertical Control Methods Used:

TCARI

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

| Station Name | Station ID |
|---|---|
| New Haven, CT | 8465705 |
| Bridgeport, CT | 8467150 |
| Kings Point, NY | 8516945 |

*Table 10: NWLON Tide Stations*

| File Name | Status |
|---|---|
| 8465705.tid | Final Approved |
| 8467150.tid | Final Approved |
| 8516945.tid | Final Approved |

*Table 11: Water Level Files (.tid)*

| File Name | Status |
|---|---|
| B340TJ2012_Rev.tc | Final |

*Table 12: Tide Correctors (.zdf or .tc)*

A request for final approved tides was sent to N/OPS1 on 06/12/2012. The final tide note was received on 07/31/2012.

Non-Standard Vertical Control Methods Used:

VDatum

Ellipsoid to Chart Datum Separation File:

Crosslines with and without SBETs applied were compared using Pydro's Time Series Comparison tool. Results of the comparison were: N,mean,stdev = 49994, 0.038, 0.049. See Appendix V for the interim deliverable memo and resulting VDATUM approval memo.
The majority, 98%, of H12417 was processed using SBETs. The majority of these lines were then processed to the ellipsoid and reduced to MLLW using the OPs provided VDATUM separation model to reduce data to MLLW.

The remaining 2% of lines from H12299 did not have SBETs applied (therefore no GPS tides were applied) and instead were processed with TCARI tides:
Launch 3101: DN140, line: 140_1845;
DN141, line: 141_1737;
DN143, line: 143_2033;
DN151, line: 151_1707;
DN153, lines: 153_1704, 153_1708, 153_1716, 153_1723, 153_1725, 153_1734, 153_1817, 153_1958.
Launch 3102: DN158, line: 158_1453, 158_2031, 158_2124.

Additionally, many of the lines have SBET and RMS correctors applied, but do not use GPS tides based inconsistencies in the vertical component of the SBET. Where this occurred, lines were re-merged with TCARI as the vertical corrector. For a listing of all lines utilizing TCARI, see Appendix V, file "H12417 TCARI lines.xlsx".

## C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The following PPK methods were used for horizontal control:

Smart Base

The following CORS Stations were used for horizontal control:

| HVCR Site ID | Base Station ID |
|---|---|
| NYRH | NYRH |
| CTDA | CTDA |
| CTGU | CTGU |
| MOR5 | MOR5 |
| MOR6 | MOR6 |
| NYCI | NYCI |
| ZNY1 | ZNY1 |
| NYRH | NYRH |
| RVDI | RVDI |

*Table 13: CORS Base Stations*

The following DGPS Stations were used for horizontal control:

| DGPS Stations |
|---|
| Moriches, NY |
| Acushnet, MA |

*Table 14: USCG DGPS Stations*

# D. Results and Recommendations

## D.1 Chart Comparison

### D.1.1 Raster Charts

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

| Chart | Scale | Edition | Edition Date | LNM Date | NM Date |
|---|---|---|---|---|---|
| 12354 | 1:80000 | 43 | 09/2010 | 08/24/2012 | 09/04/2012 |
| 12362 | 1:10000 | 17 | 02/2005 | 02/15/2005 | 02/19/2005 |

*Table 15: Largest Scale Raster Charts*

12354

Soundings from H12417 agreed well, within 2 feet, of charted soundings on raster chart 12354. There are several rocky areas that are not accurately charted but they are reflected in the FFF.

12362

Charted soundings generally agreed very well, within 1 foot of surveyed soundings. In the southwest corner of H12417, multiple rocks were discovered causing surveyed soundings to disagree with charted soundings by 6 to 10 feet.

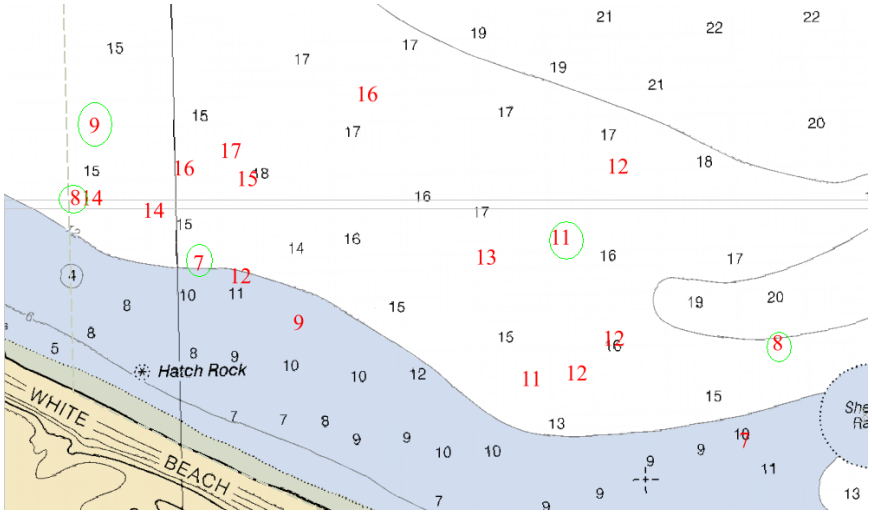


*Figure 6: Southwest corner of H12417 showing designated soundings on rocks.*

### D.1.2 Electronic Navigational Charts

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

| ENC | Scale | Edition | Update Application Date | Issue Date | Preliminary? |
|---|---|---|---|---|---|
| US4NY1GM | 1:80000 | 20 | 08/25/2008 | 07/11/2011 | NO |
| US5NY17M | 1:10000 | 7 | 03/03/2011 | 03/03/2011 | NO |
| US5CN10M | 1:40000 | 2 | 10/02/2012 | 10/02/2012 | NO |

*Table 16: Largest Scale ENCs*

US4NY1GM

Charted soundings on ENC US4NY1GM agreed within 3 feet of surveyed soundings. There are several rocky areas that are not accurately charted but they are reflected in the FFF.

US5NY17M

Charted soundings from ENC US5NY17M generally agreed very well, within 1 foot of surveyed soundings. In the southwest corner of H12417, multiple rocks were discovered causing surveyed soundings to disagree with charted soundings by 6 to 10 feet. (See figure 6).

US5CN10M

Charted soundings from ENC US5CN10M generally agreed well, within 2 feet of surveyed soundings. There are several rocky areas that are not accurately charted but they are reflected in the FFF.

### D.1.3 AWOIS Items

Number of AWOIS Items Addressed: 2
Number of AWOIS Items Not Addressed: 0

The survey contained two assigned AWOIS items and both were fully investigated.
AWOIS item #11825, a position approximate, 18 ft obstruction of shellfish racks was disproved by H12417.
AWOIS item #1766, a charted underwater wreck with a wire dragged depth of 64ft was found by by H12417. A new feature was created to show accurate position and least depth.

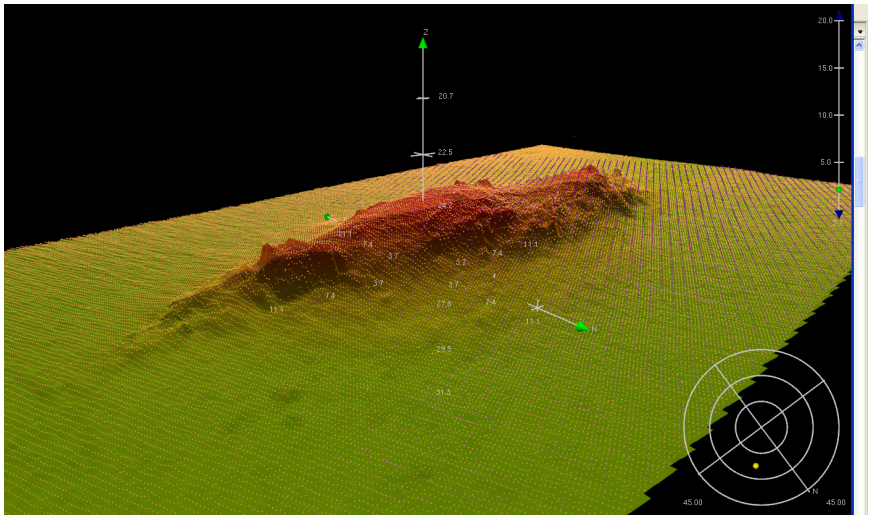

*Figure 7: AWOIS item #1766, charted wreck located by H12417, least depth found to be 78ft.*

### D.1.4 Charted Features

See AWOIS section.

### D.1.5 Uncharted Features

No uncharted features exist for this survey.

### D.1.6 Dangers to Navigation

The follwing DTON reports were submitted to the processing branch:

| DTON Report Name | Date Submitted |
|---|---|
| H12417 DtoNs | 2012-10-04 |

*Table 17: DTON Reports*

Danger to Navigation Reports are included in Appendix I of this report.

### D.1.7 Shoal and Hazardous Features

An area of rocks in the SW corner of the sheet exists. Two of these rocks were reported as DtoNs and the others have been designated as rock features.

### D.1.8 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

## D.2 Additional Results

### D.2.1 Shoreline

Shoreline was assigned in the Hydrographic Survey Project Instructions or Statement of Work, but was not investigated.

### D.2.2 Prior Surveys

Prior survey comparisons exist for this survey, but were not investigated.

### D.2.3 Aids to Navigation

Three AtoNs exist within the survey limits of H12417. All three AtoNs were confirmed to be functioning and positioned correctly.

### D.2.4 Overhead Features

Overhead features do not exist for this survey.

### D.2.5 Submarine Features

A cable area exists within the sheet limits, but evidence of cables on the sea floor was not detected in the MBES data. All cables are presumed to be properly buried.

### D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

### D.2.7 Platforms

No platforms exist for this survey.

### D.2.8 Significant Features

In the eastern, central portion of the sheet near the AtoN GC "9," an area of shifting sand waves was noticed during the survey. The FFF outlines the limits of the sandwaves.

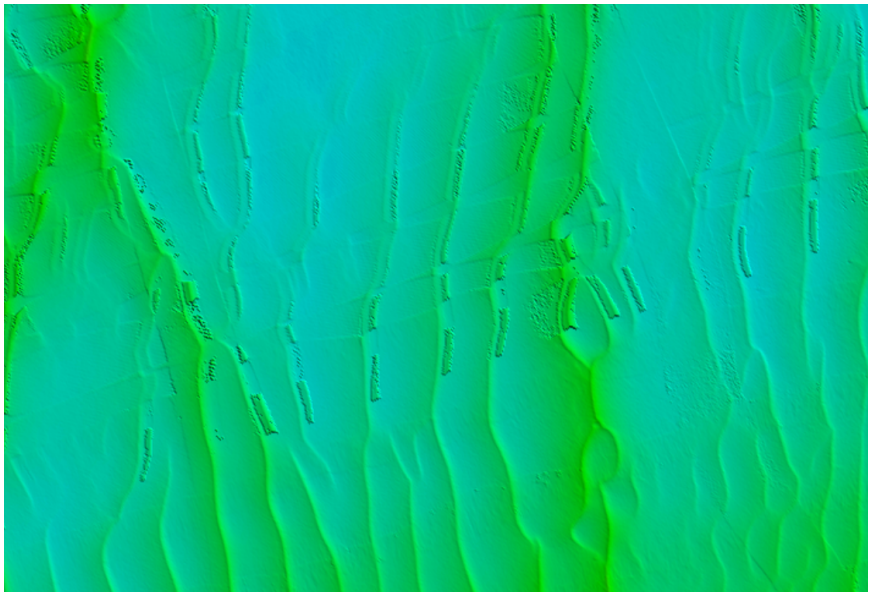

*Figure 9: Sand wave activity noticed during acquisition of H12417.*

## D.2 Construction and Dredging

There is no present or planned construction or dredging within the survey limits.

# 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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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 |
|---|---|---|---|
| ENS Andrew Clos | Sheet Manager | 03/22/2013 | |
| LT William Winner | Field Operations Officer | 03/22/2013 | |
| CDR Lawrence Krepp | Commanding Officer | 03/22/2013 | |

# F. Table of Acronyms

| Acronym | Definition |
|---|---|
| **AFF** | Assigned Features File |
| **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** | Continually Operating Reference Staiton |
| **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 |
| **ERZT** | Ellipsoidally Referenced Zoned Tides |
| **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 |
| **HSSDM** | Hydrographic Survey Specifications and Deliverables Manual |

| Acronym | Definition |
|---|---|
| **HSTP** | Hydrographic Systems Technology Programs |
| **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** | Local Notice to Mariners |
| **LNM** | Linear Nautical Miles |
| **MCD** | Marine Chart Division |
| **MHW** | Mean High Water |
| **MLLW** | Mean Lower Low Water |
| **NAD 83** | North American Datum of 1983 |
| **NAIP** | National Agriculture and Imagery Program |
| **NALL** | Navigable Area Limit Line |
| **NM** | 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 |
| **PST** | Physical Science Technician |
| **RNC** | Raster Navigational Chart |
| **RTK** | Real Time Kinematic |
| **SBES** | Singlebeam Echosounder |
| **SBET** | Smooth Best Estimate and Trajectory |
| **SNM** | Square Nautical Miles |
| **SSS** | Side Scan Sonar |
| **ST** | Survey Technician |
| **SVP** | Sound Velocity Profiler |
| **TCARI** | Tidal Constituent And Residual Interpolation |
| **TPU** | Total Porpagated Error |
| **TPU** | Topside Processing Unit |
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United Stated Coast Guard |
| **UTM** | Universal Transverse Mercator |
| **XO** | Exectutive Officer |
| **ZDA** | Global Positiong System timing message |
| **ZDF** | Zone Definition File |

H12416

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

# DESCRIPTIVE REPORT

| | |
|---|---|
| Type of Survey: | Navigable Area |
| Registry Number: | H12416 |

## LOCALITY

| | |
|---|---|
| State(s): | New York |
| General Locality: | Long Island Sound |
| Sub-locality: | Crane Neck Pt to Port Jefferson, NY |

**2012**

CHIEF OF PARTY
CDR Lawrence T. Krepp NOAA

LIBRARY & ARCHIVES

Date:

| U.S. DEPARTMENT OF COMMERCE<br>NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | REGISTRY NUMBER: |
|---|---|
| **HYDROGRAPHIC TITLE SHEET** | **H12416** |

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): | **New York** |
| General Locality: | **Long Island Sound** |
| Sub-Locality: | **Crane Neck Pt to Port Jefferson, NY** |
| Scale: | **5000** |
| Dates of Survey: | **06/06/2012 to 06/28/2012** |
| Instructions Dated: | **05/08/2012** |
| Project Number: | **OPR-B340-TJ-12** |
| Field Unit: | **NOAA Ship *Thomas Jefferson*** |
| Chief of Party: | **CDR Lawrence T. Krepp NOAA** |
| Soundings by: | **Multibeam Echo Sounder** |
| Imagery by: | **Multibeam Echo Sounder Backscatter** |
| Verification by: | **Atlantic Hydrographic Branch** |
| Soundings Acquired in: | **meters at Mean Lower Low Water** |

Remarks:

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**Descriptive Report to Accompany Survey H12416**

Project: OPR-B340-TJ-12

Locality: Long Island Sound

Sublocality: Crane Neck Pt to Port Jefferson, NY

Scale: 1:5000

June 2012 - June 2012

**NOAA Ship *Thomas Jefferson***

Chief of Party: CDR Lawrence T. Krepp NOAA

# A. Area Surveyed

This hydrographic survey was completed as specified by Hydrographic Survey Project Instructions OPR-B340-TJ-12 and all other applicable directions. The survey area is located on the northern shore of Long Island, NY, extending from Crane Neck Point in the west, eastward to White Beach and includes Port Jefferson Harbor.

## A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit | Southeast Limit |
|---|---|
| 41° 1" 45' N<br>73° 3" 37' W | 40° 56" 44' N<br>73° 10" 3' W |

*Table 1: Survey Limits*

Survey Limits were acquired in accordance with the requirements in the Project Instructions and the HSSD.

## A.2 Survey Purpose

This project is being conducted in support of NOAA's Office of Coast Survey to provide contemporary hydrographic data in order to update the nautical charting products and reduce the survey backlog within the area. In addition, data from this project will support the Long Island Sound Seafloor Mapping Initiative for the States of Connecticut and New York. This project also responds to the Coast Guard proposal to establish six anchorage grounds in Long Island Sound to increase safety for vessels through enhanced voyage planning and also by clearly indicating the location of anchorage grounds for ships proceeding to ports in New York. The USCG is requesting that NOAA confirm that their underwater surveys of Long

Island Sound did not detect any wrecks at all in the locations being proposed for the anchorage areas. Data acquired for this project will be used by partners for species and habitat identification, infrastructure projects, ocean mapping, coastal hazards and geology. Partners include the US Environmental Protection Agency, Connecticut Department of Environmental Protection, the University of Connecticut Marine Science Department, New York Department of Environmental Quality, and other organizations.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

## A.4 Survey Coverage

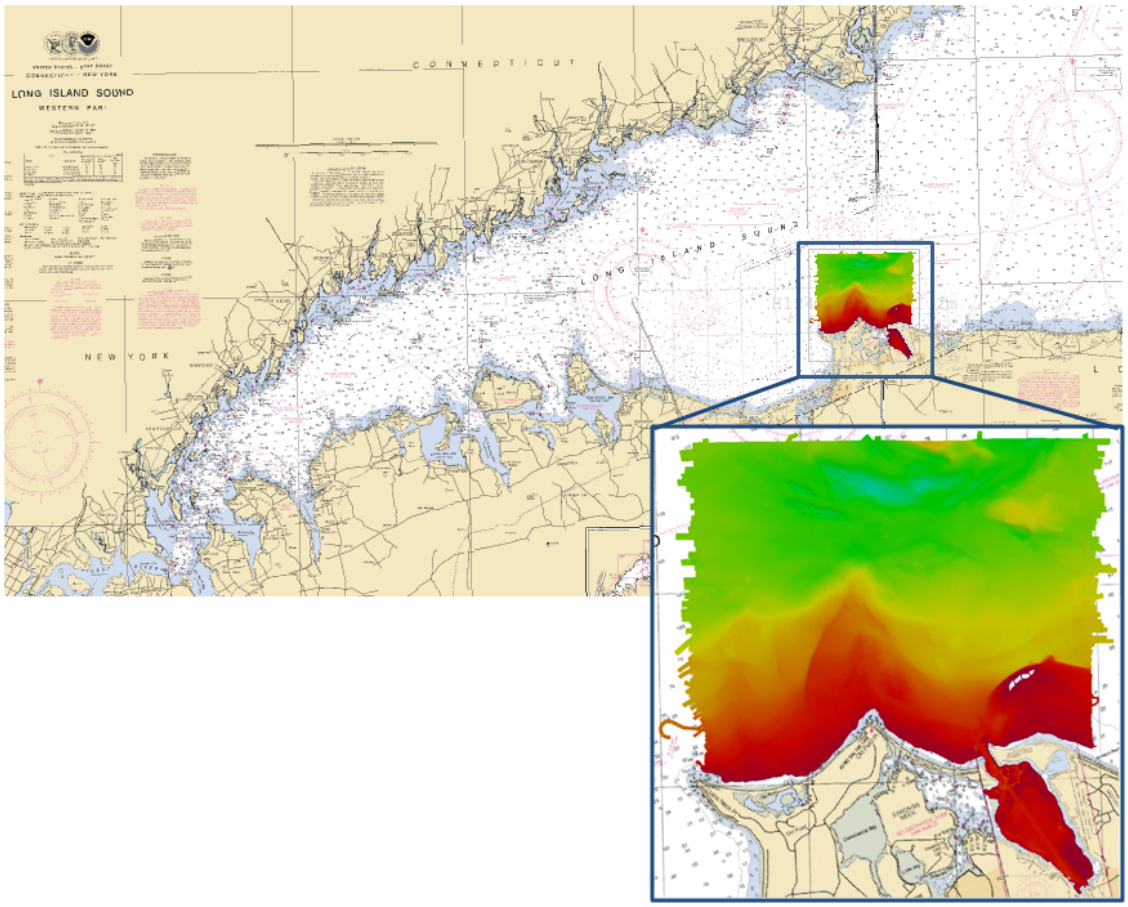



*Figure 1: Location of survey H12416.*

Coverage holidays do exist for this survey. Please see section B.2.10 for more information on the subject.

## A.5 Survey Statistics

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

| | HULL ID | *HSL 3101* | *HSL 3102* | *S-222* | *Total* |
|---|---|---|---|---|---|
| **LNM** | **SBES Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **MBES Mainscheme** | 241.39 | 311.97 | 254.71 | 808.07 |
| | **Lidar Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **SSS Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **SBES/MBES Combo Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **SBES/SSS Combo Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **MBES/SSS Combo Mainscheme** | 0.00 | 0.00 | 0.00 | 0.00 |
| | **SBES/MBES Combo Crosslines** | 6.02 | 22.57 | 7.76 | 36.35 |
| | **Lidar Crosslines** | 0.00 | 0.00 | 0.00 | 0.00 |
| **Number of Bottom Samples** | | | | | 21 |
| **Number AWOIS Items Investigated** | | | | | 4 |
| **Number Maritime Boundary Points Investigated** | | | | | 0 |
| **Number of DPs** | | | | | 5 |
| **Number of Items Items Investigated by Dive Ops** | | | | | 0 |
| **Total Number of SNM** | | | | | 14.49 |

*Table 2: Hydrographic Survey Statistics*

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

| Survey Dates | Julian Day Number |
|---|---|
| 06/06/2012 | 158 |
| 06/07/2012 | 159 |
| 06/08/2012 | 160 |
| 06/09/2012 | 161 |
| 06/10/2012 | 162 |
| 06/11/2012 | 163 |
| 06/12/2012 | 164 |
| 06/13/2012 | 165 |
| 06/19/2012 | 171 |
| 06/20/2012 | 172 |
| 06/21/2012 | 173 |
| 06/22/2012 | 174 |
| 06/23/2012 | 175 |
| 06/24/2012 | 176 |
| 06/25/2012 | 177 |
| 06/26/2012 | 178 |
| 06/28/2012 | 180 |

*Table 3: 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** | ***S-222*** | ***HSL 3101*** | ***HSL 3102*** |
|---|---|---|---|
| **LOA** | 208 feet | 31 feet | 31 feet |
| **Draft** | 15 feet | 5.2 feet | 5.2 feet |

*Table 4: Vessels Used*

S-222 acquired Multibeam data, Sound Velocity data, and Attitude data. HSL 3101 acquired Multibeam data, Sound Velocity data, and Attitude data. HSL 3102 acquired Multibeam data, Sound Velocity data, Attitude data, and bottom samples.

### B.1.2 Equipment

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

| **Manufacturer** | **Model** | **Type** |
|---|---|---|
| Reson | 7125 ROV | MBES |
| Reson | SVP71 | Sound Speed System |
| Applanix | POS/MV V4 | Positioning and Attitude System |
| Sea Bird | SBE 19 plus | Conductivity, Temperature and Depth Sensor |
| Brooke Ocean Technology | MVP100 | Sound Speed System |
| Reson | 7125 SV | MBES |
| Applied Micro Systems | Smart SV + T SSVS | Sound Speed System |
| Trimble | SPS351 | Positioning System |

*Table 5: Major Systems Used*

Vessel configurations, equipment operations, and data acquisition & processing were consistent with specifications described in the DAPR.

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 4.5% of mainscheme acquisition.

Crosslines were collected, processed and compared in accordance with section 5.2.4.3 of the HSSD (ed. 2012). All crosslines were filtered to 45 degrees on both sides and surface differencing in CARIS HIPS and SIPS was used to assess crossline agreement with mainscheme lines. Figure 1 depicts the difference surface between the 2-meter mainscheme and 2-meter crosslines surfaces. The difference surface is submitted digitally in the Separates IV folder. Percentage of crosslines collected to mainscheme lines is 4.50%, which exceeded the requirements in the HSSD for complete multibeam surveys. The differences in crosslines to mainscheme were generally less than +/- 0.07 meters (Figure3). In addition the hydrographer investigated nodes in the difference surface that exceeds the IHO tolerance to ensure that these were due to noise in the data and not systematic errors.

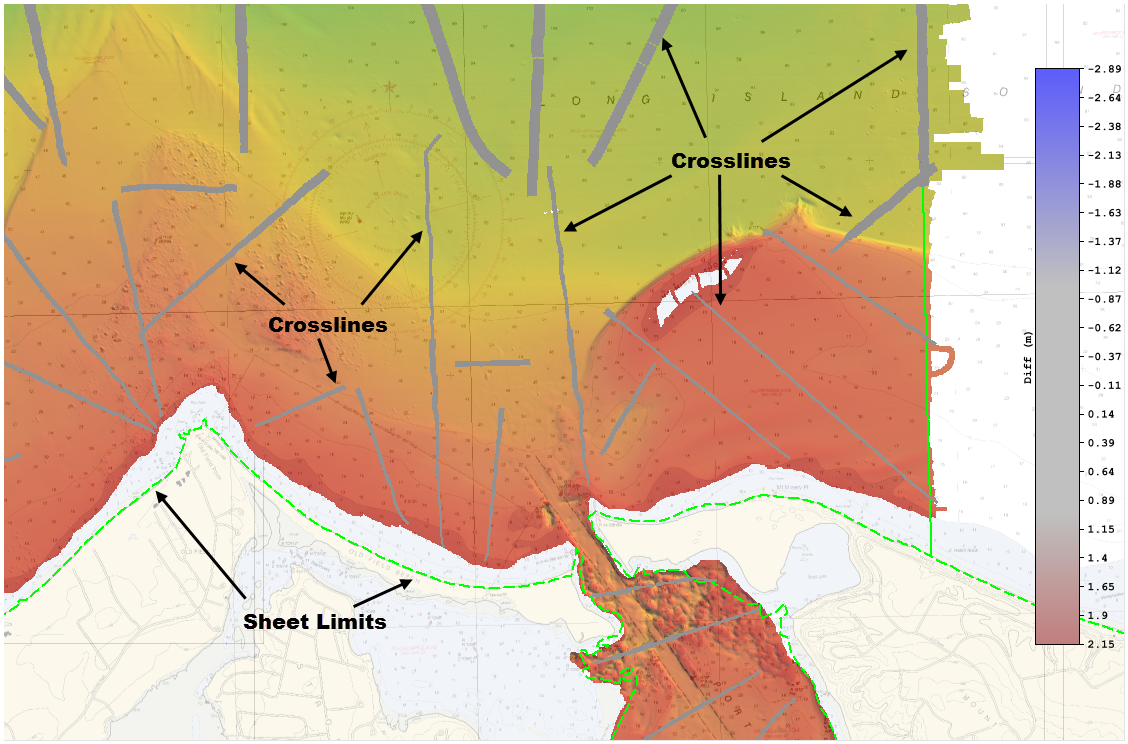
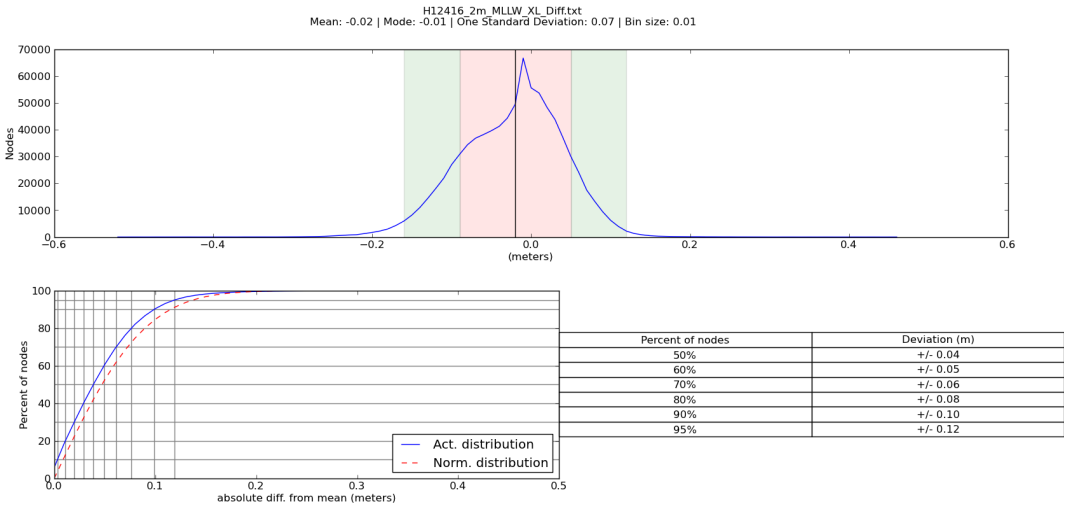



*Figure 2: Mainscheme to crosslines difference surface.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.04 |
| 60% | +/- 0.05 |
| 70% | +/- 0.06 |
| 80% | +/- 0.08 |
| 90% | +/- 0.10 |
| 95% | +/- 0.12 |

*Figure 3: Statistical representation of differences between crosslines and mainscheme surfaces.*

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Measured | Zoning |
|---|---|
| 0.104 meters | 0 meters |

*Table 6: Survey Specific Tide TPU Values*

| Hull ID | Measured - CTD | Measured - MVP | Surface |
|---|---|---|---|
| HSL 3101 | 4 meters/second | | 0.2 meters/second |
| HSL 3102 | 4 meters/second | | 0.2 meters/second |
| S222 | | 1 meters/second | 0.2 meters/second |

*Table 7: Survey Specific Sound Speed TPU Values*

For data processed to the ellipsoid, uncertainty was derived using a combination of a priori values for equipment and vessel characteristics, in combination with real time uncertainties for vessel motion, as well as field assigned values for sound speed uncertainties. The a priori values were set in accordance with Appendix 4, table 4.9 of the NOAA Field Procedure Manual (ed 2012). Vessel position and attitude were calculated using IAPPK data. Uncertainties associated with the speed of sound were entered by the field unit in accordance with guidance from Appendix 4 of the FPM.

Total Propagated Uncertainty was evaluated to ensure compliance with Section 5.1.3 of NOAA's HSSD (ed 2012). A ratio between actual uncertainty and maximum allowed uncertainty is found for each node. An IHO TVU layer (named IHO_1) was created in the finalized surface in each depth band (50cm, 2m, and 4m

respectively) by calculating the ratio of the uncertainty at the node to the maximum allowed IHO uncertainty for each node. Because this entire survey falls within IHO Order 1 the calculation was -Uncertainty/((0.5^2 +((Depth*0.013)^2))^0.5). As a result any values less than than -1 would indicate that the node exceeded the specifications in regards to total vertical uncertainty.

The resulting 'IHO_1' layer was filtered using a color map to show any areas where actual uncertainty exceeded the maximum allowed uncertainty. Areas which failed were typically found around boulders and rocky seabed areas. These are places where higher uncertainty would be expected. Figure 4 shows the percentage of nodes which met the IHO S-44 Order I requirements.

A higher uncertainty in the 50cm finalized grid was noted in the northwest section of the surface. The uncertainty of these nodes are attributed to sound velocity errors. These errors do not exceed specifications outlined in the HSSD (2012 ed).

| Surface | Nodes which Passed IHO Uncertainty |
|---|---|
| H12416_MB_50cm_MLLW_Final | 99.96% |
| H12416_MB_2m_MLLW_Final | 100.00% |
| H12416_MB_4m_MLLW_Final | 100.00% |

*Figure 4: Percentage of nodes within IHO S-44 Order 1 Requirements*

### B.2.3 Junctions

The areas of overlap between survey H12416 and adjacent junction surveys were reviewed for sounding consistency in CARIS Subset Editor and by surface differencing either the 2 meter or 4 meter combined surfaces to assess surface agreement.

The following junctions were made with this survey:

| Registry Number | Scale | Year | Field Unit | Relative Location |
|---|---|---|---|---|
| H11044 | 1:20000 | 2001 | NOAA Ship RUDE | NE |
| H11045 | 1:20000 | 2003 | NOAA Ship RUDE | NW |
| H12417 | 1:5000 | 2012 | NOAA Ship THOMAS JEFFERSON | E |
| H12488 | 1:10000 | 2012 | NOAA Ship THOMAS JEFFERSON | W |

*Table 8: Junctioning Surveys*

H11044

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between H12416_4m_Combined surface and H11044_2 surface. The H11044_2 surface was created from the H11044_2m_xyz.txt file provided to the ship in the Project Instructions and used in lieu of a H11044 combined surface. Nodes generally agree within 0.16m with 95% of the nodes agreeing with +/- 4.02m. Areas of larger differences are believed to be caused by the comparison between single-beam (H11044) and multi-beam (H12416). See Figure 5 for a graphical representation and Figure 6 for statistical information of the surface differencing.

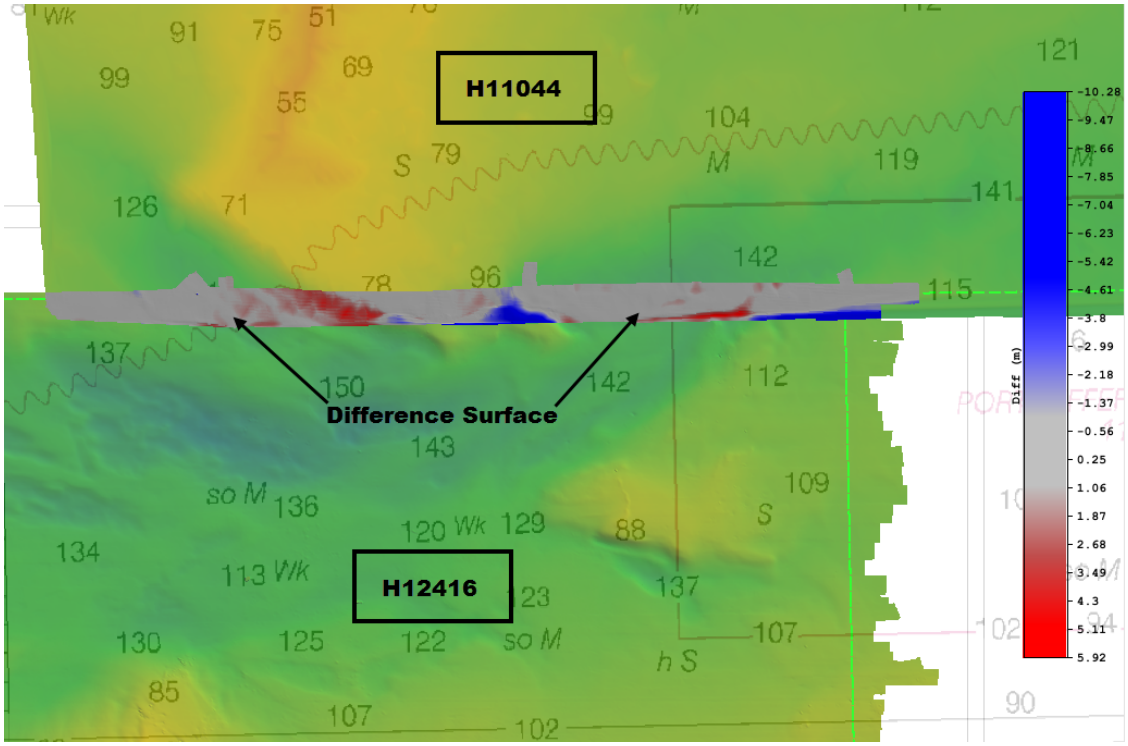
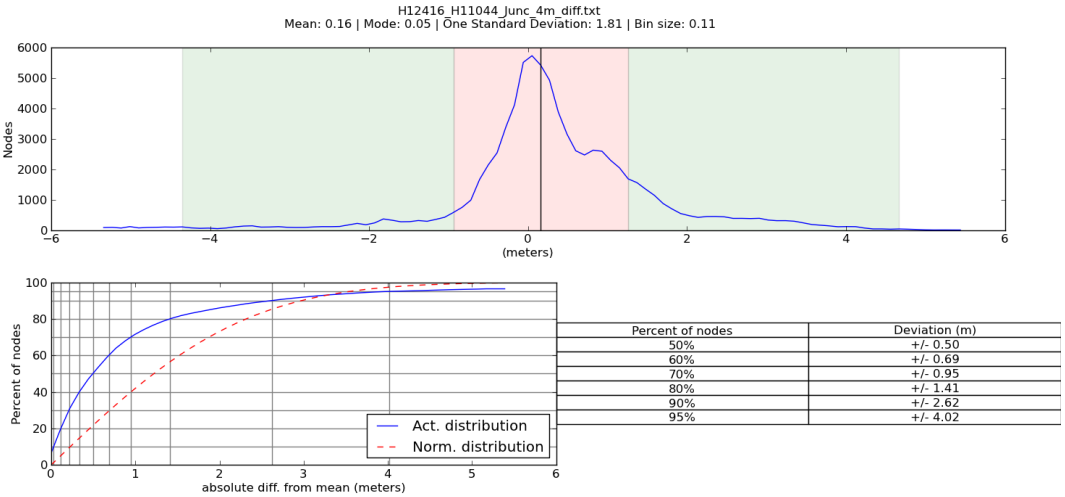



*Figure 5: Graphical representation of junction comparison between H12416 and H11044.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.50 |
| 60% | +/- 0.69 |
| 70% | +/- 0.95 |
| 80% | +/- 1.41 |
| 90% | +/- 2.62 |
| 95% | +/- 4.02 |

*Figure 6: Statistical representation of junction comparison between H12416 and H11044.*

H11045

The ship was not provided with a usable file format for a junction survey comparison; therefore, a comparison with H11045 was not performed.

H12417

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between H12416_4m_Combined surface and H12417_4m_CUBE_MLLW_Final_Combined surface. The mean difference of this survey was 0 meters with 95% of nodes agreeing within +/- 0.15 m. See Figure 7 for a graphical representation and Figure 8 for statistical information of the surface differencing.

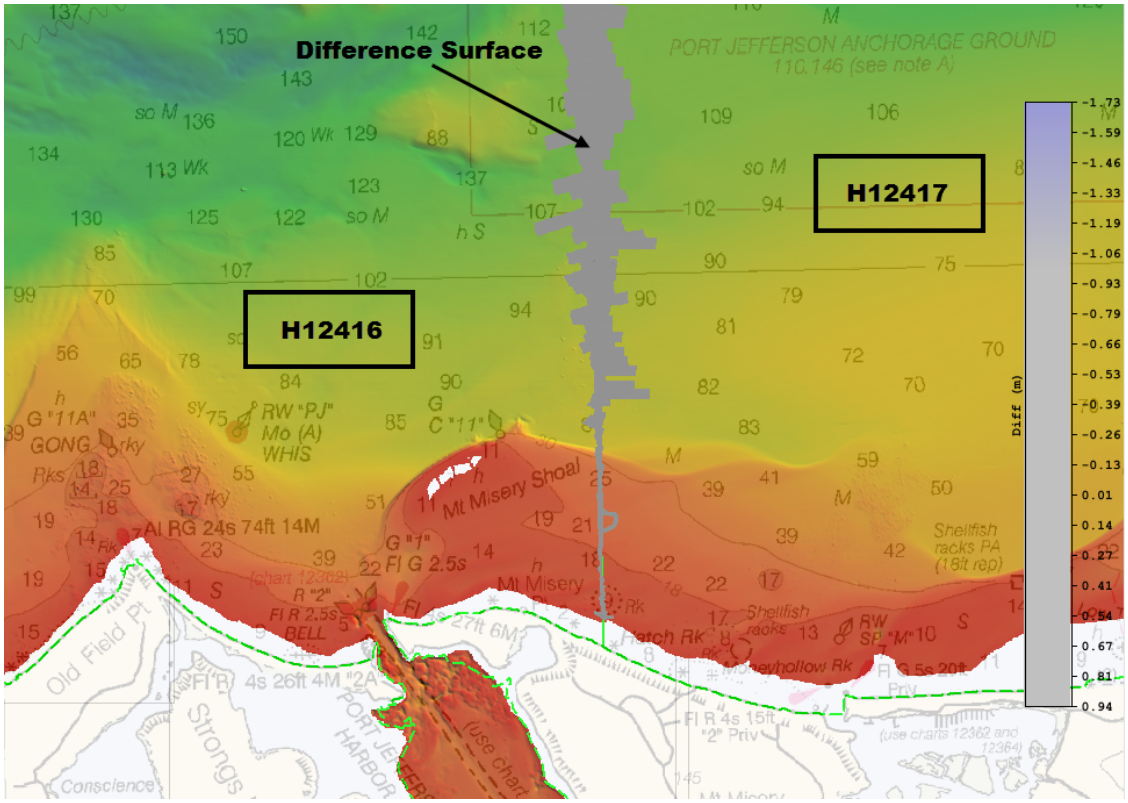
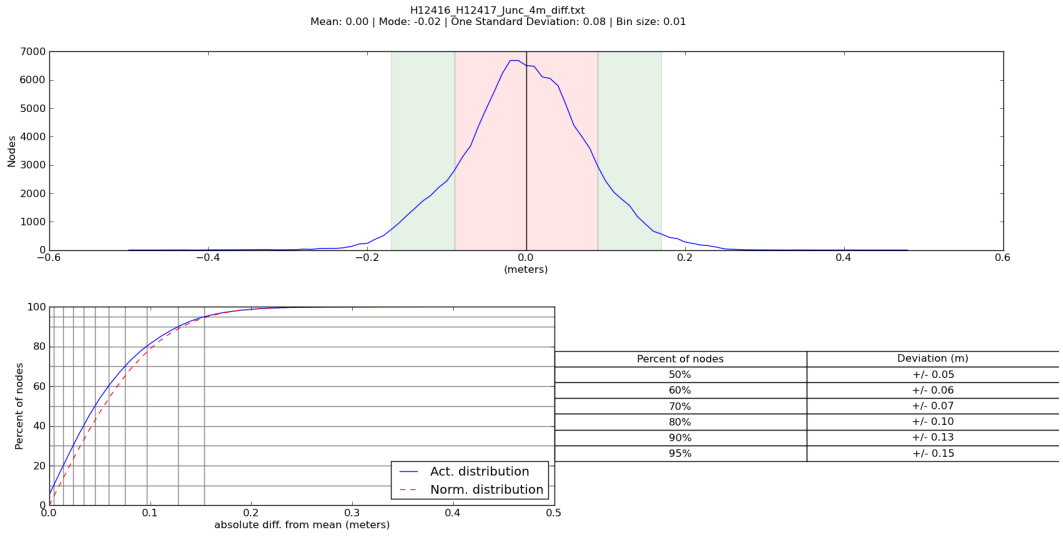



*Figure 7: Graphical representation of junction comparison between H12416 and H12417.*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.05 |
| 60% | +/- 0.06 |
| 70% | +/- 0.07 |
| 80% | +/- 0.10 |
| 90% | +/- 0.13 |
| 95% | +/- 0.15 |

*Figure 8: Statistical representation of junction comparison between H12416 and H12417.*

H12488

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between H12416_MB_2m_MLLW_Final surface and H12488_Comb_2m_MLLW surface. It should be noted that survey H12488 has not yet been submitted for acceptance and the H12488_Comb_2m_MLLW surface used

is a preliminary surface. However, the surfaces compared well; the mean difference between the surfaces was 0.01 meters with 95% of nodes agreeing within +/- 0.13m. See Figure 9 for a graphical representation and Figure 10 for statistical information of the surface differencing.

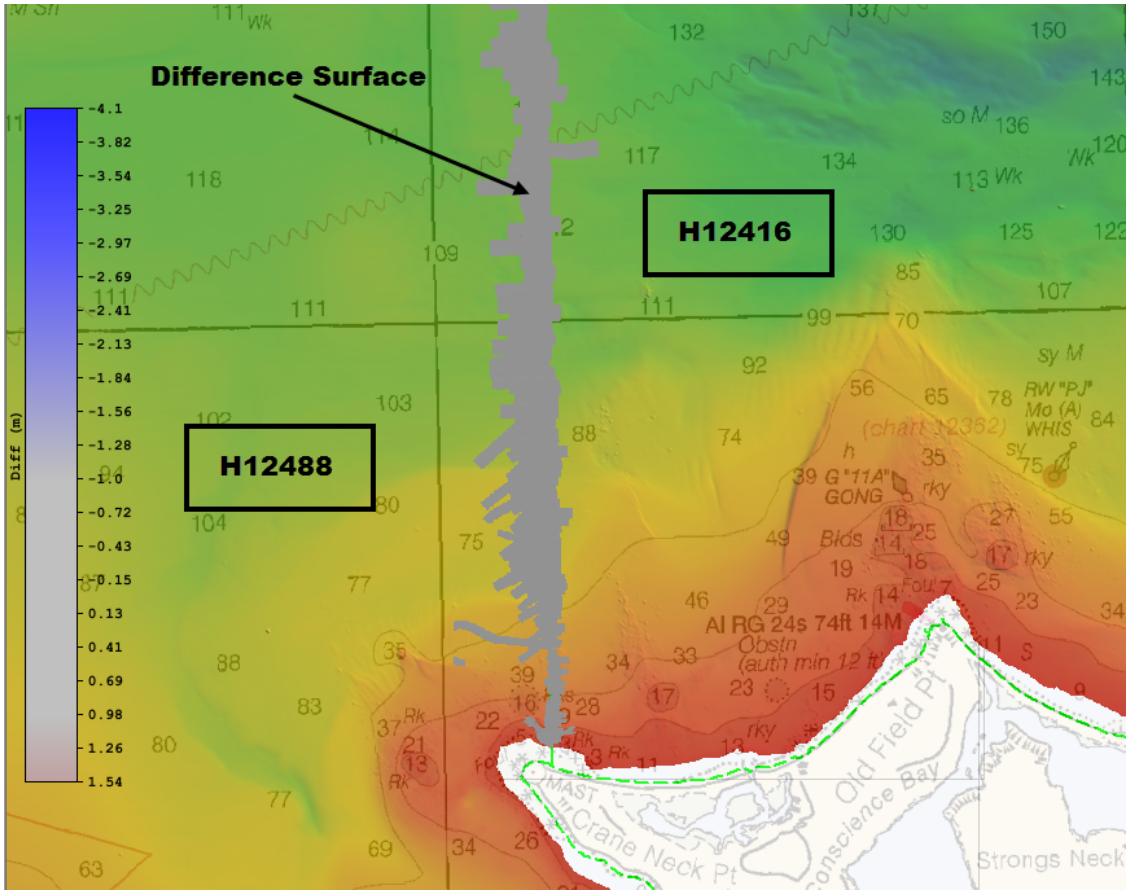
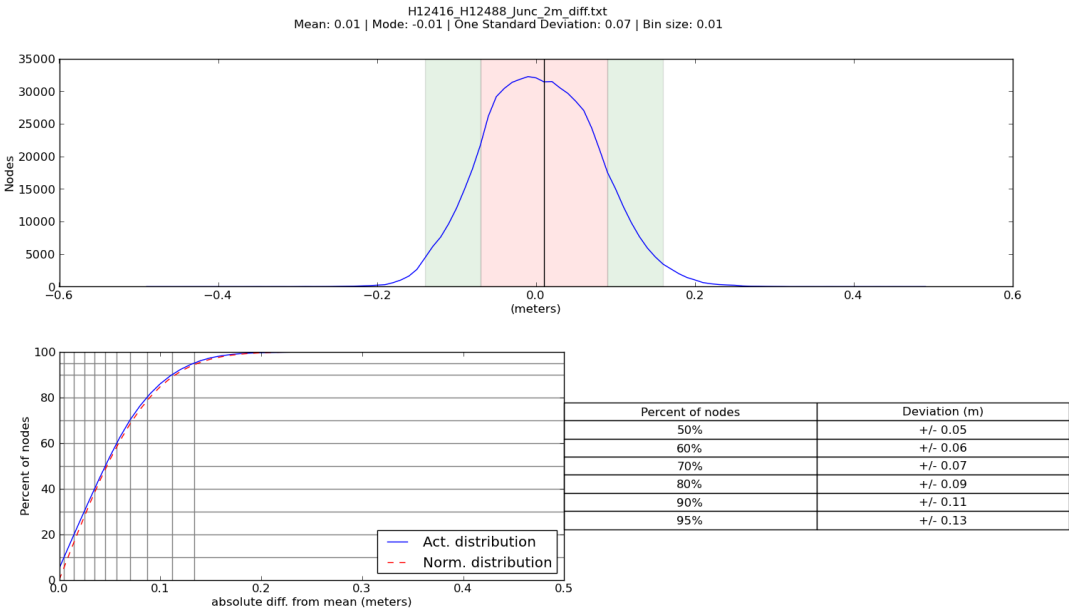



*Figure 9: Graphical representation of junction comparison between H12416 and H12488*




| Percent of nodes | Deviation (m) |
|---|---|
| 50% | +/- 0.05 |
| 60% | +/- 0.06 |
| 70% | +/- 0.07 |
| 80% | +/- 0.09 |
| 90% | +/- 0.11 |
| 95% | +/- 0.13 |

*Figure 10: Statistical representation of junction comparison between H12416 and H12488*

### 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: HSL 3101 and 3102 acquired sound speed profiles by using SBE-19 plus CTDs at discrete locations within the survey area generally once every four hours. S-222 utilized a Moving Vessel Profiler (MVP-100) for collecting sound speed profiles approximately once every 30 minutes.

Casts were grouped by vessel and applied within CARIS using the application method of "Nearest in Time". An exception to this application method was Vessel 3101 on DN 161, which utilized "Nearest in Distance within 2 hours".

On June 24, 2012 (DN176), Launch 3102 was tasked with Crosslines. No cast was obtained in the deep water, depths were in the range of 150ft plus. No other cast was available from any other platform that day. The closest cast for that depth was from S222 on DN 177. The cast name, from MVP, is H12416_3102_177_2018deep.svp. A comparison cast was performed on available casts from junction surveys. These were on the east and west side of H12416. At 50 degrees, the casts were acceptable on successive days. Nearest in distance was used for the single svp correction. The lines were then filtered to 50 degrees that will facilitate infrequent cast acquisition. TPU for Launch (CTD) was computed at 4m/sec for those lines based on frequency of cast. The cast comparison was as follows:

Wed Dec 12 16:30:37 2012
COMPARE 2 FILES
RESULTS: PERCENT DEPTH DIFFERENCE OK
SUMMARY OF RESULTS - COMPARE 2 CASTS VELOCIPY, Version 12.9
REFERENCE PROFILE: H12415_S222_175_183100.VPQ
COMPARISON PROFILE: H12488_S222_177_201800.VPQ
REFERENCE INSTRUMENT: SBE19PLUS (SN:6667)
COMPARISON INSTRUMENT: SBE19PLUS (SN:6667)
DRAFT = 0.80m
MAXIMUM COMMON DEPTH = 32.00
MAXIMUM DEPTH PERCENTAGE DIFFERENCE = 0.23%
MAXIMUM PERCENTAGE DIFFERENCE AT = 30.17m
Max percentage diff line and last line of travel time table:
Travel time, Avg Depth, Depth Diff, Pct Depth Diff, Avg Crosstrack, Crosstrack Diff, Pct Crosstrack Diff
0.03s , 30.14m, 0.07m , 0.23% , 34.29m , 0.05m , 0.15%
0.03s , 30.14m, 0.07m , 0.23% , 34.29m , 0.05m , 0.15%

Crosslines affected were 930-1658, 931-172, 932-1928, 933-1950, and 935-2052.

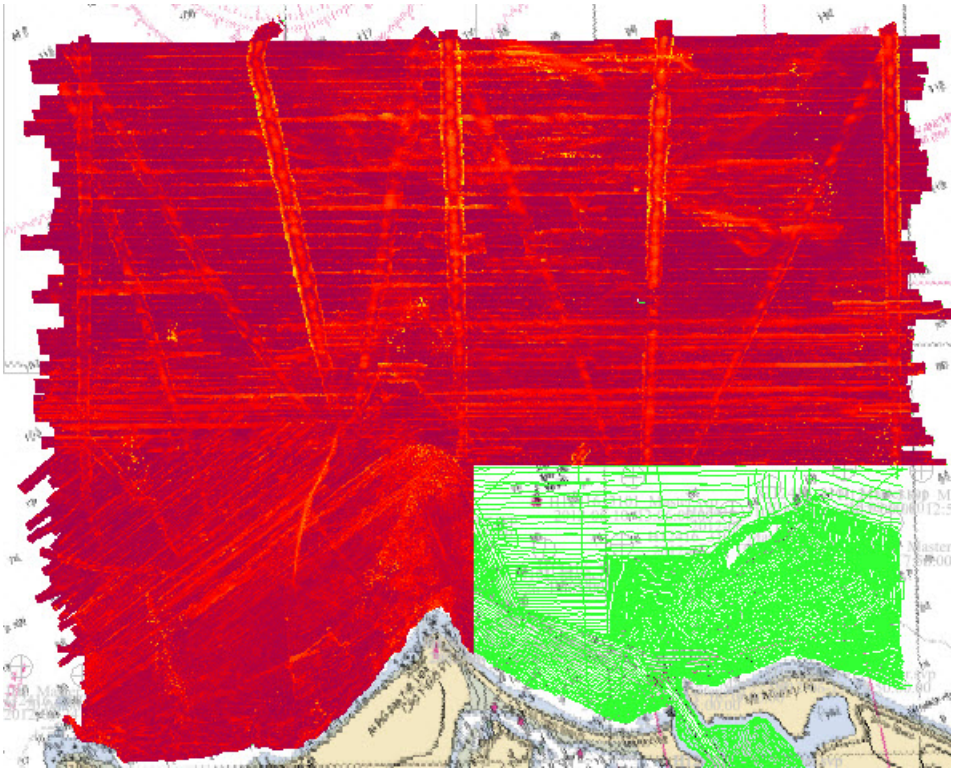


*Figure 11: Crossline Standard Deviation Before*

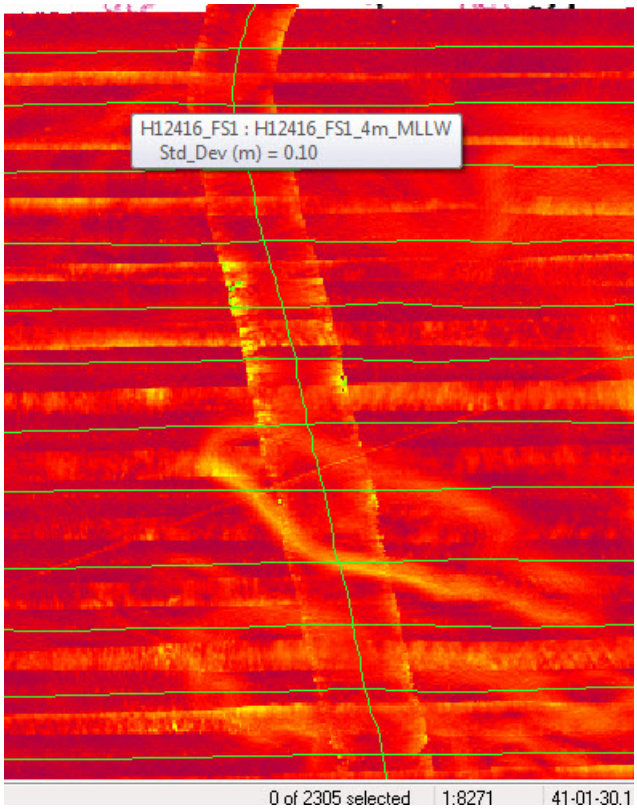



*Figure 12: Crossline Standard Deviation After*

### B.2.8 Coverage Equipment and Methods

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

### B.2.9 Density

Survey H12416 met density requirements per the HSSD. Figure 13 highlights the percentage of nodes which contains five or more soundings.

| Surface | Percentage Nodes Populated with <5 Soundings |
|---|---|
| H12416_MB_50cm_MLLW_Final | 99.81% |
| H12416_MB_2m_MLLW_Final | 99.96% |
| H12416_MB_4m_MLLW_Final | 99.98% |

*Figure 13: Density Requirements*

### B.2.10 Coverage Holidays

Complete multibeam coverage was obtained within the limits of H12416. Holidays greater than three nodes did occur, generally in areas of depths less than 4-meters. The following are examples of coverage holidays.

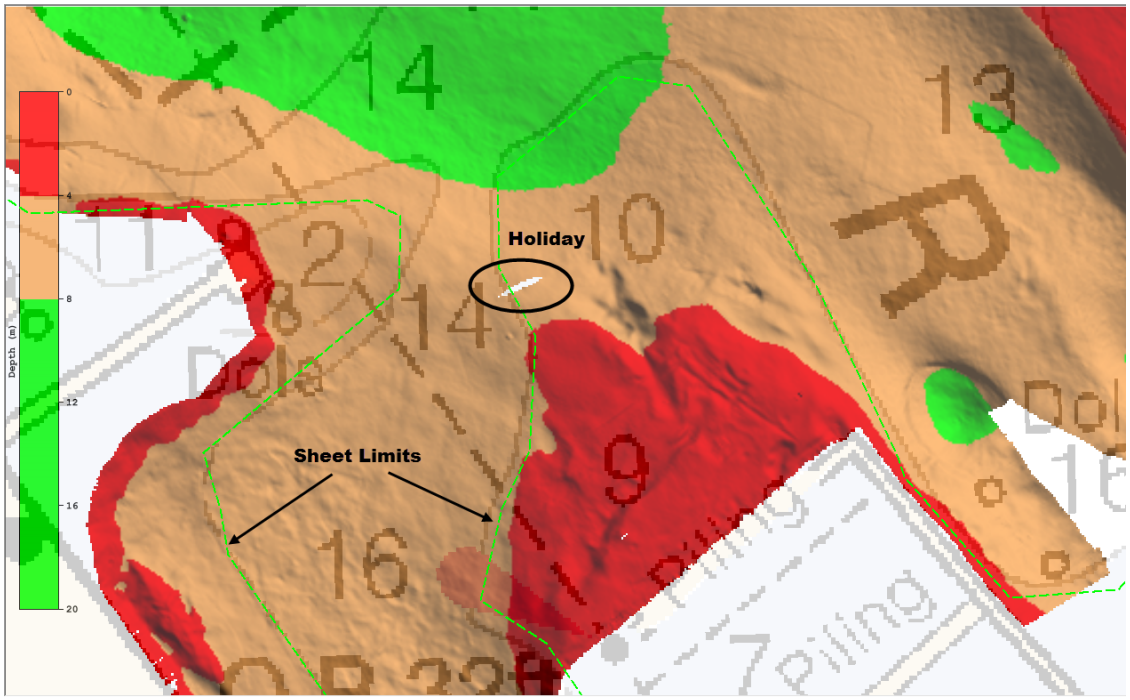



*Figure 14: Coverage holiday NW of Port Jefferson ferry pier.*

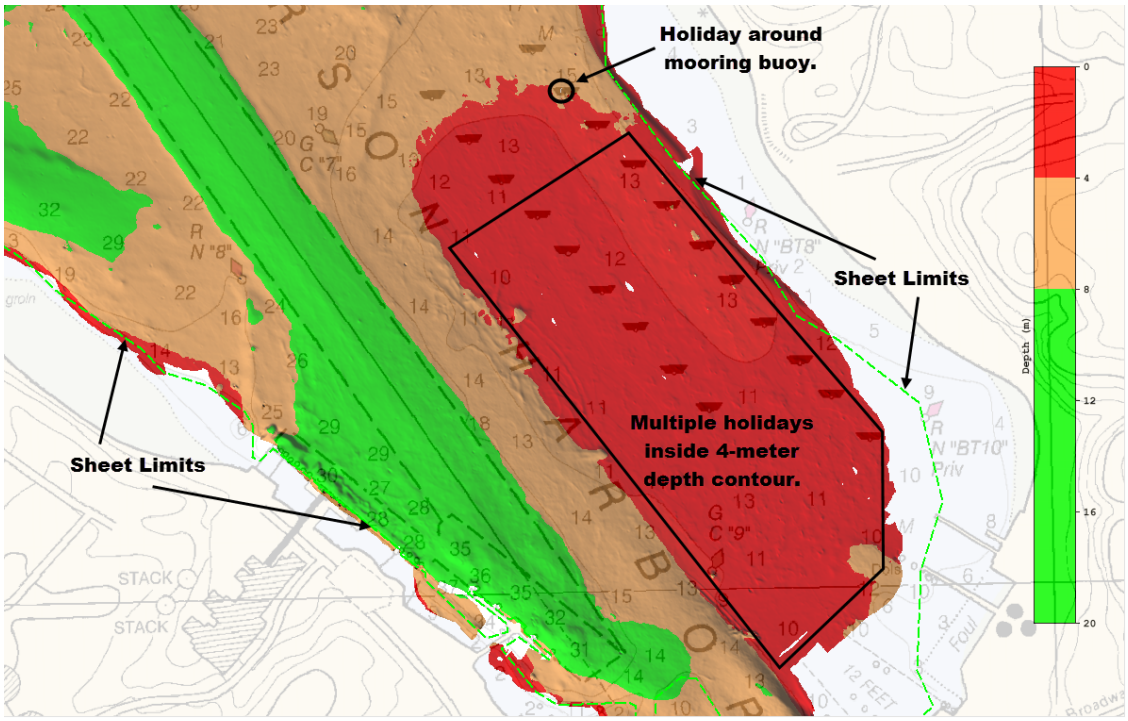



*Figure 15: Multiple coverage holidays around mooring buoys inside 4-meter depth contour.*

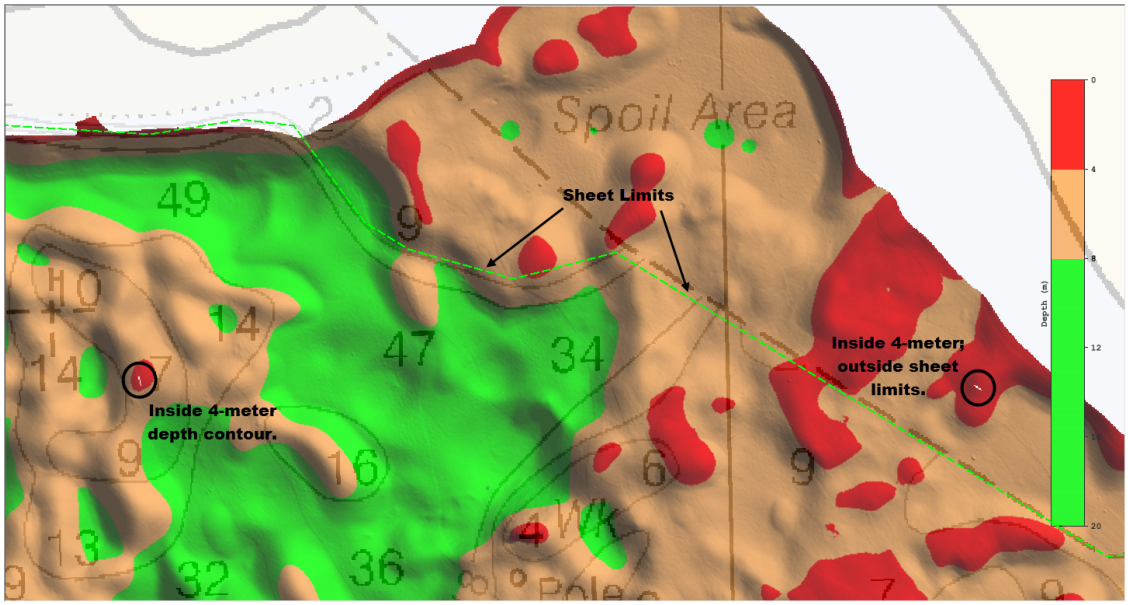



*Figure 16: Coverage holidays inside 4-meter depth contour; NE Port Jefferson.*

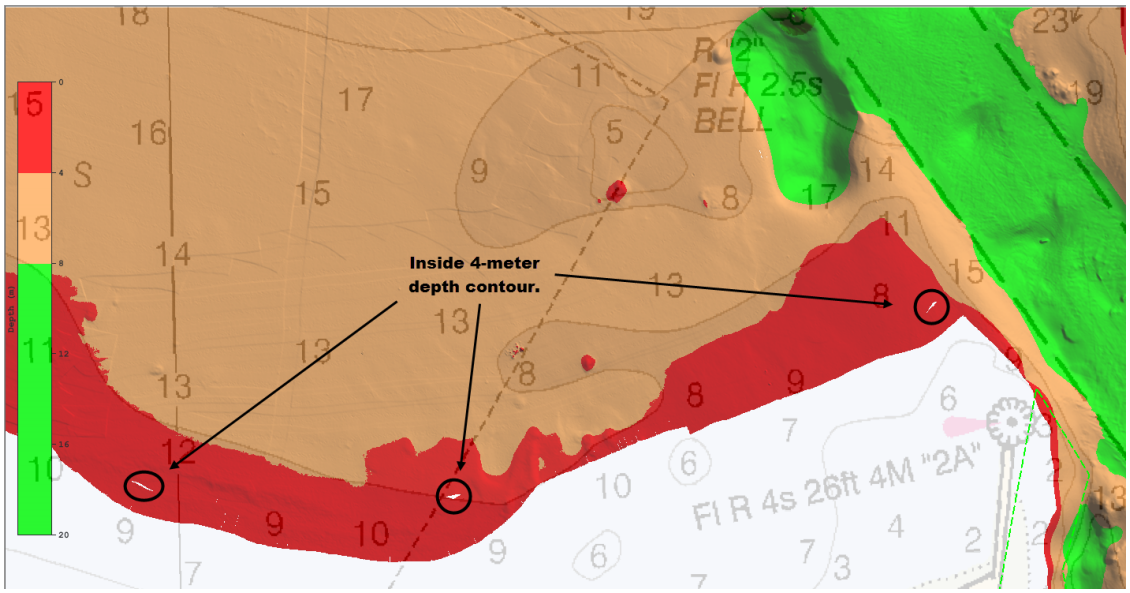



*Figure 17: Multiple coverage holidays inside 4-meter depth contour; W of Port Jefferson entrance.*

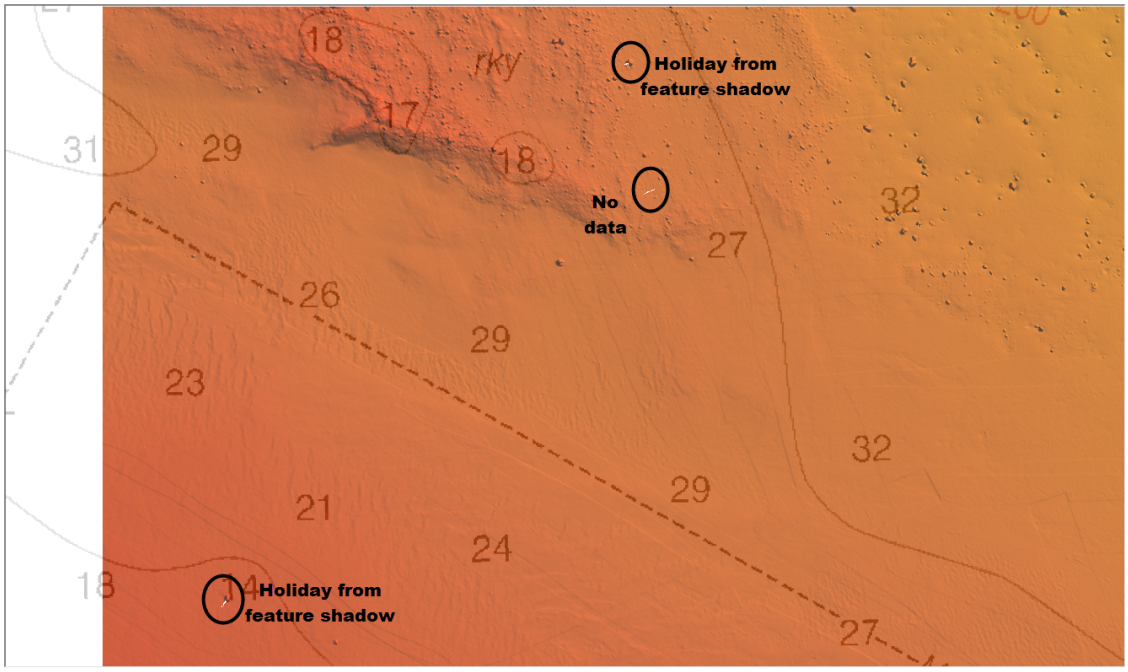



*Figure 18: Coverage holidays caused by feature shadows; NW of Port Jefferson entrance.*

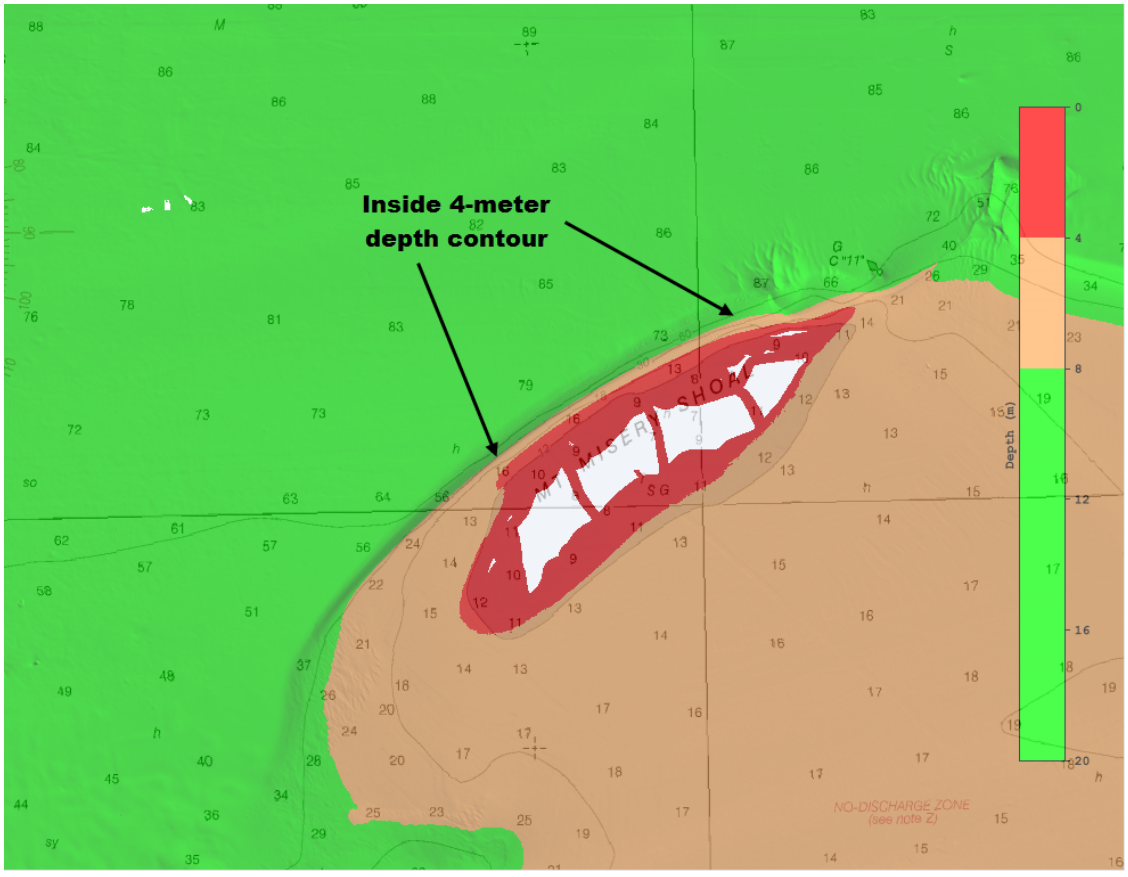



*Figure 19: Multiple coverage holidays inside 4-meter depth contour of Mt Misery Shoal.*

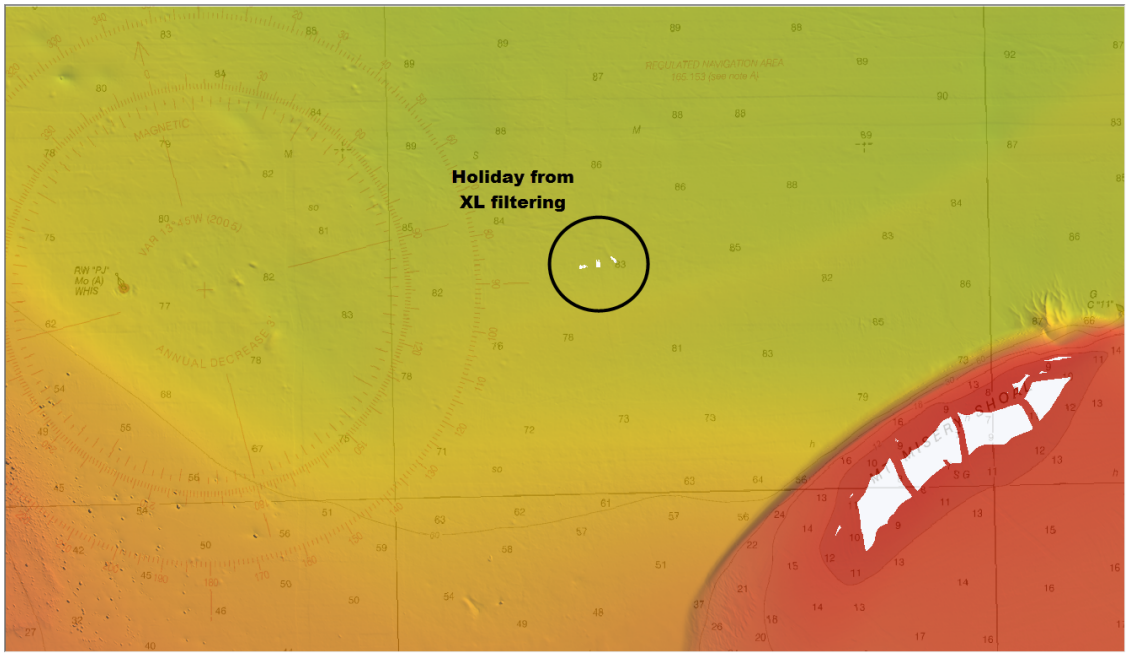



*Figure 20: Coverage holiday left from XL filtering; E of Mo (A) buoy.*

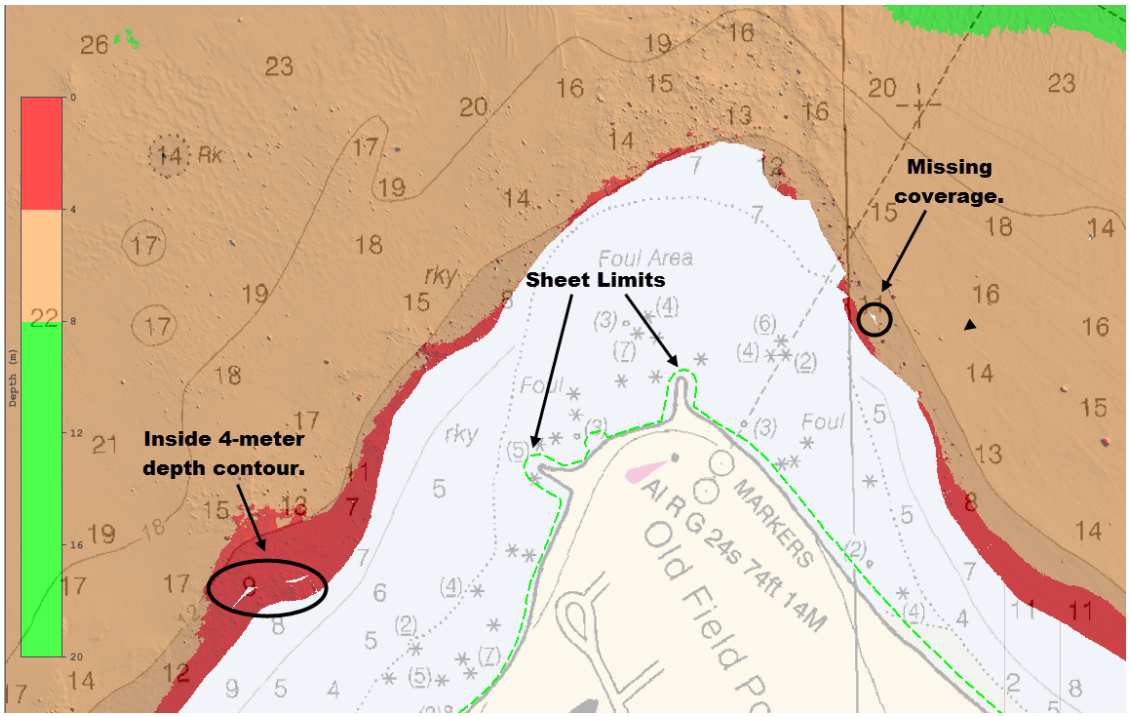



*Figure 21: Coverage holidays N of Old Field Point.*

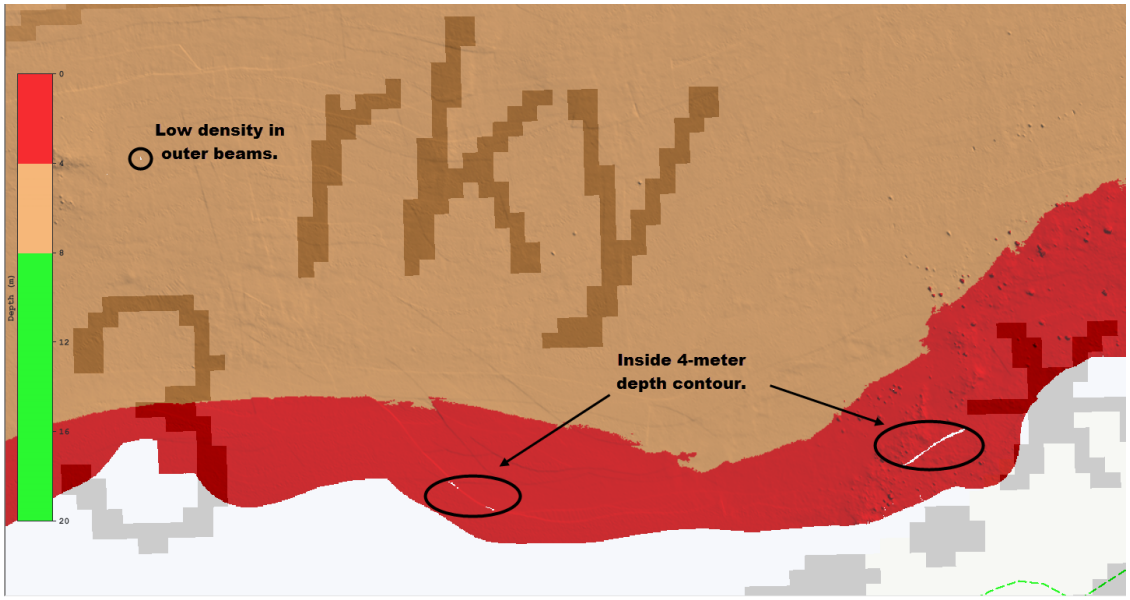



*Figure 22: Coverage holidays SW of Old Field Point.*

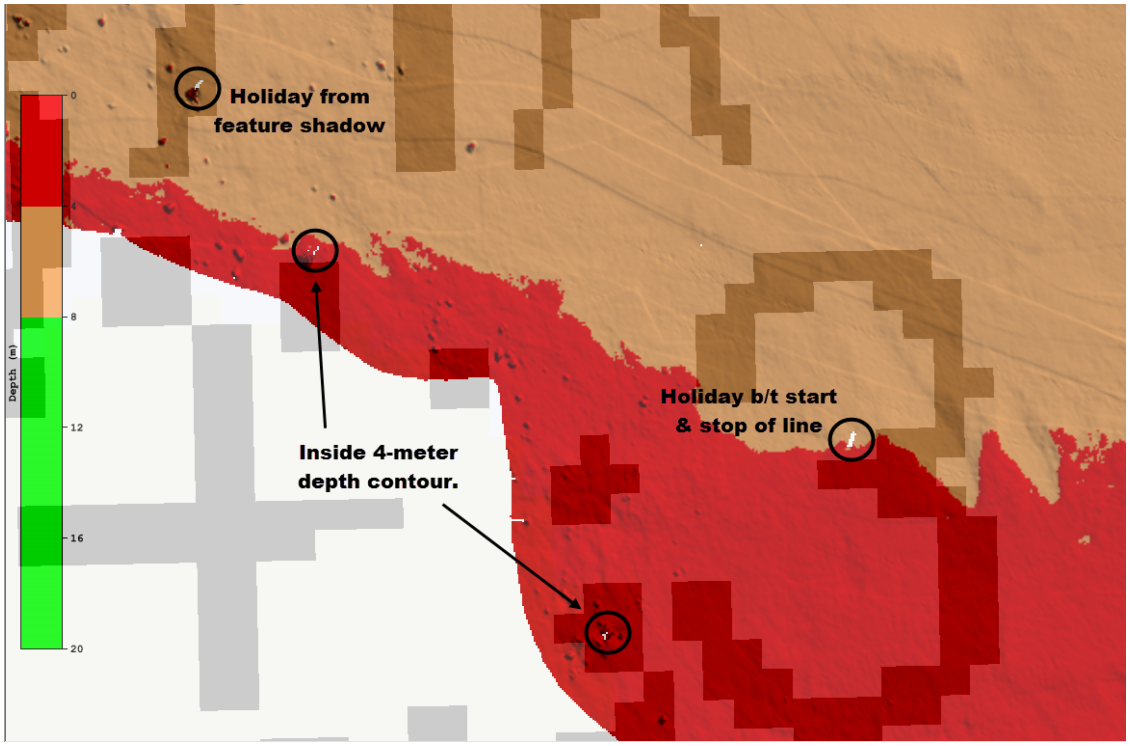



*Figure 23: Coverage holidays N of Crane Neck Point.*

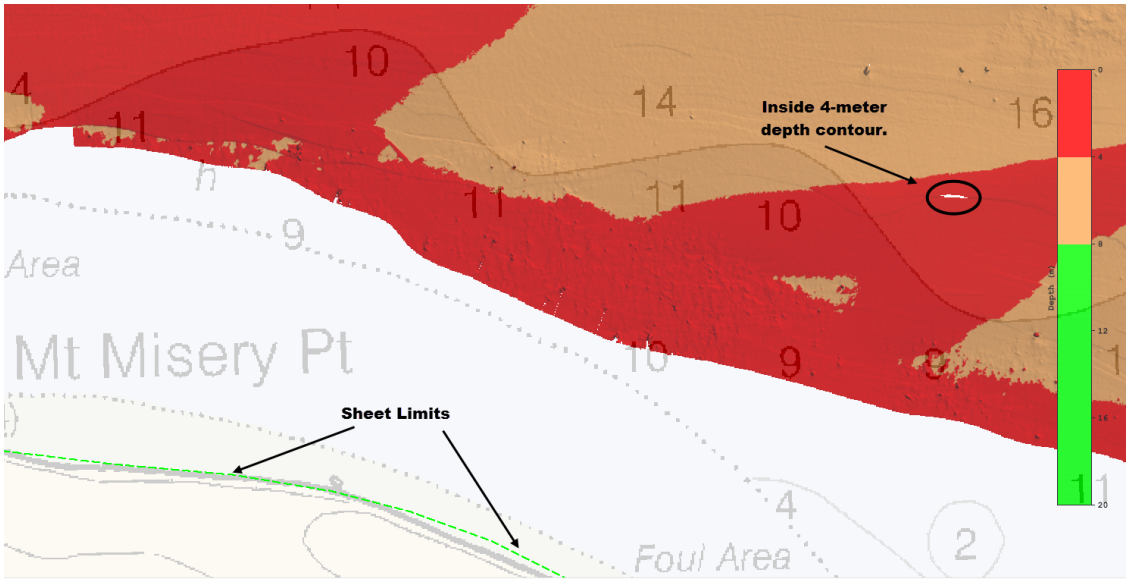



*Figure 24: Coverage holiday inside 4-meter depth contour; NE of Mt Misery Point.*

## B.3 Echo Sounding Corrections

### B.3.1 Corrections to Echo Soundings

Trueheave was not applied to four lines from vessel 3101 on DN 171 (Lines: 171_2103, 171A_1333, 171A_1704, and 171A_2059). The hydrographer investigated these lines and found that the lines were in general agreement with the surrounding data and did not exhibit any offsets due to trueheave not being applied.

### B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

## B.4 Backscatter

Backscatter was logged as a s7k file and submitted to the IOCM processing center and/or directly to NGDC, and is not included with the data submitted to the Branch.

## B.5 Data Processing

### B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAAProfileField Version 5.3.2

### 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 |
|---|---|---|---|---|---|
| H12416_MB_50cm_MLLW | CUBE | 0.5 meters | 0.85 meters - 125.47 meters | NOAA_0.5m | Object Detection |
| H12416_MB_50cm_MLLW_Final | CUBE | 0.5 meters | 0 meters - 20 meters | NOAA_0.5m | MBES TracklineSBES Set Line Spacing |
| H12416_MB_2m_MLLW | CUBE | 2 meters | 0.85 meters - 54.01 meters | NOAA_2m | Complete MBES |
| H12416_MB_2m_MLLW_Final | CUBE | 2 meters | 18 meters - 40 meters | NOAA_2m | Complete MBES |
| H12416_MB_4m_MLLW | CUBE | 4 meters | 0.89 meters - 54 meters | NOAA_4m | Complete MBES |
| H12416_MB_4m_MLLW_Final | CUBE | 4 meters | 36 meters - 54 meters | NOAA_4m | Complete MBES |

*Table 9: Submitted Surfaces*

The NOAA CUBE parameters mandated in HSSD were used for the creation of all CUBE BASE surfaces in Survey H12416. The surfaces have been reviewed where noisy data, or 'fliers', are incorporated into the gridded solution causing the surface to be shoaler or deeper than the true seafloor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable vertical uncertainty at that depth, the noisy data have been rejected and the surface recomputed.

### B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs. All data logs are submitted digitally in the Separates I folder.

# C. Vertical and Horizontal Control

No HVCR was submitted for H12416 per Section 5.1.2.3 of the NOAA Field Procedures Manual (ed 2012).

## C.1 Vertical Control

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

Standard Vertical Control Methods Used:

TCARI

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

| Station Name | Station ID |
|---|---|
| Bridgeport, CT | 8467150 |
| New Haven, CT | 8465705 |
| Kings Point, NY | 8516945 |

*Table 10: NWLON Tide Stations*

| File Name | Status |
|---|---|
| 8465705.tid | Final Approved |
| 8467150.tid | Final Approved |
| 8516945.tid | Final Approved |

*Table 11: Water Level Files (.tid)*

| File Name | Status |
|---|---|
| B340TJ2012_Rev.tc | Final |

*Table 12: Tide Correctors (.zdf or .tc)*

A request for final approved tides was sent to N/OPS1 on 07/01/2012. The final tide note was received on 08/10/2012.

TACARI tides were applied to H12416 for initial data analysis. Data for H12416 was reduced to MLLW via VDatum.

Non-Standard Vertical Control Methods Used:

VDatum

Ellipsoid to Chart Datum Separation File:

2012_B340_VDatum_Ellip_MLLW.txt

Per the Project Instructions Appendix I, a VDatum ERS test and evaluation was performed and provided to HSD. VDatum was approved by HSD as the vertical datum reducer to MLLW for survey H12416 on 8/3/2012. Memos have been provided in Appendix I of this report.

## C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is 18N.

The following PPK methods were used for horizontal control:

Smart Base

The following CORS Stations were used for horizontal control:

| HVCR Site ID | Base Station ID |
|---|---|
| CTDA | CTDA |
| MOR6 | MOR6 |
| NYCI | NYCI |
| NYQN | NYQN |
| NYRH | NYRH |
| ZNYI | ZNYI |

*Table 13: CORS Base Stations*

The following DGPS Stations were used for horizontal control:

| DGPS Stations |
|---|
| 804 Sandy Hook, NJ 286 kHZ |
| 803 Moriches, NY 293 kHz |
| 772 Acushnet, MA 306 kHz |

*Table 14: USCG DGPS Stations*

# D. Results and Recommendations

## D.1 Chart Comparison

Per Section 4.5 of the Field Procedures Manual (ed 2012), a chart comparison was performed of the largest scale ENC's and raster charts that cover the project area. Survey scale sounding selection and contours made from the combined surface were utilized in CARIS BASE Editor to perform this task.

### D.1.1 Raster Charts

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

| Chart | Scale | Edition | Edition Date | LNM Date | NM Date |
|---|---|---|---|---|---|
| 12354 | 1:80000 | 44 | 05/2012 | 06/26/2012 | 07/30/2012 |
| 12364 | 1:40000 | 39 | 09/2012 | 06/18/2013 | 06/29/2013 |
| 12364 | 1:10000 | 39 | 09/2012 | 06/18/2013 | 06/29/2013 |
| 12362 | 1:10000 | 17 | 02/2005 | 06/26/2012 | 06/30/2012 |

*Table 15: Largest Scale Raster Charts*

12354

Soundings from survey H12416 generally agreed within 3 feet of charted depths on chart 12354. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

12364

Soundings from survey H12416 generally agreed within 3 feet of charted depths on chart 12364. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

12364

Soundings from survey H12416 generally agreed within 3 feet of charted depths on small-craft chart 12364, page H. Notable exceptions to this general agreement are listed and shown in the figures below. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

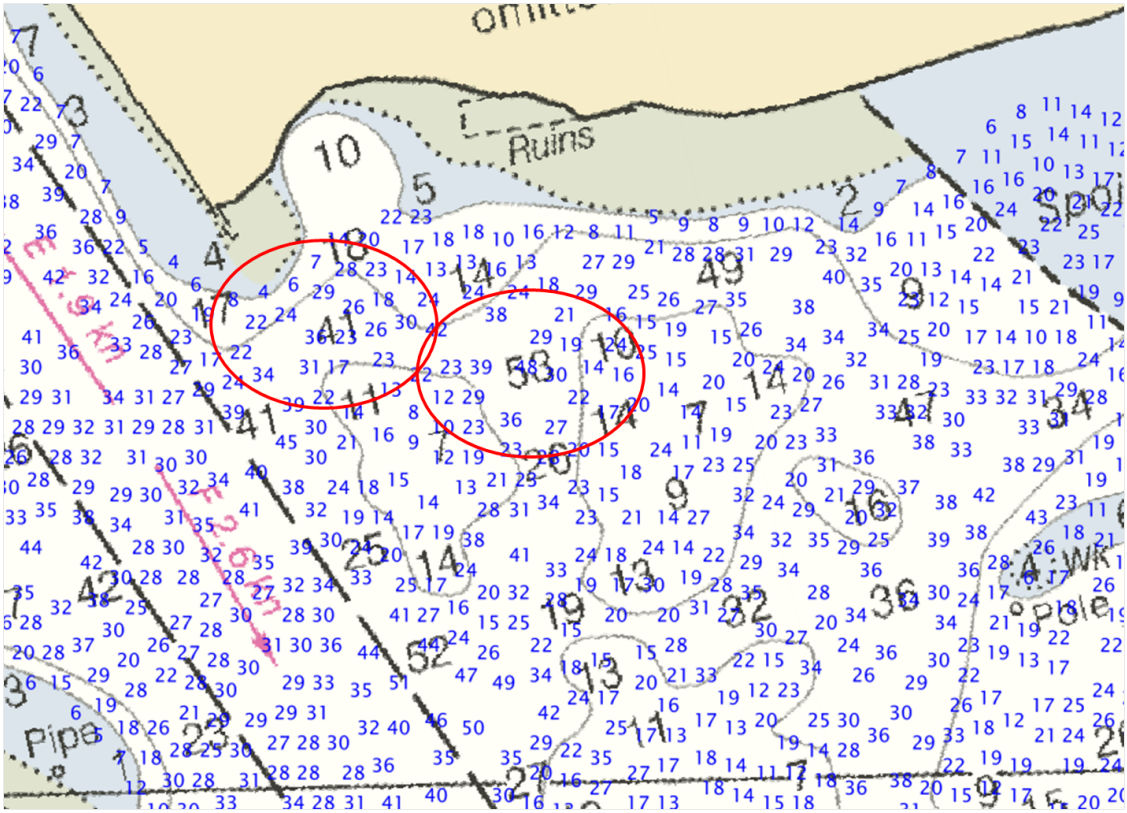



*Figure 25: Survey soundings significantly shoaler in NE Port Jefferson.*

12362

Soundings from survey H12416 generally agreed within 3 feet of charted depths on Chart 12362. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

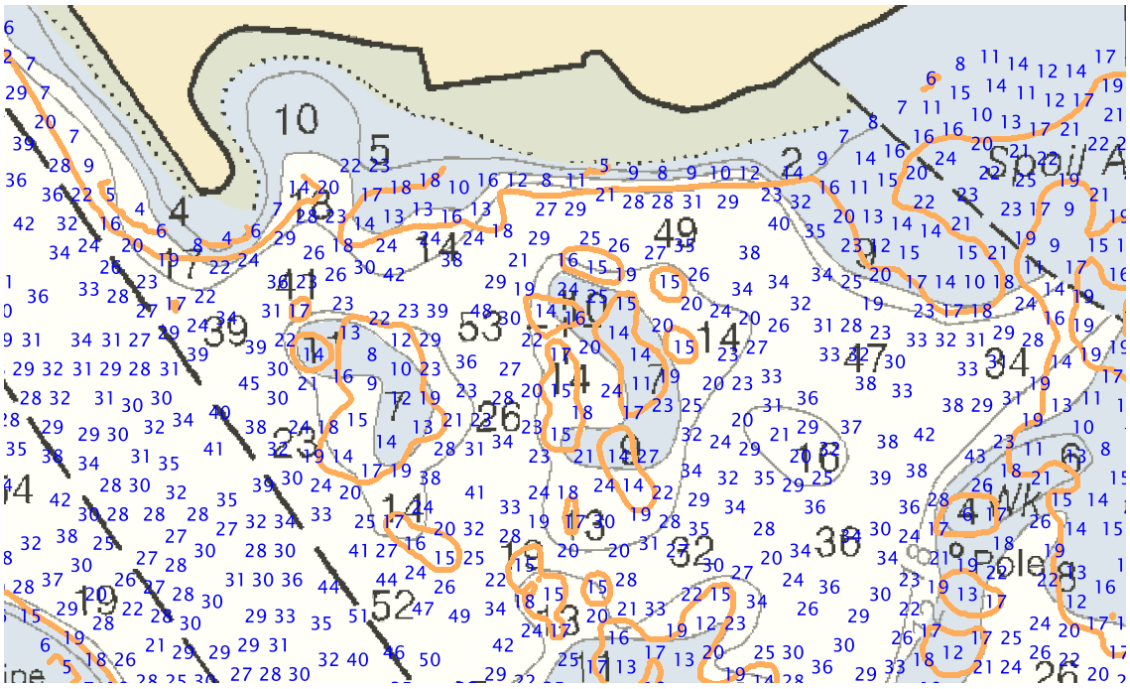


*Figure 26: Multiple discrepancies were found between charted and survey data in the NE section of Port Jefferson.*

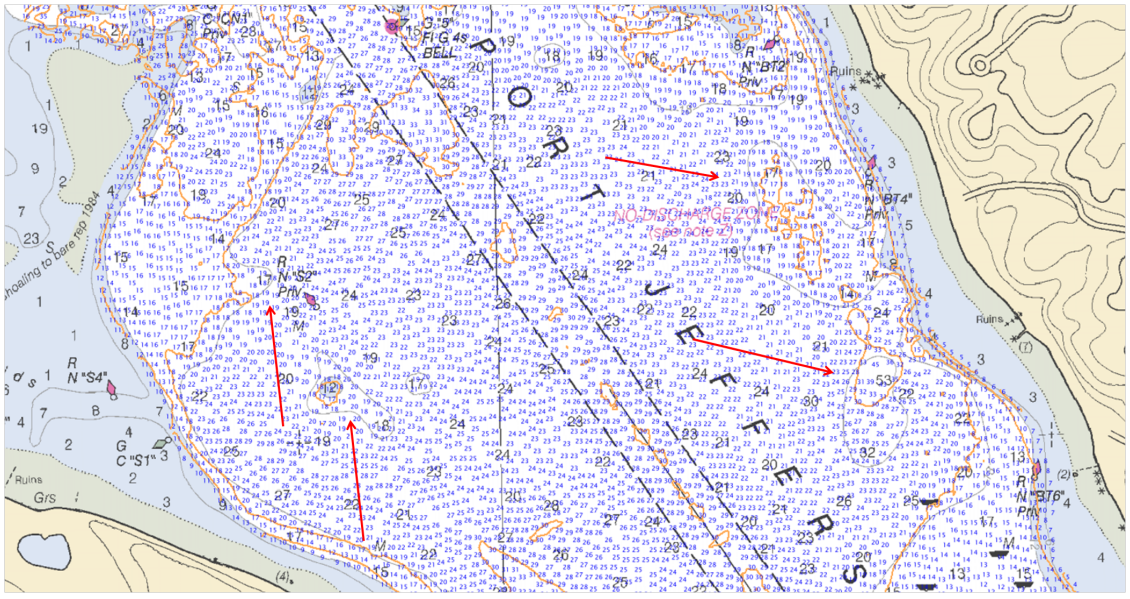



*Figure 27: Shifting of contours within Port Jefferson.*

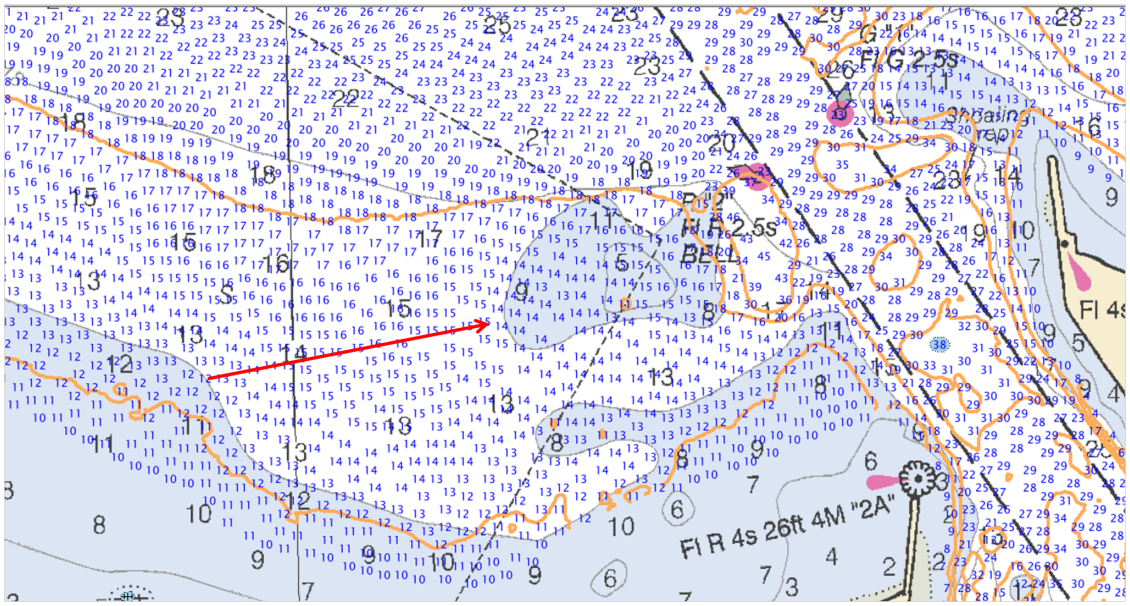



*Figure 28: Shoal at the mouth of the entrance to Jefferson Harbor was disproved by survey data.*

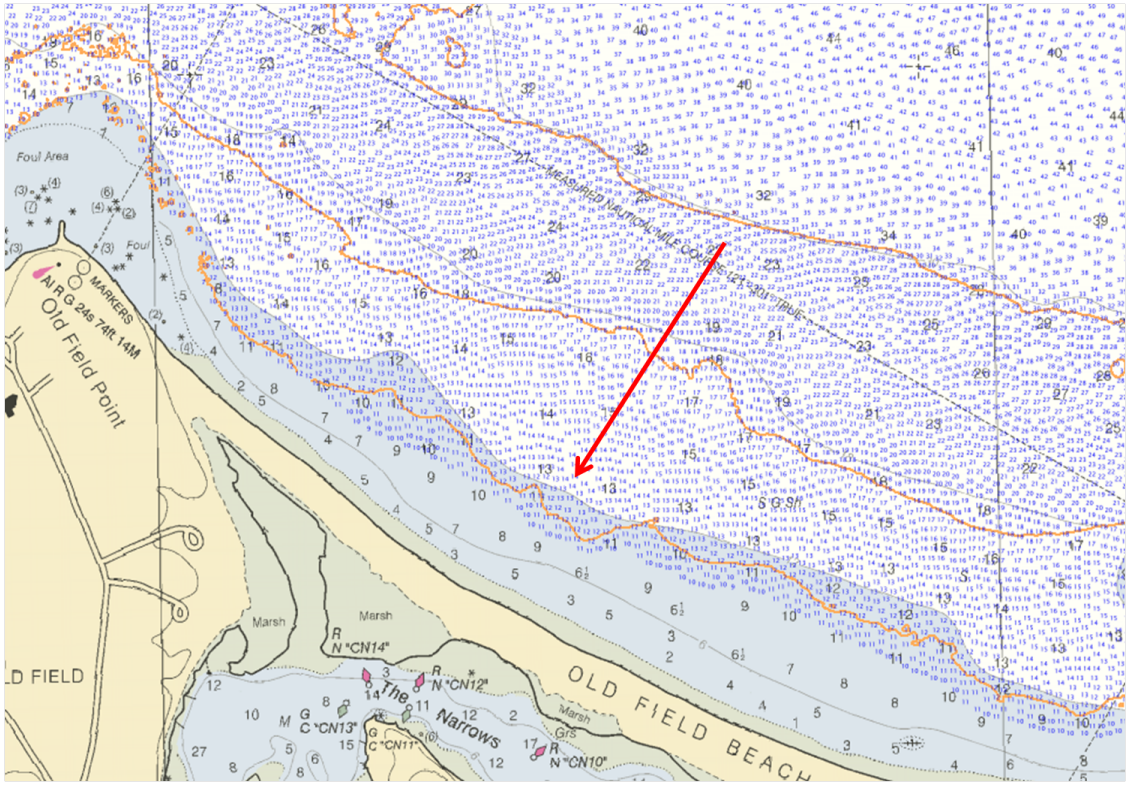



*Figure 29: The 12 foot contour has shifted shoreward along Old Field Beach.*

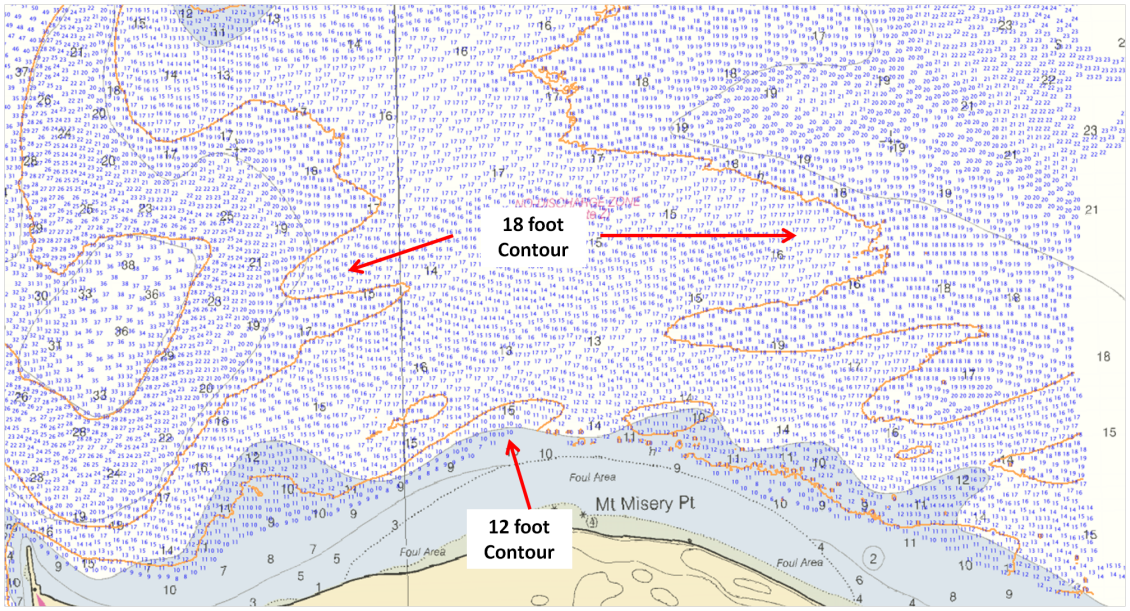



*Figure 30: 18 and 12 foot contours have shifted along Mt Misery Pt.*

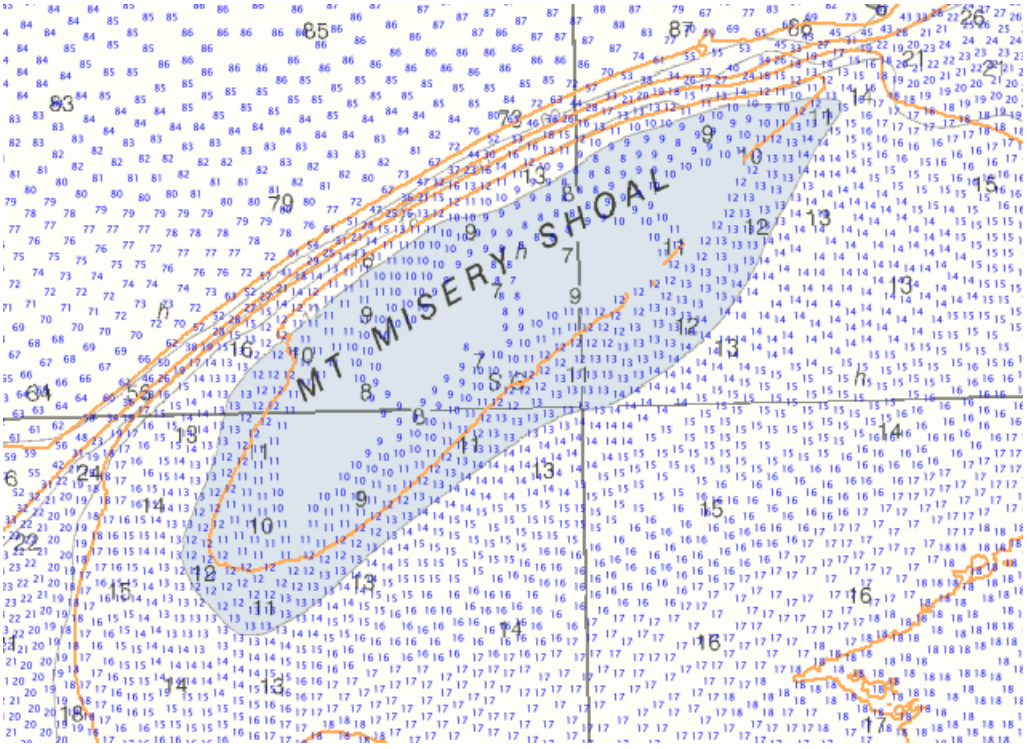



*Figure 31: Mt Misery Shoal has shifted to the NW by 80 meters.*

### D.1.2 Electronic Navigational Charts

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

| ENC | Scale | Edition | Update Application Date | Issue Date | Preliminary? |
|---|---|---|---|---|---|
| US4NY1GM | 1:80000 | 24 | 12/06/2012 | 04/12/2013 | NO |
| US5NY17M | 1:10000 | 9 | 05/22/2012 | 03/11/2012 | NO |
| US5CN10M | 1:40000 | 4 | 07/24/2013 | 05/14/2013 | NO |

*Table 16: Largest Scale ENCs*

US4NY1GM

ENC US4NY1GM depths match RNC 12354; therefore, all RNC comparisons stated in D.1.1 apply to US4NY1GM.

US5NY17M

ENC US5NY17M depths match RNC 12362; therefore, all RNC comparisons stated in D.1.1 apply to US5NY17M.

US5CN10M

ENC US5CN10M depths match RNC 12364; therefore, all RNC comparisons stated in D.1.1 apply to US5CN10M.

### D.1.3 AWOIS Items

2 AWOIS items were assigned for verification and 2 AWOIS items were provided as "Information Only". All AWOIS items were addressed in the Final Feature File.

### D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

### D.1.5 Charted Features

No charted PA, ED, PD or Rep were found within the survey area of H12416. It was observed during survey operations that there are numerous private mooring buoys found on the west side of Port Jefferson. It is

recommended to retain annotation on the chart. The annotation was not present in the Composite Source File, therefore was not added to the Final Feature File for this survey.

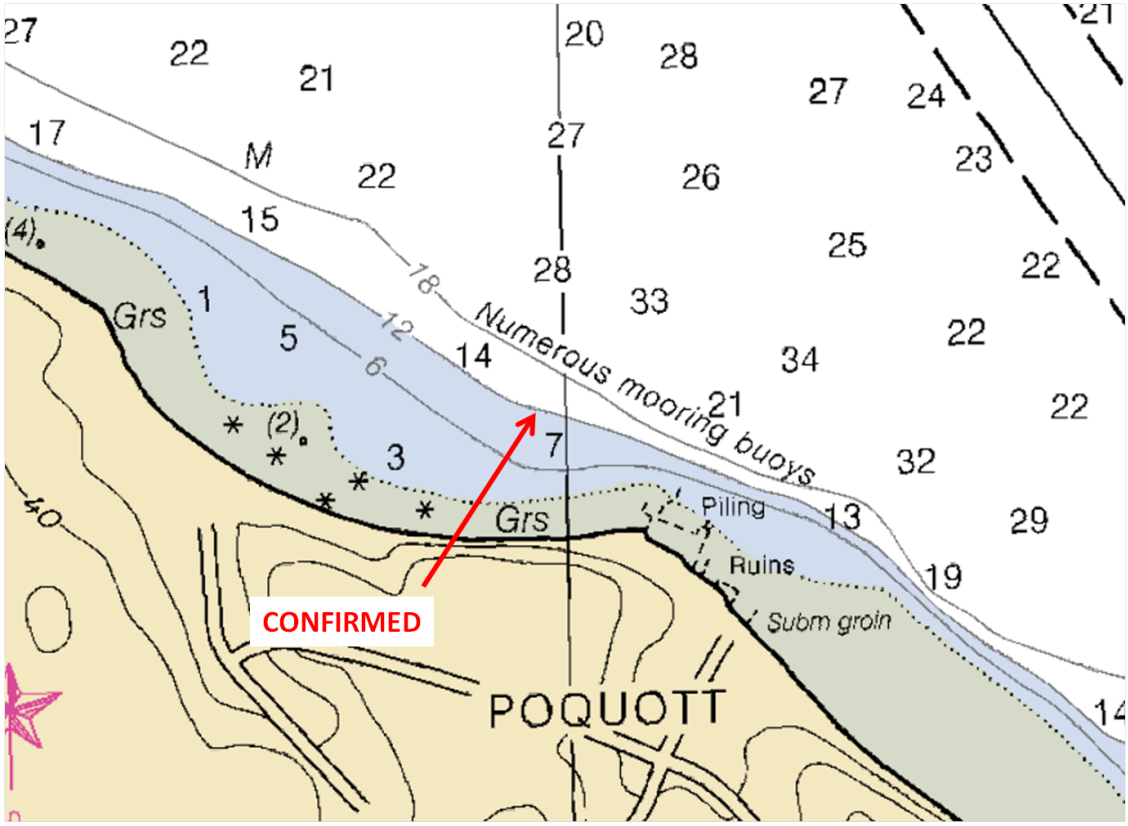



*Figure 32: Annotation on chart 12362.*

### D.1.6 Uncharted Features

Survey H12416 contains 12 new wrecks, 19 new underwater rocks, 21 new obstructions and 3 new mooring buoys. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

### D.1.7 Dangers to Navigation

The following DTON reports were submitted to the processing branch:

| DTON Report Name | Date Submitted |
|---|---|
| H12416_DTON1 | 2012-06-22 |
| H12416_DTON2 | 2012-09-11 |

*Table 17: DTON Reports*

A total number of two DTON reports were submitted to the Marine Charting Branch for survey H12416. For further information, please refer to Appendix II of this report.

### D.1.8 Shoal and Hazardous Features

Charted "Mt Misery Shoal" was confirmed with multibeam data. Full multibeam coverage was not obtained over the shoal due to safety.

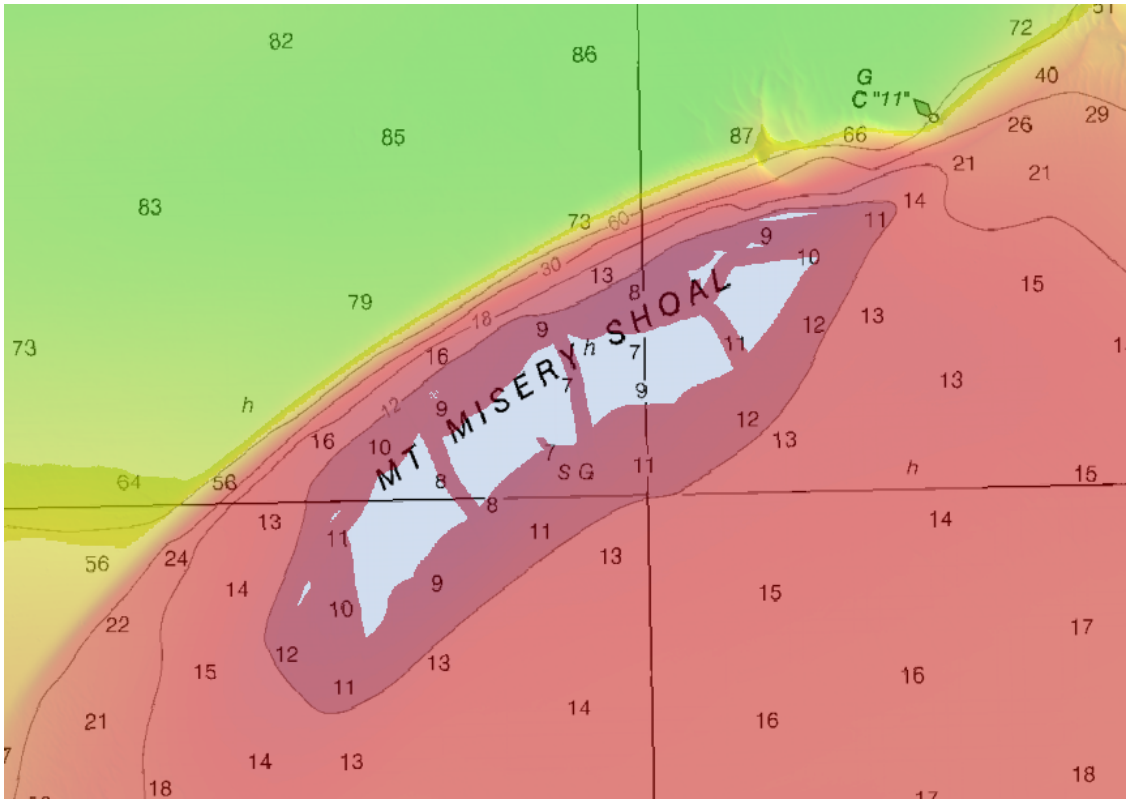



*Figure 33: Charted Mt Misery Shoal with multibeam coverage.*

### D.1.9 Channels

According to the coast pilot, a Federal project provides for a channel 26 feet deep from Long Island Sound to the south end of Port Jefferson Harbor. A 24 foot sounding was located in the channel. The location of this discrepancy is 300 meters southwest of the northeast breakwater.

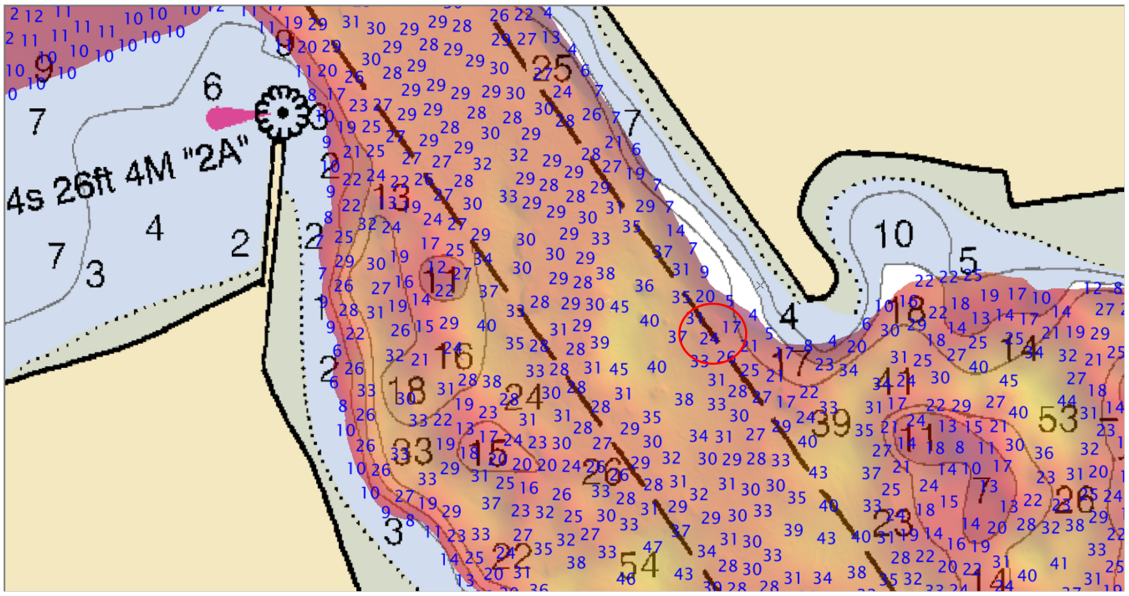



*Figure 34: 24ft sounding found within the USCG maintained channel.*

### D.1.10 Bottom Samples

21 bottom samples were collected were collected for H12416.

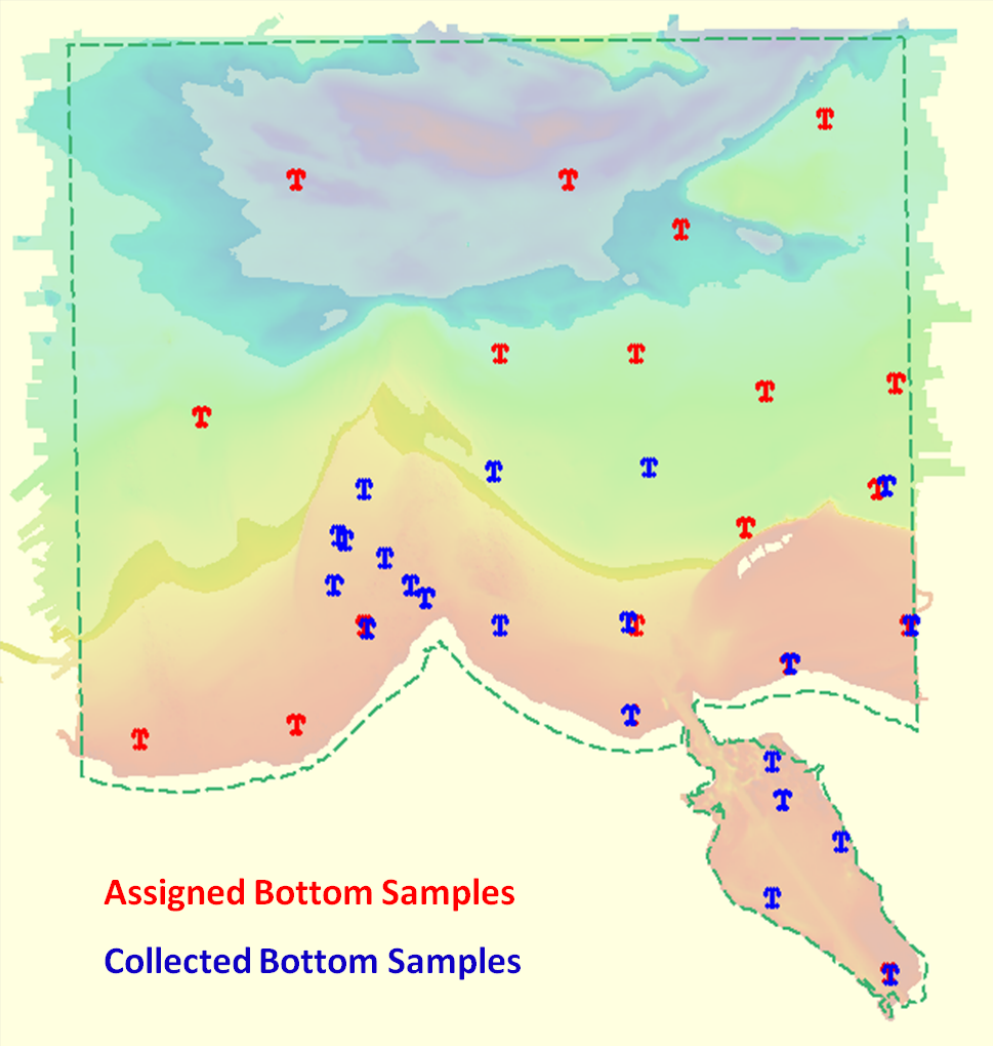



*Figure 35: Locations of bottom samples for survey H12416.*

## D.2 Additional Results

### D.2.1 Shoreline

Limited shoreline verification was accomplished using the composite source file provided with the Project Instructions. Of the 130 features assigned to H12416, 85 of the features were in areas too shallow to be safely developed. These features were not addressed. Descriptions of specific feature investigation and shoreline data are included in the Final Feature File submitted with this survey.

21 charted mooring buoys were identified for investigation. During feature investigation, it was found that these charted mooring buoys were private buoys of a seasonal nature. With guidance of the AHB's Hydrographic Team Lead, Gene Parker, it was determined that a buoy area would be used to outline the extents of the mooring field. It is recommended that the chart be updated with this area with a notation indicating “seasonal mooring buoys.” Correspondence has been provided on this subject in Appendix II.

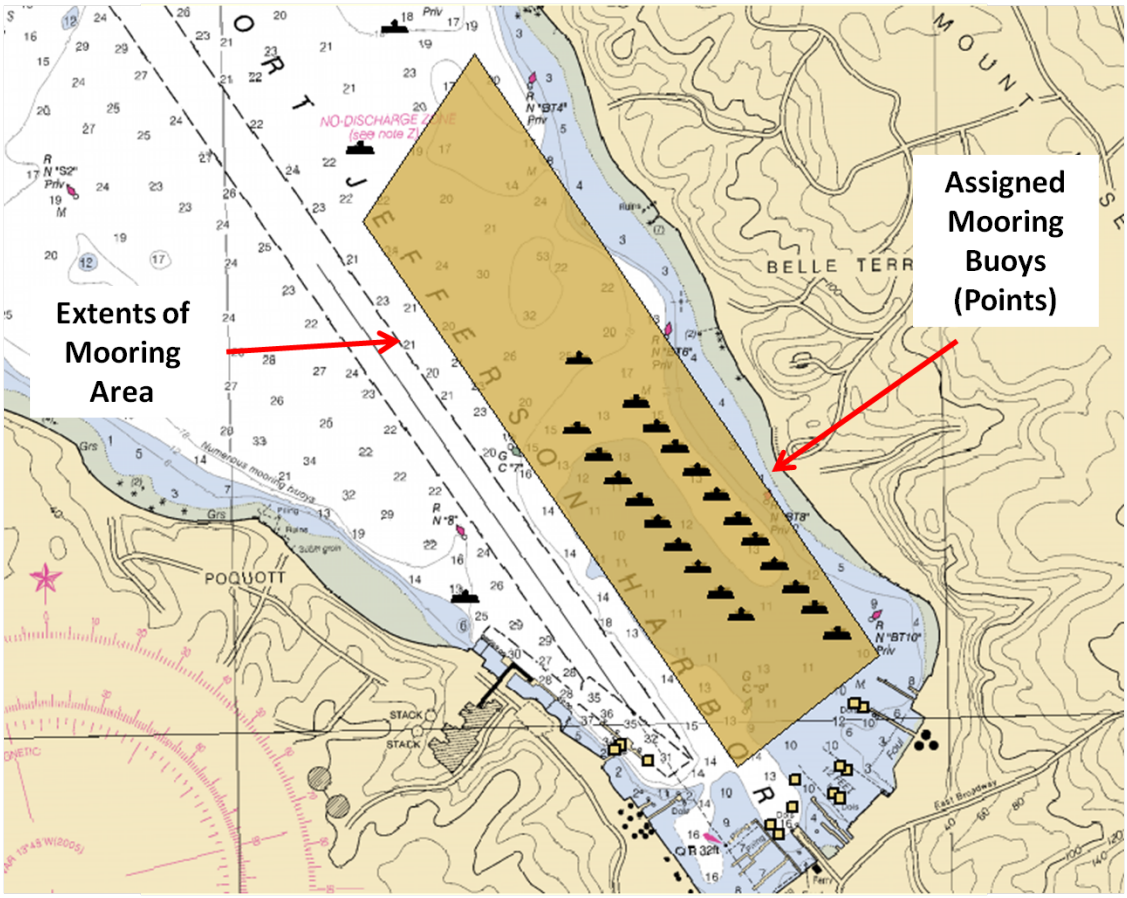



*Figure 36: Extents of New Mooring Area and assigned Buoys.*

### D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

### D.2.3 Aids to Navigation

All ATONs were found to be on station and serving their intended purpose.

### 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 Ferry Routes and Terminals

Ferry routes and/or terminals exist for this survey, but were not investigated.

### D.2.7 Platforms

No platforms exist for this survey.

### D.2.8 Significant Features

Five new sandwave areas were created during review of the high resolution mutlibeam data collected for H12416. The new sandwave areas have been provided in the final feature file for compilation purposes.

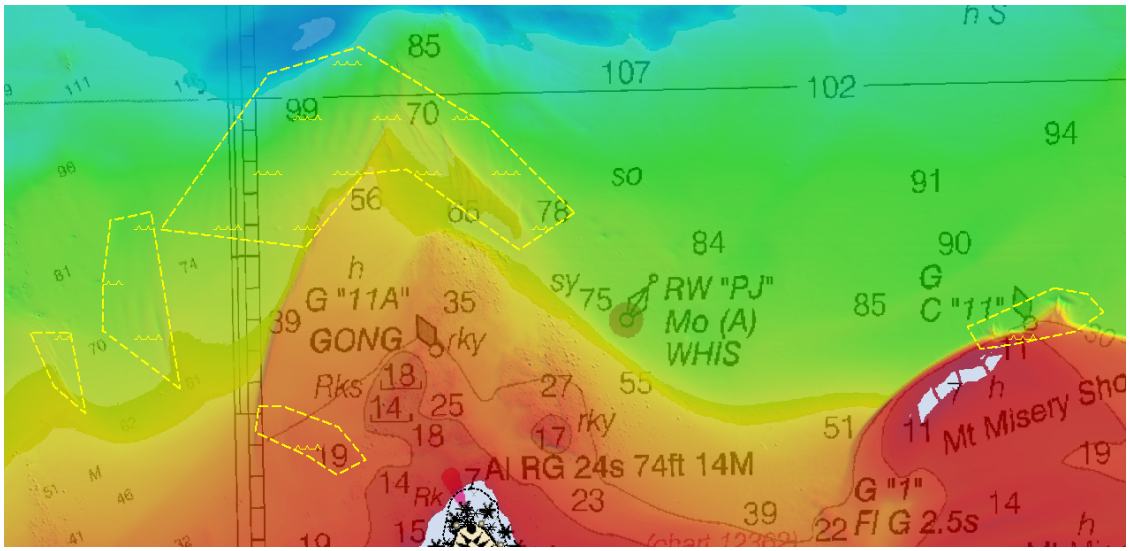



*Figure 37: Sandwaves seen in the surfaces with their corresponding new features for charting purposes.*

### D.2.9 Construction and Dredging

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

# 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 and Specifications Deliverables Manual, Field Procedures Manual, Standing and 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 |
|---|---|---|---|
| Commander<br>Lawrence T. Krepp | Commanding Officer | 08/27/2013 | |
| Lieutenant Megan<br>R. Guberski | Field Operations Officer | 08/27/2013 | |

# 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** | Continually Operating Reference Staiton |
| **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 |
| **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 |
| **HSSD** | Hydrographic Survey Specifications and Deliverables |

| Acronym | Definition |
|---|---|
| **HSTP** | Hydrographic Systems Technology Programs |
| **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** | Local Notice to Mariners |
| **LNM** | Linear Nautical Miles |
| **MCD** | Marine Chart Division |
| **MHW** | Mean High Water |
| **MLLW** | Mean Lower Low Water |
| **NAD 83** | North American Datum of 1983 |
| **NAIP** | National Agriculture and Imagery Program |
| **NALL** | Navigable Area Limit Line |
| **NM** | 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 |
| **PST** | Physical Science Technician |
| **RNC** | Raster Navigational Chart |
| **RTK** | Real Time Kinematic |
| **SBES** | Singlebeam Echosounder |
| **SBET** | Smooth Best Estimate and Trajectory |
| **SNM** | Square Nautical Miles |
| **SSS** | Side Scan Sonar |
| **ST** | Survey Technician |
| **SVP** | Sound Velocity Profiler |
| **TCARI** | Tidal Constituent And Residual Interpolation |
| **TPU** | Total Porpagated Error |
| **TPU** | Topside Processing Unit |
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United Stated Coast Guard |
| **UTM** | Universal Transverse Mercator |
| **XO** | Executive Officer |
| **ZDA** | Global Positiong System timing message |
| **ZDF** | Zone Definition File |

# Appendix 3:  Sediment Texture Cruise Details

LDEO Cruise details LIS1303 – sediment sampling

Field work was carried out in June 2013 together with sediment coring. For the grab sampling we used the *RV Seawolf* (Stony Brook University) for most areas and the *RV Pritchard* (Stony Brook University) for shallow sites along the southern shore.

Dates of sampling: 5. June. 2013 to 13. June 2013

Start and end in Port Jefferson, NY every day

Vessels:

- RV Seawolf (Stony Brook University)

- RV Pritchard (Stony Brook University)

In total we collected 196 grab samples (Tab. A3-1) and 46 sediment cores (Tab. A3-2). Figure A3-1 shows the location of the sediment grab sites collected by USGS and LDEO/Queens. Figure A3-2 shows the location of the sediment core sites.

**Table A3.1: Table A3-1: Field data details of the sediment grab collection.**

| Survey date | Field days | Vessel | Grab samples |
|---|---|---|---|
| June 5-12 2013 | 6 | Seawolf | 167 |
| June 13 2013 | 1 | Pritchard | 29 |
| **Total** | 7 | | **196** |

**Table A3.2: Field data details of the sediment core collection.**

| Survey date | Field days | Vessel | Core samples |
|---|---|---|---|
| June 5-12 2013 | 6 | Seawolf | 46 |

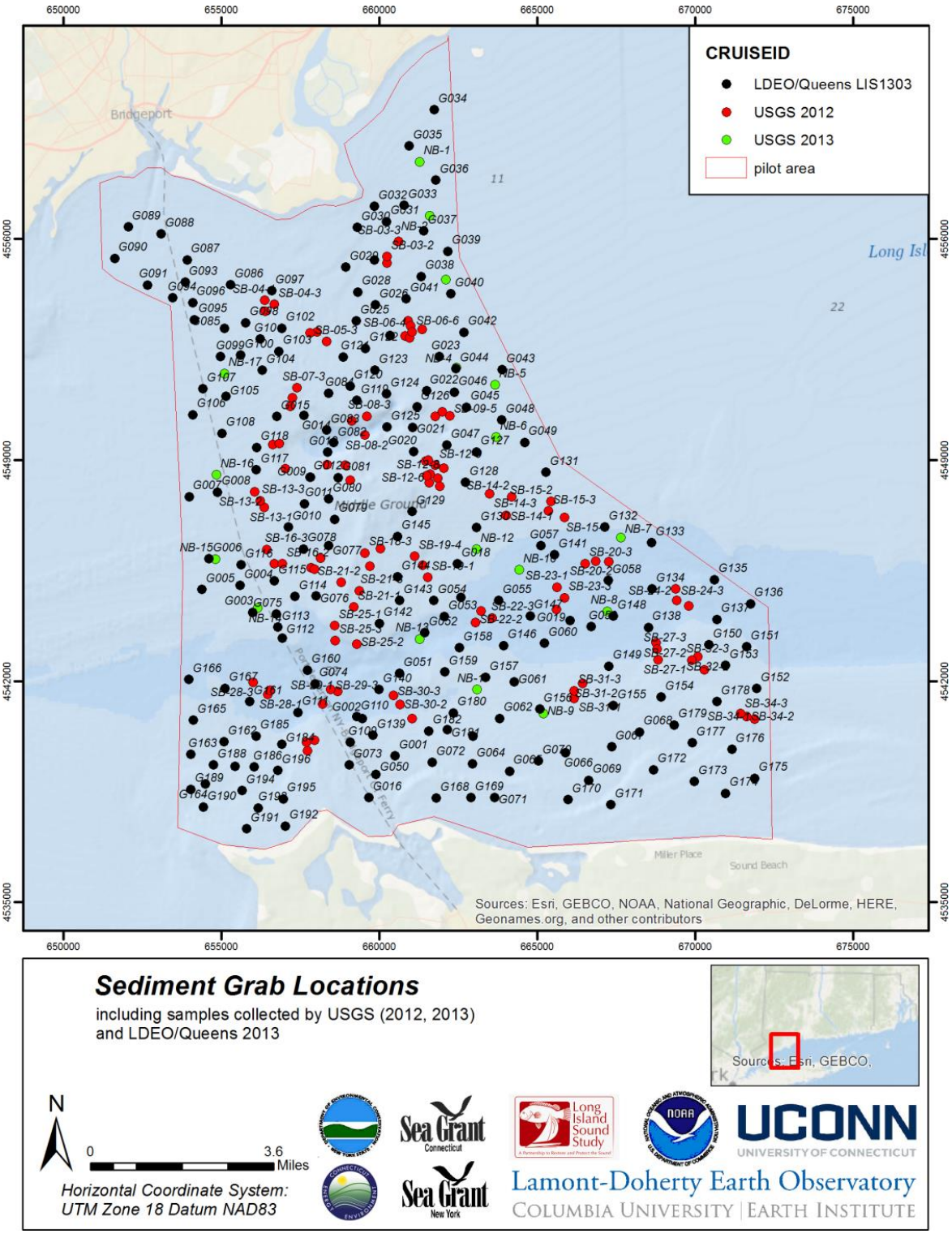



**Figure A3-1: Location of sediment grab samples collected by the USGS surveys in 2012 and 2013 (red and green respectively) and in June 2013 by the LDEO/Queens College group (black).**

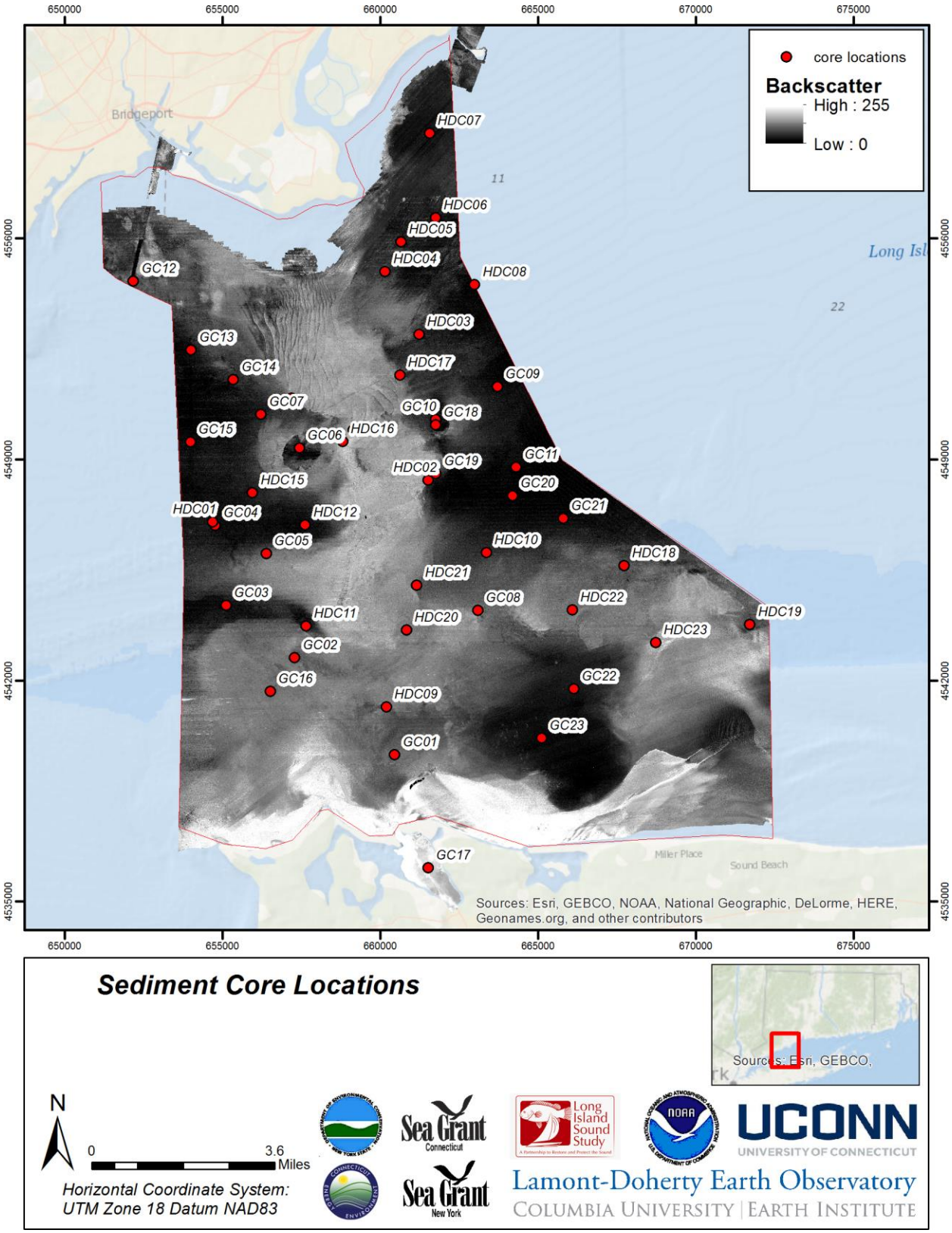



**Figure A3-2: Location of the sediment cores over the backscatter mosaic. GCxx are gravity cores and HDCxx are cores taken with the hydraulic-damped corer**

The sediment grabs were collected using a modified van Veen grab. Upon recovery of the grab samples, the following procedure was followed. A surface photo was taken and a brief description about the sediment texture and composition was noted in a table.

For the sediment core collection we used a small gravity corer (from LDEO) and a hydraulically damped gravity corer from USGS.

More details about the sampling procedures and sample handling are described in the main report (sections 3 and 4).

# LISMARC Sediment Texture Acquisition Cruise Details
# 2012 Sediment Texture Sampling Log
# 2013 Sediment Texture Sampling Log

# 2012 Sediment Texture Sampling Log

| LABNO | STATIONID | PROJECT | CRUISEID | AREA | LATITUDE |
|---|---|---|---|---|---|
| AZ909 | SB-03-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.132533 |
| AZ910 | SB-03-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.134400 |
| AZ911 | SB-03-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.138633 |
| AZ912 | SB-04-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.122717 |
| AZ913 | SB-04-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.119633 |
| AZ914 | SB-04-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.121550 |
| AZ915 | SB-05-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.113367 |
| AZ916 | SB-05-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.110533 |
| AZ917 | SB-05-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.113067 |
| AZ918 | SB-06-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.111750 |
| AZ919 | SB-06-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.116017 |
| AZ920 | SB-06-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.111133 |
| AZ921 | SB-06-4 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.114533 |
| AZ922 | SB-06-5 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.113417 |
| AZ923 | SB-06-6 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.112800 |
| AZ924 | SB-07-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.094733 |
| AZ925 | SB-07-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.092283 |
| AZ926 | SB-07-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.097583 |
| AZ927 | SB-08-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.087733 |
| AZ928 | SB-08-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.083650 |
| AZ929 | SB-08-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.089050 |
| AZ930 | SB-09-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.089783 |
| AZ931 | SB-09-4 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.088583 |
| AZ932 | SB-09-5 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.088667 |
| AZ933 | SB-10-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.081483 |
| AZ934 | SB-10-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.081750 |
| AZ935 | SB-10-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.074550 |
| AZ936 | SB-11-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.070883 |
| AZ937 | SB-11-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.075533 |
| AZ938 | SB-11-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.075283 |
| AZ939 | SB-12-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.070867 |
| AZ940 | SB-12-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.072150 |
| AZ941 | SB-12-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.075833 |
| AZ942 | SB-12-4 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.073750 |
| AZ943 | SB-12-5 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.068667 |
| AZ944 | SB-12-6 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.069717 |
| AZ945 | SB-12-7 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.076200 |
| AZ946 | SB-12-8 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.071683 |
| AZ947 | SB-12-9 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.074650 |
| AZ948 | SB-13-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.063717 |
| AZ949 | SB-13-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.068233 |
| AZ950 | SB-13-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.065633 |
| AZ951 | SB-14-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.059933 |
| AZ952 | SB-14-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.065133 |
| AZ953 | SB-14-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.066167 |
| AZ954 | SB-15-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.058983 |
| AZ955 | SB-15-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.063600 |

| | | | | | |
|---|---|---|---|---|---|
| AZ956 | SB-15-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.060883 |
| AZ957 | SB-16-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.047567 |
| AZ958 | SB-16-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.047483 |
| AZ959 | SB-16-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.051667 |
| AZ960 | SB-17-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.046167 |
| AZ961 | SB-17-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.048833 |
| AZ962 | SB-17-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.045800 |
| AZ963 | SB-18-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.046317 |
| AZ964 | SB-18-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.051167 |
| AZ965 | SB-18-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.050083 |
| AZ966 | SB-19-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.042700 |
| AZ967 | SB-19-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.046267 |
| AZ968 | SB-19-4 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.048867 |
| AZ969 | SB-20-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.046017 |
| AZ970 | SB-20-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.046300 |
| AZ971 | SB-20-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.045700 |
| AZ972 | SB-21-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.034783 |
| AZ973 | SB-21-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.041883 |
| AZ974 | SB-21-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.039383 |
| AZ975 | SB-22-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.032800 |
| AZ976 | SB-22-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.029617 |
| AZ977 | SB-22-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.030800 |
| AZ978 | SB-23-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.039117 |
| AZ979 | SB-23-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.032717 |
| AZ980 | SB-23-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.036050 |
| AZ981 | SB-24-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.032933 |
| AZ982 | SB-24-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.037833 |
| AZ983 | SB-24-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.034617 |
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| AZ986 | SB-25-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.025350 |
| AZ987 | SB-27-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.017817 |
| AZ988 | SB-27-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.022633 |
| AZ989 | SB-27-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.020850 |
| AZ990 | SB-28-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.010417 |
| AZ991 | SB-28-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.011517 |
| AZ992 | SB-28-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.013917 |
| AZ993 | SB-29-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.010817 |
| AZ994 | SB-29-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.007367 |
| AZ995 | SB-29-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.011433 |
| AZ996 | SB-30-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.002550 |
| AZ997 | SB-30-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.006733 |
| AZ998 | SB-30-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.009267 |
| AZ999 | SB-31-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.007250 |
| BA001 | SB-31-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.011550 |
| BA002 | SB-31-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.009517 |
| BA003 | SB-32-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.014567 |
| BA004 | SB-32-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.018450 |

| | | | | | |
|---|---|---|---|---|---|
| BA005 | SB-32-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.017483 |
| BA006 | SB-33-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 40.994083 |
| BA007 | SB-33-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 40.996550 |
| BA008 | SB-33-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 40.997100 |
| BA009 | SB-34-1 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.000233 |
| BA010 | SB-34-2 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.001000 |
| BA011 | SB-34-3 | LISMARC PILOT | 2012-028-FA | LONG ISLAND SOUND | 41.001967 |

| LONGITUDE | DEPTH_M | T_DEPTH | B_DEPTH | DEVICE | MONTH | DAY | YEAR | WEIGHT |
|---|---|---|---|---|---|---|---|---|
| -73.090833 | -9999 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 26.3556 |
| -73.090880 | -9999 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 17.5749 |
| -73.086450 | 12.5 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 20.7324 |
| -73.137300 | 8 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 40.5004 |
| -73.137217 | 8 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 37.4820 |
| -73.133783 | -9999 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 41.7311 |
| -73.117900 | 9 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 40.3924 |
| -73.114333 | 11 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 167.3268 |
| -73.120417 | 8 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 48.7968 |
| -73.084717 | 15.7 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 15.8962 |
| -73.083417 | 15.5 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 20.2423 |
| -73.082917 | 16.2 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 16.4379 |
| -73.082583 | 16 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 14.9856 |
| -73.078217 | 16.7 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 17.7259 |
| -73.082067 | 16.5 | 0 | 2 | SEABOSS | 10 | 10 | 2012 | 14.8790 |
| -73.127583 | 17.6 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 23.6522 |
| -73.128550 | 17 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 25.5018 |
| -73.125817 | 11 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 46.4847 |
| -73.105533 | 33 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 34.1207 |
| -73.100767 | 28 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 138.0816 |
| -73.099700 | 23 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 51.0967 |
| -73.071250 | 26 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 38.1442 |
| -73.073983 | 30 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 16.8784 |
| -73.068500 | -9999 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 47.3341 |
| -73.135400 | 19 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 42.4755 |
| -73.132850 | 11 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 55.1365 |
| -73.130850 | 19 | 0 | 2 | SEABOSS | 10 | 11 | 2012 | 37.4669 |
| -73.106583 | 16 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 52.9510 |
| -73.115050 | 24 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 43.6014 |
| -73.108350 | 15 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 160.9496 |
| -73.073500 | 24 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 16.5834 |
| -73.076317 | 24 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 30.4588 |
| -73.078017 | 23 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | -9999 |
| -73.071167 | 26 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 19.7413 |
| -73.072817 | 22 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 19.7224 |
| -73.076900 | 21 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 23.1059 |
| -73.076967 | 21 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | -9999 |
| -73.077633 | 15 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | -9999 |
| -73.074400 | 24 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 48.8459 |
| -73.139217 | 21 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 20.7306 |
| -73.142617 | 20 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 22.6893 |
| -73.140617 | 21 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 19.7520 |
| -73.048100 | 31 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 15.9794 |
| -73.045967 | 28 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 16.5476 |
| -73.054167 | 26 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 17.0332 |
| -73.026150 | 34 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 15.0834 |
| -73.031183 | 31 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 14.8721 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -73.032100 | 33 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 14.7784 |
| -73.135750 | 26 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 45.6621 |
| -73.132717 | 26 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 48.2443 |
| -73.138533 | -9999 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 30.8033 |
| -73.122017 | 32 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 101.2948 |
| -73.118400 | 27 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 41.7491 |
| -73.120633 | 32 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 108.9760 |
| -73.099900 | 22 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 172.6051 |
| -73.095683 | 22 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 133.8884 |
| -73.101733 | 22 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 168.7600 |
| -73.078150 | 34 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 33.5943 |
| -73.080033 | 33 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 37.0575 |
| -73.083017 | -9999 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 44.4398 |
| -73.009917 | 37 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 26.9092 |
| -73.014750 | 37 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 18.2120 |
| -73.018783 | 37 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 29.0528 |
| -73.106233 | 23 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 45.5227 |
| -73.110683 | 22 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 146.6863 |
| -73.104000 | 21 | 0 | 2 | SEABOSS | 10 | 13 | 2012 | 50.4779 |
| -73.058483 | 38 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 35.4281 |
| -73.060617 | 40 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 43.5435 |
| -73.054317 | 39 | 0 | 2 | SEABOSS | 10 | 15 | 2012 | 27.0618 |
| -73.029633 | 38 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 24.8118 |
| -73.030000 | 37 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 28.6543 |
| -73.026883 | 38 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 27.5802 |
| -72.980200 | 40 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 43.6516 |
| -72.984917 | 39 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 55.2776 |
| -72.984633 | -9999 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 38.4336 |
| -73.113600 | 26 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 134.2492 |
| -73.105483 | 40 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 183.6004 |
| -73.113467 | 45 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 40.4300 |
| -72.992150 | -9999 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 112.3887 |
| -72.992917 | 42 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 33.4069 |
| -72.992417 | 37 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 42.1745 |
| -73.139383 | 38 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 31.6411 |
| -73.138300 | 38 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 35.0625 |
| -73.144783 | 38 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 28.9455 |
| -73.112983 | 43 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 34.4256 |
| -73.118700 | 45 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 42.2866 |
| -73.115550 | 42 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 36.8877 |
| -73.085133 | 33 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 22.4298 |
| -73.089700 | 35 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 28.7776 |
| -73.092000 | 36 | 0 | 2 | SEABOSS | 10 | 17 | 2012 | 42.0045 |
| -73.024067 | 28 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 12.6791 |
| -73.020850 | 31 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 12.2371 |
| -73.024033 | -9999 | 0 | 2 | SEABOSS | 10 | 16 | 2012 | 15.9875 |
| -72.974883 | -9999 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 48.5249 |
| -72.977200 | 29 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 54.2715 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -72.979550 | -9999 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 44.3938 |
| -73.124783 | -9999 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 47.5542 |
| -73.125167 | 24 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 44.8022 |
| -73.122017 | 19 | 0 | 2 | SEABOSS | 10 | 12 | 2012 | 44.3974 |
| -72.956400 | -9999 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 43.7368 |
| -72.959333 | 14 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 41.1302 |
| -72.961700 | 15 | 0 | 2 | SEABOSS | 10 | 14 | 2012 | 47.7844 |

| ZGRAVEL | ZSAND | ZSILT | ZCLAY | SEDCLASS | MEDIAN | MEAN | STDDEV |
|---|---|---|---|---|---|---|---|
| 0.12 | 38.48 | 41.64 | 19.76 | SANDY SILT | 5.88 | 4.71 | 3.55 |
| 0.06 | 30.77 | 48.95 | 20.22 | SAND SILT CLAY | 6.28 | 5.88 | 2.47 |
| 0.1 | 24.8 | 45.22 | 29.88 | SAND SILT CLAY | 6.84 | 6.41 | 2.59 |
| 0.81 | 95.12 | 2.63 | 1.45 | SAND | 2.19 | 2.21 | 1.32 |
| 0 | 97.59 | 1.55 | 0.86 | SAND | 2.32 | 2.32 | 0.93 |
| 0 | 98.65 | 0.85 | 0.5 | SAND | 1.93 | 2.02 | 0.79 |
| 2.77 | 96.02 | 0.63 | 0.58 | SAND | 0.56 | 0.63 | 1.02 |
| 46.9 | 50.79 | 1.22 | 1.1 | GRAVELLY SEDIMENT | -0.55 | -0.94 | 2.71 |
| 4.8 | 90.03 | 3.23 | 1.94 | SAND | 0.88 | 1.08 | 1.79 |
| 0 | 10.4 | 51.87 | 37.73 | CLAYEY SILT | 7.51 | 7.23 | 2.27 |
| 0.06 | 18.37 | 54.56 | 27 | CLAYEY SILT | 6.82 | 6.38 | 2.63 |
| 0 | 7.81 | 56.54 | 35.65 | CLAYEY SILT | 7.41 | 7.18 | 2.14 |
| 0 | 12.01 | 53.9 | 34.09 | CLAYEY SILT | 7.26 | 6.94 | 2.41 |
| 0.16 | 22.81 | 48.34 | 28.69 | SAND SILT CLAY | 6.87 | 6.24 | 2.84 |
| 0 | 9.74 | 57.91 | 32.35 | CLAYEY SILT | 7.2 | 7 | 2.22 |
| 0.63 | 59.35 | 25.24 | 14.78 | SILTY SAND | 2.79 | 4.21 | 2.95 |
| 0 | 40.76 | 36.75 | 22.49 | SAND SILT CLAY | 6.18 | 5.42 | 2.99 |
| 2.28 | 95.42 | 1.52 | 0.79 | SAND | 0.63 | 0.76 | 1.21 |
| 0.8 | 75.25 | 14.15 | 9.8 | SAND | 1.75 | 2.91 | 2.89 |
| 81.78 | 16.34 | 1.17 | 0.71 | GRAVEL | -4.3 | -3.11 | 2.75 |
| 10.01 | 87.58 | 1.4 | 1.01 | GRAVELLY SEDIMENT | 1.08 | 0.93 | 1.6 |
| 6.64 | 75.81 | 10.22 | 7.33 | SAND | 1.79 | 2.42 | 2.83 |
| 0 | 13.44 | 49.67 | 36.89 | CLAYEY SILT | 7.38 | 7.07 | 2.35 |
| 0.9 | 93.18 | 4.06 | 1.86 | SAND | 1.72 | 1.98 | 1.59 |
| 0.38 | 96.28 | 1.99 | 1.36 | SAND | 1.54 | 1.68 | 1.35 |
| 1.93 | 94.99 | 2.03 | 1.06 | SAND | 1.29 | 1.38 | 1.41 |
| 0.14 | 85.25 | 8.29 | 6.32 | SAND | 1.93 | 2.7 | 2.31 |
| 18.66 | 76.32 | 2.59 | 2.43 | GRAVELLY SEDIMENT | 1.41 | 1.1 | 2.39 |
| 0.29 | 88.77 | 6.18 | 4.76 | SAND | 2.21 | 2.62 | 2.02 |
| 30.21 | 65.9 | 1.95 | 1.94 | GRAVELLY SEDIMENT | 0.48 | 0.03 | 2.51 |
| 0 | 9.92 | 46.78 | 43.3 | CLAYEY SILT | 7.74 | 7.5 | 2.12 |
| 0.71 | 60.36 | 23.73 | 15.2 | SILTY SAND | 2.5 | 3.74 | 3.4 |
| -9999 | -9999 | -9999 | -9999 | GRAVEL | -9999 | -9999 | -9999 |
| 0.12 | 28.99 | 43.4 | 27.49 | SAND SILT CLAY | 7 | 6.18 | 2.77 |
| 0 | 8.99 | 56.15 | 34.87 | CLAYEY SILT | 7.28 | 7.14 | 2.08 |
| 22.82 | 25.87 | 30.14 | 21.17 | GRAVELLY SEDIMENT | 4.52 | 3.66 | 4.68 |
| -9999 | -9999 | -9999 | -9999 | GRAVEL | -9999 | -9999 | -9999 |
| -9999 | -9999 | -9999 | -9999 | GRAVEL | -9999 | -9999 | -9999 |
| 16.07 | 73.18 | 6.41 | 4.35 | GRAVELLY SEDIMENT | 0.95 | 1.3 | 2.76 |
| 0 | 20.79 | 45.86 | 33.35 | SAND SILT CLAY | 7.29 | 6.82 | 2.44 |
| 0.06 | 27.76 | 44.12 | 28.06 | SAND SILT CLAY | 6.8 | 6.26 | 2.66 |
| 0 | 20.29 | 49.75 | 29.95 | SAND SILT CLAY | 7.08 | 6.63 | 2.39 |
| 0 | 5.8 | 43.97 | 50.24 | SILTY CLAY | 8.01 | 7.88 | 1.87 |
| 0 | 6.21 | 56.05 | 37.74 | CLAYEY SILT | 7.44 | 7.32 | 1.95 |
| 0 | 9.9 | 50.75 | 39.35 | CLAYEY SILT | 7.54 | 7.33 | 2.09 |
| 0 | 5.23 | 61.74 | 33.03 | CLAYEY SILT | 7.28 | 7.27 | 1.81 |
| 0 | 3.75 | 58.28 | 37.96 | CLAYEY SILT | 7.47 | 7.46 | 1.81 |

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|---|---|---|---|---|---|---|---|
| 0 | 3.92 | 58.31 | 37.77 | CLAYEY SILT | 7.46 | 7.43 | 1.83 |
| 0.1 | 95.31 | 2.59 | 2 | SAND | 1.92 | 2.08 | 1.5 |
| 0.08 | 96.08 | 2.26 | 1.59 | SAND | 2.01 | 2.1 | 1.39 |
| 0 | 64.65 | 20.49 | 14.86 | SILTY SAND | 3.42 | 4.48 | 2.64 |
| 23.32 | 46.62 | 8.42 | 21.64 | GRAVELLY SEDIMENT | 1.75 | 2.49 | 4.87 |
| 0.87 | 95.13 | 1.91 | 2.08 | SAND | 1.86 | 2.04 | 1.53 |
| 14.14 | 80.54 | 3.02 | 2.3 | GRAVELLY SEDIMENT | 1.45 | 1.14 | 2.61 |
| 40.52 | 57.2 | 1.12 | 1.16 | GRAVELLY SEDIMENT | 0.42 | -0.52 | 2.88 |
| 19.48 | 75.9 | 2.49 | 2.12 | GRAVELLY SEDIMENT | 1.04 | 0.76 | 2.39 |
| 35.61 | 62.28 | 1.13 | 0.98 | GRAVELLY SEDIMENT | 0.51 | -0.08 | 2.42 |
| 0.47 | 54.74 | 26.66 | 18.13 | SILTY SAND | 3.62 | 4.77 | 2.93 |
| 0.24 | 71.58 | 15.25 | 12.93 | SILTY SAND | 2.22 | 3.51 | 3 |
| 0.69 | 96.03 | 1.91 | 1.37 | SAND | 1.57 | 1.72 | 1.36 |
| 0.09 | 42.91 | 29.11 | 27.89 | SAND SILT CLAY | 6.43 | 5.52 | 3.18 |
| 0 | 40.25 | 36.3 | 23.45 | SAND SILT CLAY | 6.22 | 5.73 | 2.68 |
| 0.22 | 51.37 | 33.14 | 15.27 | SILTY SAND | 3.79 | 4.74 | 2.85 |
| 2.5 | 92.49 | 2.85 | 2.16 | SAND | 1.43 | 1.59 | 1.67 |
| 35.79 | 60.99 | 1.76 | 1.46 | GRAVELLY SEDIMENT | 1.13 | -0.29 | 3.15 |
| 1.37 | 92.18 | 3.45 | 3 | SAND | 1.49 | 1.78 | 1.8 |
| 1.22 | 57.19 | 24.89 | 16.7 | SILTY SAND | 2.61 | 4 | 3.38 |
| 1.35 | 75.73 | 13.91 | 9.01 | SAND | 1.53 | 2.69 | 2.94 |
| 0.08 | 56.55 | 26.21 | 17.17 | SILTY SAND | 3.46 | 4.71 | 2.83 |
| 0.34 | 45.17 | 31.63 | 22.86 | SAND SILT CLAY | 5.75 | 5.2 | 3.13 |
| 3.25 | 45.95 | 26.17 | 24.63 | SAND SILT CLAY | 4.61 | 4.97 | 3.43 |
| 0.04 | 63.82 | 20.99 | 15.15 | SILTY SAND | 2.88 | 4.31 | 2.84 |
| 2.05 | 83.15 | 9.07 | 5.74 | SAND | 1.55 | 2.24 | 2.52 |
| 14.94 | 80.64 | 2.67 | 1.75 | GRAVELLY SEDIMENT | 1.07 | 0.94 | 2.07 |
| 11.13 | 73.54 | 8.62 | 6.71 | GRAVELLY SEDIMENT | 1.58 | 2.06 | 2.87 |
| 9.16 | 87.45 | 1.74 | 1.66 | SAND | 1.36 | 1.21 | 1.92 |
| 38.62 | 58.05 | 1.78 | 1.56 | GRAVELLY SEDIMENT | 0.65 | -0.42 | 3 |
| 0.92 | 82.8 | 9.19 | 7.08 | SAND | 1.52 | 2.33 | 2.59 |
| 56.68 | 39.03 | 2.5 | 1.78 | GRAVEL | -3.8 | -1.56 | 3.49 |
| 0.8 | 73.4 | 16.37 | 9.43 | SILTY SAND | 2.07 | 3.11 | 2.88 |
| 1.62 | 90.73 | 4.41 | 3.23 | SAND | 1.56 | 1.87 | 1.99 |
| 2.02 | 70.56 | 16 | 11.42 | SILTY SAND | 2.05 | 3.23 | 3.01 |
| 0.35 | 68.56 | 18.1 | 12.99 | SILTY SAND | 2.6 | 3.75 | 2.94 |
| 0.53 | 57.31 | 25.45 | 16.71 | SILTY SAND | 2.9 | 4.23 | 3.17 |
| 21.38 | 48.93 | 17.87 | 11.82 | GRAVELLY SEDIMENT | 0.97 | 2.22 | 3.92 |
| 16.45 | 59.91 | 13.51 | 10.12 | GRAVELLY SEDIMENT | 1.25 | 2.18 | 3.48 |
| 17.31 | 60.36 | 12.86 | 9.47 | GRAVELLY SEDIMENT | 0.96 | 1.97 | 3.45 |
| 0.48 | 36.23 | 35.78 | 27.51 | SAND SILT CLAY | 6.45 | 5.5 | 3.31 |
| 3.05 | 58.35 | 22.3 | 16.3 | SILTY SAND | 2.33 | 3.77 | 3.42 |
| 18.11 | 62.86 | 11.78 | 7.26 | GRAVELLY SEDIMENT | 1.48 | 1.8 | 3.41 |
| 0 | 3.71 | 59.16 | 37.12 | CLAYEY SILT | 7.45 | 7.4 | 1.83 |
| 0 | 3.36 | 67.47 | 29.16 | CLAYEY SILT | 7 | 7.06 | 1.8 |
| 0 | 3.47 | 61.1 | 35.43 | CLAYEY SILT | 7.46 | 7.42 | 1.72 |
| 7.1 | 83.25 | 6.03 | 3.61 | SAND | 1.51 | 1.75 | 2.36 |
| 0.23 | 92.69 | 4.01 | 3.06 | SAND | 1.86 | 2.19 | 1.75 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.82 | 93.87 | 2.71 | 2.6 | SAND | 1.69 | 1.96 | 1.66 |
| 8.12 | 89.54 | 1.19 | 1.16 | SAND | 1 | 0.94 | 1.55 |
| 3.19 | 95.31 | 0.82 | 0.69 | SAND | 1.21 | 1.13 | 1.11 |
| 8.65 | 87.89 | 1.78 | 1.69 | SAND | 1.45 | 1.39 | 1.68 |
| 0 | 93.81 | 4.04 | 2.15 | SAND | 1.41 | 1.71 | 1.63 |
| 0.1 | 99.09 | 0.46 | 0.35 | SAND | 1.31 | 1.26 | 0.75 |
| 0.67 | 97.91 | 0.69 | 0.74 | SAND | 1.19 | 1.17 | 1.02 |

| SKEWNESS | KURTOSIS | PHI_11 | PHI_10 | PHI_9 | PHI_8 | PHI_7 | PHI_6 | PHI_5 | PHI_4 |
|---|---|---|---|---|---|---|---|---|---|
| -0.04 | -1.52 | 3.58 | 5.52 | 10.66 | 14.1 | 14.93 | 9.77 | 2.85 | 0.03 |
| -0.06 | -0.58 | 3.63 | 5.47 | 11.12 | 16.07 | 19.15 | 7.14 | 6.59 | 18.28 |
| -0.19 | -0.4 | 5.87 | 8.41 | 15.6 | 17.25 | 17.61 | 5.55 | 4.82 | 15.09 |
| 1.4 | 15.51 | 0.33 | 0.43 | 0.69 | 0.76 | 0.9 | 0.56 | 0.41 | 0.83 |
| 2.49 | 35.56 | 0.2 | 0.26 | 0.4 | 0.44 | 0.49 | 0.34 | 0.28 | 0.44 |
| 2.8 | 47.72 | 0.12 | 0.14 | 0.23 | 0.25 | 0.27 | 0.14 | 0.19 | 0.52 |
| 2.44 | 40.49 | 0.15 | 0.18 | 0.25 | 0.26 | 0.17 | 0.11 | 0.09 | 0.08 |
| 0.31 | 1.09 | 0.23 | 0.32 | 0.55 | 0.63 | 0.37 | 0.12 | 0.1 | 0.42 |
| 1.3 | 10.13 | 0.43 | 0.57 | 0.95 | 1.1 | 1.11 | 0.8 | 0.23 | 0.2 |
| -0.52 | 1.54 | 6.9 | 10.68 | 20.16 | 25.21 | 20.08 | 4.43 | 2.16 | 2.83 |
| -0.34 | 0.15 | 5.06 | 7.73 | 14.21 | 19.62 | 18.93 | 10.34 | 5.68 | 5.35 |
| -0.39 | 1.34 | 6.59 | 10.09 | 18.97 | 24.17 | 17.38 | 9.61 | 5.38 | 2.87 |
| -0.42 | 0.92 | 6.68 | 9.94 | 17.47 | 21.41 | 19.06 | 10.21 | 3.22 | 2.94 |
| -0.32 | -0.25 | 5.16 | 8.16 | 15.38 | 18.92 | 18.33 | 5.81 | 5.27 | 5.75 |
| -0.42 | 1.38 | 5.92 | 9.28 | 17.16 | 22.02 | 22.28 | 10.14 | 3.47 | 3.18 |
| 0.32 | -0.77 | 2.95 | 4.26 | 7.57 | 9.1 | 8.56 | 4.41 | 3.16 | 3.53 |
| 0.01 | -1.32 | 4.17 | 6.39 | 11.91 | 17.97 | 11.63 | 3.83 | 3.31 | 4.46 |
| 2.11 | 26.29 | 0.18 | 0.24 | 0.37 | 0.44 | 0.43 | 0.39 | 0.26 | 0.07 |
| 0.63 | 0.38 | 2 | 2.83 | 4.98 | 5.91 | 4.8 | 1.79 | 1.65 | 2.34 |
| 1.05 | 3.82 | 0.15 | 0.2 | 0.36 | 0.43 | 0.36 | 0.16 | 0.22 | 0.38 |
| 0.76 | 9.38 | 0.26 | 0.31 | 0.45 | 0.46 | 0.46 | 0.23 | 0.25 | 0.58 |
| 0.58 | 0.98 | 1.4 | 2.07 | 3.86 | 5.15 | 3.51 | 0.75 | 0.81 | 3.16 |
| -0.41 | 0.91 | 7.14 | 10.5 | 19.24 | 21.3 | 20.07 | 4.45 | 3.86 | 7.44 |
| 1.28 | 9.4 | 0.3 | 0.5 | 1.06 | 1.54 | 1.49 | 0.47 | 0.57 | 2.19 |
| 1.64 | 16.56 | 0.33 | 0.41 | 0.62 | 0.64 | 0.55 | 0.35 | 0.45 | 1.61 |
| 1.33 | 13.25 | 0.23 | 0.31 | 0.52 | 0.64 | 0.72 | 0.28 | 0.39 | 1.02 |
| 0.95 | 2.83 | 1.25 | 1.82 | 3.25 | 4.09 | 3.15 | 0.52 | 0.54 | 4.64 |
| 0.31 | 2.84 | 0.51 | 0.73 | 1.2 | 1.17 | 0.85 | 0.33 | 0.25 | 1.51 |
| 1.1 | 4.89 | 0.98 | 1.39 | 2.39 | 2.75 | 2.18 | 0.62 | 0.64 | 5.5 |
| 0.45 | 2.73 | 0.37 | 0.59 | 0.98 | 1.03 | 0.58 | 0.18 | 0.16 | 0.45 |
| -0.43 | 1.21 | 8.34 | 12.34 | 22.62 | 25.51 | 15.74 | 3.13 | 2.39 | 6.05 |
| 0.25 | -1.14 | 2.97 | 4.39 | 7.84 | 10.03 | 8.99 | 2.25 | 2.47 | 7.19 |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 |
| -0.23 | -0.67 | 4.76 | 7.57 | 15.17 | 22.45 | 14.22 | 3.77 | 2.96 | 12.93 |
| -0.23 | 0.6 | 6.8 | 10.08 | 17.99 | 20.94 | 20.68 | 9.12 | 5.4 | 5.63 |
| -0.14 | -1.32 | 4.08 | 6 | 11.09 | 12.99 | 11.28 | 3.33 | 2.54 | 6.03 |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 |
| 0.61 | 1.92 | 0.85 | 1.23 | 2.26 | 2.79 | 2.41 | 0.64 | 0.58 | 4.76 |
| -0.28 | -0.24 | 6.29 | 9.72 | 17.35 | 23.53 | 16.74 | 3.64 | 1.94 | 11.64 |
| -0.17 | -0.64 | 5.38 | 7.93 | 14.76 | 18.4 | 17.58 | 4.33 | 3.8 | 12.79 |
| -0.2 | -0.38 | 5.43 | 8.54 | 15.97 | 21.7 | 16.59 | 6.02 | 5.45 | 11.66 |
| -0.35 | 1.26 | 10.09 | 15.12 | 25.02 | 25.82 | 12.95 | 2.35 | 2.85 | 4.13 |
| -0.13 | 0.19 | 7.28 | 10.61 | 19.85 | 21.72 | 17.34 | 11.44 | 5.54 | 3.96 |
| -0.31 | 0.56 | 7.23 | 11.45 | 20.66 | 23.23 | 19.03 | 4.34 | 4.14 | 5.56 |
| -0.13 | 0.86 | 5.92 | 9.24 | 17.88 | 23.53 | 23.81 | 10.62 | 3.79 | 3.22 |
| -0.14 | 1.05 | 7.4 | 11.02 | 19.55 | 22.58 | 21.2 | 11.75 | 2.75 | 2.39 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| -0.18 | 1.17 | 7.03 | 10.9 | 19.84 | 22.78 | 21.3 | 9.92 | 4.32 | 2.45 |
| 1.49 | 12.2 | 0.45 | 0.6 | 0.95 | 1.08 | 0.96 | 0.37 | 0.19 | 3.15 |
| 1.46 | 13.12 | 0.33 | 0.46 | 0.8 | 0.91 | 0.73 | 0.39 | 0.23 | 5.06 |
| 0.42 | -0.51 | 2.82 | 4.32 | 7.71 | 8.82 | 7.47 | 2.21 | 2 | 25.07 |
| 0.1 | -0.99 | 6.99 | 6.82 | 7.84 | 5.19 | 2.3 | 0.51 | 0.42 | 3.93 |
| 1.33 | 11.74 | 0.48 | 0.64 | 0.97 | 0.93 | 0.55 | 0.18 | 0.26 | 6.27 |
| 0 | 2.33 | 0.45 | 0.67 | 1.18 | 1.38 | 1.05 | 0.39 | 0.21 | 3.74 |
| 0.12 | 0.24 | 0.26 | 0.35 | 0.56 | 0.59 | 0.34 | 0.1 | 0.09 | 0.63 |
| 0.36 | 2.93 | 0.44 | 0.63 | 1.07 | 1.06 | 0.9 | 0.33 | 0.21 | 1.51 |
| 0.16 | 1.41 | 0.23 | 0.29 | 0.46 | 0.48 | 0.39 | 0.11 | 0.15 | 0.65 |
| 0.21 | -1.06 | 3.44 | 5.3 | 9.4 | 11.96 | 9.87 | 2.1 | 2.73 | 13.64 |
| 0.49 | -0.39 | 2.51 | 3.7 | 6.72 | 8.35 | 5.62 | 0.65 | 0.63 | 5.84 |
| 1.56 | 16.24 | 0.3 | 0.41 | 0.66 | 0.71 | 0.6 | 0.36 | 0.24 | 1.64 |
| -0.02 | -1.38 | 5.43 | 8 | 14.45 | 16.87 | 9.24 | 1.93 | 1.07 | 6.75 |
| 0.04 | -1.13 | 4.3 | 6.63 | 12.52 | 15.26 | 14.41 | 3.65 | 2.98 | 20.2 |
| 0.15 | -1.16 | 2.43 | 4.06 | 8.78 | 13.61 | 13.19 | 3.48 | 2.87 | 7.6 |
| 1.32 | 11.32 | 0.45 | 0.63 | 1.08 | 1.16 | 1 | 0.36 | 0.34 | 0.87 |
| 0.04 | -0.19 | 0.3 | 0.42 | 0.74 | 0.78 | 0.69 | 0.15 | 0.14 | 0.47 |
| 1.42 | 9.7 | 0.66 | 0.88 | 1.46 | 1.48 | 1.14 | 0.42 | 0.41 | 0.91 |
| 0.21 | -1.22 | 3.05 | 4.71 | 8.94 | 11.13 | 9.11 | 2.72 | 1.93 | 5.58 |
| 0.61 | 0.29 | 1.62 | 2.52 | 4.87 | 6.41 | 4.74 | 1.36 | 1.41 | 5.65 |
| 0.27 | -1.02 | 3.17 | 4.87 | 9.12 | 11.15 | 9.49 | 3.37 | 2.19 | 12.21 |
| 0.03 | -1.33 | 4.21 | 6.39 | 12.26 | 16.88 | 9.66 | 2.42 | 2.68 | 8.07 |
| -0.02 | -1.12 | 4.78 | 6.96 | 12.89 | 14.95 | 8.92 | 0.99 | 1.31 | 6.24 |
| 0.38 | -0.77 | 2.88 | 4.32 | 7.95 | 10.32 | 7.7 | 1.26 | 1.71 | 9.44 |
| 0.81 | 2.21 | 1.13 | 1.66 | 2.95 | 3.85 | 3.55 | 0.81 | 0.85 | 4.29 |
| 0.61 | 4.95 | 0.37 | 0.52 | 0.85 | 1.09 | 0.98 | 0.33 | 0.28 | 1.04 |
| 0.55 | 1.25 | 1.3 | 1.88 | 3.52 | 3.96 | 3.28 | 0.75 | 0.62 | 2.51 |
| 0.39 | 6.33 | 0.33 | 0.48 | 0.85 | 0.88 | 0.57 | 0.14 | 0.15 | 1 |
| 0.15 | 0.3 | 0.27 | 0.44 | 0.84 | 0.83 | 0.66 | 0.15 | 0.14 | 0.49 |
| 0.89 | 2.16 | 1.4 | 2.02 | 3.66 | 4.19 | 3.14 | 0.95 | 0.9 | 1.42 |
| 0.45 | 0.13 | 0.35 | 0.51 | 0.92 | 1.09 | 0.91 | 0.24 | 0.27 | 1.39 |
| 0.53 | -0.03 | 1.7 | 2.62 | 5.11 | 6.99 | 6.51 | 1.53 | 1.34 | 3.67 |
| 1.08 | 5.97 | 0.66 | 0.94 | 1.64 | 1.92 | 1.58 | 0.41 | 0.5 | 2.1 |
| 0.48 | -0.16 | 2.27 | 3.31 | 5.84 | 6.93 | 5.41 | 1.9 | 1.75 | 4.85 |
| 0.43 | -0.49 | 2.46 | 3.66 | 6.87 | 8.18 | 6.78 | 1.66 | 1.49 | 7.76 |
| 0.24 | -1.1 | 3.13 | 4.85 | 8.74 | 10.43 | 8.98 | 2.95 | 3.09 | 6.15 |
| 0.31 | -0.86 | 2.19 | 3.33 | 6.29 | 8.02 | 6.19 | 1.99 | 1.67 | 2.83 |
| 0.44 | -0.26 | 1.84 | 2.83 | 5.45 | 6.35 | 5.11 | 1.03 | 1.02 | 2.87 |
| 0.5 | -0.07 | 1.8 | 2.7 | 4.98 | 5.74 | 4.83 | 1.14 | 1.16 | 2.74 |
| -0.1 | -1.28 | 5.38 | 7.96 | 14.17 | 16.15 | 11.52 | 4.73 | 3.38 | 4.55 |
| 0.25 | -1.08 | 3.08 | 4.59 | 8.64 | 10.14 | 7.5 | 2.04 | 2.62 | 4.47 |
| 0.3 | 0.15 | 1.38 | 2.04 | 3.84 | 4.35 | 4.37 | 1.65 | 1.41 | 2.85 |
| -0.1 | 0.53 | 7.08 | 10.63 | 19.42 | 23.37 | 20.61 | 7.91 | 7.27 | 2.93 |
| 0.04 | 0.24 | 5.49 | 8.18 | 15.49 | 20.91 | 24.26 | 11.47 | 10.84 | 2.71 |
| -0.1 | 0.78 | 6.08 | 9.76 | 19.6 | 27.02 | 20.62 | 7.6 | 5.86 | 2.82 |
| 0.6 | 3.43 | 0.71 | 1.04 | 1.87 | 2.36 | 2.17 | 0.76 | 0.75 | 1.41 |
| 1.39 | 8.78 | 0.66 | 0.91 | 1.5 | 1.75 | 1.46 | 0.45 | 0.35 | 2.05 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.45 | 11.21 | 0.61 | 0.78 | 1.22 | 1.27 | 0.88 | 0.34 | 0.23 | 1.54 |
| 1.02 | 11.6 | 0.27 | 0.34 | 0.54 | 0.49 | 0.38 | 0.14 | 0.18 | 0.98 |
| 1.7 | 26.46 | 0.18 | 0.21 | 0.3 | 0.29 | 0.26 | 0.14 | 0.13 | 0.16 |
| 0.87 | 9.72 | 0.4 | 0.52 | 0.77 | 0.7 | 0.56 | 0.24 | 0.28 | 1.53 |
| 1.6 | 11.36 | 0.4 | 0.61 | 1.14 | 1.41 | 1.23 | 0.69 | 0.72 | 0.44 |
| 3 | 65.27 | 0.1 | 0.11 | 0.14 | 0.14 | 0.12 | 0.1 | 0.1 | 0.06 |
| 2.48 | 38.79 | 0.18 | 0.23 | 0.33 | 0.37 | 0.19 | 0.07 | 0.06 | 0.09 |

| PHI_3 | PHI_2 | PHI_1 | PHI_0 | PHIM1 | PHIM2 | PHIM3 | PHIM4 | PHIM5 | ANALYST |
|---|---|---|---|---|---|---|---|---|---|
| 0.02 | 0.01 | 38.42 | 0 | 0.12 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 7.89 | 2.6 | 1.21 | 0.78 | 0.06 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 4.85 | 2.38 | 1.55 | 0.93 | 0.1 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 55.55 | 32.93 | 4.51 | 1.31 | 0.28 | 0.53 | 0 | 0 | 0 | KMCMULLEN |
| 68.93 | 26.85 | 1.09 | 0.28 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 44.33 | 53.06 | 0.6 | 0.15 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 0.61 | 18.55 | 66.51 | 10.27 | 2.48 | 0.29 | 0 | 0 | 0 | KMCMULLEN |
| 4.2 | 18.79 | 20.46 | 6.91 | 7.87 | 7.67 | 12.55 | 18.8 | 0 | KMCMULLEN |
| 2.61 | 37.2 | 40.42 | 9.6 | 2.08 | 2.71 | 0 | 0 | 0 | KMCMULLEN |
| 2.62 | 2.72 | 1.67 | 0.57 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 4.33 | 3.63 | 3.05 | 2.01 | 0.06 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.88 | 1.46 | 0.98 | 0.61 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 3.3 | 3.09 | 1.42 | 1.26 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 6.08 | 4.93 | 3.04 | 3.01 | 0.16 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 2.31 | 2.09 | 1.24 | 0.91 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 30.43 | 22.18 | 2.44 | 0.78 | 0.03 | 0.6 | 0 | 0 | 0 | KMCMULLEN |
| 20.71 | 12.93 | 2.37 | 0.28 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 0.26 | 26.36 | 57.01 | 11.72 | 2.28 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 13.11 | 41.82 | 13.28 | 4.71 | 0.8 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 7.55 | 5.69 | 1.69 | 1.03 | 1.09 | 0.66 | 9.07 | 70.96 | 0 | KMCMULLEN |
| 6.91 | 43.39 | 28.95 | 7.75 | 4.35 | 5.66 | 0 | 0 | 0 | KMCMULLEN |
| 22.92 | 30.66 | 12.18 | 6.88 | 4.2 | 2.44 | 0 | 0 | 0 | KMCMULLEN |
| 2.36 | 1.32 | 1.02 | 1.29 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 28.38 | 47.89 | 13.04 | 1.69 | 0.41 | 0.49 | 0 | 0 | 0 | KMCMULLEN |
| 21.19 | 51.68 | 18.48 | 3.32 | 0.38 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 15.75 | 42.57 | 29.56 | 6.09 | 1.61 | 0.32 | 0 | 0 | 0 | KMCMULLEN |
| 27.6 | 45.17 | 6.17 | 1.67 | 0.14 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 18.32 | 42.82 | 11.79 | 1.88 | 2.54 | 10.36 | 5.76 | 0 | 0 | KMCMULLEN |
| 42.61 | 31.92 | 7.7 | 1.04 | 0.29 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 2.57 | 29.41 | 26.29 | 7.18 | 3.99 | 7.58 | 18.64 | 0 | 0 | KMCMULLEN |
| 1.55 | 1.34 | 0.9 | 0.09 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 7.74 | 16.35 | 22.28 | 6.8 | 0.71 | 0 | 0 | 0 | 0 | KMCMULLEN |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | KMCMULLEN |
| 5.95 | 6.18 | 3.19 | 0.75 | 0.12 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.51 | 1.13 | 0.52 | 0.2 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 3.31 | 7.7 | 5.16 | 3.68 | 2.28 | 3.54 | 17 | 0 | 0 | KMCMULLEN |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | KMCMULLEN |
| -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | -9999 | KMCMULLEN |
| 10.11 | 23.14 | 23.33 | 11.85 | 6.89 | 6.69 | 2.48 | 0 | 0 | KMCMULLEN |
| 5.82 | 2.14 | 1.01 | 0.18 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 9.34 | 3.09 | 1.81 | 0.74 | 0.06 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 5.91 | 1.79 | 0.66 | 0.28 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.12 | 0.38 | 0.16 | 0.01 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.9 | 0.23 | 0.11 | 0.02 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 3.16 | 0.79 | 0.33 | 0.07 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.41 | 0.34 | 0.24 | 0.02 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 0.57 | 0.38 | 0.35 | 0.06 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |

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|---|---|---|---|---|---|---|---|---|---|
| 0.59 | 0.38 | 0.33 | 0.16 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 39.06 | 38.54 | 12.92 | 1.65 | 0.1 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 41.38 | 36.07 | 12.2 | 1.37 | 0.08 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 30.01 | 7.68 | 1.71 | 0.19 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 10.57 | 21.85 | 8.12 | 2.16 | 1.32 | 2.32 | 2.62 | 17.05 | 0 | KMCMULLEN |
| 34.15 | 40.96 | 11.83 | 1.92 | 0.42 | 0.45 | 0 | 0 | 0 | KMCMULLEN |
| 18.54 | 40.91 | 14.39 | 2.95 | 1.66 | 0.94 | 2.5 | 9.05 | 0 | KMCMULLEN |
| 9.26 | 30.03 | 13.34 | 3.94 | 3.92 | 9.58 | 5.69 | 21.33 | 0 | KMCMULLEN |
| 12.42 | 32.82 | 23.8 | 5.35 | 3.54 | 6.26 | 9.69 | 0 | 0 | KMCMULLEN |
| 9.31 | 30.27 | 15.59 | 6.47 | 10.42 | 9.99 | 9.26 | 5.95 | 0 | KMCMULLEN |
| 26.12 | 11.93 | 2.55 | 0.51 | 0.47 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 20.54 | 32.91 | 10.7 | 1.59 | 0.24 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 22.05 | 53.51 | 16.81 | 2.03 | 0.08 | 0.61 | 0 | 0 | 0 | KMCMULLEN |
| 19.01 | 13.41 | 2.78 | 0.97 | 0.09 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 14.97 | 4.19 | 0.72 | 0.17 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 27.1 | 12.96 | 3.03 | 0.67 | 0.22 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 9.63 | 60.43 | 19.43 | 2.12 | 0.14 | 2.36 | 0 | 0 | 0 | KMCMULLEN |
| 11.79 | 39.55 | 7.4 | 1.79 | 0.96 | 2.23 | 6.1 | 26.51 | 0 | KMCMULLEN |
| 13.78 | 56.52 | 18.33 | 2.65 | 0.96 | 0.42 | 0 | 0 | 0 | KMCMULLEN |
| 7.24 | 26.34 | 13.33 | 4.7 | 0.9 | 0.31 | 0 | 0 | 0 | KMCMULLEN |
| 5.84 | 33.36 | 26.64 | 4.23 | 0.84 | 0.51 | 0 | 0 | 0 | KMCMULLEN |
| 31.44 | 11.4 | 1.29 | 0.21 | 0.08 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 16.62 | 16.1 | 3.36 | 1.02 | 0.34 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 18.58 | 17.65 | 2.61 | 0.87 | 0.58 | 2.67 | 0 | 0 | 0 | KMCMULLEN |
| 37.54 | 14.46 | 1.76 | 0.62 | 0.04 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 13.64 | 38.27 | 22.08 | 4.88 | 1.02 | 1.02 | 0 | 0 | 0 | KMCMULLEN |
| 10.69 | 36.34 | 25.27 | 7.3 | 5.4 | 7.7 | 1.84 | 0 | 0 | KMCMULLEN |
| 17.09 | 36.08 | 13.2 | 4.65 | 3.79 | 7.34 | 0 | 0 | 0 | KMCMULLEN |
| 14.01 | 49.16 | 20.4 | 2.88 | 1.42 | 2.63 | 5.11 | 0 | 0 | KMCMULLEN |
| 7.48 | 34.83 | 11.16 | 4.08 | 4.08 | 4.52 | 8.41 | 21.6 | 0 | KMCMULLEN |
| 8.94 | 48.58 | 19.61 | 4.25 | 0.92 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 10.17 | 15.93 | 9.52 | 2.03 | 0 | 0 | 8.39 | 48.29 | 0 | KMCMULLEN |
| 22.11 | 27.65 | 16.28 | 3.69 | 0.8 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 26.82 | 30.52 | 26.58 | 4.7 | 0.96 | 0.67 | 0 | 0 | 0 | KMCMULLEN |
| 18.58 | 31.43 | 12.65 | 3.05 | 1.47 | 0.55 | 0 | 0 | 0 | KMCMULLEN |
| 27.9 | 22.61 | 8.1 | 2.19 | 0.35 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 17.2 | 23.1 | 8.83 | 2.02 | 0.53 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 4.16 | 12.8 | 16.24 | 12.9 | 8.97 | 9.25 | 3.16 | 0 | 0 | KMCMULLEN |
| 7.13 | 21.92 | 18.36 | 9.63 | 9.96 | 6.5 | 0 | 0 | 0 | KMCMULLEN |
| 5.84 | 18.2 | 20.89 | 12.69 | 11.45 | 5.86 | 0 | 0 | 0 | KMCMULLEN |
| 4.74 | 18.6 | 7.06 | 1.28 | 0.48 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 10.35 | 24.72 | 14.24 | 4.57 | 2.62 | 0.43 | 0 | 0 | 0 | KMCMULLEN |
| 13.26 | 28.66 | 13.68 | 4.41 | 2.81 | 3.69 | 11.61 | 0 | 0 | KMCMULLEN |
| 0.34 | 0.21 | 0.15 | 0.09 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 0.32 | 0.17 | 0.11 | 0.06 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 0.31 | 0.16 | 0.13 | 0.05 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 21.37 | 36.01 | 21.21 | 3.25 | 1.99 | 1.45 | 3.65 | 0 | 0 | KMCMULLEN |
| 34.72 | 43 | 11.93 | 0.99 | 0.23 | 0 | 0 | 0 | 0 | KMCMULLEN |

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|---|---|---|---|---|---|---|---|---|---|
| 28.27 | 48.29 | 14.38 | 1.39 | 0.34 | 0.48 | 0 | 0 | 0 | KMCMULLEN |
| 5.57 | 41.24 | 32.34 | 9.41 | 4.59 | 3.52 | 0 | 0 | 0 | KMCMULLEN |
| 2.31 | 58.16 | 29.5 | 5.17 | 3.19 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 9.21 | 64.72 | 8.86 | 3.58 | 5.13 | 3.52 | 0 | 0 | 0 | KMCMULLEN |
| 14.59 | 48.62 | 29.75 | 0.41 | 0 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 2.12 | 67.68 | 27.83 | 1.41 | 0.1 | 0 | 0 | 0 | 0 | KMCMULLEN |
| 1.38 | 58.43 | 34.43 | 3.58 | 0.67 | 0 | 0 | 0 | 0 | KMCMULLEN |

# 2013 LISMARC Sediment Texture Sampling Log

| LABNO | STATIONID | PROJECT | CRUISEID | AREA | LATITUDE |
|---|---|---|---|---|---|
| BA427 | NB-1 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.161233 |
| BA428 | NB-2 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.14576 |
| BA429 | NB-3 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.127457 |
| BA430 | NB-4 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.102401 |
| BA431 | NB-5 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.09715 |
| BA432 | NB-6 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.082316 |
| BA433 | NB-7 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.052833 |
| BA434 | NB-8 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.031902 |
| BA435 | NB-9 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.003158 |
| BA436 | NB-10 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.044267 |
| BA437 | NB-11 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.010452 |
| BA438 | NB-12 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.050423 |
| BA439 | NB-13 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.025222 |
| BA440 | NB-14 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.035027 |
| BA441 | NB-15 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.049263 |
| BA442 | NB-16 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.073295 |
| BA443 | NB-17 | LISMARC PILOT | 2013-009-FA | LONG ISLAND SOUND | 41.102083 |

| LONGITUDE | DEPTH_M | T_DEPTH | B_DEPTH | DEVICE | MONTH | DAY | YEAR | WEIGHT |
|---|---|---|---|---|---|---|---|---|
| -73.0777 | -9999 | 0 | 2 | SEABOSS | 5 | 21 | 2013 | 22.3762 |
| -73.074447 | 12.8 | 0 | 2 | SEABOSS | 5 | 21 | 2013 | 15.8413 |
| -73.06893 | 15.2 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 20.5393 |
| -73.065672 | 18.1 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 18.5540 |
| -73.051167 | 22 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 14.0969 |
| -73.05125 | 24.7 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 17.8459 |
| -73.005233 | 36.6 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 20.2694 |
| -73.018686 | 39.9 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 33.6454 |
| -73.035755 | 25.5 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 14.3653 |
| -73.043667 | 36 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 29.2921 |
| -73.060565 | 34.2 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 16.8075 |
| -73.05964 | 34.1 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 20.9372 |
| -73.081788 | 46 | 0 | 2 | SEABOSS | 5 | 22 | 2013 | 24.4968 |
| -73.142362 | 36.6 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 15.7156 |
| -73.157843 | 26.5 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 14.8618 |
| -73.156898 | 20.1 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 17.0616 |
| -73.153117 | 13.1 | 0 | 2 | SEABOSS | 5 | 23 | 2013 | 23.9151 |

| ZGRAVEL | ZSAND | ZSILT | ZCLAY | SEDCLASS | MEDIAN | MEAN | STDEV | SKEWNESS |
|---|---|---|---|---|---|---|---|---|
| 0 | 51.62 | 32.26 | 16.11 | SILTY SAND | 3.95 | 5.06 | 2.52 | 0.16 |
| 0 | 7.69 | 70.23 | 22.07 | CLAYEY SILT | 6.55 | 6.58 | 1.82 | -0.12 |
| 0 | 35.65 | 44.97 | 19.38 | SANDY SILT | 6.06 | 5.61 | 2.56 | -0.09 |
| 0 | 15.98 | 55.4 | 28.6 | CLAYEY SILT | 6.97 | 6.55 | 2.37 | -0.38 |
| 0 | 14.43 | 51.12 | 34.45 | CLAYEY SILT | 7.22 | 6.84 | 2.2 | -0.26 |
| 0 | 19.37 | 54.5 | 26.12 | CLAYEY SILT | 6.69 | 6.32 | 2.37 | -0.25 |
| 0 | 16.32 | 57.8 | 25.88 | CLAYEY SILT | 6.84 | 6.47 | 2.24 | -0.27 |
| 0 | 68.84 | 20.77 | 10.39 | SILTY SAND | 2.59 | 3.7 | 2.65 | 0.48 |
| 0 | 1.42 | 63.85 | 34.73 | CLAYEY SILT | 7.36 | 7.41 | 1.46 | -0.01 |
| 0 | 52.07 | 32.4 | 15.53 | SILTY SAND | 3.85 | 4.86 | 2.6 | 0.22 |
| 2.2 | 44.55 | 34.45 | 18.79 | SILTY SAND | 4.79 | 4.63 | 3.29 | -0.02 |
| 0 | 33.75 | 47.3 | 18.96 | SANDY SILT | 5.74 | 5.69 | 2.32 | 0.07 |
| 3.1 | 55.86 | 26.67 | 14.38 | SILTY SAND | 3.2 | 4.09 | 3.1 | 0.13 |
| 0 | 18.01 | 53.02 | 28.96 | CLAYEY SILT | 6.89 | 6.51 | 2.29 | -0.23 |
| 0 | 24.75 | 48.43 | 26.82 | SAND SILT CLAY | 6.7 | 6.3 | 2.35 | -0.14 |
| 0 | 19.34 | 56.32 | 24.33 | CLAYEY SILT | 6.54 | 6.27 | 2.26 | -0.17 |
| 0 | 29.89 | 50.55 | 19.54 | SANDY SILT | 6.08 | 5.63 | 2.58 | -0.16 |

| KURTOSIS | PHI_11 | PHI_10 | PHI_9 | PHI_8 | PHI_7 | PHI_6 | PHI_5 | PHI_4 |
|---|---|---|---|---|---|---|---|---|
| -0.8 | 3.67 | 5.16 | 8.48 | 10.61 | 12.27 | 4.42 | 4.96 | 33.87 |
| 0.41 | 4.46 | 6.77 | 12.29 | 17.58 | 23.04 | 20.68 | 8.93 | 5.24 |
| -0.75 | 3.98 | 5.94 | 10.75 | 15.05 | 16.57 | 6.65 | 6.7 | 21.57 |
| -0.04 | 5.65 | 8.78 | 15.99 | 20.78 | 18.96 | 11.79 | 3.87 | 3.34 |
| -0.46 | 7.36 | 10.97 | 18.46 | 20.05 | 14.79 | 7.75 | 8.53 | 8.68 |
| -0.42 | 5.15 | 7.91 | 14.72 | 17.98 | 18.77 | 9.88 | 7.87 | 7.79 |
| -0.38 | 4.92 | 7.82 | 14.74 | 21.4 | 17.3 | 11.86 | 7.24 | 4.85 |
| -0.41 | 2.06 | 3.16 | 5.85 | 7.56 | 7.22 | 3.04 | 2.95 | 6.05 |
| -0.02 | 6.6 | 10.48 | 19.75 | 23.99 | 24.09 | 14.61 | 1.16 | 1.22 |
| -1.18 | 3.04 | 4.68 | 8.81 | 11.73 | 11.59 | 4.94 | 4.14 | 14.27 |
| -1.28 | 3.5 | 5.44 | 10.99 | 14.85 | 11.29 | 4.19 | 4.12 | 4.01 |
| -1.06 | 3.78 | 5.79 | 10.62 | 14.48 | 14.1 | 9.42 | 9.3 | 21.51 |
| -0.96 | 2.79 | 4.24 | 8.26 | 10.28 | 9.78 | 3.53 | 3.08 | 11.23 |
| -0.65 | 5.51 | 8.65 | 16.57 | 19.07 | 18.43 | 7.67 | 7.85 | 5.5 |
| -0.96 | 5.17 | 8.18 | 15.13 | 17.86 | 17.79 | 6.02 | 6.76 | 13.51 |
| -0.56 | 4.77 | 7.45 | 13.65 | 17.21 | 18.32 | 10.89 | 9.9 | 10.34 |
| -0.63 | 3.84 | 5.78 | 11.18 | 14.57 | 17.2 | 9.3 | 9.48 | 11.73 |

| PHI_3 | PHI_2 | PHI_1 | PHI_0 | PHIm1 | PHIm2 | PHIm3 | PHIm4 | PHIm5 |
|---|---|---|---|---|---|---|---|---|
| 12.22 | 2.21 | 1.71 | 1.61 | 0 | 0 | 0 | 0 | 0 |
| 1.09 | 0.75 | 0.42 | 0.19 | 0 | 0 | 0 | 0 | 0 |
| 6.78 | 3.34 | 2.08 | 1.88 | 0 | 0 | 0 | 0 | 0 |
| 4.95 | 6.57 | 0.92 | 0.2 | 0 | 0 | 0 | 0 | 0 |
| 4.21 | 1.03 | 0.42 | 0.09 | 0 | 0 | 0 | 0 | 0 |
| 6.28 | 3.53 | 1.5 | 0.27 | 0 | 0 | 0 | 0 | 0 |
| 7.72 | 3.26 | 0.43 | 0.06 | 0 | 0 | 0 | 0 | 0 |
| 31.25 | 27.55 | 3.15 | 0.84 | 0 | 0 | 0 | 0 | 0 |
| 0.11 | 0.05 | 0.03 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| 31.05 | 5.76 | 0.76 | 0.23 | 0 | 0 | 0 | 0 | 0 |
| 7.94 | 23.75 | 7.16 | 1.69 | 0.23 | 1.97 | 0 | 0 | 0 |
| 10.19 | 1.45 | 0.59 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| 15.19 | 22.07 | 5.19 | 2.18 | 1.17 | 1.93 | 0 | 0 | 0 |
| 11.06 | 1.04 | 0.32 | 0.09 | 0 | 0 | 0 | 0 | 0 |
| 9.58 | 1.22 | 0.37 | 0.07 | 0 | 0 | 0 | 0 | 0 |
| 5.41 | 2.65 | 0.82 | 0.12 | 0 | 0 | 0 | 0 | 0 |
| 10.24 | 3.15 | 2.36 | 2.41 | 0 | 0 | 0 | 0 | 0 |

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# Appendix 4:  Sediment Environment Acquisition Cruise Details

For sediment environment we used data from the sediment sampling surveys (s. Appendix 3 for details on the sediment sampling survey) and subbottom survey data described here..

The subbottom surveys were conducted using a high-resolution Chirp subbottom profiler system consisting of an EdgeTech 424 tow fish and an EdgeTech P3200 acquisition unit with Discovery software (Fig. A4-1).




**Lamont EdgeTech Chirp 424 subbottom profiler system (left) and EdgeTech Discovery software (right).**

The system was operated using an acoustic sweep signal between 4-24 kHz that results in a nominal high vertical resolution of 0.1-0.2m. The horizontal resolution depends on the survey speed. The system transmits data at a rate of 4-5 pings/second. At survey speeds of 5-6 knots these transmission rates results in an along track spacing of traces between 0.5 and 1m. Data were recorded in EdgeTech's proprietary jsf format as well as in Standard SEGY format.

The subbottom data are geo-referenced using a differential GPS system, which provides horizontal accuracy <1m. The offset between the ships DGPS antenna and the actual towed fish location was determined for later correction of the positions

Files were recorded continuously along a line and named <survey><orientation><line><part>, for example: LIS1301w100a, with orientation indicated by w (east-west) or n (north-south), line numbers consecutively numbered in the order of acquisition, and different segments marked a, b, c, if these segments are part of a continuous line that was collected into different parts or has been repeated.

The original plan proposed to acquire subbottom data along a grid with a spacing of 500 m in EW direction and 1000 m in NS direction over the entire pilot area except the shallowest areas (<2-3m), but it was modified to cover most of the pilot area while minimizing the efforts and resulting costs. The actual subbottom survey was performed in three stages (Fig. A4-6, Table A4-1):

(1) System test (LIS1201).
To test the Chirp subbottom system on the Stony Brook vessels and optimize acquisition parameters we conducted a field test in June 2012, which covered mainly the harbor area of Port Jefferson (Fig.A4-6; green line).

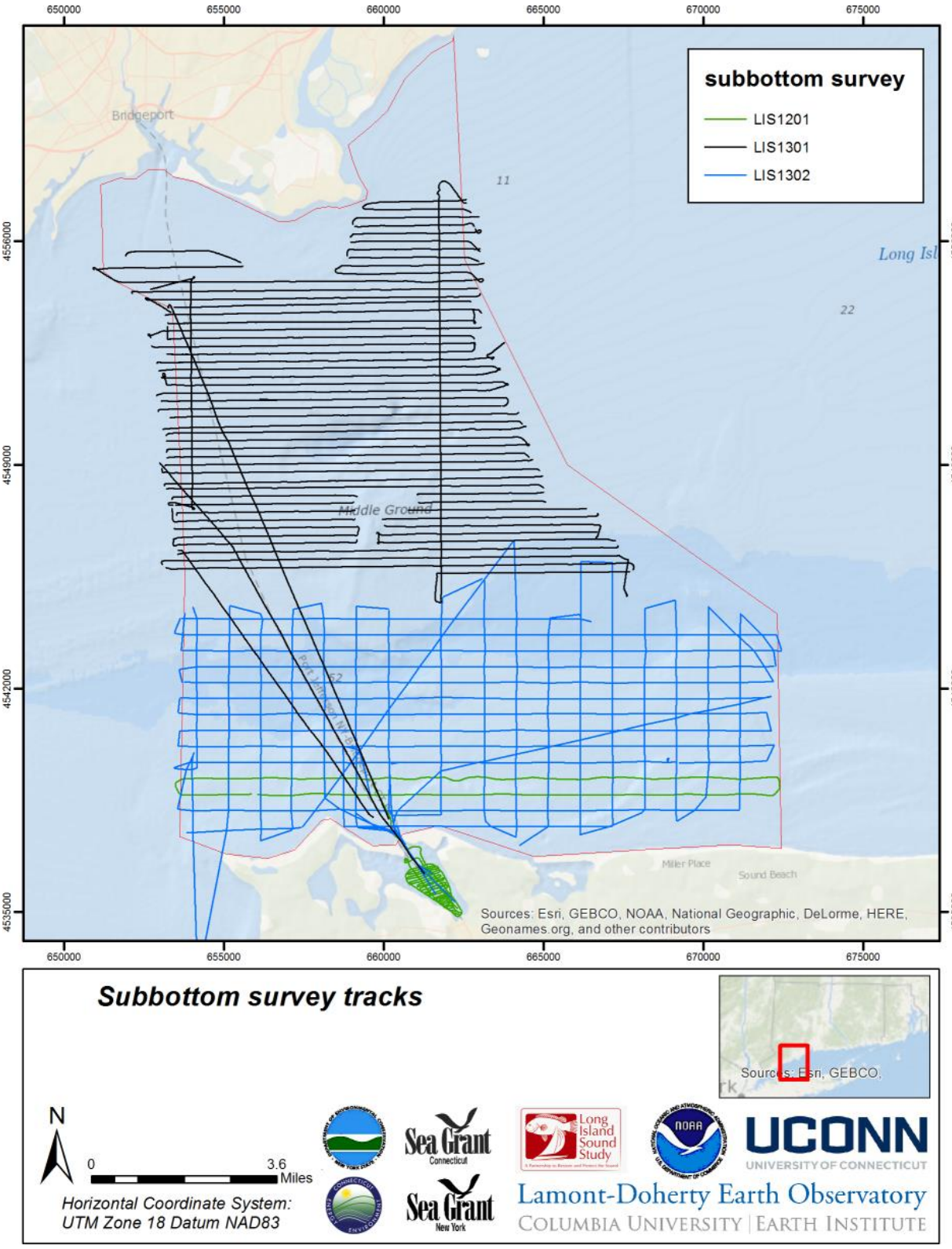
(2) Measurements in tandem with multibeam collection (LIS1301)
For data collection in northern areas (D and E) we towed the subbottom system from the *R/V Seawolf* while the vessel is collecting multibeam data (LIS1301; Fig A4-6 black lines). This resulted in denser (~ 250 m) line spacing in east-west direction and fewer crossing north-south lines.

(3) Survey of the Southern section (LIS1302).
The original plan was that the NOAA vessel *T Jefferson* would collect subbottom data in the area C as part of their multibeam survey, but they were unable to do so. Hence we stretched the surveys planned for the A and B areas in a way that they covered most of area C as well (LIS1302; Fig. A4-6 blue lines). To combine the different surveys we acquired lines that connect the different surveys.

In total we collected 179 subbottom lines, which represent 1036km of subbottom data:.

**Table A3.3: Subbottom field data collection details.**

| Survey | Survey date | Field days | Vessel | # lines | Length/km |
|---|---|---|---|---|---|
| **LIS1201** | June 4 -5 2012 | 2 days | Pritchard | 34 | 70 |
| **LIS1301** | March 18-27 2013 | 8 days | Seawolf | 73 | 550 |
| **LIS1302** | April 16–25 2013 | 8 days | Pritchard | 72 | 416 |
| **total** | | **18** | | **179** | **1036** |

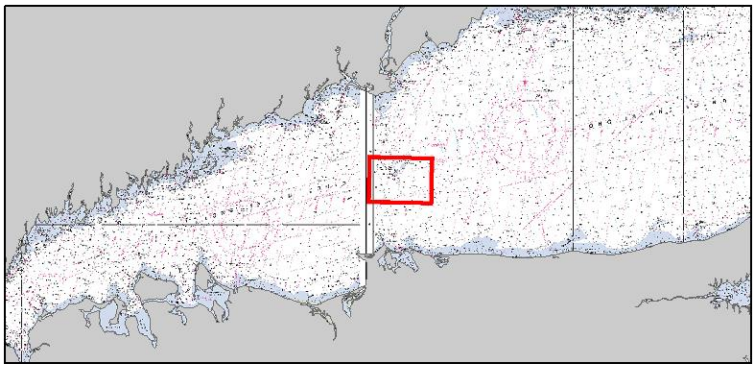


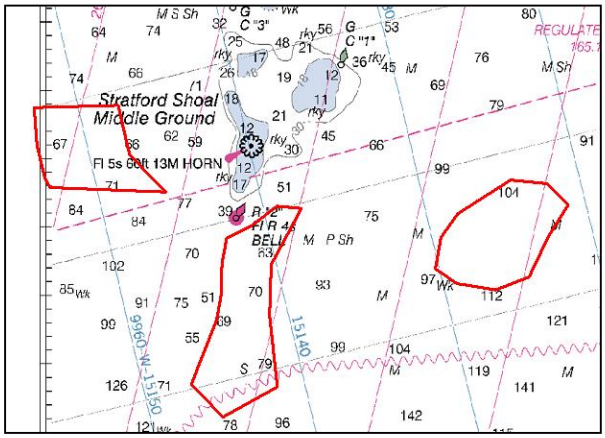

**Map of the new subbottom profiles collected as part of the pilot project. Different colors indicate the different surveys described in the text.**

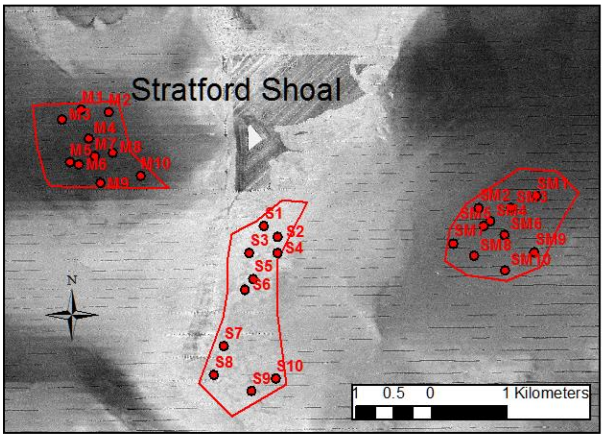
# Appendix 5:  Ecological Characterization Cruise Details

Stony Brook University:

**Station locations. S = Sand, M = Mud, and SM = sandy mud areas.**






**Field data for each sampling location.**

| Station ID | Sample ID | Latitude | Longitude | Date | Water Depth (m) | Grab Depth (cm) |
|---|---|---|---|---|---|---|
| M1 | L010 | 41.0640333 | -73.1282833 | 6/18/2013 | 21.4 | 9.5 |
| M2 | L009 | 41.0636167 | -73.1239667 | 6/18/2013 | 20.7 | 9.5 |
| M3 | L011 | 41.0628500 | -73.1313833 | 6/18/2013 | 21 | 9.5 |
| M4 | L012 | 41.0605167 | -73.1272000 | 6/18/2013 | 20.3 | 9.5 |
| M5 | L013 | 41.0577500 | -73.1302500 | 6/18/2013 | 21.3 | 9.5 |
| M6 | L014 | 41.0574500 | -73.1288833 | 6/18/2013 | 21.3 | 9.5 |
| M7 | L015 | 41.0583833 | -73.1262833 | 6/18/2013 | 20.9 | 9.5 |

| Station ID | Sample ID | Latitude | Longitude | Date | Water Depth (m) | Grab Depth (cm) |
|---|---|---|---|---|---|---|
| M8 | L008 | 41.0587500 | -73.1234500 | 6/18/2013 | 20.9 | 8.5 |
| M9 | L016 | 41.0551667 | -73.1255000 | 6/18/2013 | 21.9 | 9.5 |
| M10 | L007 | 41.0559333 | -73.1191000 | 6/18/2013 | 21.4 | 9.5 |
| S1 | L006 | 41.0496167 | -73.0998000 | 6/18/2013 | 20.7 | 6 |
| S2 | L005 | 41.0482833 | -73.0976500 | 6/18/2013 | 22.6 | 6.5 |
| S3 | L003 | 41.0464167 | -73.1022333 | 6/18/2013 | 21.6 | 7 |
| S4 | L004 | 41.0463450 | -73.0978410 | 6/18/2013 | 22.9 | 6 |
| S5 | L017 | 41.0433000 | -73.1016833 | 6/18/2013 | 21.6 | 6.5 |
| S6 | L002 | 41.0420500 | -73.1030167 | 6/18/2013 | 22.9 | 6 |
| S7 | L018 | 41.0353667 | -73.1065833 | 6/18/2013 | 22.3 | 5 |
| S8 | L001 | 41.0319333 | -73.1082167 | 6/18/2013 | 21.2 | 5 |
| S9 | L020 | 41.0299333 | -73.1023167 | 6/18/2013 | 24 | 5 |
| S10 | L019 | 41.0313667 | -73.0984500 | 6/18/2013 | 26.4 | 5 |
| SM1 | L029 | 41.0524833 | -73.0565500 | 9/11/2013 | 32.7 | 10 |
| SM2 | L027 | 41.0512000 | -73.0657833 | 9/11/2013 | 32.4 | 10 |
| SM3 | L028 | 41.0511500 | -73.0607000 | 9/11/2013 | 32.6 | 10 |
| SM4 | L026 | 41.0495833 | -73.0640000 | 9/11/2013 | 32.7 | 10 |
| SM5 | L025 | 41.0490333 | -73.0650500 | 9/11/2013 | 32.7 | 10 |
| SM6 | L030 | 41.0479167 | -73.0617667 | 9/11/2013 | 33.3 | 10 |
| SM7 | L024 | 41.0470167 | -73.0699333 | 9/11/2013 | 32.7 | 10 |
| SM8 | L023 | 41.0455167 | -73.0666667 | 9/11/2013 | 32.9 | 10 |
| SM9 | L022 | 41.0457667 | -73.0571333 | 9/11/2013 | 33 | 10 |

| Station ID | Sample ID | Latitude | Longitude | Date | Water Depth (m) | Grab Depth (cm) |
|---|---|---|---|---|---|---|
| SM10 | L021 | 41.0436667 | -73.0618333 | 9/11/2013 | 33 | 10 |

# Appendix 5: LISMARC Ecological Characterization Acquisition Cruise Details

## 2012 SEABOSS Photo Log, October, 2012

## 2012 SEABOSS Video Log, October, 2012

## 2012 ISIS Log, December, 2012

## 2013 SEABOSS Photo Log, May, 2013

## 2013 SEABOSS Video Log, May, 2013

## 2013 K2 ROV Summary Log, May, 2013

# 2012 SEABOSS Photo Log, October, 2012

| STATION | PHOTO | ARCHIVE.JPG | LATITUDE | LONGITUDE | DATE | DEVICE |
|---|---|---|---|---|---|---|
| SB-03-1 | SB-03-1-1 | IMG_2994.JPG | 41.132567 | -73.09055 | 10/10/12 | SEABOSS |
| SB-03-1 | SB-03-1-2 | IMG_2995.JPG | 41.13255 | -73.090617 | 10/10/12 | SEABOSS |
| SB-03-1 | SB-03-1-3 | IMG_2996.JPG | 41.13255 | -73.090733 | 10/10/12 | SEABOSS |
| SB-03-2 | SB-03-2-1 | IMG_2997.JPG | 41.1344 | -73.090817 | 10/10/12 | SEABOSS |
| SB-03-3 | SB-03-3-1 | IMG_3000.JPG | 41.138717 | -73.086317 | 10/10/12 | SEABOSS |
| SB-03-3 | SB-03-3-2 | IMG_3001.JPG | 41.138667 | -73.0864 | 10/10/12 | SEABOSS |
| SB-03-3 | SB-03-3-3 | IMG_3002.JPG | 41.138633 | -73.086433 | 10/10/12 | SEABOSS |
| SB-03-3 | SB-03-3-4 | IMG_3003.JPG | 41.1386 | -73.0865 | 10/10/12 | SEABOSS |
| SB-04-1 | SB-04-1-1 | IMG_3203.JPG | 41.122792 | -73.13823 | 10/11/12 | SEABOSS |
| SB-04-1 | SB-04-1-2 | IMG_3204.JPG | 41.1228 | -73.138063 | 10/11/12 | SEABOSS |
| SB-04-1 | SB-04-1-3 | IMG_3205.JPG | 41.122792 | -73.137972 | 10/11/12 | SEABOSS |
| SB-04-1 | SB-04-1-4 | IMG_3207.JPG | 41.122747 | -73.137615 | 10/11/12 | SEABOSS |
| SB-04-1 | SB-04-1-5 | IMG_3208.JPG | 41.122747 | -73.137537 | 10/11/12 | SEABOSS |
| SB-04-2 | SB-04-2-1 | IMG_3209.JPG | 41.119787 | -73.1379 | 10/11/12 | SEABOSS |
| SB-04-2 | SB-04-2-2 | IMG_3210.JPG | 41.119787 | -73.137812 | 10/11/12 | SEABOSS |
| SB-04-2 | SB-04-2-3 | IMG_3212.JPG | 41.119773 | -73.137617 | 10/11/12 | SEABOSS |
| SB-04-2 | SB-04-2-4 | IMG_3213.JPG | 41.119747 | -73.137473 | 10/11/12 | SEABOSS |
| SB-04-2 | SB-04-2-5 | IMG_3214.JPG | 41.119732 | -73.137405 | 10/11/12 | SEABOSS |
| SB-04-3 | SB-04-3-1 | IMG_3217.JPG | 41.121652 | -73.134355 | 10/11/12 | SEABOSS |
| SB-04-3 | SB-04-3-2 | IMG_3218.JPG | 41.12163 | -73.134288 | 10/11/12 | SEABOSS |
| SB-04-3 | SB-04-3-3 | IMG_3219.JPG | 41.121605 | -73.13414 | 10/11/12 | SEABOSS |
| SB-04-3 | SB-04-3-4 | IMG_3220.JPG | 41.121583 | -73.134048 | 10/11/12 | SEABOSS |
| SB-04-3 | SB-04-3-5 | IMG_3221.JPG | 41.121553 | -73.133948 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-1 | IMG_3301.JPG | 41.113405 | -73.119163 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-2 | IMG_3302.JPG | 41.113402 | -73.119078 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-3 | IMG_3303.JPG | 41.11338 | -73.11894 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-4 | IMG_3305.JPG | 41.113393 | -73.118478 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-5 | IMG_3306.JPG | 41.113405 | -73.118372 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-6 | IMG_3307.JPG | 41.113415 | -73.118282 | 10/11/12 | SEABOSS |
| SB-05-1 | SB-05-1-7 | IMG_3308.JPG | 41.113417 | -73.118173 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-1 | IMG_3309.JPG | 41.110687 | -73.115227 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-2 | IMG_3310.JPG | 41.110658 | -73.115107 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-3 | IMG_3311.JPG | 41.110638 | -73.11503 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-4 | IMG_3312.JPG | 41.11062 | -73.114982 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-5 | IMG_3313.JPG | 41.110587 | -73.114888 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-6 | IMG_3314.JPG | 41.110547 | -73.114733 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-7 | IMG_3315.JPG | 41.110537 | -73.114705 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-8 | IMG_3316.JPG | 41.110528 | -73.114628 | 10/11/12 | SEABOSS |
| SB-05-2 | SB-05-2-9 | IMG_3317.JPG | 41.110532 | -73.11459 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-1 | IMG_3319.JPG | 41.113262 | -73.121628 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-2 | IMG_3320.JPG | 41.113252 | -73.121443 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-3 | IMG_3321.JPG | 41.113245 | -73.121223 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-4 | IMG_3322.JPG | 41.11316 | -73.120925 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-5 | IMG_3323.JPG | 41.113142 | -73.120863 | 10/11/12 | SEABOSS |

| | | | | | | |
|---|---|---|---|---|---|---|
| SB-05-3 | SB-05-3-6 | IMG_3324.JPG | 41.113095 | -73.120707 | 10/11/12 | SEABOSS |
| SB-05-3 | SB-05-3-7 | IMG_3325.JPG | 41.113072 | -73.120595 | 10/11/12 | SEABOSS |
| SB-06-1 | SB-06-1-1 | IMG_3073.JPG | 41.1118 | -73.085217 | 10/10/12 | SEABOSS |
| SB-06-1 | SB-06-1-2 | IMG_3074.JPG | 41.1118 | -73.085183 | 10/10/12 | SEABOSS |
| SB-06-1 | SB-06-1-3 | IMG_3075.JPG | 41.1118 | -73.085083 | 10/10/12 | SEABOSS |
| SB-06-1 | SB-06-1-4 | IMG_3078.JPG | 41.111783 | -73.084817 | 10/10/12 | SEABOSS |
| SB-06-2 | SB-06-2-1 | IMG_3080.JPG | 41.11605 | -73.083783 | 10/10/12 | SEABOSS |
| SB-06-2 | SB-06-2-2 | IMG_3081.JPG | 41.116033 | -73.08365 | 10/10/12 | SEABOSS |
| SB-06-2 | SB-06-2-3 | IMG_3082.JPG | 41.116017 | -73.08355 | 10/10/12 | SEABOSS |
| SB-06-2 | SB-06-2-4 | IMG_3083.JPG | 41.116017 | -73.0835 | 10/10/12 | SEABOSS |
| SB-06-3 | SB-06-3-1 | IMG_3086.JPG | 41.111183 | -73.083283 | 10/10/12 | SEABOSS |
| SB-06-3 | SB-06-3-2 | IMG_3087.JPG | 41.111183 | -73.08325 | 10/10/12 | SEABOSS |
| SB-06-3 | SB-06-3-3 | IMG_3088.JPG | 41.111183 | -73.0832 | 10/10/12 | SEABOSS |
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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:11:17:08:02 |
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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:52:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:52:47 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:53:31 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:53:50 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:54:05 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:17:57:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:07:33 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:07:40 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:07:53 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:08:12 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:08:41 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:13:18:09:09 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:44:59 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:45:41 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:45:58 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:46:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:46:41 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:56:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:57:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:12:58:39 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:13:10:12 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:13:10:54 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:13:11:46 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:13:12:13 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:04:24 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:05:02 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:05:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:05:53 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:06:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:19:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:19:46 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:20:32 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:20:58 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:21:05 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:34:27 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:34:44 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:35:11 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:35:45 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:18:36:00 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:34:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:35:55 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:36:10 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:36:26 |

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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:36:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:51:39 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:51:56 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:52:04 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:52:14 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:52:36 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:53:00 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:11:53:17 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:15:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:15:36 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:15:53 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:16:01 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:16:14 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:12:16:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:25:51 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:26:05 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:26:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:26:50 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:27:04 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:27:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:27:31 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:40:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:40:55 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:41:14 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:41:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:41:51 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:53:47 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:54:04 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:54:34 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:54:48 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:55:07 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:16:55:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:31:51 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:32:00 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:32:12 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:32:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:32:30 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:32:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:43:02 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:43:15 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:43:31 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:43:45 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:43:56 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:56:34 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:57:03 |

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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:57:13 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:18:57:27 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:07:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:08:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:08:41 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:08:48 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:09:13 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:09:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:10:13 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:10:51 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:11:02 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:26:55 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:27:11 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:27:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:27:43 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:28:01 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:41:08 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:41:25 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:41:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:41:54 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:14:42:14 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:55:41 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:55:58 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:56:20 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:56:31 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:56:55 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:10:57:17 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:08:23 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:08:50 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:09:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:09:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:10:05 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:20:33 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:21:09 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:21:53 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:22:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:22:42 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:17:11:22:59 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:03:27 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:03:57 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:04:18 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:04:47 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:17:25 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:17:59 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:18:21 |

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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:18:39 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:19:02 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:28:48 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:29:20 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:16:14:29:51 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:36:55 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:37:21 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:37:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:37:32 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:51:17 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:51:31 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:52:32 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:52:44 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:52:52 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:53:22 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:53:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:53:30 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:53:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:14:53:47 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:15:13:52 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:15:14:47 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:15:15:02 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:15:15:12 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:15:15:59 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:46:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:46:33 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:46:46 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:46:59 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:47:27 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:48:00 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:48:08 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:48:37 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:59:27 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:16:59:45 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:00:00 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:00:13 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:00:37 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:00:54 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:11:58 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:12:08 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:12:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:12:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:12:33 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:12:17:12:48 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:07:30 |

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| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:08:50 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:09:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:09:43 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:30:50 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:30:56 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:31:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:32:06 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:32:16 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:45:26 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:45:38 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:45:58 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:46:14 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:46:30 |
| LISMaRC PILOT | LONG ISLAND SOUND | LPOPPE | 2012:10:14:16:46:41 |

# 2012 SEABOSS Video Log, October, 2012

| STATION | LINELOC | LATITUDE | LONGITUDE | DATE | DEVICE |
|---|---|---|---|---|---|
| SB-03-1 | SOL | 41.13258333 | -73.09028333 | 10/10/12 | SEABOSS |
| SB-03-1 | EOL | 41.13253333 | -73.09083333 | 10/10/12 | SEABOSS |
| SB-03-2 | SOL | 41.13438333 | -73.09065 | 10/10/12 | SEABOSS |
| SB-03-2 | EOL | 41.1344 | -73.09088333 | 10/10/12 | SEABOSS |
| SB-03-3 | SOL | 41.13871667 | -73.0863 | 10/10/12 | SEABOSS |
| SB-03-3 | EOL | 41.13856667 | -73.08655 | 10/10/12 | SEABOSS |
| SB-04-1 | SOL | 41.12281667 | -73.13826667 | 10/11/12 | SEABOSS |
| SB-04-1 | EOL | 41.12271667 | -73.1373 | 10/11/12 | SEABOSS |
| SB-04-2 | SOL | 41.11978333 | -73.13795 | 10/11/12 | SEABOSS |
| SB-04-2 | EOL | 41.11963333 | -73.13721667 | 10/11/12 | SEABOSS |
| SB-04-3 | SOL | 41.12173333 | -73.13455 | 10/11/12 | SEABOSS |
| SB-04-3 | EOL | 41.12155 | -73.13378333 | 10/11/12 | SEABOSS |
| SB-05-1 | SOL | 41.1134 | -73.11923333 | 10/11/12 | SEABOSS |
| SB-05-1 | EOL | 41.11336667 | -73.1179 | 10/11/12 | SEABOSS |
| SB-05-2 | SOL | 41.11065 | -73.11521667 | 10/11/12 | SEABOSS |
| SB-05-2 | EOL | 41.11053333 | -73.11433333 | 10/11/12 | SEABOSS |
| SB-05-3 | SOL | 41.11333333 | -73.1215 | 10/11/12 | SEABOSS |
| SB-05-3 | EOL | 41.11306667 | -73.12041667 | 10/11/12 | SEABOSS |
| SB-06-1 | SOL | 41.1118 | -73.08528333 | 10/10/12 | SEABOSS |
| SB-06-1 | EOL | 41.11175 | -73.08471667 | 10/10/12 | SEABOSS |
| SB-06-2 | SOL | 41.11606667 | -73.08381667 | 10/10/12 | SEABOSS |
| SB-06-2 | EOL | 41.11601667 | -73.08341667 | 10/10/12 | SEABOSS |
| SB-06-3 | SOL | 41.11118333 | -73.08336667 | 10/10/12 | SEABOSS |
| SB-06-3 | EOL | 41.11113333 | -73.08291667 | 10/10/12 | SEABOSS |
| SB-06-4 | SOL | 41.11463333 | -73.08296667 | 10/10/12 | SEABOSS |
| SB-06-4 | EOL | 41.11453333 | -73.08258333 | 10/10/12 | SEABOSS |
| SB-06-5 | SOL | 41.11341667 | -73.07851667 | 10/10/12 | SEABOSS |
| SB-06-5 | EOL | 41.11341667 | -73.07821667 | 10/10/12 | SEABOSS |
| SB-06-6 | SOL | 41.11288333 | -73.08233333 | 10/10/12 | SEABOSS |
| SB-06-6 | EOL | 41.1128 | -73.08206667 | 10/10/12 | SEABOSS |
| SB-07-1 | SOL | 41.09505 | -73.12861667 | 10/11/12 | SEABOSS |
| SB-07-1 | EOL | 41.09473333 | -73.12758333 | 10/11/12 | SEABOSS |
| SB-07-2 | SOL | 41.0923 | -73.12965 | 10/11/12 | SEABOSS |
| SB-07-2 | EOL | 41.09228333 | -73.12855 | 10/11/12 | SEABOSS |
| SB-07-3 | SOL | 41.0976 | -73.12645 | 10/11/12 | SEABOSS |
| SB-07-3 | EOL | 41.09758333 | -73.12581667 | 10/11/12 | SEABOSS |
| SB-08-1 | SOL | 41.0873 | -73.10535 | 10/15/12 | SEABOSS |
| SB-08-1 | EOL | 41.08773333 | -73.10553333 | 10/15/12 | SEABOSS |
| SB-08-2 | SOL | 41.08326667 | -73.10063333 | 10/15/12 | SEABOSS |
| SB-08-2 | EOL | 41.08365 | -73.10076667 | 10/15/12 | SEABOSS |
| SB-08-3 | SOL | 41.08856667 | -73.09948333 | 10/15/12 | SEABOSS |
| SB-08-3 | EOL | 41.08905 | -73.0997 | 10/15/12 | SEABOSS |
| SB-09-3 | SOL | 41.08938333 | -73.07118333 | 10/15/12 | SEABOSS |
| SB-09-3 | EOL | 41.08978333 | -73.07125 | 10/15/12 | SEABOSS |
| SB-09-4 | SOL | 41.088185 | -73.074087 | 10/15/12 | SEABOSS |
| SB-09-4 | EOL | 41.08858333 | -73.07398333 | 10/15/12 | SEABOSS |
| SB-09-5 | SOL | 41.088138 | -73.068542 | 10/15/12 | SEABOSS |

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|---|---|---|---|---|---|
| SB-09-5 | EOL | 41.08866667 | -73.0685 | 10/15/12 | SEABOSS |
| SB-10-1 | SOL | 41.08148333 | -73.1354 | 10/11/12 | SEABOSS |
| SB-10-1 | EOL | 41.08146667 | -73.13501667 | 10/11/12 | SEABOSS |
| SB-10-2 | SOL | 41.08176667 | -73.13333333 | 10/11/12 | SEABOSS |
| SB-10-2 | EOL | 41.08175 | -73.13285 | 10/11/12 | SEABOSS |
| SB-10-3 | SOL | 41.0746 | -73.13121667 | 10/11/12 | SEABOSS |
| SB-10-3 | EOL | 41.07455 | -73.13085 | 10/11/12 | SEABOSS |
| SB-11-1 | SOL | 41.070962 | -73.106893 | 10/13/12 | SEABOSS |
| SB-11-1 | EOL | 41.07088333 | -73.10658333 | 10/13/12 | SEABOSS |
| SB-11-2 | SOL | 41.075272 | -73.11481 | 10/13/12 | SEABOSS |
| SB-11-2 | EOL | 41.07553333 | -73.11505 | 10/13/12 | SEABOSS |
| SB-11-3 | SOL | 41.075408 | -73.108702 | 10/13/12 | SEABOSS |
| SB-11-3 | EOL | 41.07525 | -73.10836667 | 10/13/12 | SEABOSS |
| SB-12-1 | SOL | 41.07053333 | -73.07378333 | 10/15/12 | SEABOSS |
| SB-12-1 | EOL | 41.07086667 | -73.0735 | 10/15/12 | SEABOSS |
| SB-12-2 | SOL | 41.07171667 | -73.07666667 | 10/15/12 | SEABOSS |
| SB-12-2 | EOL | 41.07215 | -73.07631667 | 10/15/12 | SEABOSS |
| SB-12-3 | SOL | 41.07615 | -73.07738333 | 10/15/12 | SEABOSS |
| SB-12-3 | EOL | 41.07666667 | -73.07618333 | 10/15/12 | SEABOSS |
| SB-12-4 | SOL | 41.07335 | -73.07185 | 10/15/12 | SEABOSS |
| SB-12-4 | EOL | 41.07375 | -73.07116667 | 10/15/12 | SEABOSS |
| SB-12-5 | SOL | 41.06833333 | -73.07341667 | 10/15/12 | SEABOSS |
| SB-12-5 | EOL | 41.06866667 | -73.07281667 | 10/15/12 | SEABOSS |
| SB-12-6 | SOL | 41.0693 | -73.0776 | 10/15/12 | SEABOSS |
| SB-12-6 | EOL | 41.06971667 | -73.0769 | 10/15/12 | SEABOSS |
| SB-12-7 | SOL | 41.07561667 | -73.07813333 | 10/15/12 | SEABOSS |
| SB-12-7 | EOL | 41.0762 | -73.07696667 | 10/15/12 | SEABOSS |
| SB-12-8 | SOL | 41.07121667 | -73.07901667 | 10/15/12 | SEABOSS |
| SB-12-8 | EOL | 41.07168333 | -73.07763333 | 10/15/12 | SEABOSS |
| SB-12-9 | SOL | 41.07431667 | -73.07515 | 10/15/12 | SEABOSS |
| SB-12-9 | EOL | 41.07465 | -73.0744 | 10/15/12 | SEABOSS |
| SB-13-1 | SOL | 41.06415 | -73.13928333 | 10/12/12 | SEABOSS |
| SB-13-1 | EOL | 41.06371667 | -73.13921667 | 10/12/12 | SEABOSS |
| SB-13-2 | SOL | 41.0689667 | -73.14246667 | 10/12/12 | SEABOSS |
| SB-13-2 | EOL | 41.0686333 | -73.1424 | 10/12/12 | SEABOSS |
| SB-13-3 | SOL | 41.0662 | -73.14051667 | 10/12/12 | SEABOSS |
| SB-13-3 | EOL | 41.06563333 | -73.14061667 | 10/12/12 | SEABOSS |
| SB-14-1 | SOL | 41.05945 | -73.04886667 | 10/15/12 | SEABOSS |
| SB-14-1 | EOL | 41.05993333 | -73.0481 | 10/15/12 | SEABOSS |
| SB-14-2 | SOL | 41.06453333 | -73.04691667 | 10/15/12 | SEABOSS |
| SB-14-2 | EOL | 41.06513333 | -73.04596667 | 10/15/12 | SEABOSS |
| SB-14-3 | SOL | 41.06596667 | -73.05446667 | 10/15/12 | SEABOSS |
| SB-14-3 | EOL | 41.06616667 | -73.05416667 | 10/15/12 | SEABOSS |
| SB-15-1 | SOL | 41.059092 | -73.026333 | 10/17/12 | SEABOSS |
| SB-15-1 | EOL | 41.05898333 | -73.02615 | 10/17/12 | SEABOSS |
| SB-15-2 | SOL | 41.064097 | -73.03073 | 10/17/12 | SEABOSS |
| SB-15-2 | EOL | 41.0636 | -73.03118333 | 10/17/12 | SEABOSS |
| SB-15-3 | SOL | 41.060878 | -73.031675 | 10/17/12 | SEABOSS |

| | | | | | |
|---|---|---|---|---|---|
| SB-15-3 | EOL | 41.06088333 | -73.0321 | 10/17/12 | SEABOSS |
| SB-16-1 | SOL | 41.047727 | -73.135652 | 10/17/12 | SEABOSS |
| SB-16-1 | EOL | 41.04756667 | -73.13575 | 10/17/12 | SEABOSS |
| SB-16-2 | SOL | 41.047643 | -73.132642 | 10/17/12 | SEABOSS |
| SB-16-2 | EOL | 41.04748333 | -73.13271667 | 10/17/12 | SEABOSS |
| SB-16-3 | SOL | 41.051588 | -73.138037 | 10/17/12 | SEABOSS |
| SB-16-3 | EOL | 41.05166667 | -73.13853333 | 10/17/12 | SEABOSS |
| SB-17-1 | SOL | 41.046318 | -73.122792 | 10/13/12 | SEABOSS |
| SB-17-1 | EOL | 41.04616667 | -73.12215 | 10/13/12 | SEABOSS |
| SB-17-2 | SOL | 41.049123 | -73.11893 | 10/13/12 | SEABOSS |
| SB-17-2 | EOL | 41.04883333 | -73.1184 | 10/13/12 | SEABOSS |
| SB-17-3 | SOL | 41.04617 | -73.121173 | 10/13/12 | SEABOSS |
| SB-17-3 | EOL | 41.0458 | -73.12063333 | 10/13/12 | SEABOSS |
| SB-18-1 | SOL | 41.046505 | -73.10025 | 10/13/12 | SEABOSS |
| SB-18-1 | EOL | 41.04631667 | -73.0999 | 10/13/12 | SEABOSS |
| SB-18-2 | SOL | 41.051392 | -73.096477 | 10/13/12 | SEABOSS |
| SB-18-2 | EOL | 41.05116667 | -73.09568333 | 10/13/12 | SEABOSS |
| SB-18-3 | SOL | 41.049908 | -73.102042 | 10/13/12 | SEABOSS |
| SB-18-3 | EOL | 41.05008333 | -73.10173333 | 10/13/12 | SEABOSS |
| SB-19-1 | SOL | 41.042985 | -73.078253 | 10/13/12 | SEABOSS |
| SB-19-1 | EOL | 41.0427 | -73.07815 | 10/13/12 | SEABOSS |
| SB-19-2 | SOL | 41.04664 | -73.079553 | 10/13/12 | SEABOSS |
| SB-19-2 | EOL | 41.04626667 | -73.08003333 | 10/13/12 | SEABOSS |
| SB-19-4 | SOL | 41.04908 | -73.082618 | 10/13/12 | SEABOSS |
| SB-19-4 | EOL | 41.04886667 | -73.08301667 | 10/13/12 | SEABOSS |
| SB-20-1 | SOL | 41.046288 | -73.011475 | 10/16/12 | SEABOSS |
| SB-20-1 | EOL | 41.04601667 | -73.00991667 | 10/16/12 | SEABOSS |
| SB-20-2 | SOL | 41.046455 | -73.015502 | 10/16/12 | SEABOSS |
| SB-20-2 | EOL | 41.0463 | -73.01475 | 10/16/12 | SEABOSS |
| SB-20-3 | SOL | 41.04603333 | -73.01983333 | 10/16/12 | SEABOSS |
| SB-20-3 | EOL | 41.0457 | -73.01878333 | 10/16/12 | SEABOSS |
| SB-21-1 | SOL | 41.035417 | -73.107047 | 10/13/12 | SEABOSS |
| SB-21-1 | EOL | 41.03478333 | -73.10621667 | 10/13/12 | SEABOSS |
| SB-21-2 | SOL | 41.041308 | -73.111447 | 10/13/12 | SEABOSS |
| SB-21-2 | EOL | 41.04188333 | -73.11068333 | 10/13/12 | SEABOSS |
| SB-21-3 | SOL | 41.0395578 | -73.1048 | 10/13/12 | SEABOSS |
| SB-21-3 | EOL | 41.03938333 | -73.104 | 10/13/12 | SEABOSS |
| SB-22-1 | SOL | 41.032818 | -73.058137 | 10/15/12 | SEABOSS |
| SB-22-1 | EOL | 41.03325 | -73.05736667 | 10/15/12 | SEABOSS |
| SB-22-2 | SOL | 41.029007 | -73.061258 | 10/15/12 | SEABOSS |
| SB-22-2 | EOL | 41.02961667 | -73.06061667 | 10/15/12 | SEABOSS |
| SB-22-3 | SOL | 41.030005 | -73.05523 | 10/15/12 | SEABOSS |
| SB-22-3 | EOL | 41.03058333 | -73.05463333 | 10/15/12 | SEABOSS |
| SB-23-1 | SOL | 41.039872 | -73.029473 | 10/16/12 | SEABOSS |
| SB-23-1 | EOL | 41.03911667 | -73.02963333 | 10/16/12 | SEABOSS |
| SB-23-2 | SOL | 41.033453 | -73.029805 | 10/16/12 | SEABOSS |
| SB-23-2 | EOL | 41.03271667 | -73.03 | 10/16/12 | SEABOSS |
| SB-23-3 | SOL | 41.036802 | -73.026783 | 10/16/12 | SEABOSS |

| | | | | | |
|---|---|---|---|---|---|
| SB-23-3 | EOL | 41.03605 | -73.02688333 | 10/16/12 | SEABOSS |
| SB-24-1 | SOL | 41.0334 | -72.98123333 | 10/16/12 | SEABOSS |
| SB-24-1 | EOL | 41.03293333 | -72.9802 | 10/16/12 | SEABOSS |
| SB-24-2 | SOL | 41.03816667 | -72.98583333 | 10/16/12 | SEABOSS |
| SB-24-2 | EOL | 41.03783333 | -72.98491667 | 10/16/12 | SEABOSS |
| SB-24-3 | SOL | 41.03511667 | -72.9856 | 10/16/12 | SEABOSS |
| SB-24-3 | EOL | 41.03461667 | -72.98463333 | 10/16/12 | SEABOSS |
| SB-25-1 | SOL | 41.029463 | -73.113718 | 10/12/12 | SEABOSS |
| SB-25-1 | EOL | 41.0296 | -73.11348333 | 10/12/12 | SEABOSS |
| SB-25-2 | SOL | 41.024117 | -73.105862 | 10/12/12 | SEABOSS |
| SB-25-2 | EOL | 41.02418333 | -73.10548333 | 10/12/12 | SEABOSS |
| SB-25-3 | SOL | 41.02521 | -73.113905 | 10/12/12 | SEABOSS |
| SB-25-3 | EOL | 41.02535 | -73.11346667 | 10/12/12 | SEABOSS |
| SB-27-1 | SOL | 41.01811667 | -72.99298333 | 10/16/12 | SEABOSS |
| SB-27-1 | EOL | 41.01781667 | -72.99215 | 10/16/12 | SEABOSS |
| SB-27-2 | SOL | 41.02296667 | -72.99358333 | 10/16/12 | SEABOSS |
| SB-27-2 | EOL | 41.02263333 | -72.99291667 | 10/16/12 | SEABOSS |
| SB-27-3 | SOL | 41.021 | -72.99318333 | 10/16/12 | SEABOSS |
| SB-27-3 | EOL | 41.02085 | -72.99241667 | 10/16/12 | SEABOSS |
| SB-28-1 | SOL | 41.01083 | -73.139872 | 10/12/12 | SEABOSS |
| SB-28-1 | EOL | 41.01041667 | -73.13938333 | 10/12/12 | SEABOSS |
| SB-28-2 | SOL | 41.012003 | -73.138793 | 10/12/12 | SEABOSS |
| SB-28-2 | EOL | 41.01151667 | -73.1383 | 10/12/12 | SEABOSS |
| SB-28-3 | SOL | 41.014402 | -73.145168 | 10/12/12 | SEABOSS |
| SB-28-3 | EOL | 41.01391667 | -73.14478333 | 10/12/12 | SEABOSS |
| SB-29-1 | SOL | 41.01081667 | -73.11298333 | 10/12/12 | SEABOSS |
| SB-29-1 | EOL | 41.01045 | -73.1117 | 10/12/12 | SEABOSS |
| SB-29-2 | SOL | 41.007535 | -73.119497 | 10/12/12 | SEABOSS |
| SB-29-2 | EOL | 41.00736667 | -73.1187 | 10/12/12 | SEABOSS |
| SB-29-3 | SOL | 41.01172 | -73.116165 | 10/12/12 | SEABOSS |
| SB-29-3 | EOL | 41.01143333 | -73.11555 | 10/12/12 | SEABOSS |
| SB-30-1 | SOL | 41.002975 | -73.085345 | 10/17/12 | SEABOSS |
| SB-30-1 | EOL | 41.00255 | -73.08513333 | 10/17/12 | SEABOSS |
| SB-30-2 | SOL | 41.006733 | -73.089485 | 10/17/12 | SEABOSS |
| SB-30-2 | EOL | 41.00673333 | -73.0897 | 10/17/12 | SEABOSS |
| SB-30-3 | SOL | 41.009448 | -73.091753 | 10/17/12 | SEABOSS |
| SB-30-3 | EOL | 41.00926667 | -73.092 | 10/17/12 | SEABOSS |
| SB-31-1 | SOL | 41.007908 | -73.024238 | 10/16/12 | SEABOSS |
| SB-31-1 | EOL | 41.00725 | -73.02406667 | 10/16/12 | SEABOSS |
| SB-31-2 | SOL | 41.012222 | -73.021157 | 10/16/12 | SEABOSS |
| SB-31-2 | EOL | 41.01155 | -73.02085 | 10/16/12 | SEABOSS |
| SB-31-3 | SOL | 41.01036667 | -73.02436667 | 10/16/12 | SEABOSS |
| SB-31-3 | EOL | 41.00951667 | -73.02403333 | 10/16/12 | SEABOSS |
| SB-32-1 | SOL | 41.01396667 | -72.97516667 | 10/14/12 | SEABOSS |
| SB-32-1 | EOL | 41.01456667 | -72.97488333 | 10/14/12 | SEABOSS |
| SB-32-2 | SOL | 41.019523 | -72.976502 | 10/14/12 | SEABOSS |
| SB-32-2 | EOL | 41.02038333 | -72.9759 | 10/14/12 | SEABOSS |
| SB-32-3 | SOL | 41.016848 | -72.979758 | 10/14/12 | SEABOSS |

| | | | | | |
|---|---|---|---|---|---|
| SB-32-3 | EOL | 41.01748333 | -72.97955 | 10/14/12 | SEABOSS |
| SB-33-1 | SOL | 40.994525 | -73.126078 | 10/12/12 | SEABOSS |
| SB-33-1 | EOL | 40.99408333 | -73.12478333 | 10/12/12 | SEABOSS |
| SB-33-2 | SOL | 40.996908 | -73.126008 | 10/12/12 | SEABOSS |
| SB-33-2 | EOL | 40.99655 | -73.12516667 | 10/12/12 | SEABOSS |
| SB-33-3 | SOL | 40.99733 | -73.122508 | 10/12/12 | SEABOSS |
| SB-33-3 | EOL | 40.9971 | -73.12201667 | 10/12/12 | SEABOSS |
| SB-34-1 | SOL | 41.00018333 | -72.9579 | 10/14/12 | SEABOSS |
| SB-34-1 | EOL | 41.00023333 | -72.9564 | 10/14/12 | SEABOSS |
| SB-34-2 | SOL | 41.00095 | -72.9612 | 10/14/12 | SEABOSS |
| SB-34-2 | EOL | 41.001 | -72.95933333 | 10/14/12 | SEABOSS |
| SB-34-3 | SOL | 41.00175 | -72.96301667 | 10/14/12 | SEABOSS |
| SB-34-3 | EOL | 41.00196667 | -72.9617 | 10/14/12 | SEABOSS |

# 2012 ISIS Log, December, 2012

10 Dec 2012

ISIS Set-up on RV Loosanoff

Video 1 - Feed from Aurora / CCD video camera
↳ goes to RMS 0/GPT Horita "Video IN"

Horita "video OUT" goes to yellow "Input 1" on DVDR

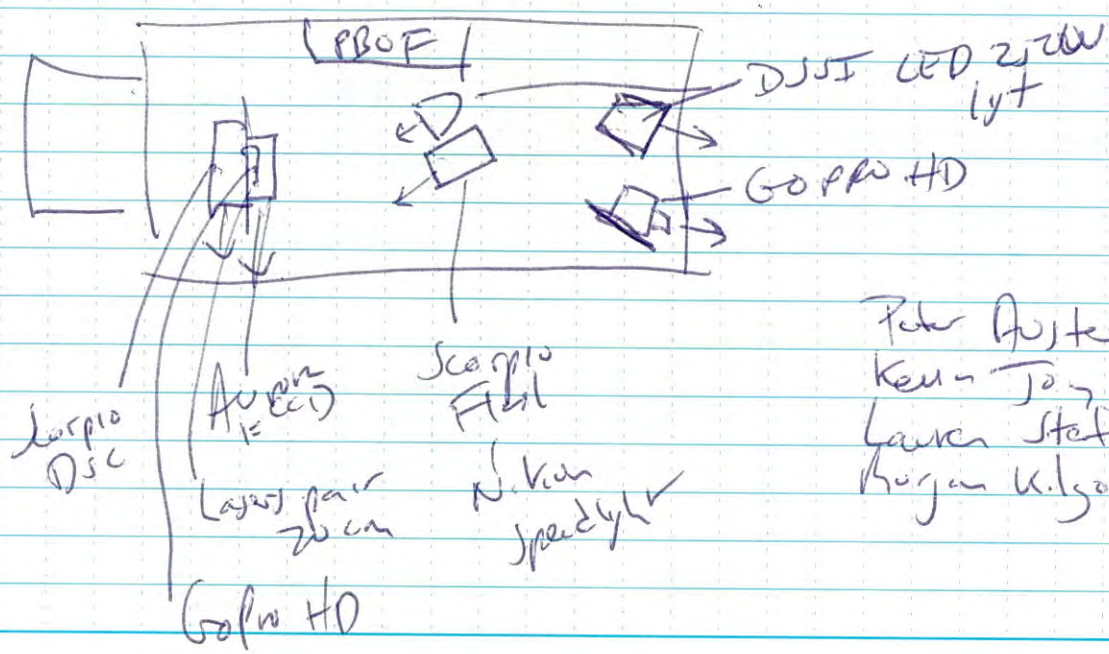
DVDR yellow "Output 1" to bottom monitor

Video 2 - from Inside Pacific Scorpio Plus DSC
↳ to top monitor

GPS from bridge to "serial in" on Horita
↳ Model Furuno Navnet C-Map NT Max

Lasers (parallel - downward) 20 cm spacing.

ISIS Config.




Peter Auster
Kevin Joy
Lauren Stefaniak
Morgan Kilgour

"Rite in the Rain" ALL WEATHER WRITING PAPER

Scale: 1 square = _____

12 Dec 2012

0800 - UW from Milford dock to "Sponge City" site - SS3
41° 02.316 / 073 06.558

TIDES Dec 12
Bridgeport 0941 - High
1613 - Low

DIVE 1 64 ft. under hull
41° 02.318' 073° 06.547

Dec 13
1034 - High
1705 - Low

1450 / 0915 - In water 48°F surface
OTC

1631 - off bottom

1645 - on deck

boulders with coral, Eleona, spider crab, hermit crab, transition zone w/ scattered boulder, cobble, crepidoula shell

Scorpio Images - large boulders > 50% cover
small boulder/cobble < 50% cover
cobble-shell w/ surrounding sand ~10%

No sponges Halichoma as in past - species interactions (predation, competition)?, life history?, diseases?, temp stress?

Scorpio - first images set to "Normal" then to "Fine"
reset time mid-dive ~20 stills of boulder surfaces

GoPro - success! Edit HD for clips & stills

Aurora - recorded to hard drive on deck - set to "fine" part to DVDs

Scale: 1 square =

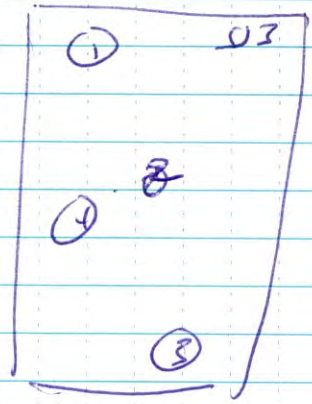
Multiple drifts past boulder reef along crest of shoal.
Positions on boulders

1- boulders 41 02.324
073 06.578

2- large blders - 41 02.306
** 073 06.572

3- 41 02.277
073 06.556

4- 41 02.310
073 06.570




1205 - UW for Charles Island sites CI3

DIVE 2 Charles Island CI-3

1812-1828 41° 11.013'/073° 03.823' 26 ft.

Gravel - boulders
Cliona, coral, spider crab, Asterias ⇒ Crepidula,
oyster shell transitions from boulders

DIVE 3 Charles Island CI2 (-1,-2,-3) 1832-1849
mud, boulders, shell hash 2-3 41 11.057 73 03.776
oyster, whelk, sponge Cliona 2-2 41 11.066 73 03.771
2-1 41 11.075 73 03.766

"Rite in the Rain" ALL-WEATHER WRITING PAPER

Scale: 1 square = _____

DIVE 4 Charles Island CI-1 (1-2)

1903-1915

1-1 41 11.261 / 73 03.730

1-2 41 11.256 / 73 03.712

mud, gravel, boulder, shell

dense crepidula transitions from and within boulder reef

urchin, sponge-cliona, coral

UW for Milford dock

1445 - lines on dock

Scale: 1 square =

13 Dec 2012 RV Coosanoff

0740 - UW from Milford Dock
- heading to northern transect sites
- plan is to traverse reef along line 3 - NT3
41 02.690/73 06.516 → 41 02.652/73 06.379

0856 - on site - had "diet size" black + white from Starbucks

DIVES

1406 UTC/0906 - in water

GoPro 0855

Scorpio DSC
GoPro HD-2
Aurora SD

Transect 1 - NNW - SSE along reef
drift ~1.2 kt.
- start in dense boulders - no Haliclona sponges.
- 64 ft → 71 ft. to transition of shell debris

Transect 2 - same course but ~100 yds to east
- fewer boulders but crossed reef
- no Haliclona sponges.

Transect 3 - between lines 1 + 2 - boulders, shell debris along margins - no sponges

Transect 4 - 59 ft → 67 ft. - started in dense boulders - transit ~~drift~~ to west side of reef - sparse large boulders

1548/1048 - on deck

"Rite in the Rain" ALL WEATHER WRITING PAPER

Scale: 1 square =

Dive 6

1617/1117 - In water
UTC
- on bottom - cobble - shell

1649 - sponges?
- abundant Libinia
- review stills for small Haliclona?
↳ looked similar enough.

GoPro slow over seafloor - good test of utility for frame grabs for analysis

1654/1154 - on deck

UW to SB11 - T1 Eastern end Crepidula mounds
41° 04.5769/073 06.54712 → 41° 04.5756/073 06.33466

Dive 7

1719/1219 - In water
- Patchy high density Crepidula on gravel-sand
drift 0.5 kt - barnacles, horseshoe crabs, few patchy corals on boulders

1743/1243 - on deck

1744/1244 - back to the barn!!
1845/1345 - at dock

12-12 - 145 image files
12-13 - 156 image files

Scale: 1 square =

12 May 2013 RV Connecticut

2310 - UW from Avery Pt. dock

Peter Auster
Lauren Stefanick
Morgan Kilgour
Andrea McCarthy
Denna Chadi
Kevin Joy
Matthew Jewell

Primary site for AM dive

SB-05-T2

41 06.789733/073 07.296688 →
41 06.603859/073 07.084022

If weather-seas high - alternate site v

SB-33-T3

40 59.52904/073 07.836499 →
40 59.~~726113~~ 527636/073 07.624116

"Rite in the Rain" WEATHER WRITING PAPER

Scale: 1 square =

# 2013 SEABOSS Photo Log, May, 2013

| STATION | PHOTO | ARCHIVE.JPG | LATITUDE | LONGITUDE | DATE | DEVICE |
|---|---|---|---|---|---|---|
| NB-1 | NB-1-1 | DSC_0432.JPG | 41.161183 | -73.077895 | 5/21/13 | SEABOSS |
| NB-1 | NB-1-2 | DSC_0433.JPG | 41.161202 | -73.07785 | 5/21/13 | SEABOSS |
| NB-1 | NB-1-3 | DSC_0434.JPG | 41.161208 | -73.07783 | 5/21/13 | SEABOSS |
| NB-1 | NB-1-4 | DSC_0435.JPG | 41.161223 | -73.07778 | 5/21/13 | SEABOSS |
| NB-2 | NB-2-1 | DSC_0436.JPG | 41.145952 | -73.074213 | 5/21/13 | SEABOSS |
| NB-2 | NB-2-2 | DSC_0437.JPG | 41.14591 | -73.074255 | 5/21/13 | SEABOSS |
| NB-2 | NB-2-3 | DSC_0438.JPG | 41.145858 | -73.07431 | 5/21/13 | SEABOSS |
| NB-2 | NB-2-4 | DSC_0439.JPG | 41.145827 | -73.074345 | 5/21/13 | SEABOSS |
| NB-2 | NB-2-5 | DSC_0440.JPG | 41.14579 | -73.074392 | 5/21/13 | SEABOSS |
| NB-3 | NB-3-1 | DSC_0565.JPG | 41.12745 | -73.069132 | 5/21/13 | SEABOSS |
| NB-3 | NB-3-2 | DSC_0566.JPG | 41.127447 | -73.069082 | 5/21/13 | SEABOSS |
| NB-3 | NB-3-3 | DSC_0567.JPG | 41.127448 | -73.069032 | 5/21/13 | SEABOSS |
| NB-3 | NB-3-4 | DSC_0568.JPG | 41.127452 | -73.068967 | 5/21/13 | SEABOSS |
| NB-4 | NB-4-1 | DSC_0696.JPG | 41.10235 | -73.066185 | 5/21/13 | SEABOSS |
| NB-4 | NB-4-2 | DSC_0697.JPG | 41.10235 | -73.066133 | 5/21/13 | SEABOSS |
| NB-4 | NB-4-3 | DSC_0698.JPG | 41.102353 | -73.066048 | 5/21/13 | SEABOSS |
| NB-4 | NB-4-4 | DSC_0699.JPG | 41.10236 | -73.065945 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-1 | DSC_0700.JPG | 41.097215 | -73.051405 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-2 | DSC_0701.JPG | 41.097195 | -73.051378 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-3 | DSC_0702.JPG | 41.097178 | -73.051348 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-4 | DSC_0703.JPG | 41.097168 | -73.051325 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-5 | DSC_0704.JPG | 41.09716 | -73.051297 | 5/21/13 | SEABOSS |
| NB-5 | NB-5-6 | DSC_0705.JPG | 41.097158 | -73.051235 | 5/21/13 | SEABOSS |
| NB-6 | NB-6-1 | DSC_0707.JPG | 41.081877 | -73.051085 | 5/21/13 | SEABOSS |
| NB-6 | NB-6-2 | DSC_0708.JPG | 41.08194 | -73.05112 | 5/21/13 | SEABOSS |
| NB-6 | NB-6-3 | DSC_0709.JPG | 41.08203 | -73.051162 | 5/21/13 | SEABOSS |
| NB-6 | NB-6-4 | DSC_0710.JPG | 41.08218 | -73.051215 | 5/21/13 | SEABOSS |
| NB-6 | NB-6-5 | DSC_0711.JPG | 41.082252 | -73.051233 | 5/21/13 | SEABOSS |
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| NB-7 | NB-7-2 | DSC_0795.JPG | 41.052633 | -73.004348 | 5/22/13 | SEABOSS |
| NB-7 | NB-7-3 | DSC_0796.JPG | 41.052667 | -73.00449 | 5/22/13 | SEABOSS |
| NB-7 | NB-7-4 | DSC_0797.JPG | 41.052707 | -73.004707 | 5/22/13 | SEABOSS |
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| NB-8 | NB-8-2 | DSC_0800.JPG | 41.031998 | -73.01052 | 5/22/13 | SEABOSS |
| NB-8 | NB-8-3 | DSC_0801.JPG | 41.031982 | -73.010652 | 5/22/13 | SEABOSS |
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| NB-9 | NB-9-1 | DSC_0955.JPG | 41.003003 | -73.035982 | 5/22/13 | SEABOSS |
| NB-9 | NB-9-2 | DSC_0956.JPG | 41.003077 | -73.035932 | 5/22/13 | SEABOSS |
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| NB-10 | NB-10-2 | DSC-1591.JPG | 41.043957 | -73.043918 | 5/23/13 | SEABOSS |
| NB-10 | NB-10-3 | DSC-1592.JPG | 41.044005 | -73.043883 | 5/23/13 | SEABOSS |

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| NB-11 | NB-11-1 | DSC_0960.JPG | 41.01056 | -73.061018 | 5/22/13 | SEABOSS |
| NB-11 | NB-11-2 | DSC_0961.JPG | 41.010535 | -73.060915 | 5/22/13 | SEABOSS |
| NB-11 | NB-11-3 | DSC_0962.JPG | 41.010517 | -73.06084 | 5/22/13 | SEABOSS |
| NB-11 | NB-11-4 | DSC_0963.JPG | 41.0105 | -73.060775 | 5/22/13 | SEABOSS |
| NB-12 | NB-12-1 | DSC-1585.JPG | 41.049835 | -73.059988 | 5/23/13 | SEABOSS |
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| NB-16 | NB-16-2 | DSC_1538.JPG | 41.072922 | -73.157347 | 5/23/13 | SEABOSS |
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| SBM-03-1 | SBM-03-1 | DSC_0443.JPG | 41.132923 | -73.087793 | 5/21/13 | SEABOSS |
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| SBM-03-3 | SBM-03-3 | DSC_0451.JPG | 41.137868 | -73.090033 | 5/21/13 | SEABOSS |
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| SBM-05-1 | SBM-05-1 | DSC_1566.JPG | 41.110247 | -73.118557 | 5/23/13 | SEABOSS |

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| SBM-05-1 | SBM-05-1 | DSC_1568.JPG | 41.110428 | -73.118325 | 5/23/13 | SEABOSS |
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| SBM-06-5 | SBM-06-5 | DSC_0590.JPG | 41.111742 | -73.078757 | 5/21/13 | SEABOSS |
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| SBM-11-1 | SBM-11-1 | DSC_1544.JPG | 41.071283 | -73.108748 | 5/23/13 | SEABOSS |
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| SBM-11-1 | SBM-11-1 | DSC_1546.JPG | 41.071497 | -73.10866 | 5/23/13 | SEABOSS |
| SBM-11-1 | SBM-11-1 | DSC_1547.JPG | 41.071608 | -73.108555 | 5/23/13 | SEABOSS |
| SBM-11-2 | SBM-11-2 | DSC_1549.JPG | 41.071907 | -73.112118 | 5/23/13 | SEABOSS |

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| SBM-11-2 | SBM-11-2 | DSC_1552.JPG | 41.072232 | -73.111685 | 5/23/13 | SEABOSS |
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| SBM-11-3 | SBM-11-3 | DSC_1555.JPG | 41.075195 | -73.109367 | 5/23/13 | SEABOSS |
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| SBM-13-3 | SBM-13-3 | DSC_1442.JPG | 41.069468 | -73.143467 | 5/23/13 | SEABOSS |

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| SBM-16-2 | SBM-16-2 | DSC_1416.JPG | 41.052712 | -73.134943 | 5/23/13 | SEABOSS |
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| SBM-16-2 | SBM-16-2 | DSC_1418.JPG | 41.052818 | -73.134907 | 5/23/13 | SEABOSS |
| SBM-16-2 | SBM-16-2 | DSC_1419.JPG | 41.052878 | -73.134885 | 5/23/13 | SEABOSS |
| SBM-16-3 | SBM-16-3 | DSC_1421.JPG | 41.055783 | -73.135108 | 5/23/13 | SEABOSS |
| SBM-16-3 | SBM-16-3 | DSC_1422.JPG | 41.055812 | -73.135045 | 5/23/13 | SEABOSS |
| SBM-16-3 | SBM-16-3 | DSC_1423.JPG | 41.055865 | -73.134933 | 5/23/13 | SEABOSS |
| SBM-16-3 | SBM-16-3 | DSC_1424.JPG | 41.055912 | -73.134847 | 5/23/13 | SEABOSS |
| SBM-19-1 | SBM-19-1 | DSC_1947.JPG | 41.051385 | -73.082163 | 5/24/13 | SEABOSS |
| SBM-19-1 | SBM-19-1 | DSC_1948.JPG | 41.05134 | -73.082087 | 5/24/13 | SEABOSS |
| SBM-19-1 | SBM-19-1 | DSC_1949.JPG | 41.051235 | -73.081895 | 5/24/13 | SEABOSS |
| SBM-19-2 | SBM-19-2 | DSC_1952.JPG | 41.051162 | -73.082107 | 5/24/13 | SEABOSS |
| SBM-19-2 | SBM-19-2 | DSC_1953.JPG | 41.050975 | -73.08181 | 5/24/13 | SEABOSS |
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| SBM-19-3 | SBM-19-3 | DSC_1956.JPG | 41.046375 | -73.076307 | 5/24/13 | SEABOSS |
| SBM-19-3 | SBM-19-3 | DSC_1957.JPG | 41.046288 | -73.076137 | 5/24/13 | SEABOSS |
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| SBM-24-1 | SBM-24-1 | DSC_0713.JPG | 41.03461 | -72.98128 | 5/21/13 | SEABOSS |
| SBM-24-1 | SBM-24-1 | DSC_0714.JPG | 41.03466 | -72.981235 | 5/21/13 | SEABOSS |
| SBM-24-1 | SBM-24-1 | DSC_0715.JPG | 41.034732 | -72.98118 | 5/21/13 | SEABOSS |
| SBM-24-1 | SBM-24-1 | DSC_0716.JPG | 41.034833 | -72.98112 | 5/21/13 | SEABOSS |
| SBM-24-2 | SBM-24-2 | DSC_0718.JPG | 41.037272 | -72.986297 | 5/21/13 | SEABOSS |
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| SBM-24-2 | SBM-24-2 | DSC_0720.JPG | 41.03739 | -72.986385 | 5/21/13 | SEABOSS |
| SBM-24-2 | SBM-24-2 | DSC_0721.JPG | 41.037535 | -72.986445 | 5/21/13 | SEABOSS |
| SBM-24-3 | SBM-24-3 | DSC_0723.JPG | 41.03957 | -72.988795 | 5/21/13 | SEABOSS |
| SBM-24-3 | SBM-24-3 | DSC_0724.JPG | 41.039618 | -72.98882 | 5/21/13 | SEABOSS |
| SBM-24-3 | SBM-24-3 | DSC_0725.JPG | 41.039707 | -72.988853 | 5/21/13 | SEABOSS |
| SBM-24-3 | SBM-24-3 | DSC_0726.JPG | 41.03977 | -72.988867 | 5/21/13 | SEABOSS |
| SBM-24-3 | SBM-24-3 | DSC_0727.JPG | 41.039823 | -72.988877 | 5/21/13 | SEABOSS |
| SBM-25-1 | SBM-25-1 | DSC_1059.JPG | 41.022107 | -73.107578 | 5/22/13 | SEABOSS |
| SBM-25-1 | SBM-25-1 | DSC_1060.JPG | 41.02212 | -73.107615 | 5/22/13 | SEABOSS |
| SBM-25-1 | SBM-25-1 | DSC_1061.JPG | 41.022162 | -73.10772 | 5/22/13 | SEABOSS |
| SBM-25-1 | SBM-25-1 | DSC_1062.JPG | 41.02218 | -73.107762 | 5/22/13 | SEABOSS |

| | | | | | | |
|---|---|---|---|---|---|---|
| SBM-25-2 | SBM-25-2 | DSC_1064.JPG | 41.02559 | -73.107232 | 5/22/13 | SEABOSS |
| SBM-25-2 | SBM-25-2 | DSC_1065.JPG | 41.0255 | -73.1072 | 5/22/13 | SEABOSS |
| SBM-25-2 | SBM-25-2 | DSC_1066.JPG | 41.025403 | -73.10718 | 5/22/13 | SEABOSS |
| SBM-25-2 | SBM-25-2 | DSC_1067.JPG | 41.025305 | -73.107177 | 5/22/13 | SEABOSS |
| SBM-25-3 | SBM-25-3 | DSC_1069.JPG | 41.029095 | -73.108213 | 5/22/13 | SEABOSS |
| SBM-25-3 | SBM-25-3 | DSC_1070.JPG | 41.029048 | -73.10825 | 5/22/13 | SEABOSS |
| SBM-25-3 | SBM-25-3 | DSC_1071.JPG | 41.029013 | -73.108278 | 5/22/13 | SEABOSS |
| SBM-25-3 | SBM-25-3 | DSC_1072.JPG | 41.028967 | -73.108313 | 5/22/13 | SEABOSS |
| SBM-25-3 | SBM-25-3 | DSC_1073.JPG | 41.028933 | -73.108338 | 5/22/13 | SEABOSS |
| SBM-28-1 | SBM-28-1 | DSC_1273.JPG | 41.008845 | -73.14027 | 5/23/13 | SEABOSS |
| SBM-28-1 | SBM-28-1 | DSC_1274.JPG | 41.008887 | -73.14032 | 5/23/13 | SEABOSS |
| SBM-28-1 | SBM-28-1 | DSC_1275.JPG | 41.008923 | -73.140363 | 5/23/13 | SEABOSS |
| SBM-28-1 | SBM-28-1 | DSC_1276.JPG | 41.008967 | -73.140413 | 5/23/13 | SEABOSS |
| SBM-28-2 | SBM-28-2 | DSC_1278.JPG | 41.013658 | -73.139968 | 5/23/13 | SEABOSS |
| SBM-28-2 | SBM-28-2 | DSC_1279.JPG | 41.013755 | -73.140145 | 5/23/13 | SEABOSS |
| SBM-28-2 | SBM-28-2 | DSC_1280.JPG | 41.013793 | -73.14023 | 5/23/13 | SEABOSS |
| SBM-28-2 | SBM-28-2 | DSC_1281.JPG | 41.013807 | -73.140255 | 5/23/13 | SEABOSS |
| SBM-28-3 | SBM-28-3 | DSC_1282.JPG | 41.012722 | -73.141875 | 5/23/13 | SEABOSS |
| SBM-28-3 | SBM-28-3 | DSC_1283.JPG | 41.012743 | -73.141883 | 5/23/13 | SEABOSS |
| SBM-28-3 | SBM-28-3 | DSC_1284.JPG | 41.012778 | -73.1419 | 5/23/13 | SEABOSS |
| SBM-28-3 | SBM-28-3 | DSC_1285.JPG | 41.012803 | -73.141913 | 5/23/13 | SEABOSS |
| SBM-31-1 | SBM-31-1 | DSC_0940.JPG | 41.00646 | -73.026098 | 5/22/13 | SEABOSS |
| SBM-31-1 | SBM-31-1 | DSC_0941.JPG | 41.006452 | -73.026037 | 5/22/13 | SEABOSS |
| SBM-31-1 | SBM-31-1 | DSC_0942.JPG | 41.006435 | -73.025928 | 5/22/13 | SEABOSS |
| SBM-31-1 | SBM-31-1 | DSC_0943.JPG | 41.006425 | -73.025868 | 5/22/13 | SEABOSS |
| SBM-31-2 | SBM-31-2 | DSC_0945.JPG | 41.01198 | -73.025258 | 5/22/13 | SEABOSS |
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| SBM-31-2 | SBM-31-2 | DSC_0947.JPG | 41.011982 | -73.025142 | 5/22/13 | SEABOSS |
| SBM-31-2 | SBM-31-2 | DSC_0948.JPG | 41.011973 | -73.025043 | 5/22/13 | SEABOSS |
| SBM-31-3 | SBM-31-3 | DSC_0950.JPG | 41.011807 | -73.019275 | 5/22/13 | SEABOSS |
| SBM-31-3 | SBM-31-3 | DSC_0951.JPG | 41.011797 | -73.019225 | 5/22/13 | SEABOSS |
| SBM-31-3 | SBM-31-3 | DSC_0952.JPG | 41.01178 | -73.019152 | 5/22/13 | SEABOSS |
| SBM-31-3 | SBM-31-3 | DSC_0953.JPG | 41.01175 | -73.019027 | 5/22/13 | SEABOSS |
| SBM-34-1 | SBM-34-1 | DSC_0805.JPG | 40.999527 | -72.965553 | 5/22/13 | SEABOSS |
| SBM-34-1 | SBM-34-1 | DSC_0806.JPG | 40.999582 | -72.965743 | 5/22/13 | SEABOSS |
| SBM-34-1 | SBM-34-1 | DSC_0807.JPG | 40.999615 | -72.9659 | 5/22/13 | SEABOSS |
| SBM-34-1 | SBM-34-1 | DSC_0808.JPG | 40.999593 | -72.966017 | 5/22/13 | SEABOSS |
| SBM-34-1 | SBM-34-1 | DSC_0809.JPG | 40.999592 | -72.966032 | 5/22/13 | SEABOSS |
| SBM-34-2 | SBM-34-2 | DSC_0811.JPG | 40.998268 | -72.961093 | 5/22/13 | SEABOSS |
| SBM-34-2 | SBM-34-2 | DSC_0812.JPG | 40.998258 | -72.961165 | 5/22/13 | SEABOSS |
| SBM-34-2 | SBM-34-2 | DSC_0813.JPG | 40.998245 | -72.96124 | 5/22/13 | SEABOSS |
| SBM-34-2 | SBM-34-2 | DSC_0814.JPG | 40.998235 | -72.961312 | 5/22/13 | SEABOSS |
| SBM-34-3 | SBM-34-3 | DSC_0816.JPG | 40.998233 | -72.958378 | 5/22/13 | SEABOSS |
| SBM-34-3 | SBM-34-3 | DSC_0817.JPG | 40.998267 | -72.958373 | 5/22/13 | SEABOSS |
| SBM-34-3 | SBM-34-3 | DSC_0818.JPG | 40.998305 | -72.958415 | 5/22/13 | SEABOSS |

| | | | | | | |
|---|---|---|---|---|---|---|
| SBM-34-3 | SBM-34-3 | DSC_0819.JPG | 40.998332 | -72.958465 | 5/22/13 | SEABOSS |

# 2013 SEABOSS Video Log, May, 2013

| Name2 | StartLat | StartLon | EndLat | EndLong |
|---|---|---|---|---|
| SB-03-Track-1 | 41° 8.334996 | -73° 5.389530 | 41° 8.333609 | -73° 5.176784 |
| SB-03-Track-2 | 41° 8.140687 | -73° 5.381930 | 41° 8.139300 | -73° 5.169194 |
| SB-03-Track-3 | 41° 7.949466 | -73° 5.387116 | 41° 7.948057 | -73° 5.174442 |
| SB-05-Track-1 | 41° 6.963141 | -73° 7.285314 | 41° 6.961814 | -73° 7.072639 |
| SB-05-Track-2 | 41° 6.789733 | -73° 7.296688 | 41° 6.788406 | -73° 7.084022 |
| SB-05-Track-3 | 41° 6.605188 | -73° 7.221409 | 41° 6.603859 | -73° 7.008754 |
| SB-06-Track-1 | 41° 6.973946 | -73° 4.973330 | 41° 6.972547 | -73° 4.760658 |
| SB-06-Track-2 | 41° 6.808226 | -73° 5.085545 | 41° 6.806831 | -73° 4.872882 |
| SB-06-Track-3 | 41° 6.637080 | -73° 5.194925 | 41° 6.635689 | -73° 4.982270 |
| SB-11-Track-1 | 41° 4.576930 | -73° 6.547119 | 41° 4.575611 | -73° 6.334658 |
| SB-11-Track-2 | 41° 4.363881 | -73° 6.607704 | 41° 4.362536 | -73° 6.395170 |
| SB-11-Track-3 | 41° 4.152185 | -73° 6.695518 | 41° 4.150735 | -73° 6.482889 |
| SB-12-Track-1 | 41° 4.441987 | -73° 4.768016 | 41° 4.440612 | -73° 4.555565 |
| SB-12-Track-2 | 41° 4.257455 | -73° 4.772880 | 41° 4.256052 | -73° 4.560354 |
| SB-12-Track-3 | 41° 4.098574 | -73° 4.820164 | 41° 4.097066 | -73° 4.607540 |
| SB-13-Track-1 | 41° 4.187106 | -73° 8.566783 | 41° 4.185849 | -73° 8.354340 |
| SB-13-Track-2 | 41° 4.015362 | -73° 8.565633 | 41° 4.014077 | -73° 8.353114 |
| SB-13-Track-3 | 41° 3.843064 | -73° 8.570986 | 41° 3.841672 | -73° 8.358371 |
| SB-15-Track-1 | 41° 3.903097 | -73° 1.875265 | 41° 3.901635 | -73° 1.662848 |
| SB-15-Track-2 | 41° 3.725474 | -73° 1.872689 | 41° 3.723984 | -73° 1.660195 |
| SB-15-Track-3 | 41° 3.545881 | -73° 1.869105 | 41° 3.544283 | -73° 1.656516 |
| SB-16-Track-1 | 41° 3.270227 | -73° 8.186445 | 41° 3.268959 | -73° 7.974052 |
| SB-16-Track-2 | 41° 3.089667 | -73° 8.187166 | 41° 3.088372 | -73° 7.974698 |
| SB-16-Track-3 | 41° 2.924590 | -73° 8.188831 | 41° 2.923187 | -73° 7.976266 |
| SB-18-Track-1 | 41° 3.090155 | -73° 6.037594 | 41° 3.088821 | -73° 5.825214 |
| SB-18-Track-2 | 41° 2.917521 | -73° 5.991794 | 41° 2.916159 | -73° 5.779338 |
| SB-18-Track-3 | 41° 2.751678 | -73° 6.006892 | 41° 2.750208 | -73° 5.794339 |
| SB-19-Track-1 | 41° 3.002878 | -73° 4.921881 | 41° 3.001511 | -73° 4.709507 |
| SB-19-Track-2 | 41° 2.850860 | -73° 4.916198 | 41° 2.849464 | -73° 4.703747 |
| SB-19-Track-3 | 41° 2.689244 | -73° 4.931353 | 41° 2.687741 | -73° 4.718805 |
| SB-24-Track-1 | 41° 2.289425 | -72° 59.219375 | 41° 2.287884 | -72° 59.007049 |
| SB-24-Track-2 | 41° 2.141077 | -72° 59.222823 | 41° 2.139508 | -72° 59.010419 |
| SB-24-Track-3 | 41° 1.976998 | -72° 59.242725 | 41° 1.975322 | -72° 59.030224 |
| SB-25-Track-1 | 41° 1.654412 | -73° 6.799603 | 41° 1.653104 | -73° 6.587299 |
| SB-25-Track-2 | 41° 1.496566 | -73° 6.712404 | 41° 1.495227 | -73° 6.500023 |
| SB-25-Track-3 | 41° 1.334026 | -73° 6.719818 | 41° 1.332580 | -73° 6.507339 |
| SB-28-Track-1 | 41° 0.910165 | -73° 8.589049 | 41° 0.908913 | -73° 8.376782 |
| SB-28-Track-2 | 41° 0.736624 | -73° 8.591340 | 41° 0.735344 | -73° 8.378997 |
| SB-28-Track-3 | 41° 0.569556 | -73° 8.601821 | 41° 0.568168 | -73° 8.389381 |
| SB-29-Track-1 | 41° 0.846798 | -73° 7.203248 | 41° 0.845503 | -73° 6.990987 |
| SB-29-Track-2 | 41° 0.677832 | -73° 7.205469 | 41° 0.676510 | -73° 6.993132 |
| SB-29-Track-3 | 41° 0.497894 | -73° 7.198253 | 41° 0.496463 | -73° 6.985819 |
| SB-30-Track-1 | 41° 0.522966 | -73° 5.371942 | 41° 0.521615 | -73° 5.159701 |
| SB-30-Track-2 | 41° 0.320819 | -73° 5.373689 | 41° 0.319440 | -73° 5.161373 |
| SB-30-Track-3 | 41° 0.129446 | -73° 5.366886 | 41° 0.127959 | -73° 5.154475 |
| SB-31-Track-1 | 41° 0.775362 | -73° 1.513497 | 41° 0.773893 | -73° 1.301248 |
| SB-31-Track-2 | 41° 0.593334 | -73° 1.504269 | 41° 0.591836 | -73° 1.291945 |

| | | | | |
|---|---|---|---|---|
| SB-31-Track-3 | 41° 0.412368 | -73° 1.504138 | 41° 0.410763 | -73° 1.291718 |
| SB-33-Track-1 | 40° 59.88891 | -73° 7.601164 | 40° 59.887638 | -73° 7.388953 |
| SB-33-Track-2 | 40° 59.72741 | -73° 7.724061 | 40° 59.726113 | -73° 7.511773 |
| SB-33-Track-3 | 40° 59.52904 | -73° 7.836499 | 40° 59.527636 | -73° 7.624116 |
| SB-34-Track-1 | 41° 0.113477 | -72° 57.699956 | 41° 0.111892 | -72° 57.487749 |
| SB-34-Track-2 | 40° 59.96794 | -72° 57.617110 | 40° 59.966325 | -72° 57.404825 |
| SB-34-Track-3 | 40° 59.79466 | -72° 57.647492 | 40° 59.792943 | -72° 57.435111 |

# 2013 K2 ROV Summary Log, May, 2013

| Dive # | Sampling Block | Start Lat | Start Long | End Lat | End Long |
|---|---|---|---|---|---|
| 01 | SB-05 | N41 06.7897 | W073 07.2708 | N41 06.7851 | W073 07.2338 |
| 02 | SB-11 | N41 04.5842 | W073 06.5269 | N41 04.5768 | W073 06.3338 |
| 03 | SB-21 | N41 02.1899 | W073 06.6202 | N41 02.3319 | W073 06.5640 |
| 04 | SB-08 | N41 05.1449 | W073 06.0633 | N41 05.3251 | W073 06.0811 |
| 05 | SB-08 | N41 05.0782 | W073 06.1549 | N41 04.9460 | W073 06.1349 |
| 06 | SB-21 | N41 02.3212 | W073 06.5571 | N41 02.4365 | W073 06.4949 |
| 07 | SB-12 | N41 04.4813 | W073 04.6520 | N41 04.4265 | W073 04.6594 |
| 08 | SB-06 | N41 06.5476 | W073 05.1526 | N41 06.5363 | W073 05.1221 |
| | | | | | Total |

| Hours HD video (approx) | # Still images | Comments |
|---|---|---|
| 2.5 | | Sand wave forms |
| 2 | | Crepidula mound area, few mounds seen |
| 2.25 | | Boulder ridge |
| 1.5 | | transit up northern wall of cut |
| 2.5 | | transit up southern wall of cut |
| 2 | | Boulder ridge |
| 3.5 | | Boulder area |
| 2.5 | | Transects on and 50m off pipeline trench |
| 18.75 | 1310 | |

# Appendix 6:  Physical Oceanographic Cruise Details

# LISMARC Summary Log of Seafloor Frame Locations

| PolygonID | Sampling Block | Sample # | DDM Lat | DDM Lon | Latitude | Longitude |
|---|---|---|---|---|---|---|
| 1 | SB-06 | 6 | 41 06.77951N | 073 04.96170W | 41 06.805N | 073 04.956W |
| 1 | SB-04 | 3 | 41 07.31557N | 073 08.04942W | 41 07.311N | 073 08.089W |
| 2 | SB-11 | 1 | 41 04.25308N | 073 06.41018W | 41 04.258N | 073 06.395W |
| 2 | SB-18 | 2 | 41 03.05745N | 073 05.82326W | 41 03.153N | 073 05.805W |
| 2 | SB-33 | 2 | 40 59.83400N | 073 07.60927W | 40 59.759N | 073 07.571W |

| Time Period | Duration (days) | Depth (m) | ADCP/Waves | Temp/Sal | AQD HR |
|---|---|---|---|---|---|
| 2012, Dec 7-20 | 13 | 14.6 | YES | YES | YES |
| 2012-2013, Dec 20 - Jan 11 | 22 | 8.0 | YES | YES | NO |
| 2013, Jan 11-15 | 4 | 16.7 | YES | YES | YES |
| 2013, Feb 26 - Apr 10 | 44 | 18.5 | YES | YES | YES |
| 2013, Apr 10 - May 9 | 30 | 22.5 | YES | YES | YES |

# LISMARC Summary Log of ADCP Sampling

| PolygonID | Sampling Block | Sample # | DDM Lat | DDM Lon |
|---|---|---|---|---|
| 1 | SB-03 | 2 | 41 08.05492N | 073 05.42561W |
| 1 | SB-06 | 6 | 41 06.77951N | 073 04.96170W |
| 1 | SB-09 | 2 | 41 05.07053N | 073 04.20707W |
| 1 | SB-10 | 2 | 41 04.91242N | 073 08.05659W |
| 1 | SB-04 | 3 | 41 07.31557N | 073 08.04942W |
| 2 | SB-11 | 1 | 41 04.25308N | 073 06.41018W |
| 2 | SB-18 | 2 | 41 03.05745N | 073 05.82326W |
| 2 | SB-25 | 3 | 41 01.50310N | 073 06.81304W |
| 2 | SB-33 | 2 | 40 59.83400N | 073 07.60927W |
| 2 | SB-13 | 3 | 41 04.01255N | 073 08.41581W |
| 3 | SB-12 | 2 | 41 04.29056N | 073 04.60809W |
| 3 | SB-15 | 3 | 41 03.66076N | 073 01.87293W |
| 3 | SB-26 | 2 | 41 01.47613N | 073 02.07550W |
| 3 | SB-30 | 1 | 41 00.17263N | 073 05.17984W |
| 3 | SB-19 | 2 | 41 02.78168N | 073 04.76100W |
| 4 | SB-20 | 2 | 41 02.77703N | 073 00.99047W |
| 4 | SB-24 | 3 | 41 02.10744N | 072 59.21174W |
| 4 | SB-34 | 3 | 41 00.01847N | 072 57.73209W |
| 4 | SB-31 | 3 | 41 00.61058N | 073 01.44413W |

# Appendix 7:  Data Products Inventory

Extract of data sets from the Long Island Sound Data Portal (http://www.marine-geo.org/portals/lis/) hosted as part of the Interdisciplinary Earth Data Alliance (IDEA) at Lamont-Doherty Earth Observatory of Coulmbia University
Visit http://www.marine-geo.org/tools/new_search/index.php?&a=1&funding=LISS&output_info_all=on for more information and to access data.

| Entry_id | Data Set | Investigator | Date Range | Platform |
|---|---|---|---|---|
| LIS:Epifauna | Biology:Species:Abundance, Biology:Species:Distribution | Auster | ;; | NotApplicable |
| LIS:Epifauna | Biology:Species:Abundance, Biology:Species:Distribution | Auster | ;; | NotApplicable |
| | | | | |
| LIS:FVCOM | BottomStress, Salinity, Temperature | O'Donnell, Fake | ;; | NotApplicable |
| | | | | |
| LIS:NOAA_Acoustics | Backscatter:Acoustic | Battista | ;; | NotApplicable |
| LIS:NOAA_Acoustics | Backscatter:Acoustic, Bathymetry | Battista | ;; | NotApplicable |
| LIS:NOAA_Acoustics | Backscatter:Acoustic, Bathymetry, Bathymetry:BPI, Sidescan | Battista | ;; | NotProvided |
| LIS:NOAA_Acoustics | Backscatter:Acoustic, Bathymetry, Sidescan | Battista | ;; | NotApplicable |
| LIS:NOAA_Acoustics | Backscatter:Acoustic, Bathymetry:BPI, Sidescan | Battista | ;; | NotApplicable |
| LIS:NOAA_Acoustics | Bathymetry:Swath | Beaver | ;; | Rude |
| LIS:NOAA_Acoustics | Documentation | Battista | ;; | Thomas Jefferson |
| | | | | |
| LIS:Sediments | Interpretation:Geologic | Nitsche, Kenna, McHugh | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic | Kenna, McHugh, Nitsche | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic | Kenna, McHugh, Nitsche | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic | Kenna, McHugh, Nitsche | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic:Map | Kenna, Nitsche, McHugh | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic:SedimentaryEnvironments | Kenna, McHugh, Nitsche | ;; | NotApplicable |
| LIS:Sediments | Interpretation:Geologic:SedimentaryEnvironments | Nitsche | ;; | NotApplicable |
| | | | | |
| LIS:SOMAS_Biology | Biology:Species:Abundance, Biology:Species:List | Cerrato | 2013-06-01;;2013-09-11 | NotProvided |
| LIS:SOMAS_Biology | SampleInfo:Biology | Cerrato | 2013-06-01;;2013-09-11 | NotApplicable |
| | | | | |
| LIS:URI | Bathymetry, Sidescan | King | ;; | Shanna Rose |
| LIS:URI | Bathymetry, Sidescan | King | ;; | Shanna Rose |
| | | | | |
| LIS1201 | Seismic:Active:Subbottom | Nitsche | 2012-06-04;;2012-06-05 | Pritchard |
| LIS1201 | Seismic:Navigation | Nitsche | 2012-06-04;;2012-06-05 | Pritchard |
| | | | | |
| LIS1301 | Backscatter:Acoustic, Bathymetry:Swath | Flood | 2013-03-18;;2013-03-30 | Seawolf |
| LIS1301 | Seismic:Active:Subbottom | Nitsche | 2013-03-18;;2013-03-30 | Seawolf |
| LIS1301 | Seismic:Navigation | Nitsche | 2013-03-18;;2013-03-30 | Seawolf |
| | | | | |
| LIS1302 | Seismic:Active:Subbottom | Nitsche | 2013-04-16;;2013-04-25 | Pritchard |
| LIS1302 | Seismic:Navigation | Nitsche | 2013-04-16;;2013-04-25 | Pritchard |
| | | | | |
| LIS1303 | Chemistry:Sediment, Sediment:Description | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Chemistry:Sediment, Sediment:Description | Kenna, McHugh, Nitsche | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Navigation:Primary | Nitsche, Kenna, McHugh | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Photograph | Kenna, Nitsche, McHugh | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Photograph | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Photograph, Sediment:Description | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | PhysicalDescription | Nitsche | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | PhysicalProperties:Sediment | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | SampleInfo | Nitsche, Kenna, McHugh | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | SampleInfo:Sediment | Nitsche, Kenna, McHugh | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | SampleInfo:Sediment | Kenna, Nitsche, McHugh | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Sediment:Description | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Sediment:Description | Kenna, McHugh, Nitsche | 2013-06-05;;2013-06-13 | Seawolf |
| LIS1303 | Sediment:Description | Nitsche, McHugh, Kenna | 2013-06-05;;2013-06-13 | Seawolf |
| | | | | |
| LIS1304 | Backscatter:Acoustic, Bathymetry:Swath | Flood | 2013-08-29;;2013-09-18 | Pritchard |
| LIS1304 | Sidescan | Flood | 2013-08-29;;2013-09-18 | Pritchard |
| | | | | |
| LISMARC:PO | Navigation, SampleInfo | O'Donnell | 2013-06-01;;2013-06-02 | Connecticut |
| | | | | |
| LISMARC12:ISIS | Navigation | Auster | 2013-12-10;;2013-12-12 | NotProvided |
| LISMARC12:ISIS | Photograph | Auster, Stefaniak | 2013-12-10;;2013-12-12 | Isis |
| | | | | |
| LISMARC12:SEABOSS | Biology:Species:Abundance, Biology:Species:Distribution | Zajac | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | Biology:Species:Abundance, Biology:Species:Distribution | Zajac | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | Documentation, SampleInfo | Poppe, Zajac | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | Navigation | Poppe, Zajac | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | Navigation | Zajac | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | Photograph | Zajac, Poppe | 2012-10-10;;2012-10-19 | SEABOSS |
| LISMARC12:SEABOSS | SampleInfo, Sediment:Description | Poppe | 2012-10-10;;2012-10-19 | SEABOSS |
| | | | | |
| LISMARC13:ROV | Photograph | Auster, Stefaniak | 2013-05-13;;2013-05-16 | Kraken2 |
| | | | | |
| LISMARC13:SEABOSS | Documentation, SampleInfo | Poppe, Zajac | 2013-05-20;;2013-05-25 | SEABOSS |
| LISMARC13:SEABOSS | Navigation | Zajac | 2013-05-20;;2013-05-25 | NotProvided |
| LISMARC13:SEABOSS | Navigation | Poppe | 2013-05-20;;2013-05-25 | SEABOSS |
| LISMARC13:SEABOSS | Navigation | Zajac | 2013-05-20;;2013-05-25 | SEABOSS |
| LISMARC13:SEABOSS | Photograph | Zajac, Auster, Poppe, Stefaniak | 2013-05-20;;2013-05-25 | SEABOSS |
| LISMARC13:SEABOSS | SampleInfo, Sediment:Description | Poppe | 2013-05-20;;2013-05-25 | SEABOSS |

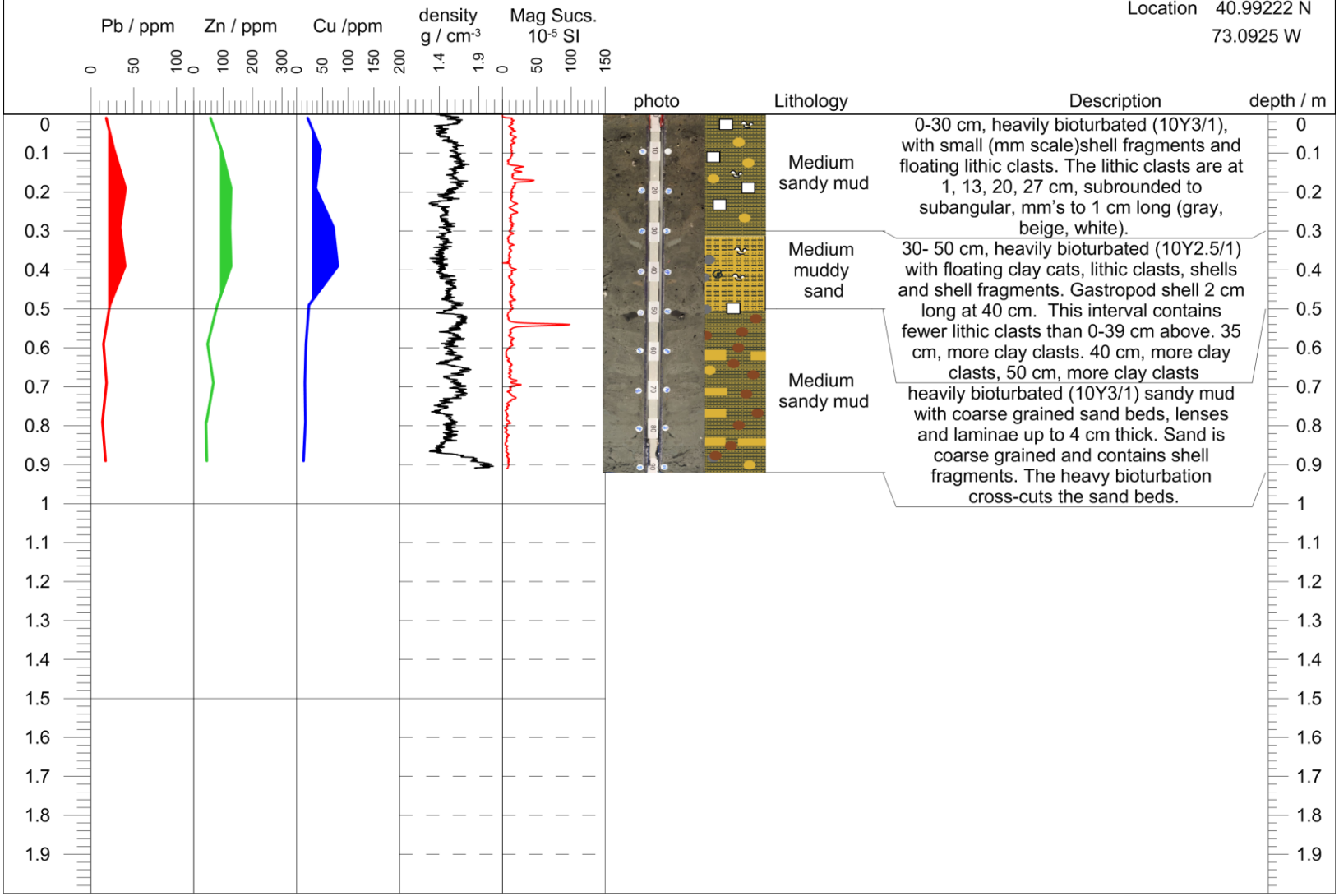
# Appendix 8:  Sediment Core Logs and Descriptions

# APPENDIX 8 – Sediment Core Log Data

As part of the pilot of the Long Island Sound mapping project LDEO collected 46 sediment cores. The main text (section 4.4) describes the details of the core analysis and presents examples of the findings of the sediment cores. In this appendix we present the descriptions, photos and the most important log data next to each other. Plots have been generated using the Strater software program. The plots show metal content derived from X-Ray Fluorescence measurements (Lead/Pb, zinc/Zn, Copper/Cu with filled graphs for values above background), density, magnetic susceptibility, core photograph, as well as drawing and text description of lithology.

core ID: **GC01**

Location 40.99222 N
73.0925 W

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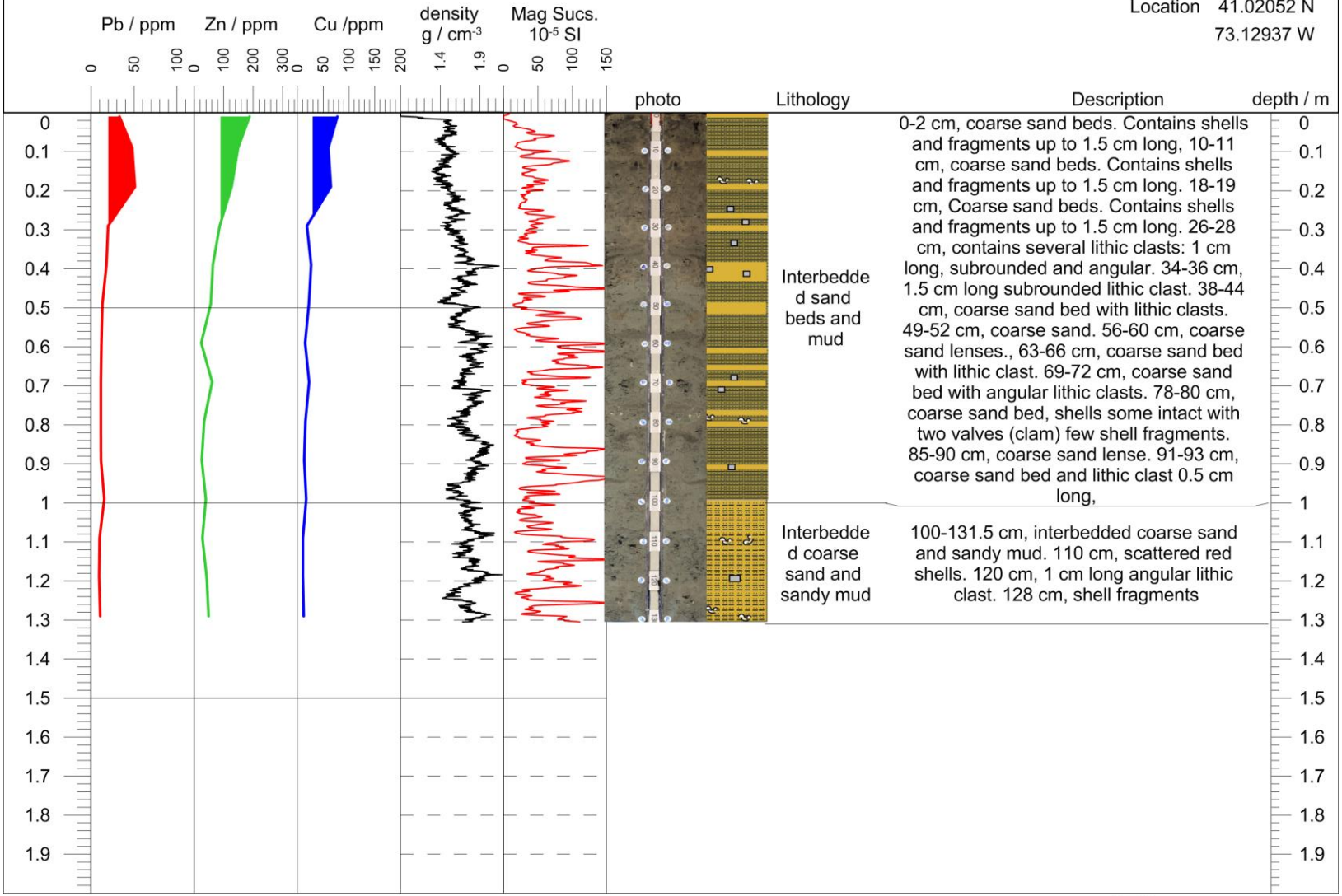
core ID: **GC02**

Location 41.02052 N
73.12937 W

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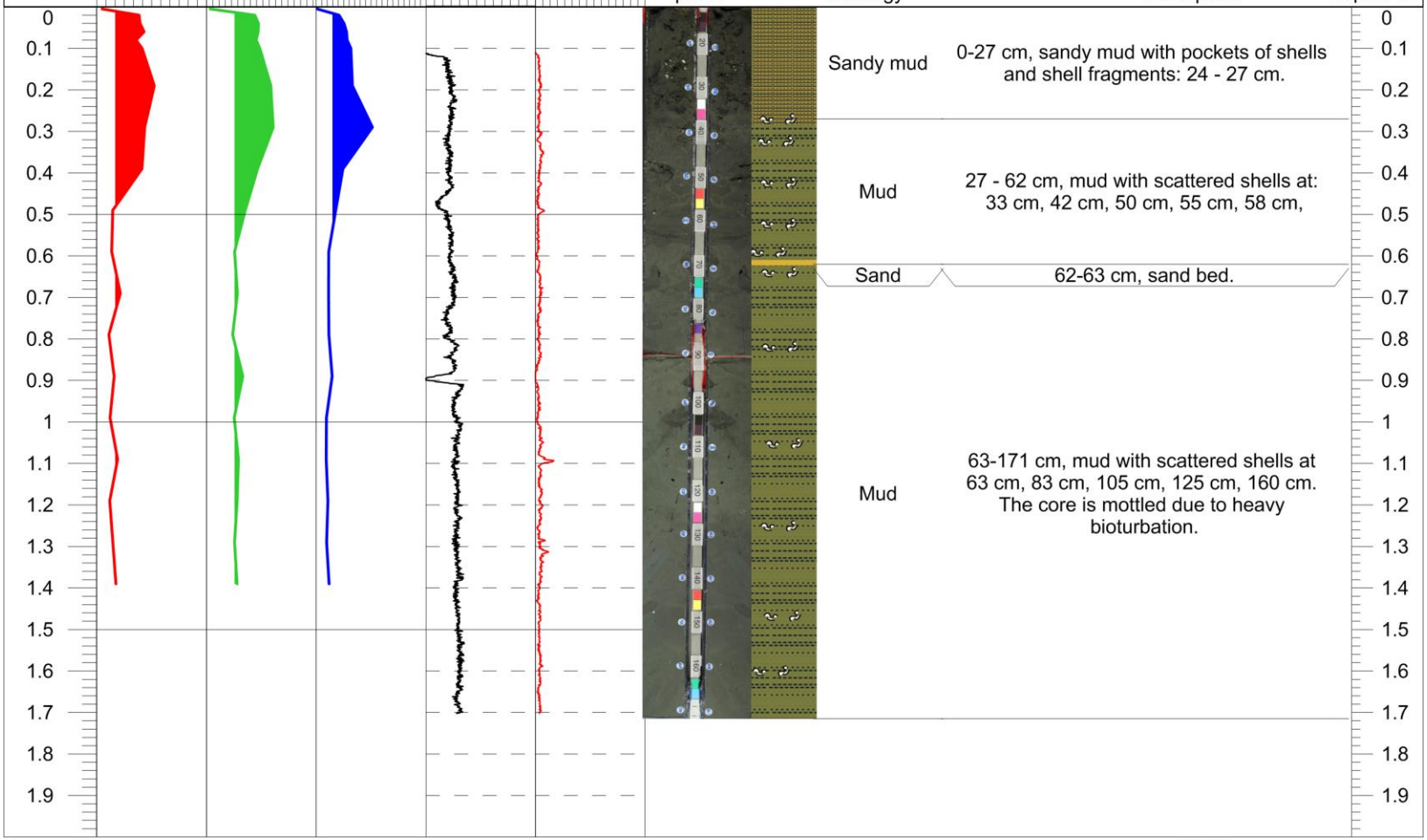
core ID: **GC03**

Location 41.03588 N
73.15472 W

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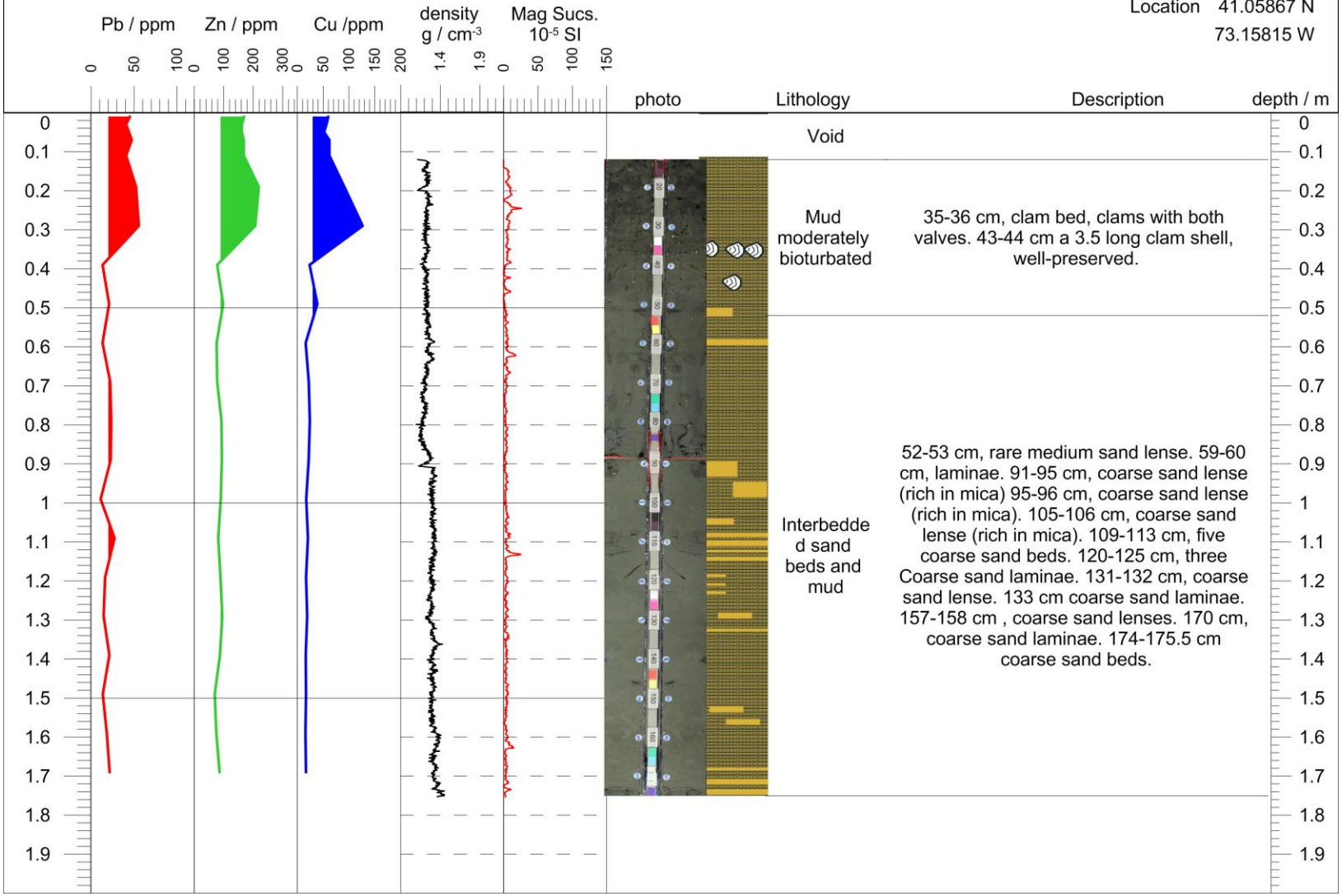
core ID: **GC04**

Location 41.05867 N
73.15815 W

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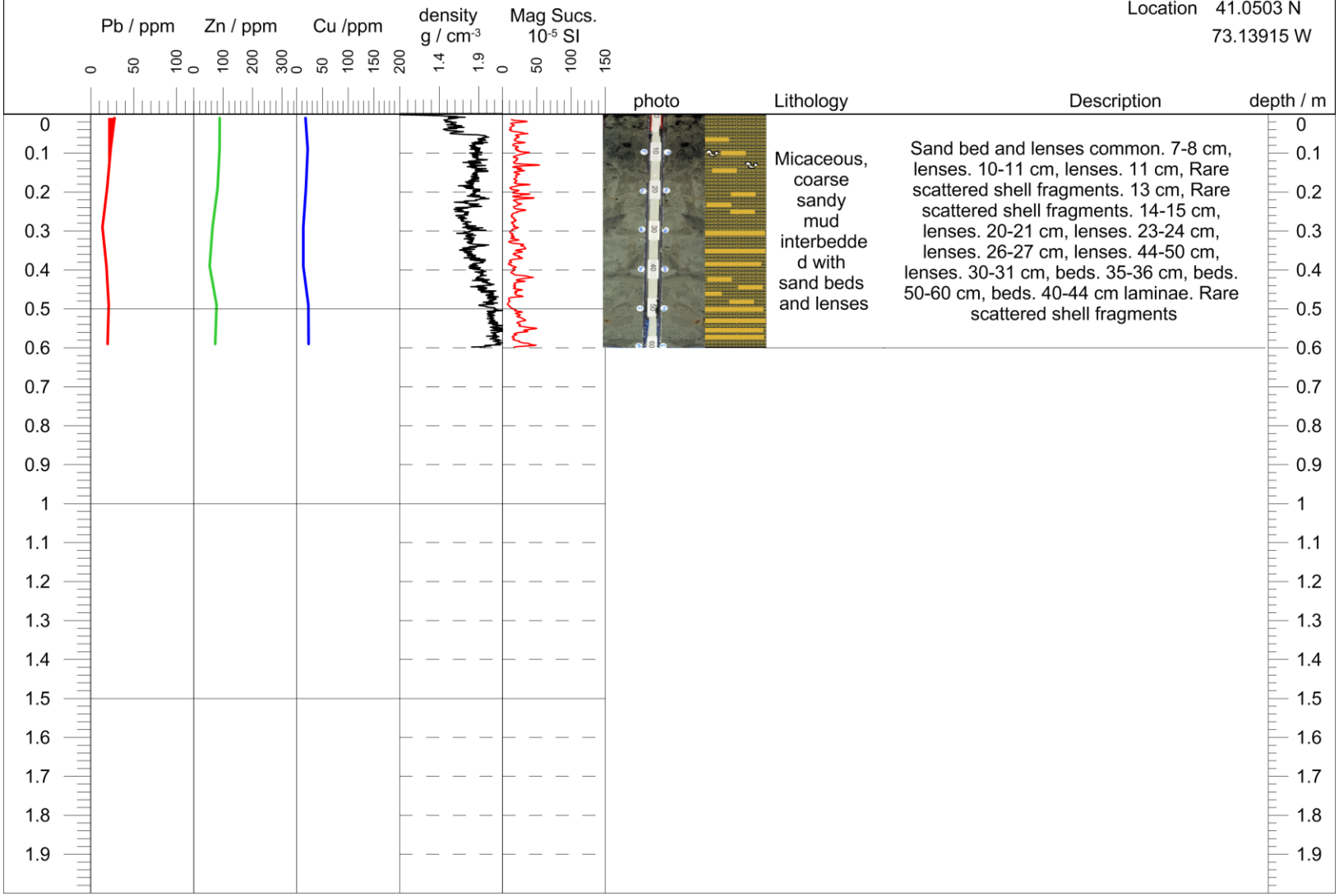
core ID: **GC05**

Location 41.0503 N
73.13915 W

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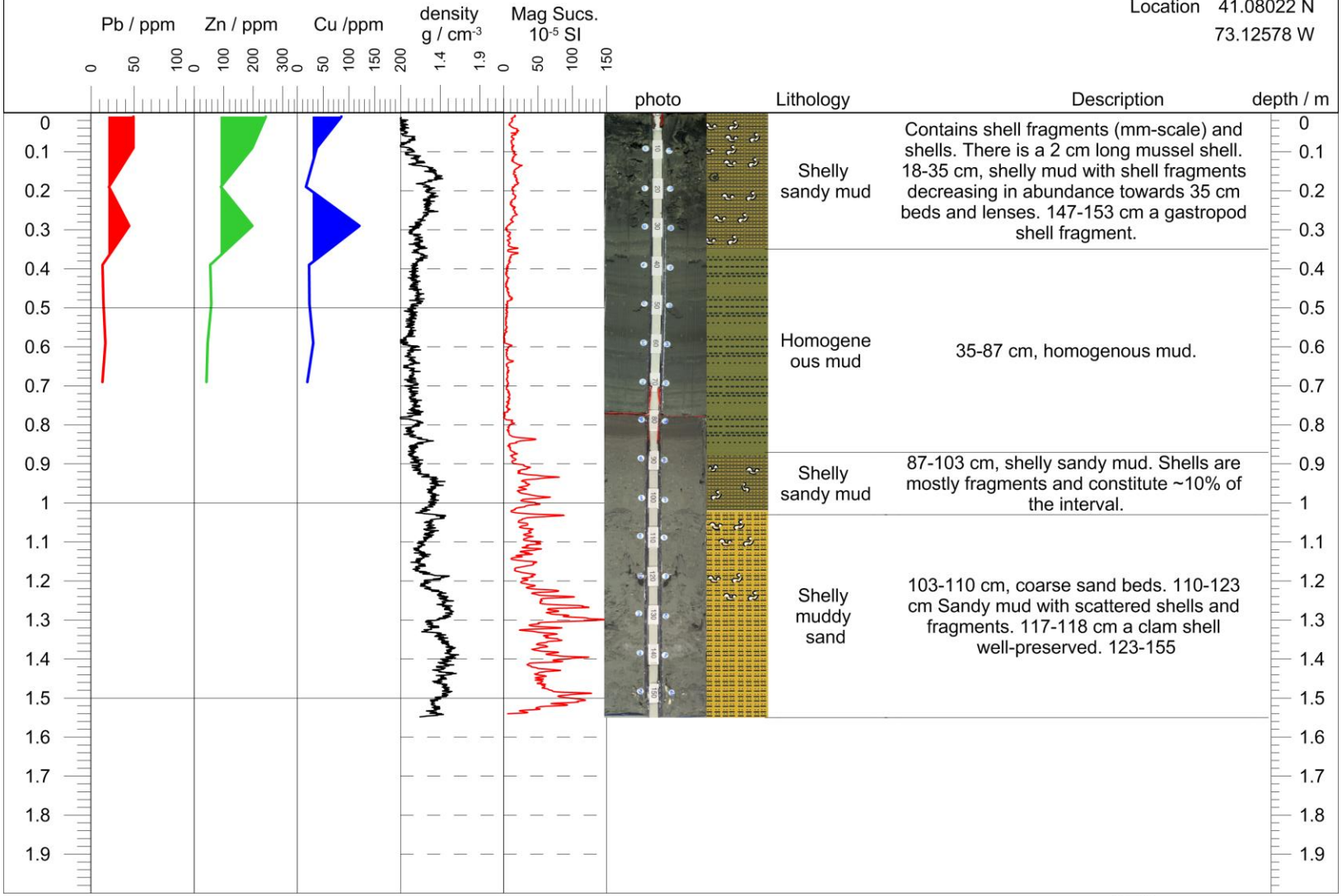
core ID: **GC06**

Location 41.08022 N
73.12578 W

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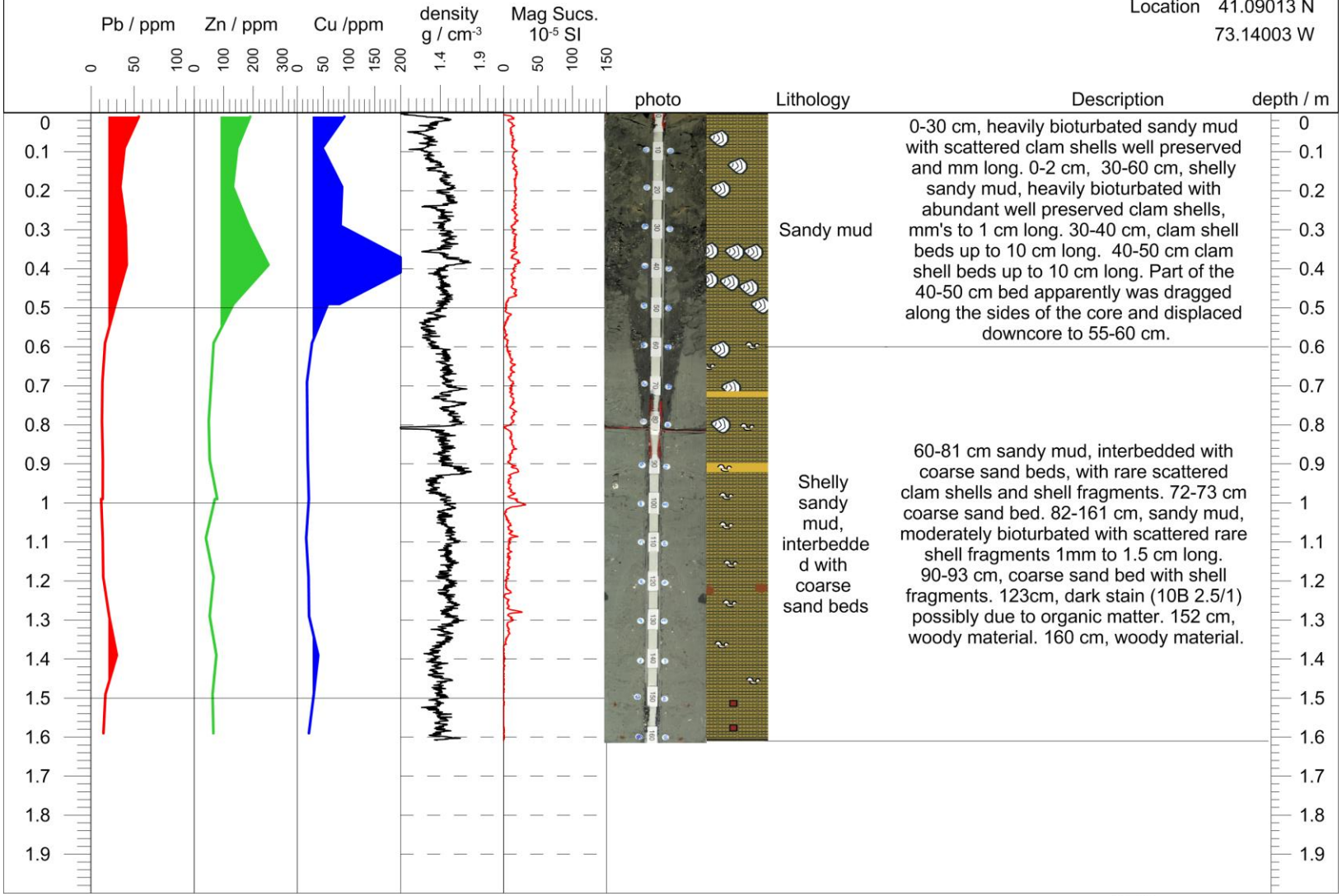
core ID: **GC07**

Location 41.09013 N
73.14003 W

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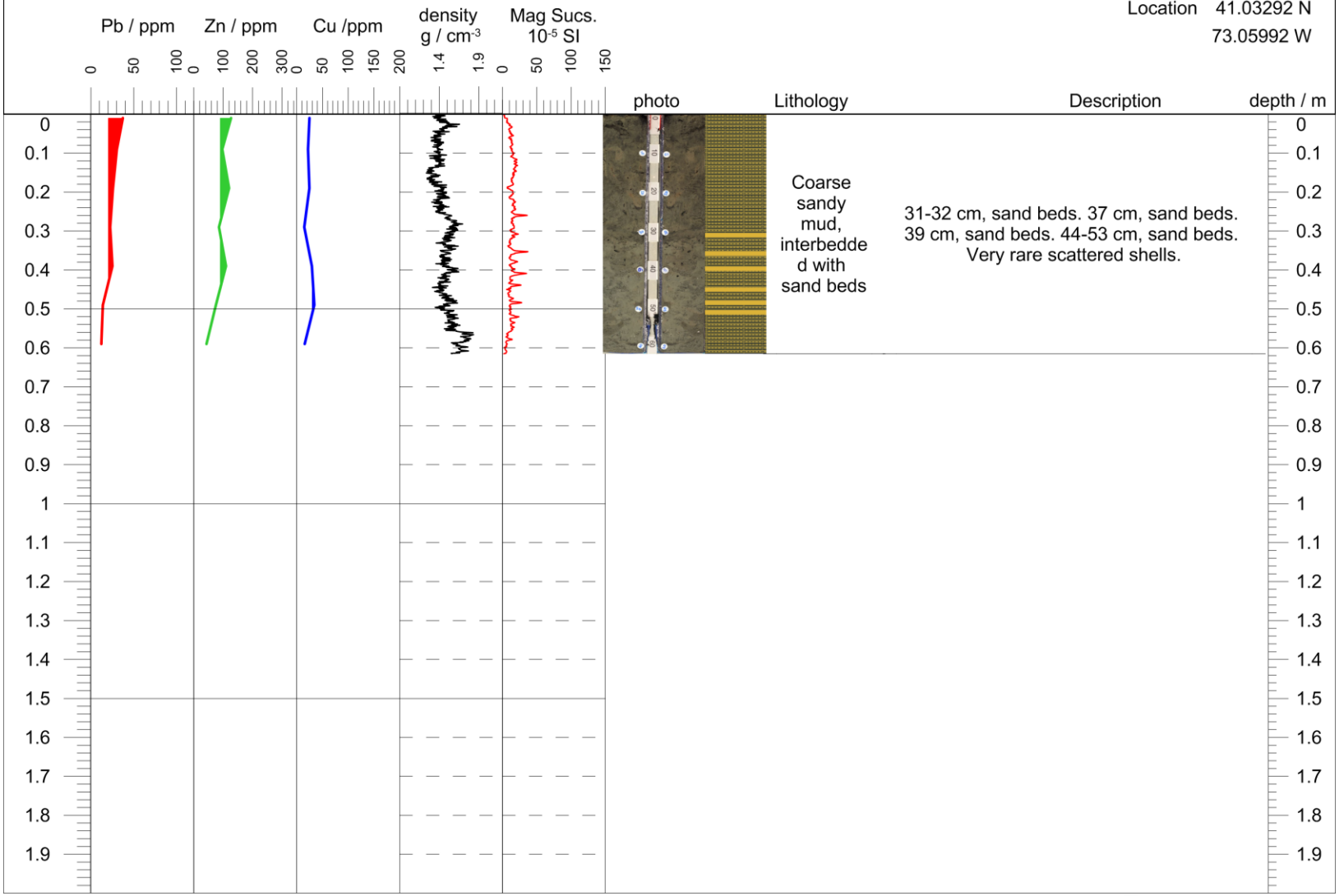
core ID: **GC08**

Location 41.03292 N
73.05992 W

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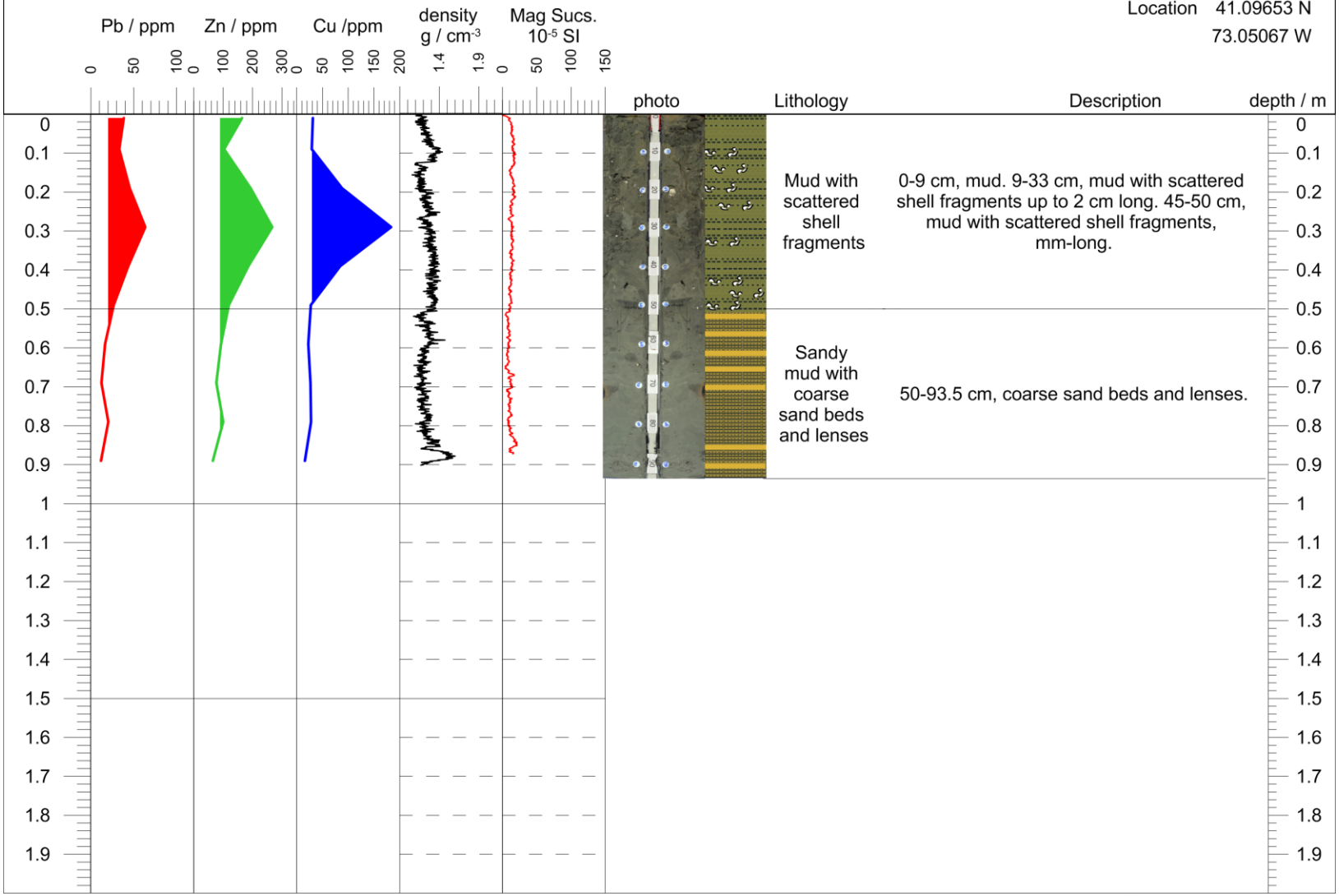
core ID: **GC09**

Location 41.09653 N
73.05067 W

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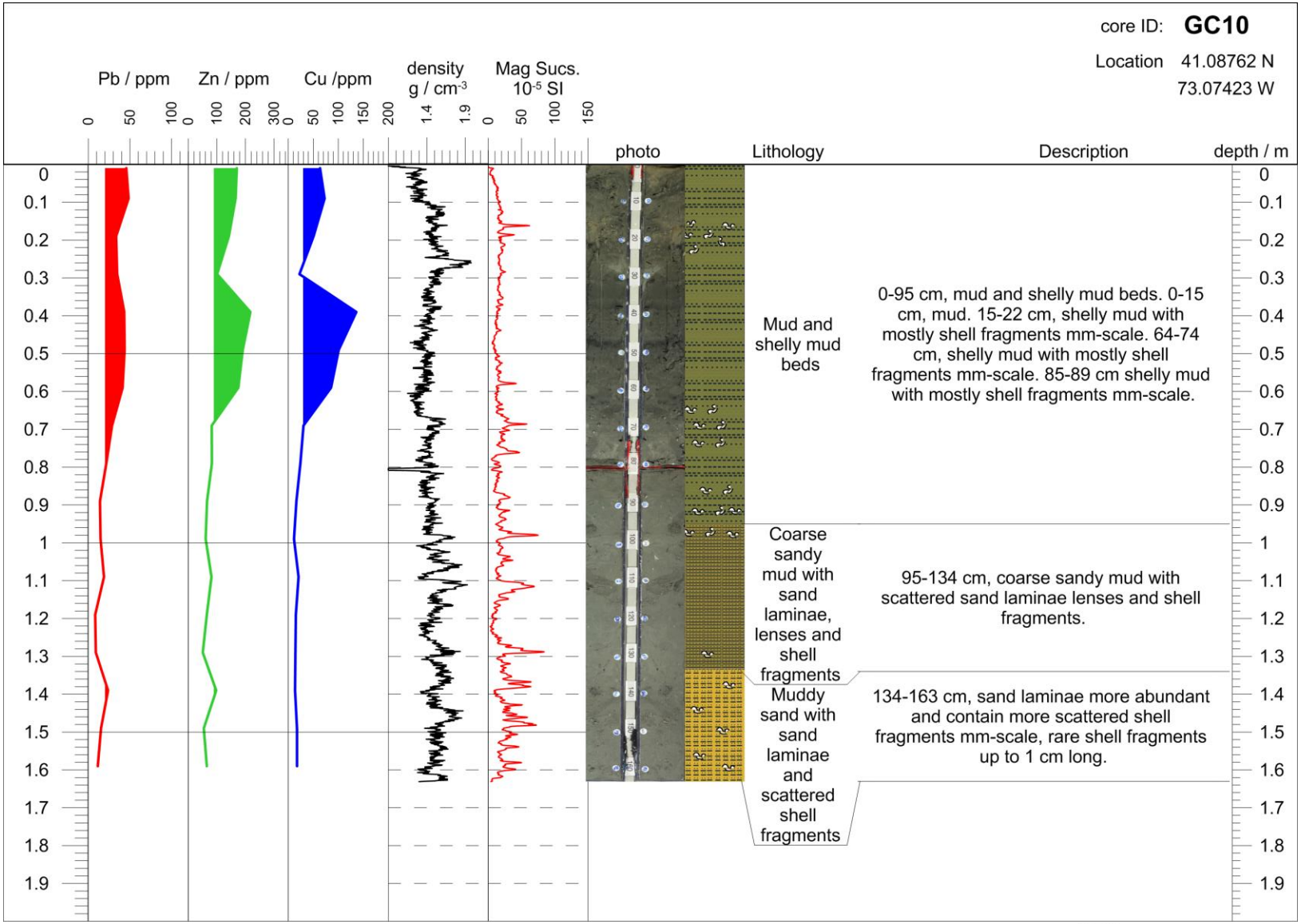


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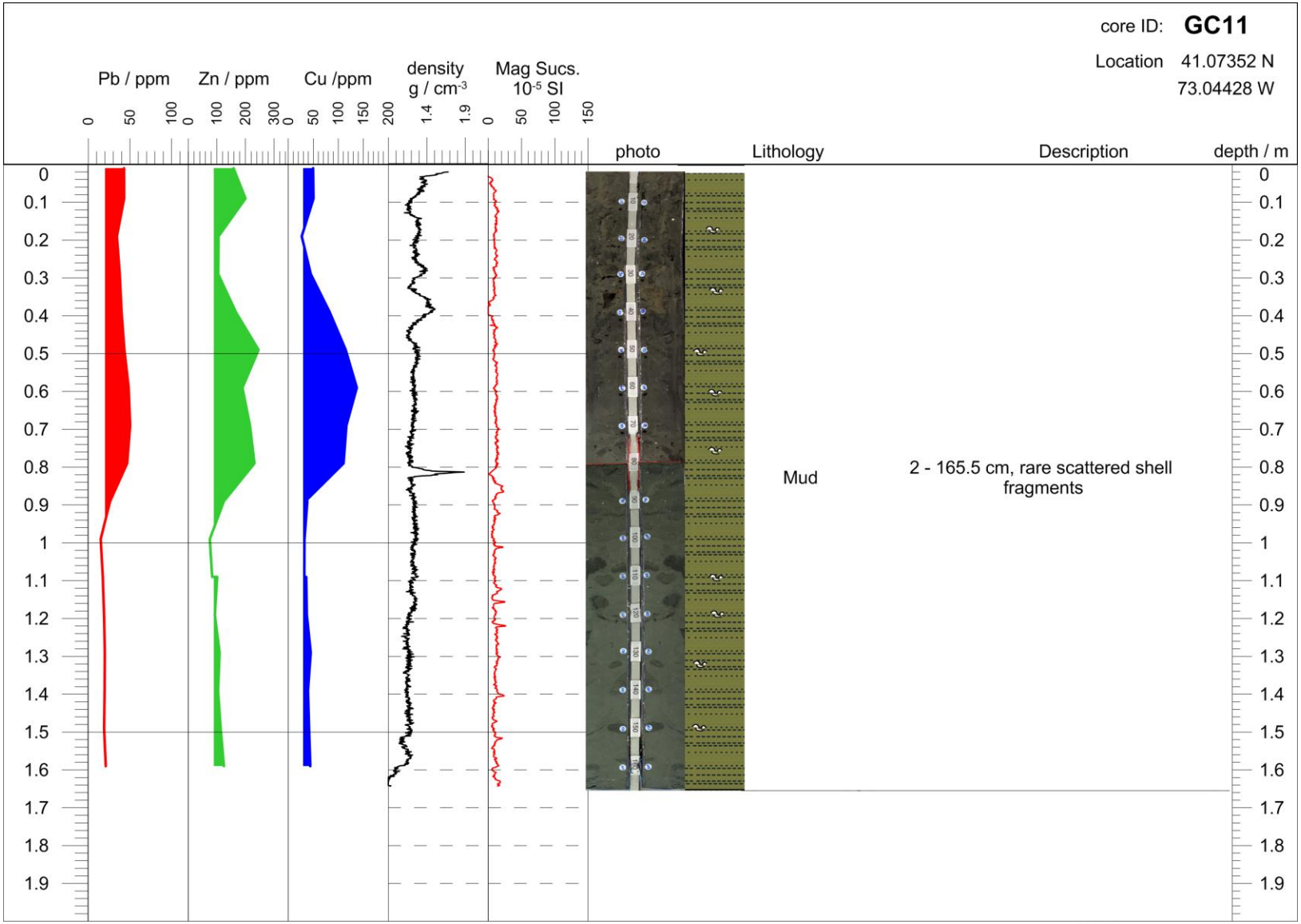


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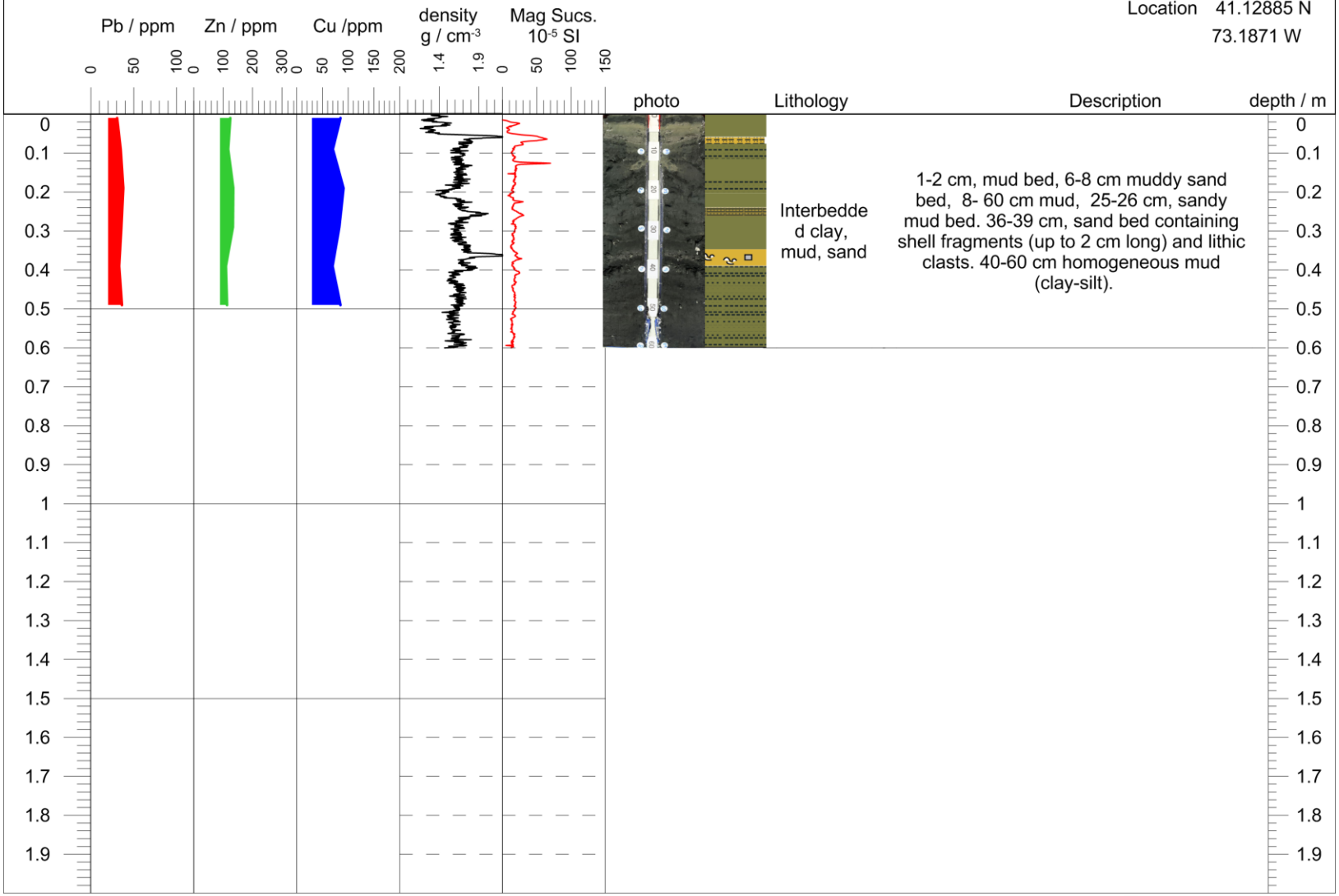
core ID: **GC12**

Location 41.12885 N
73.1871 W

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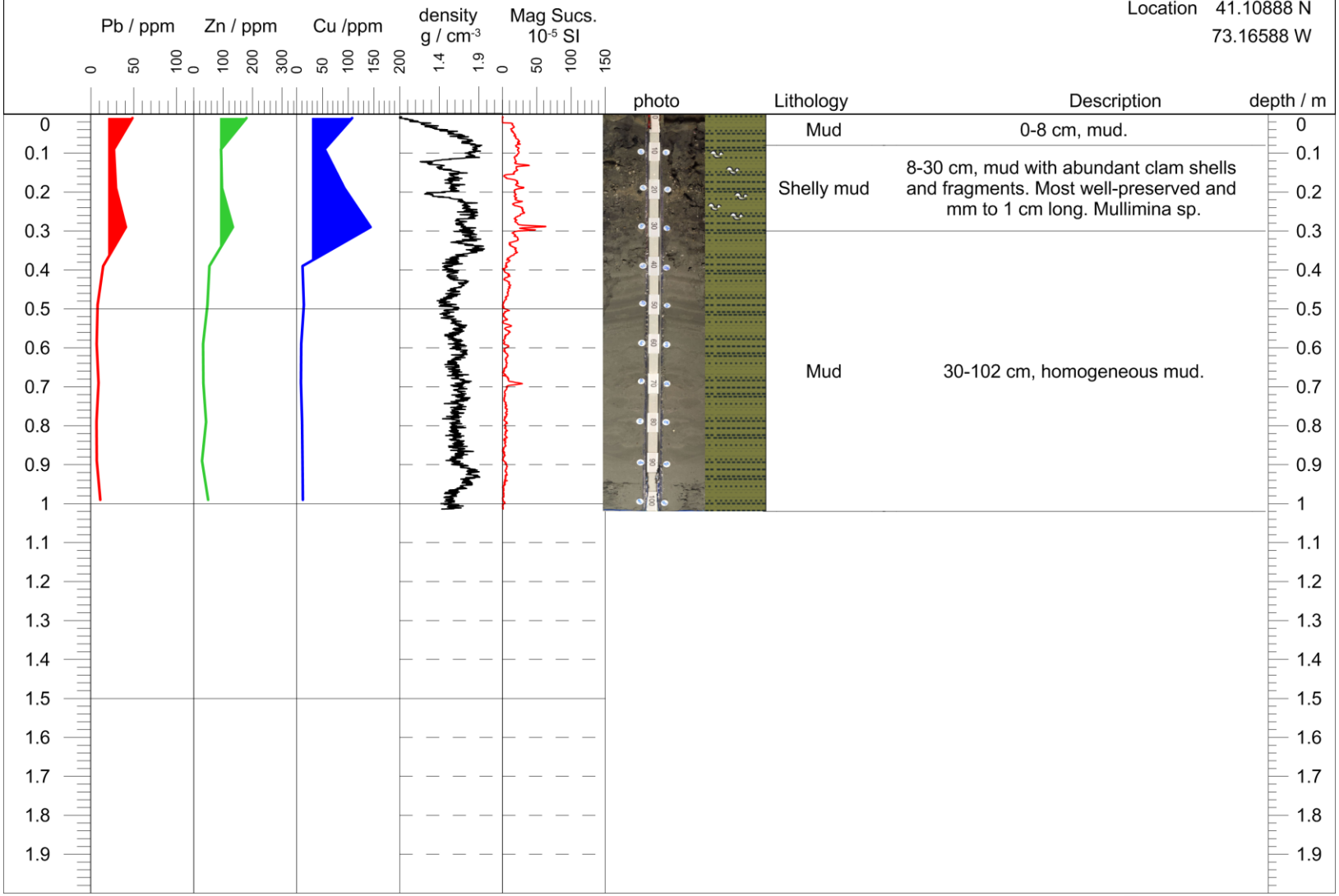
core ID: **GC13**

Location 41.10888 N
73.16588 W

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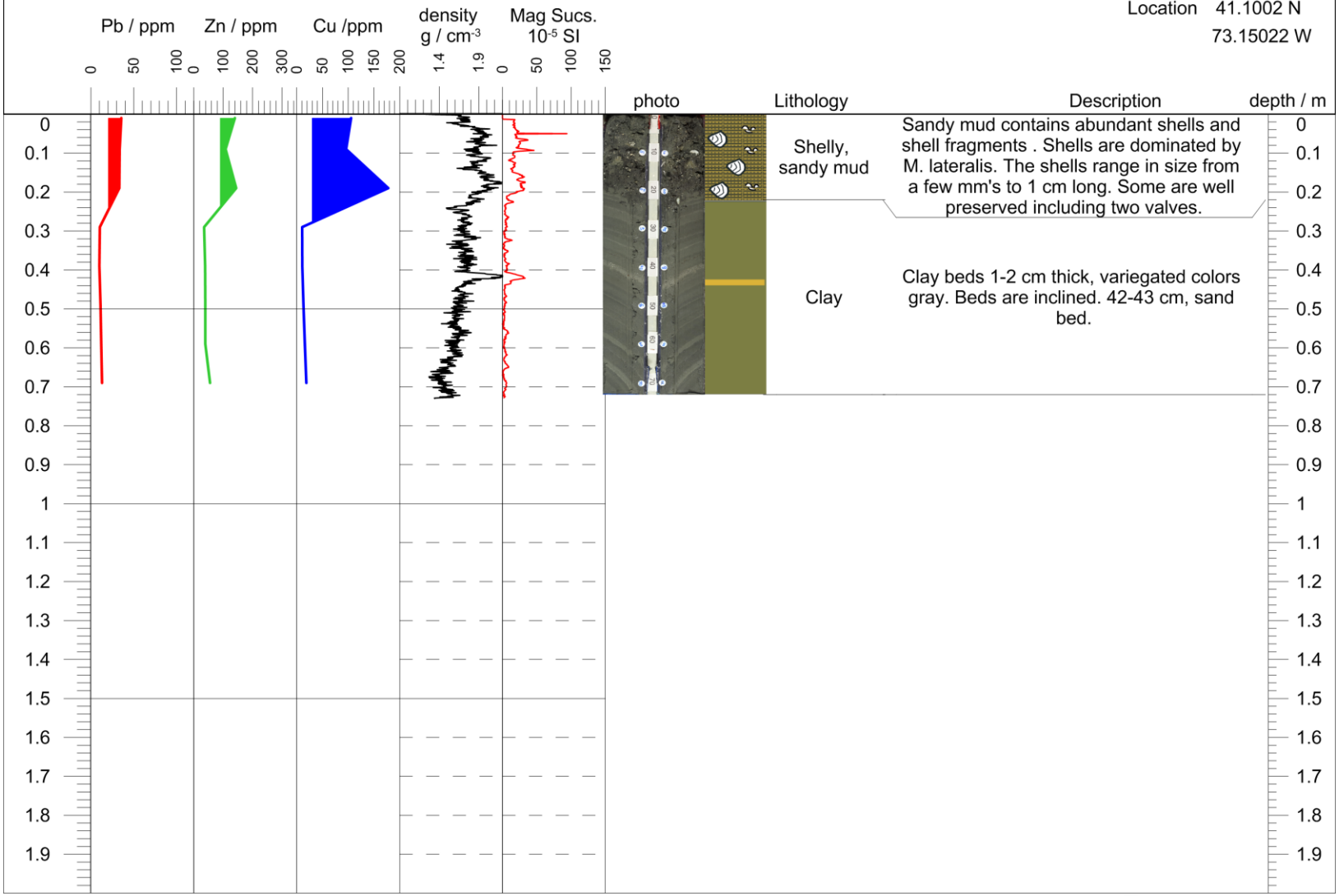
core ID: **GC14**

Location 41.1002 N
73.15022 W

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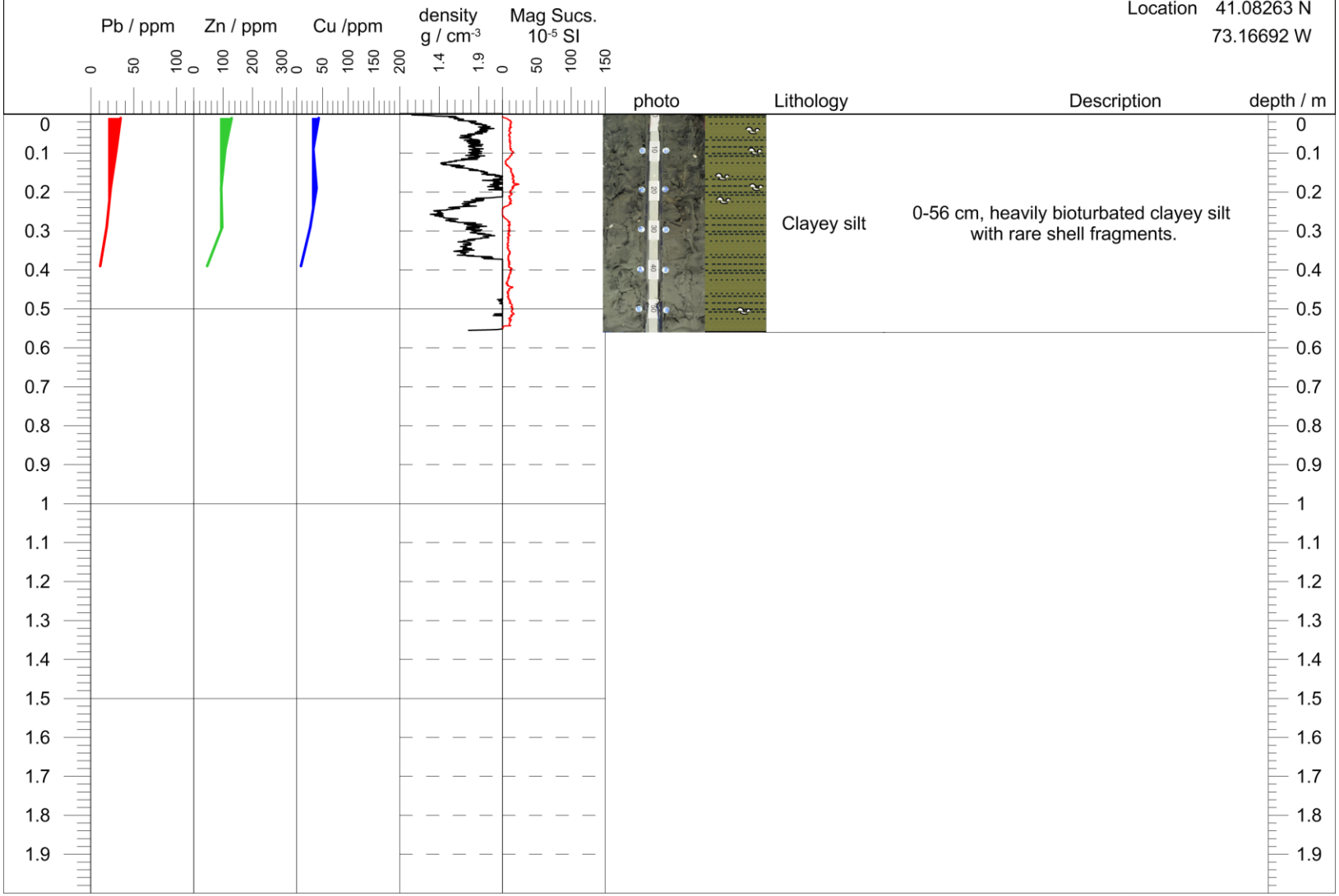
core ID: **GC15**

Location 41.08263 N
73.16692 W

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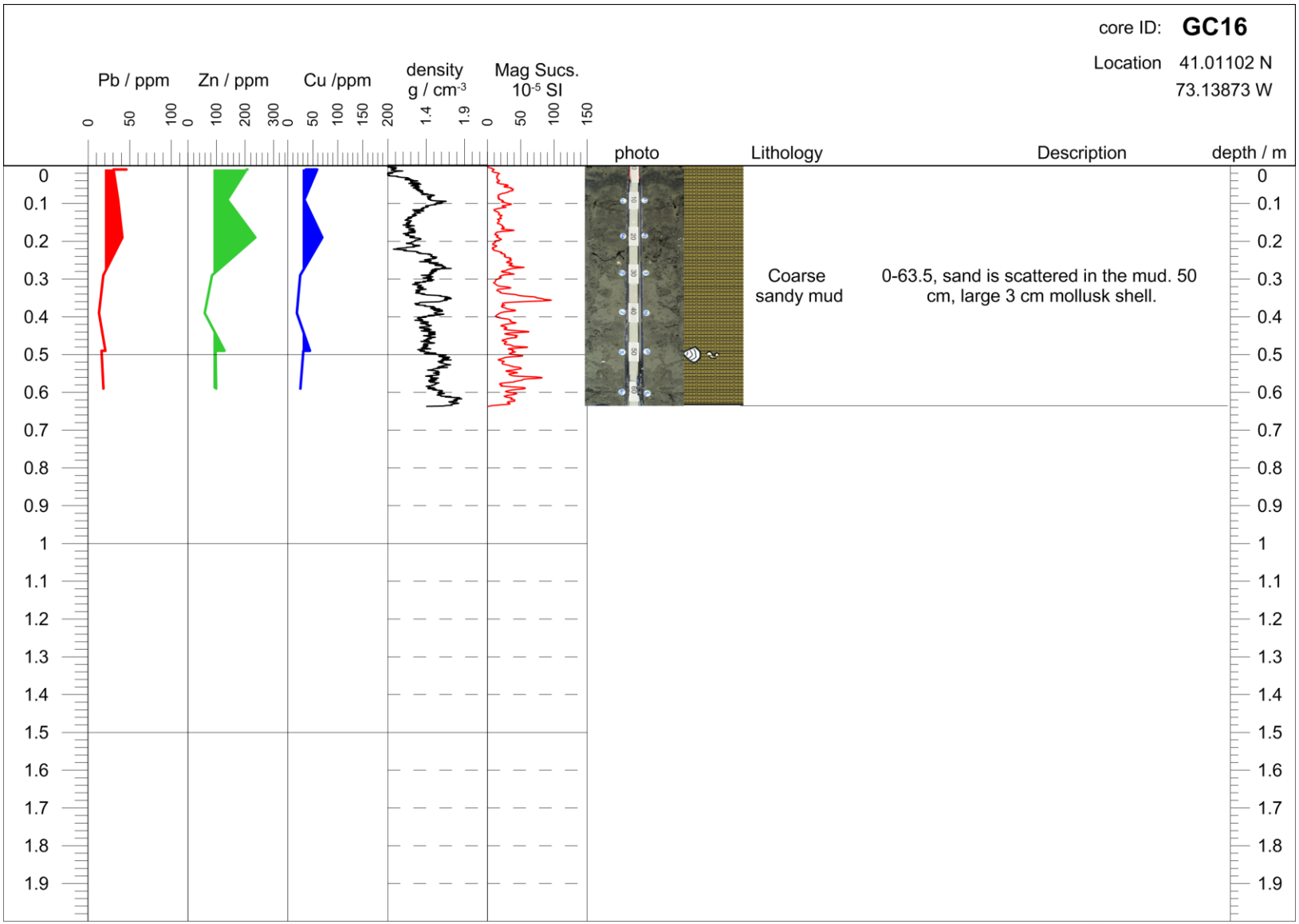
core ID: **GC16**

Location 41.01102 N
73.13873 W

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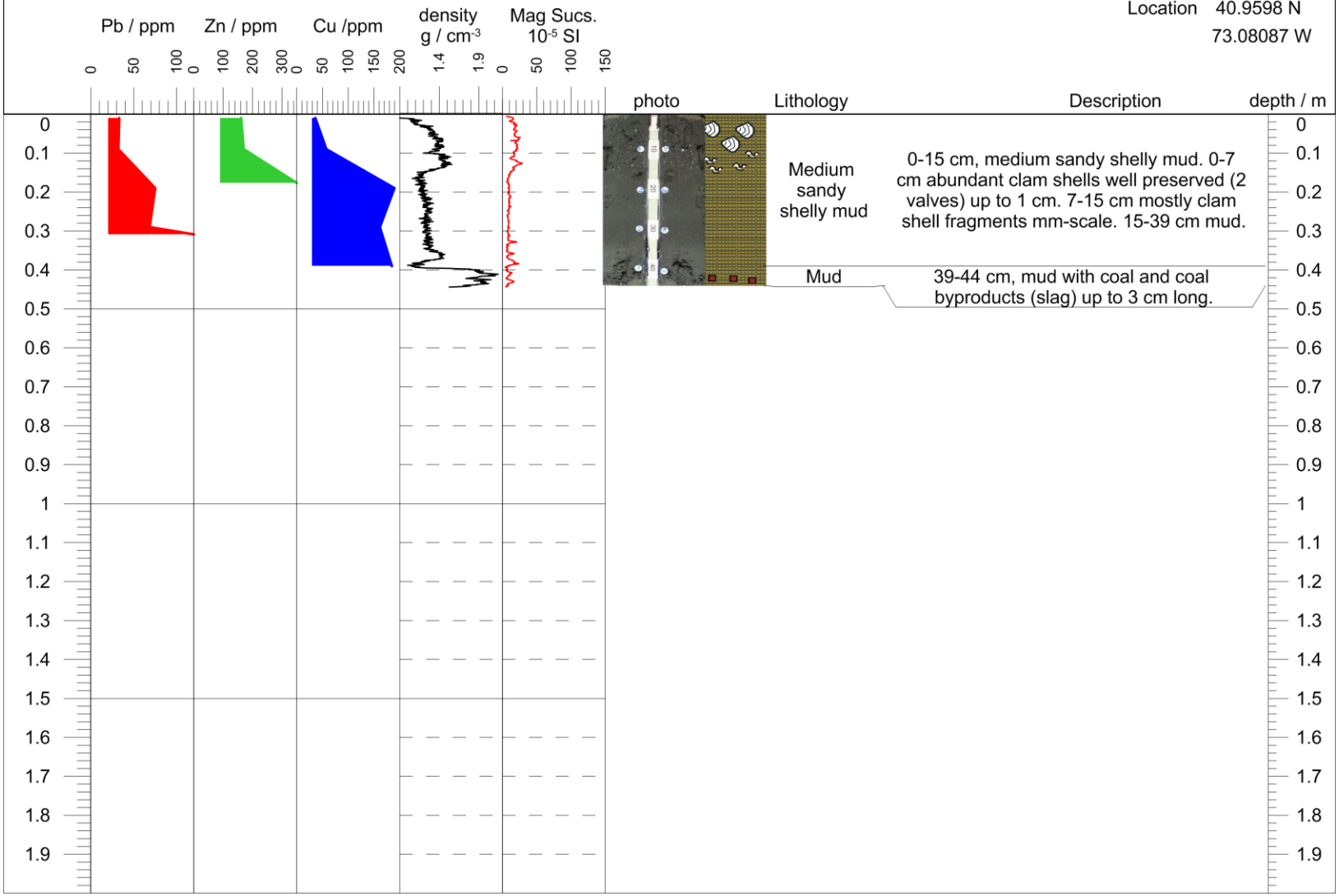
core ID: **GC17**

Location 40.9598 N
73.08087 W

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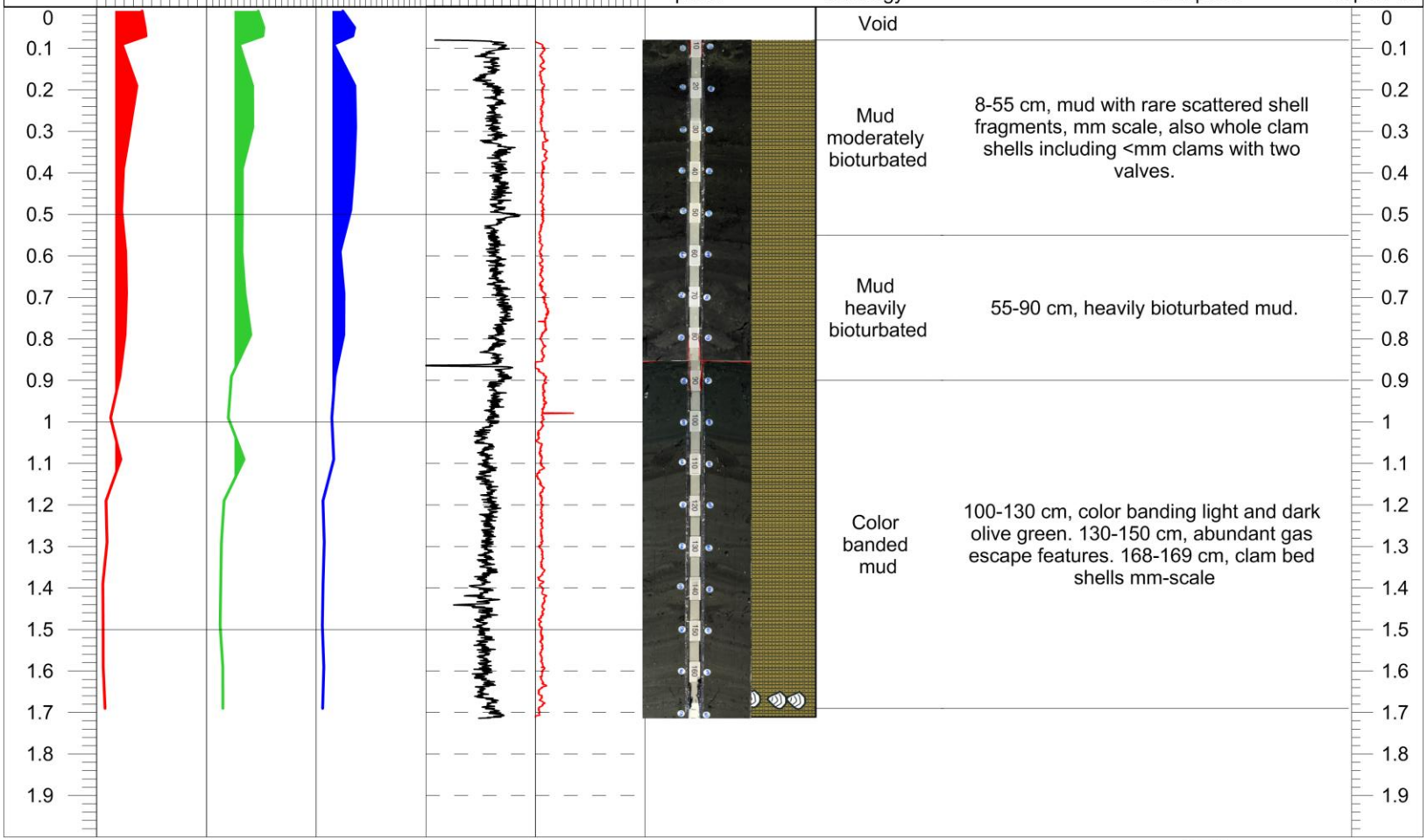
core ID: **GC18**

Location 41.08595 N
73.07435 W

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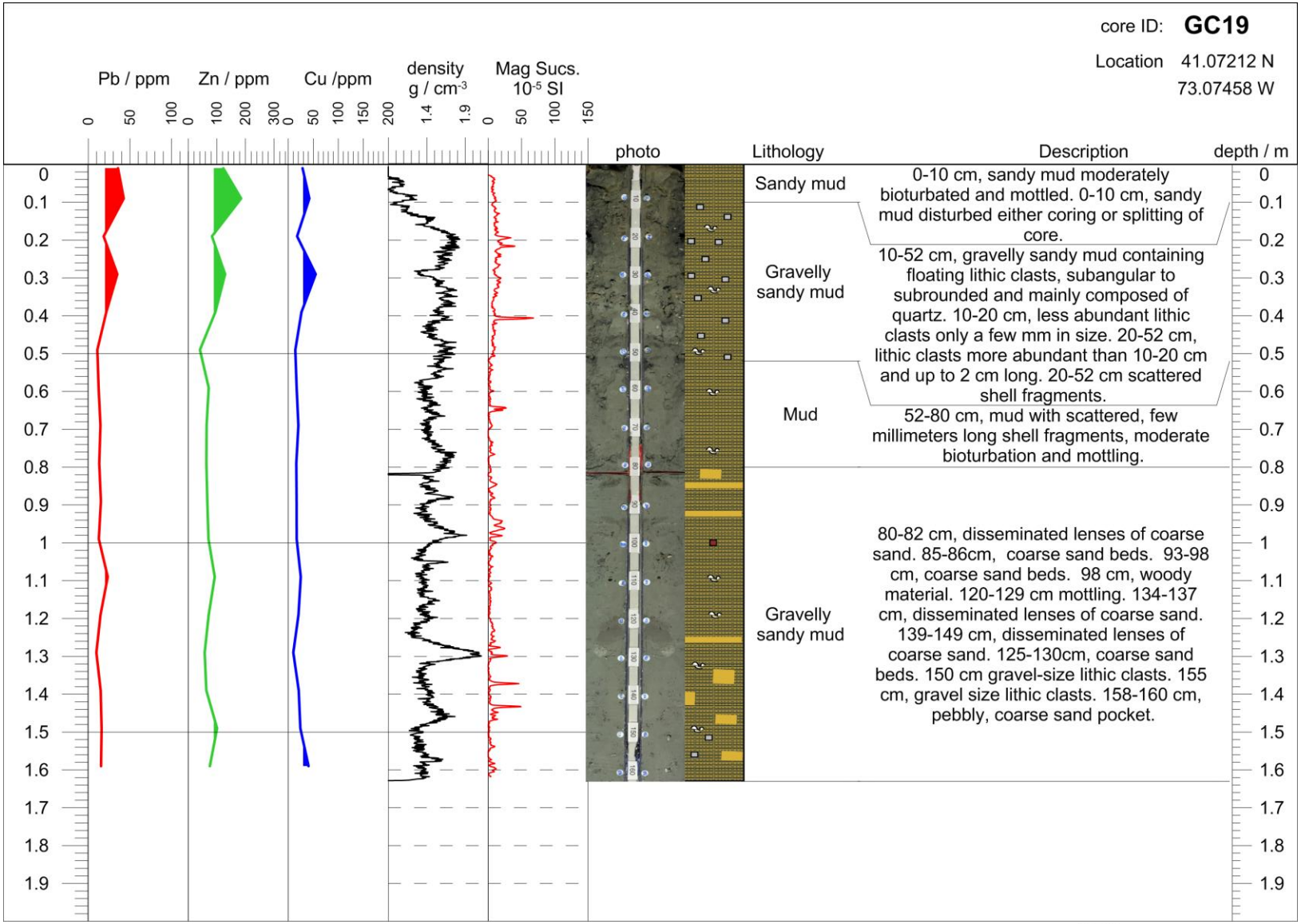


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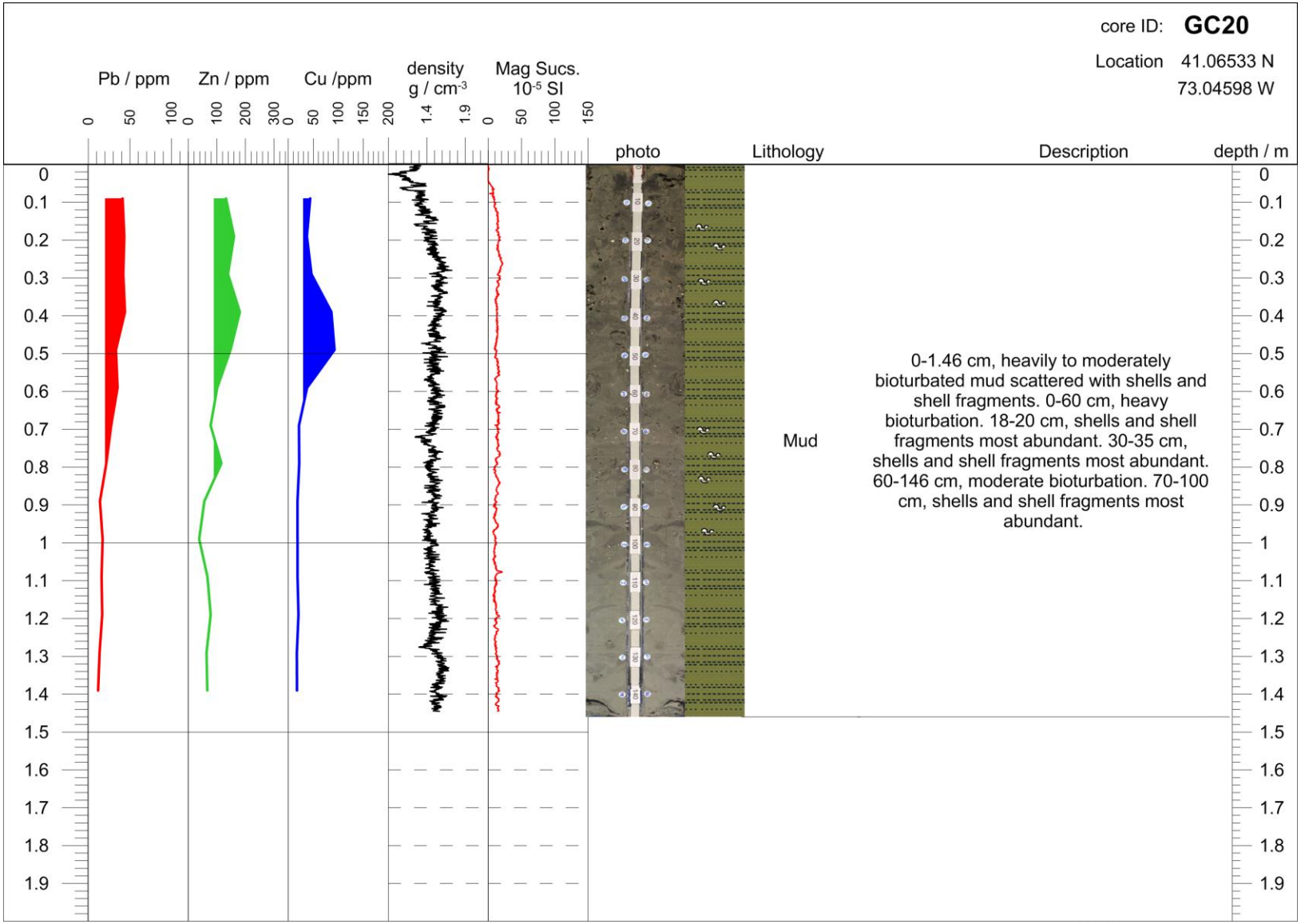


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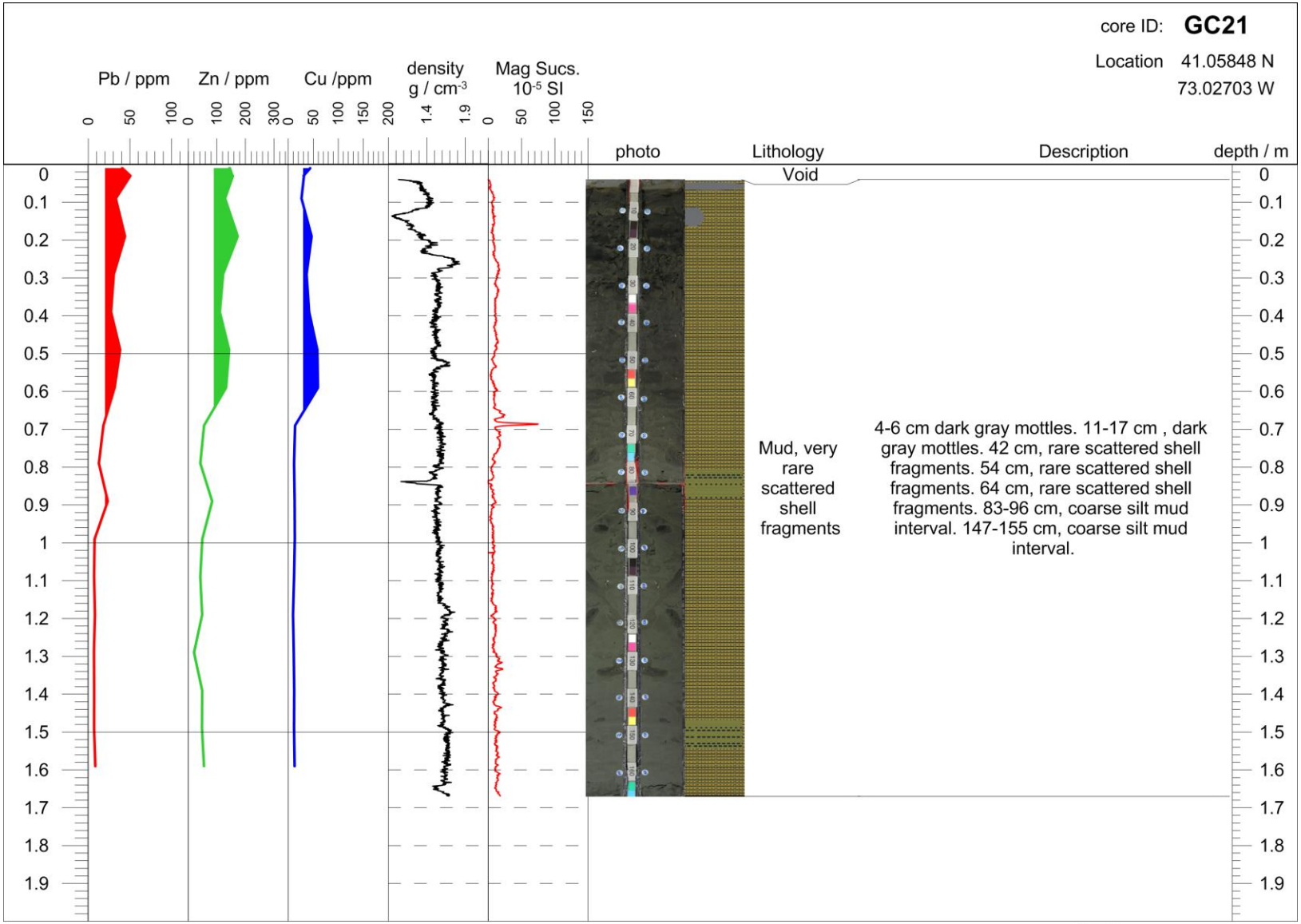


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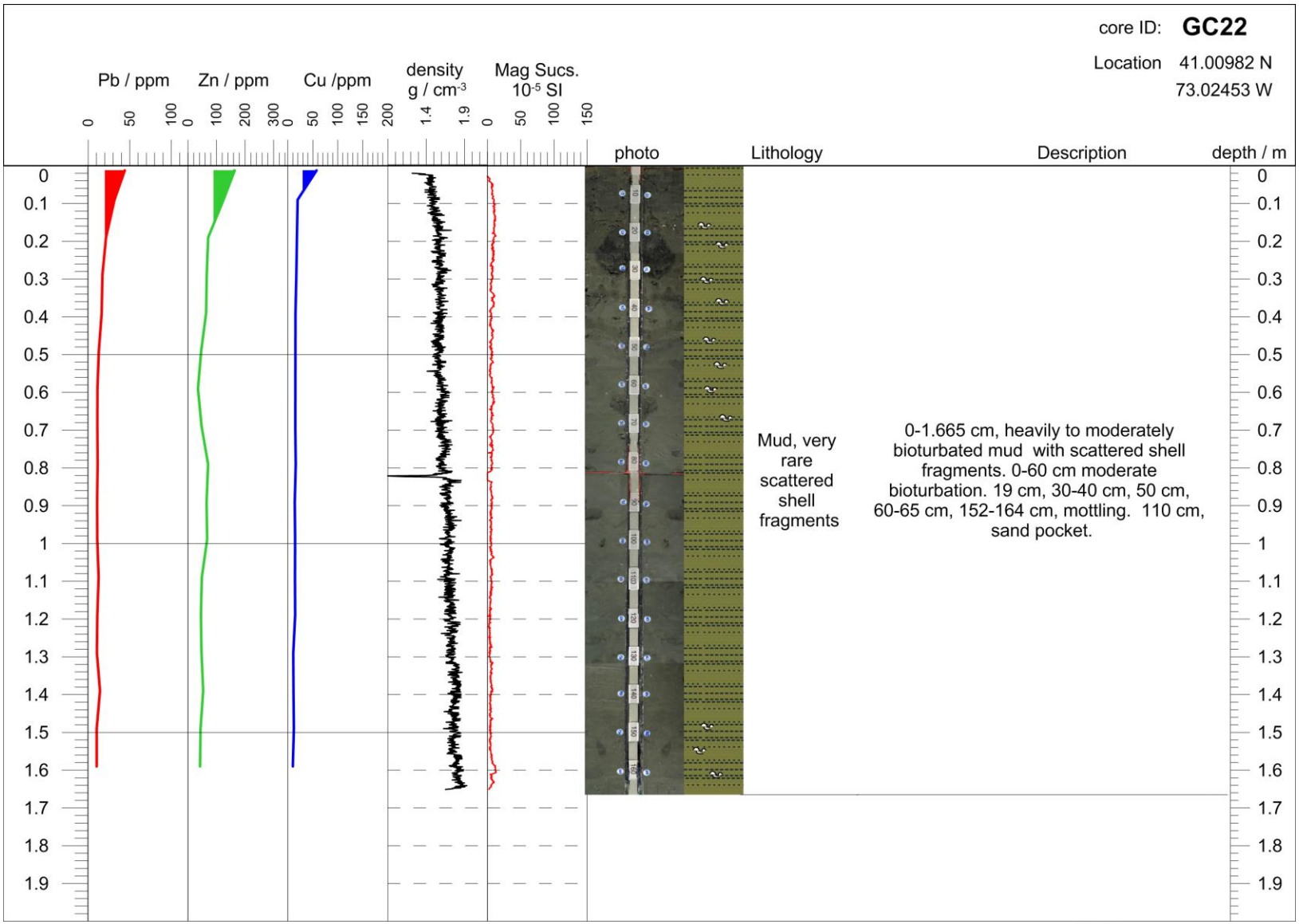
core ID: **GC22**

Location 41.00982 N
73.02453 W

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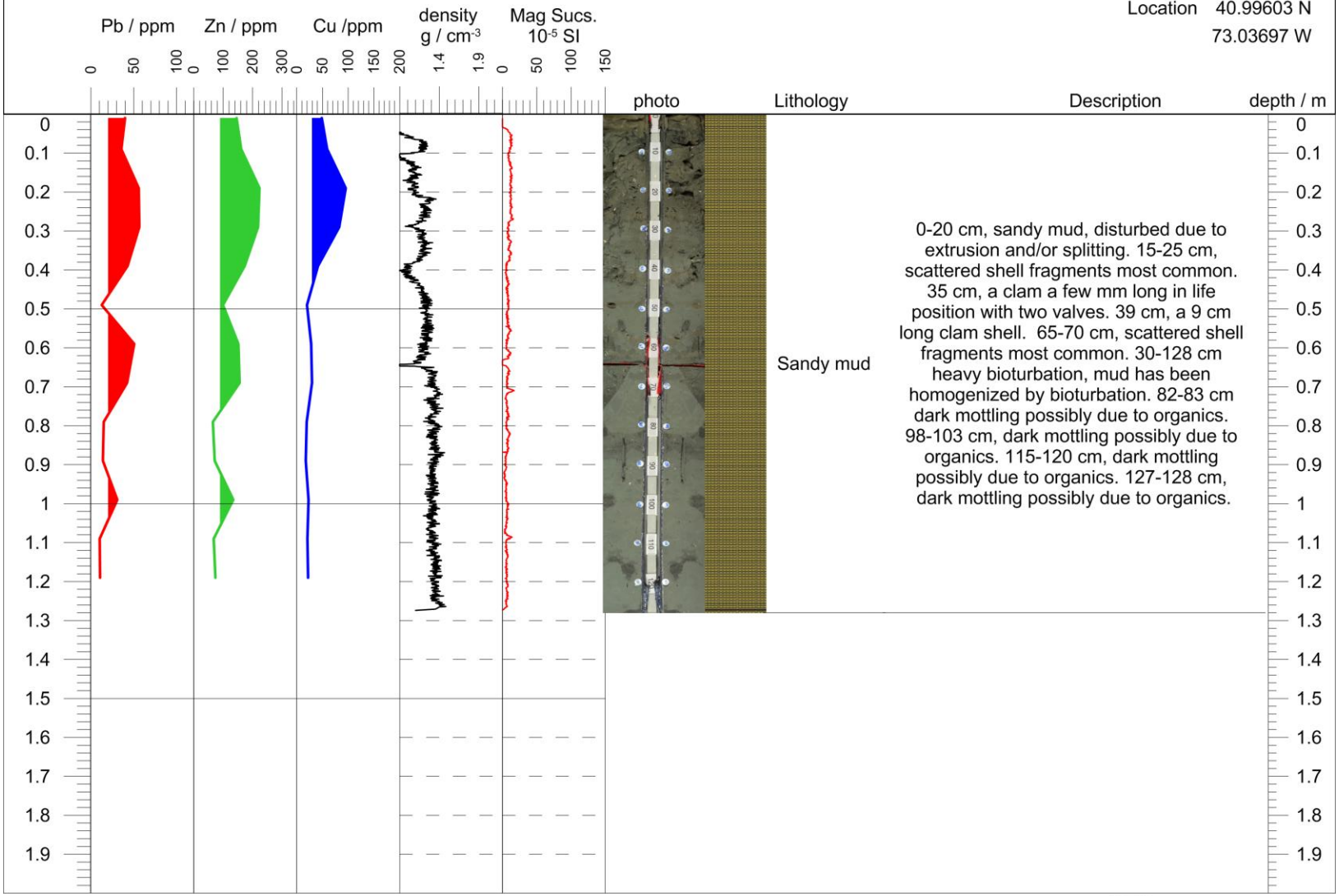
core ID: **GC23**

Location 40.99603 N
73.03697 W

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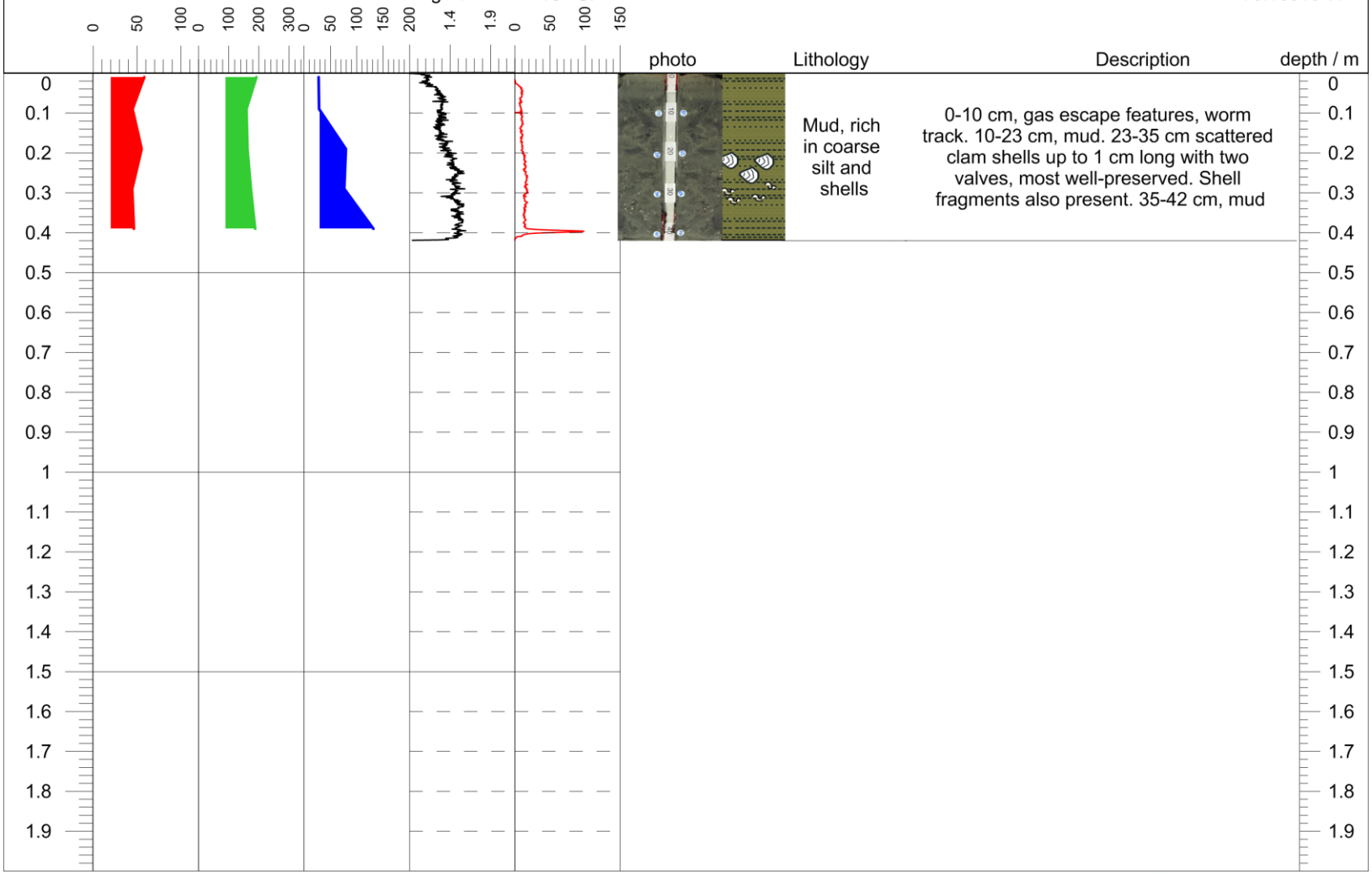
core ID: **HDC01**

Location 41.05977 N
73.15915 W

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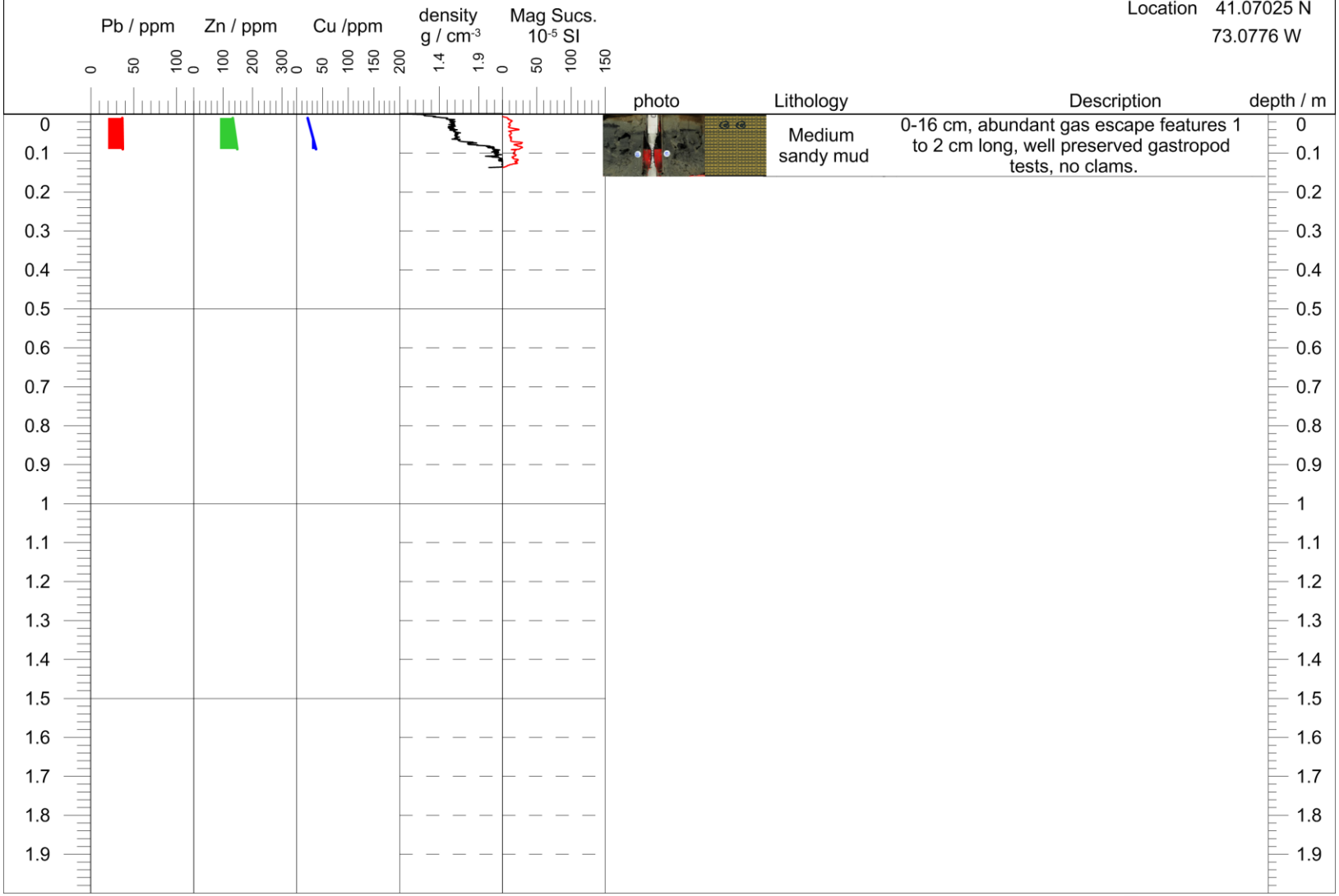
core ID: **HDC02**

Location 41.07025 N
73.0776 W

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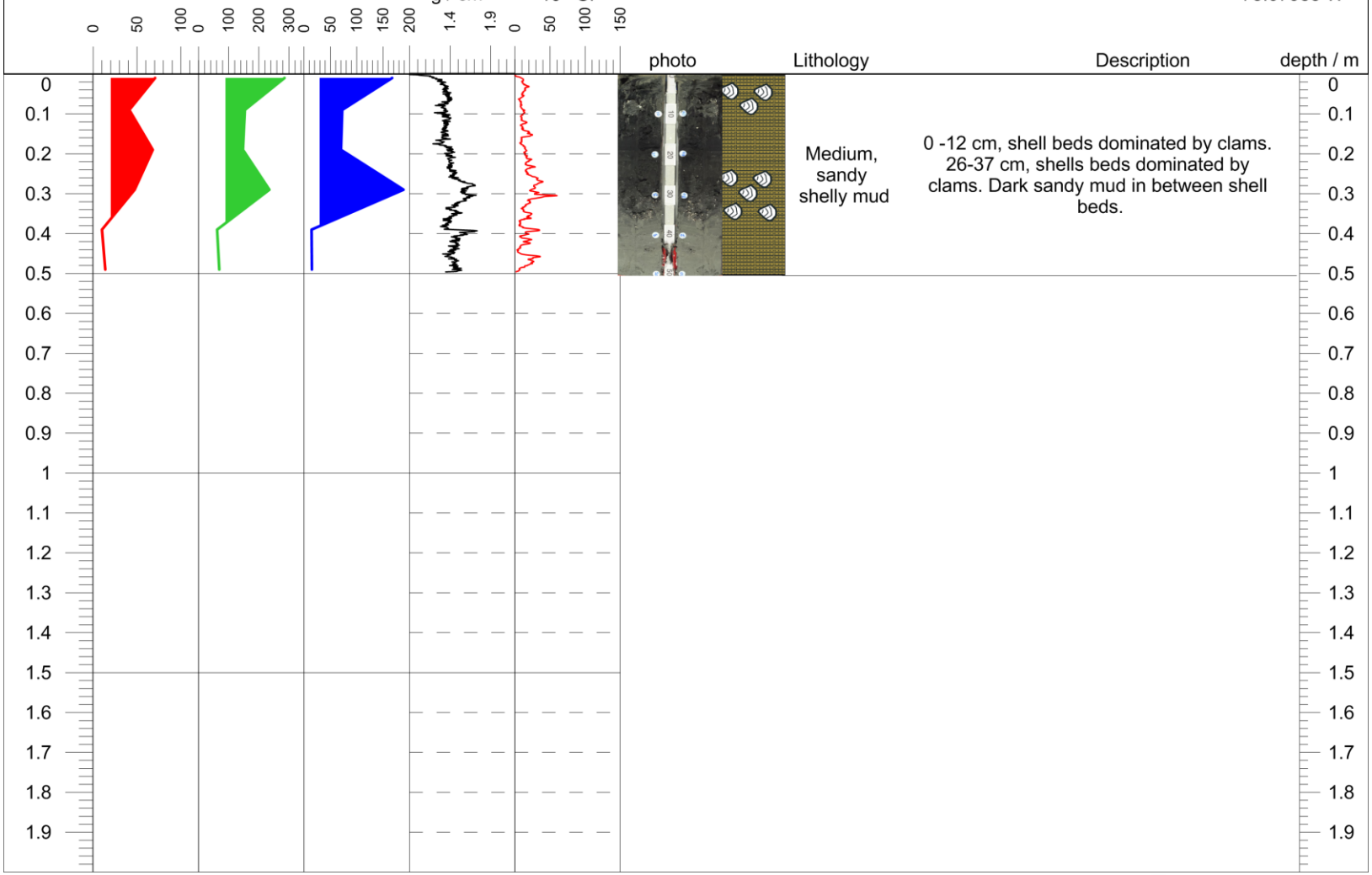
core ID: **HDC03**

Location 41.11185 N
73.07985 W

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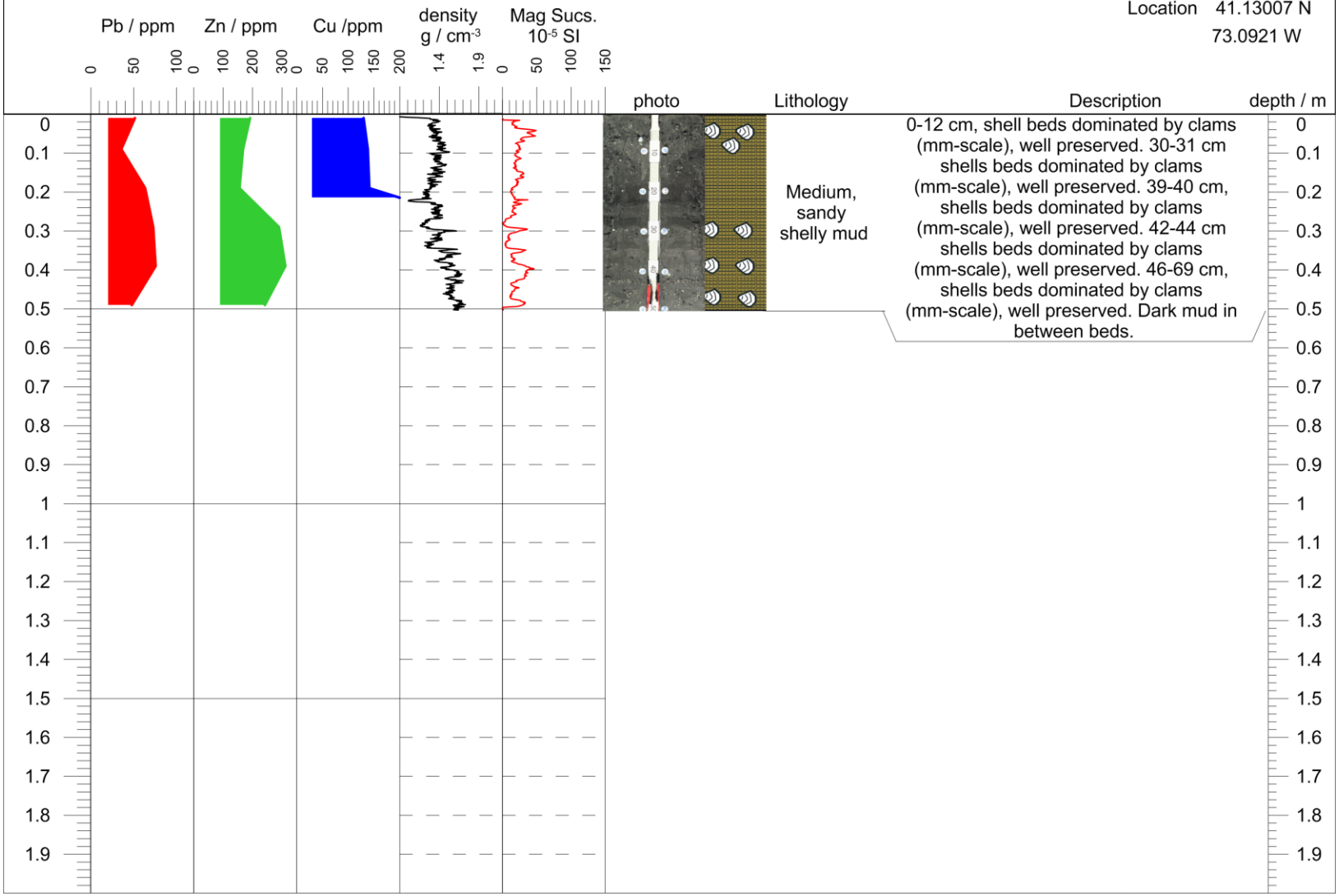
core ID: **HDC04**

Location 41.13007 N
73.0921 W

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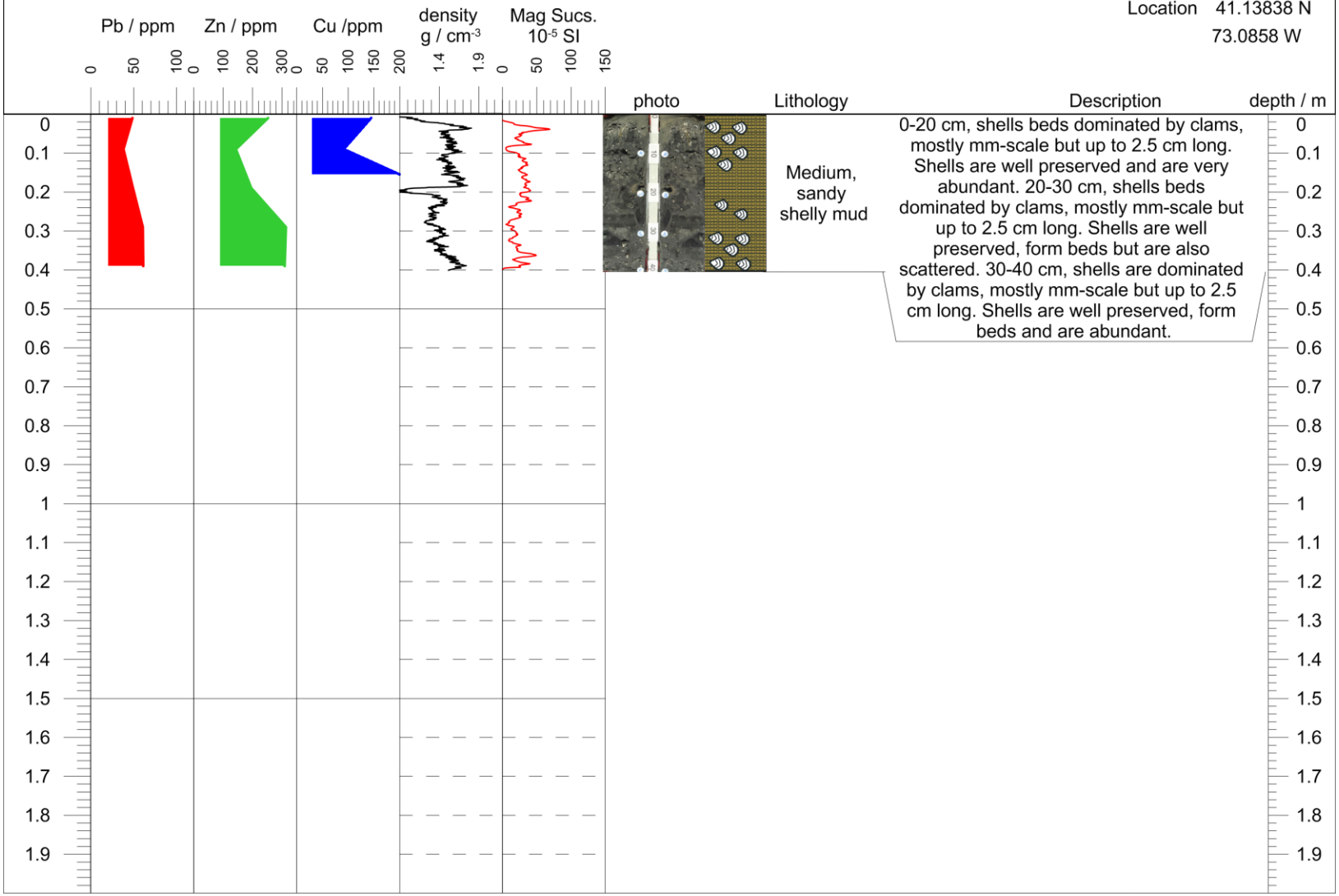
core ID: **HDC05**

Location 41.13838 N
73.0858 W

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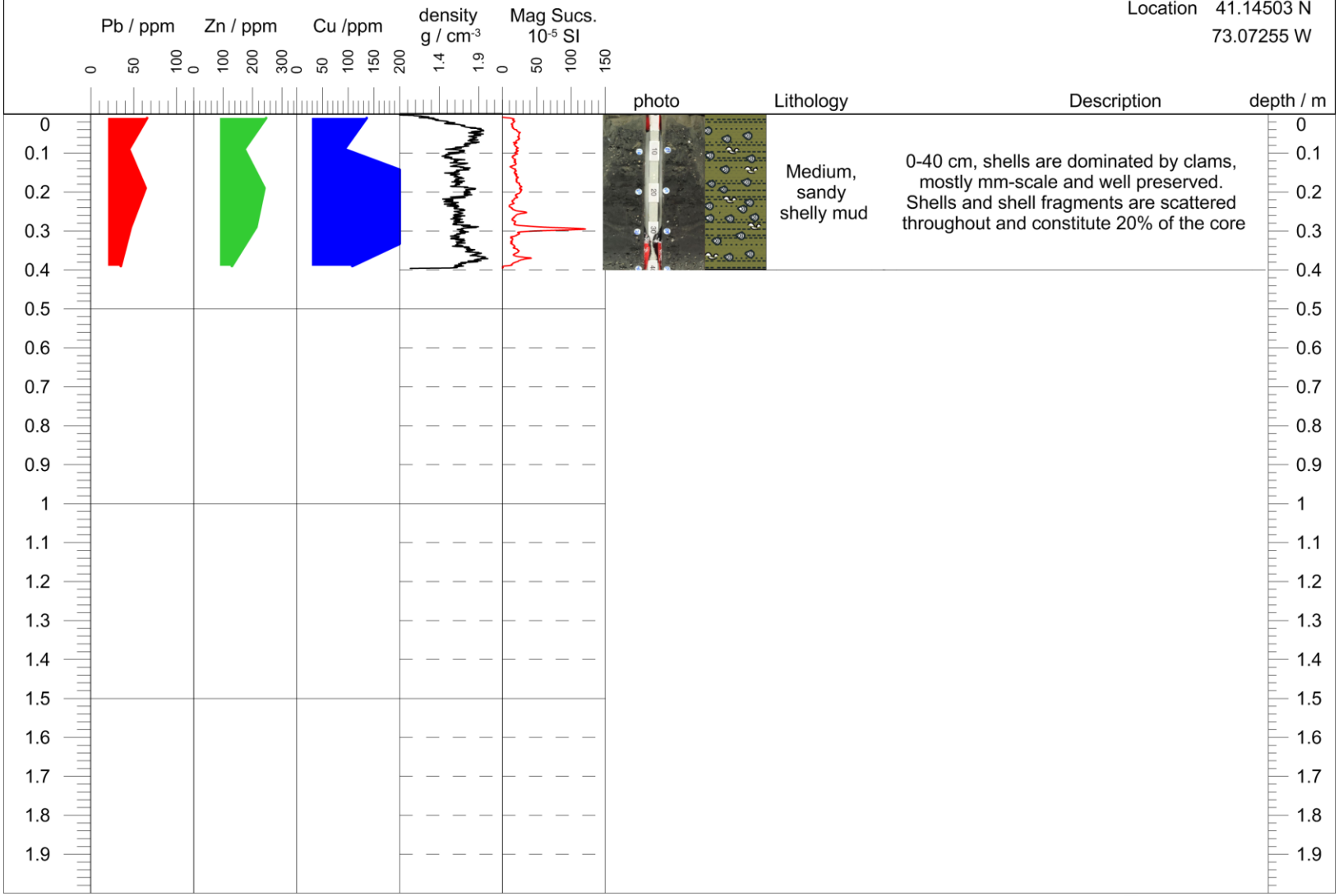
core ID: **HDC06**

Location 41.14503 N
73.07255 W

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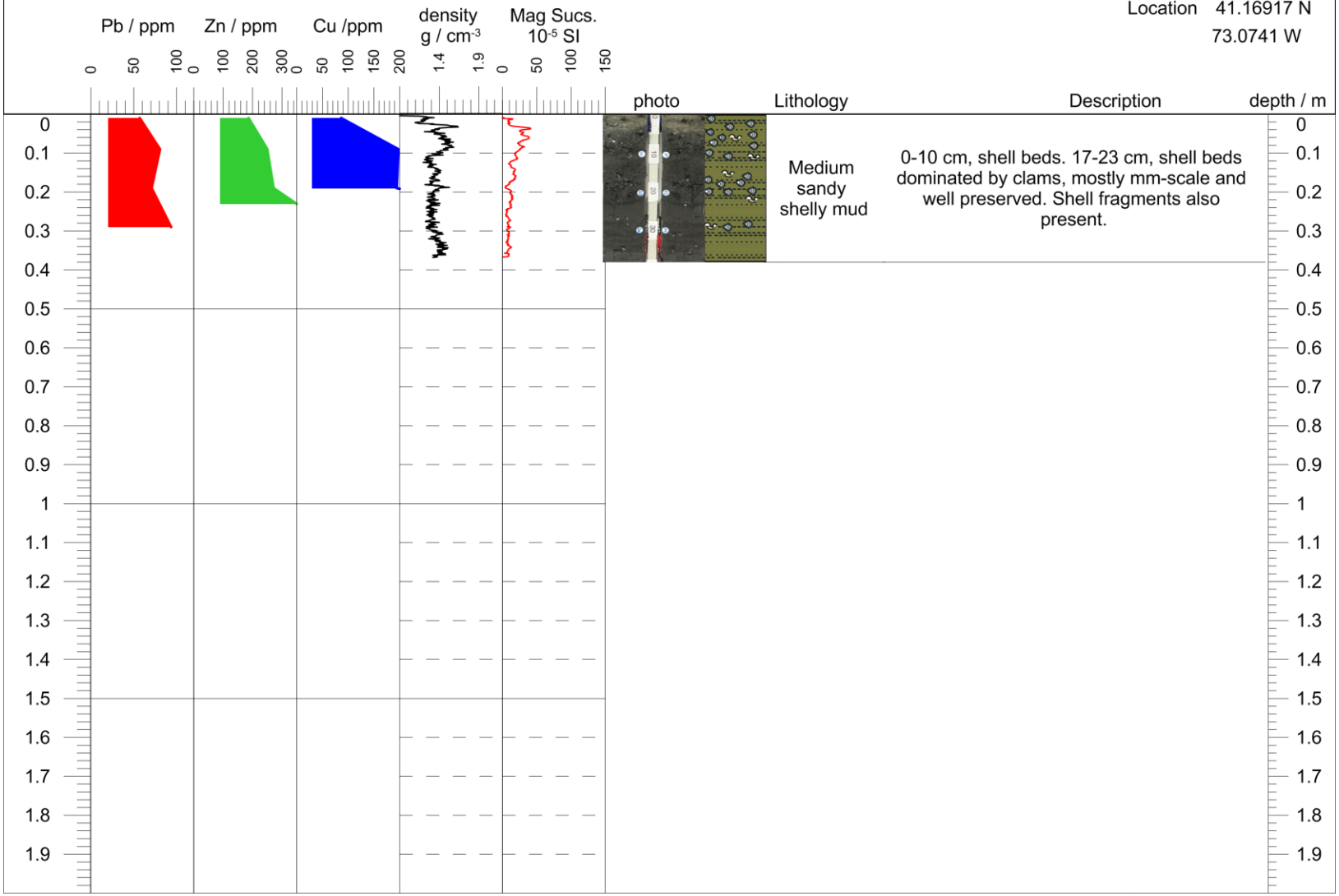
Queens College
CITY UNIVERSITY OF NEW YORK

core ID: **HDC07**

Location 41.16917 N
73.0741 W

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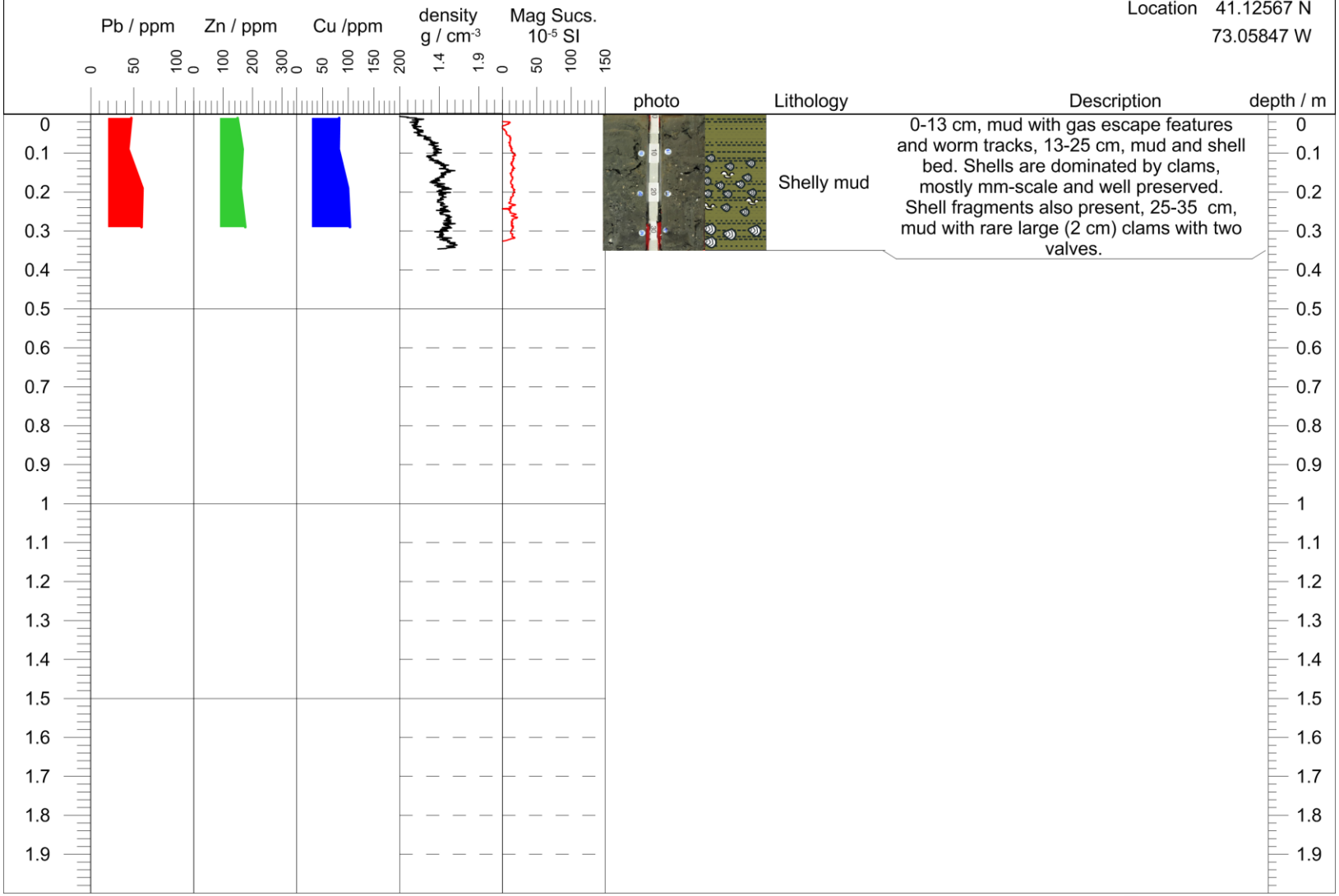
core ID: **HDC08**

Location 41.12567 N
73.05847 W

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core ID: **HDC09**

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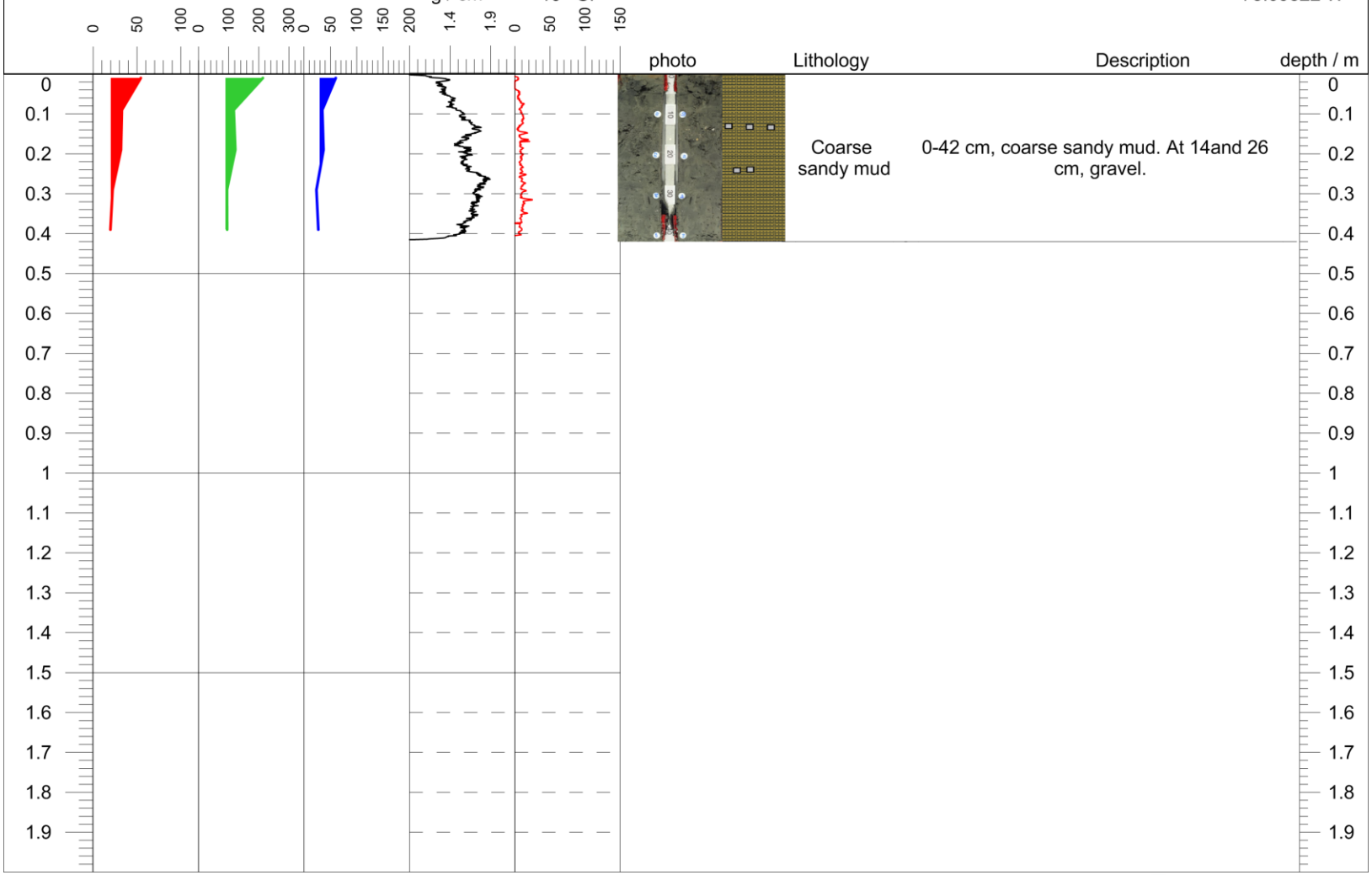
73.09522 W

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core ID: **HDC10**

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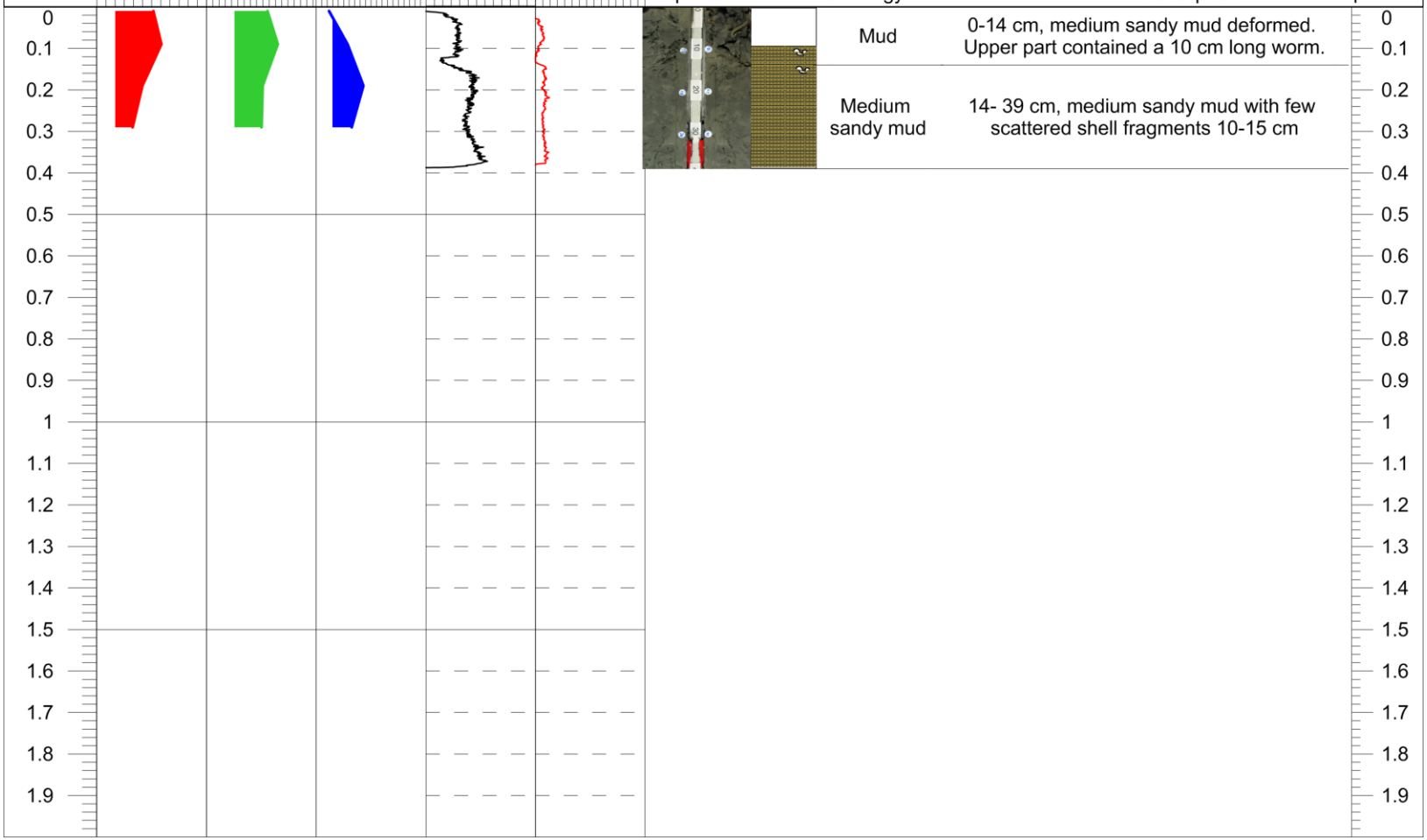


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core ID: **HDC11**

Location 41.02955 N
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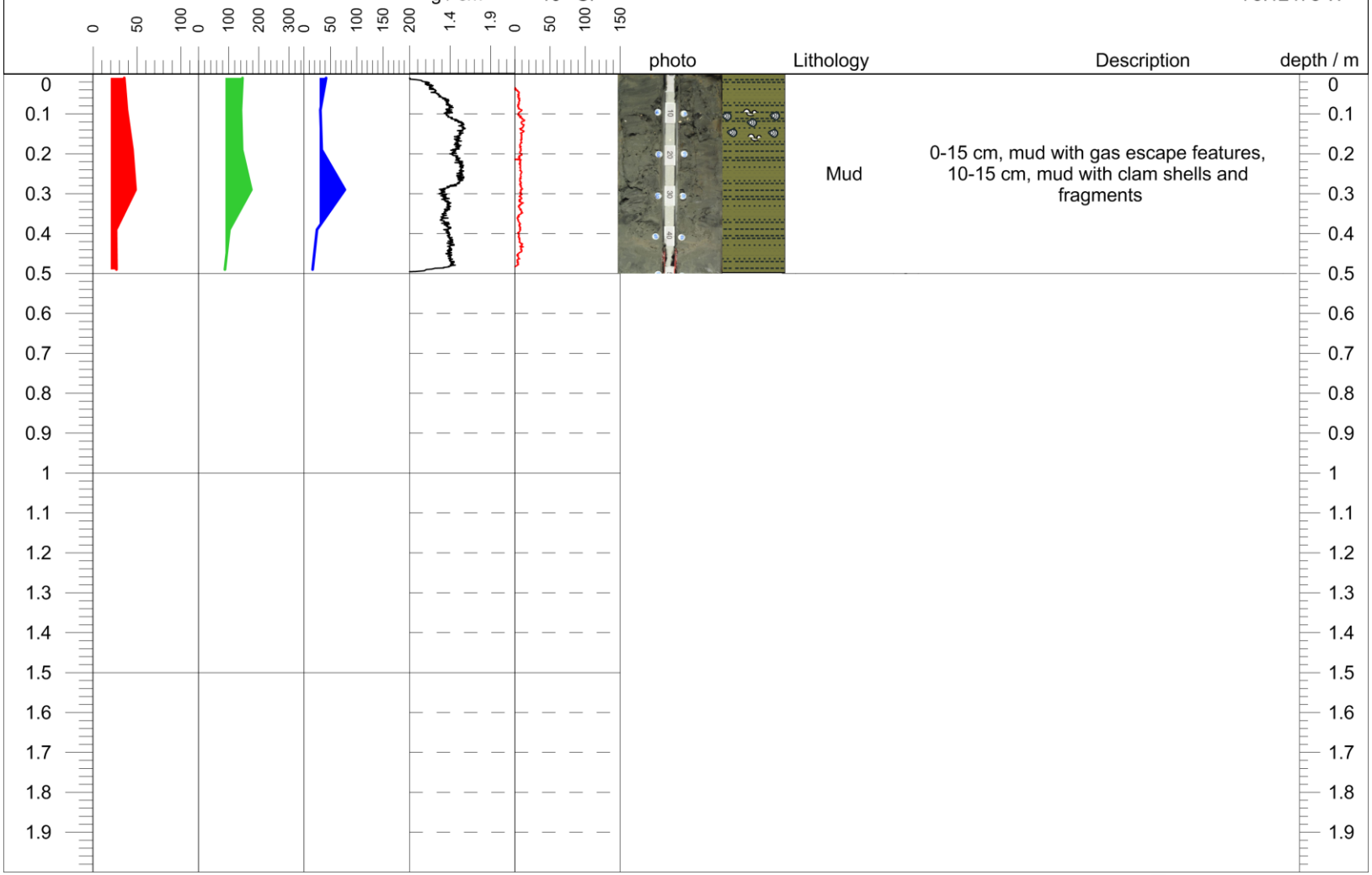


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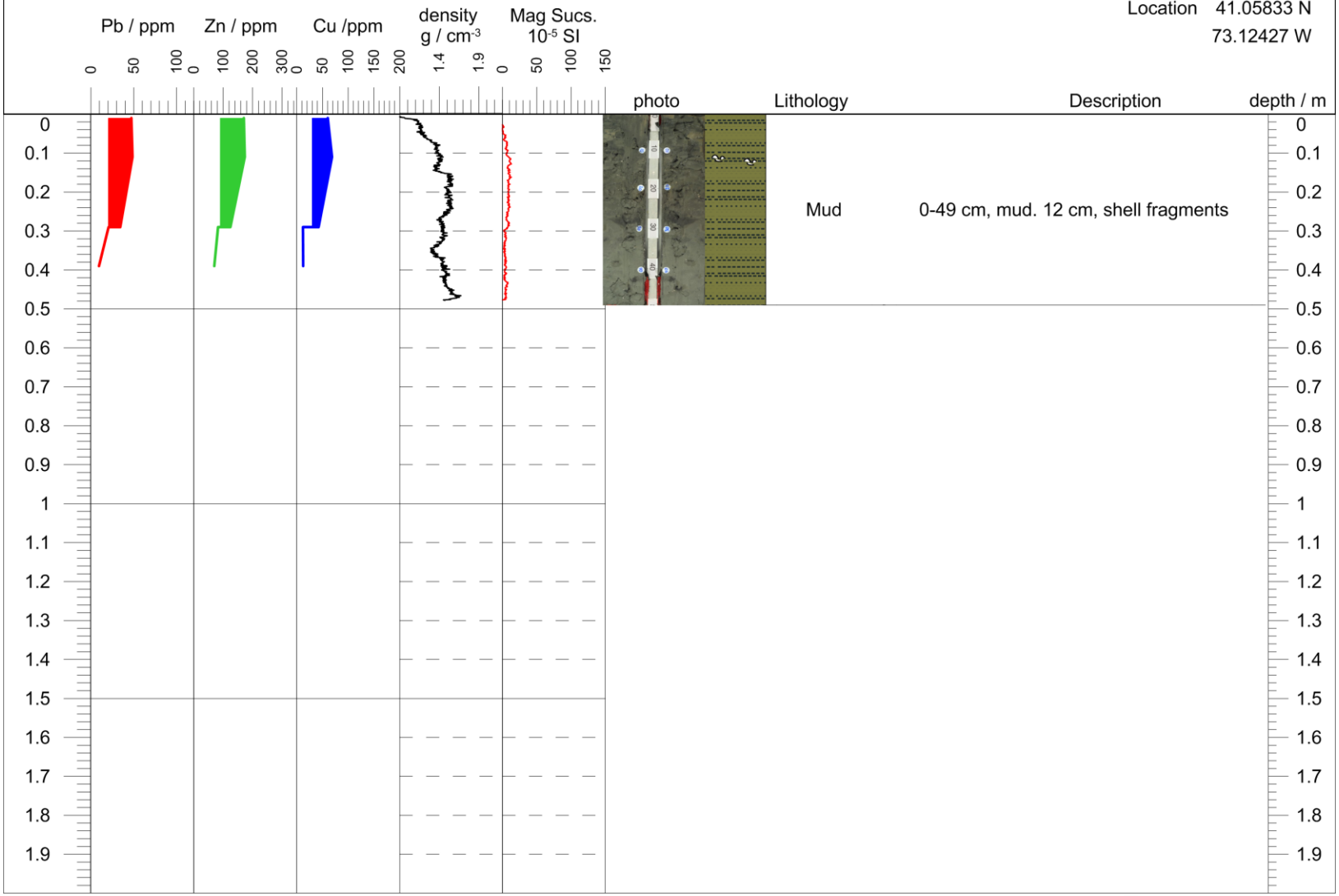
core ID: **HDC12**

Location 41.05833 N
73.12427 W

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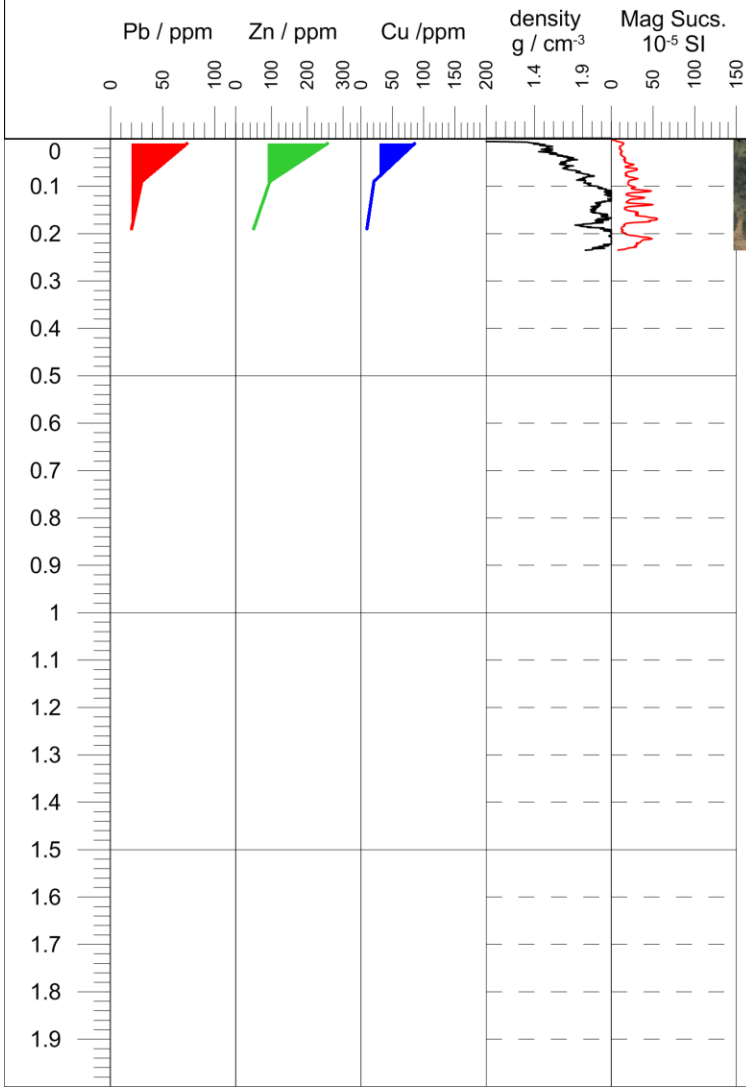
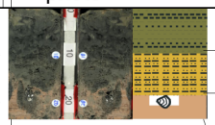
core ID: **HDC13**

Location 41.08505 N
73.10535 W



| photo | Lithology | Description | depth / m |
|---|---|---|---|
| | Mud | 0-9 cm, mud. | |
| | Mud | 9-18 cm, coarse muddy sand. | |
| | Coarse muddy sand | 18-23.5 cm, reddish pink clay with scour surface on top and a large shell fragment in scoured surface, likely a razor clam. | |

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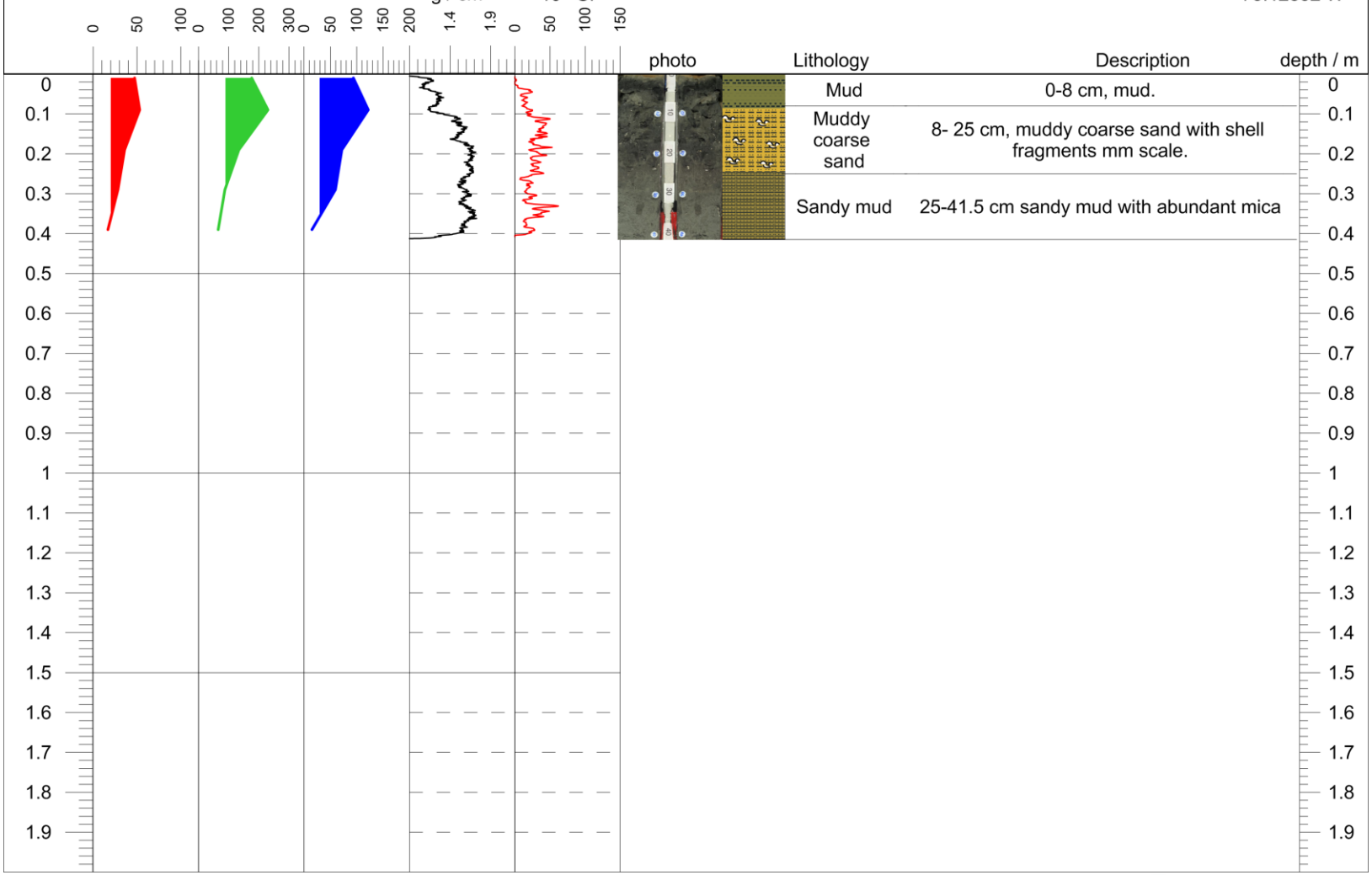
core ID: **HDC14**

Location 41.09445 N
73.12832 W

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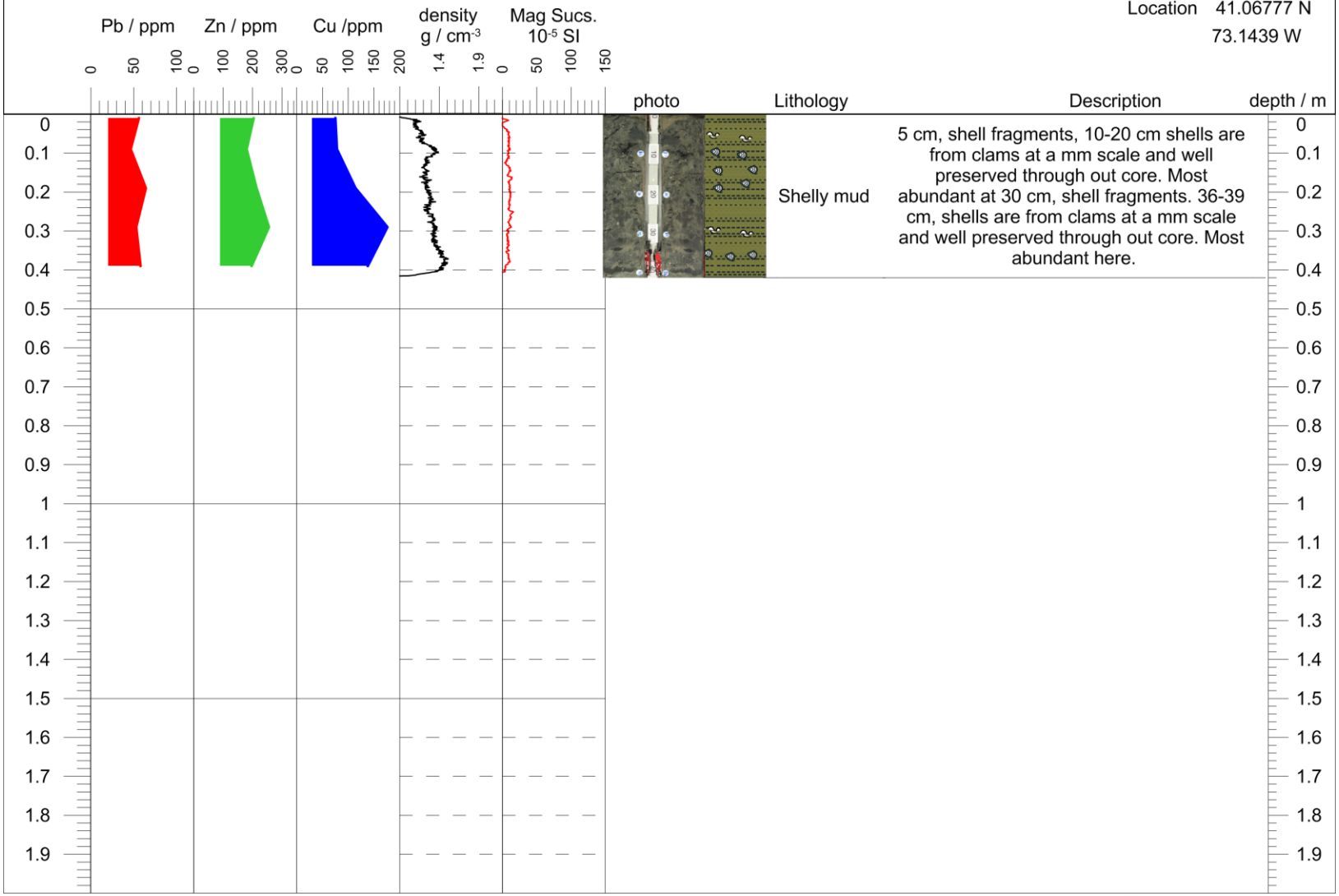
core ID: **HDC15**

Location 41.06777 N
73.1439 W

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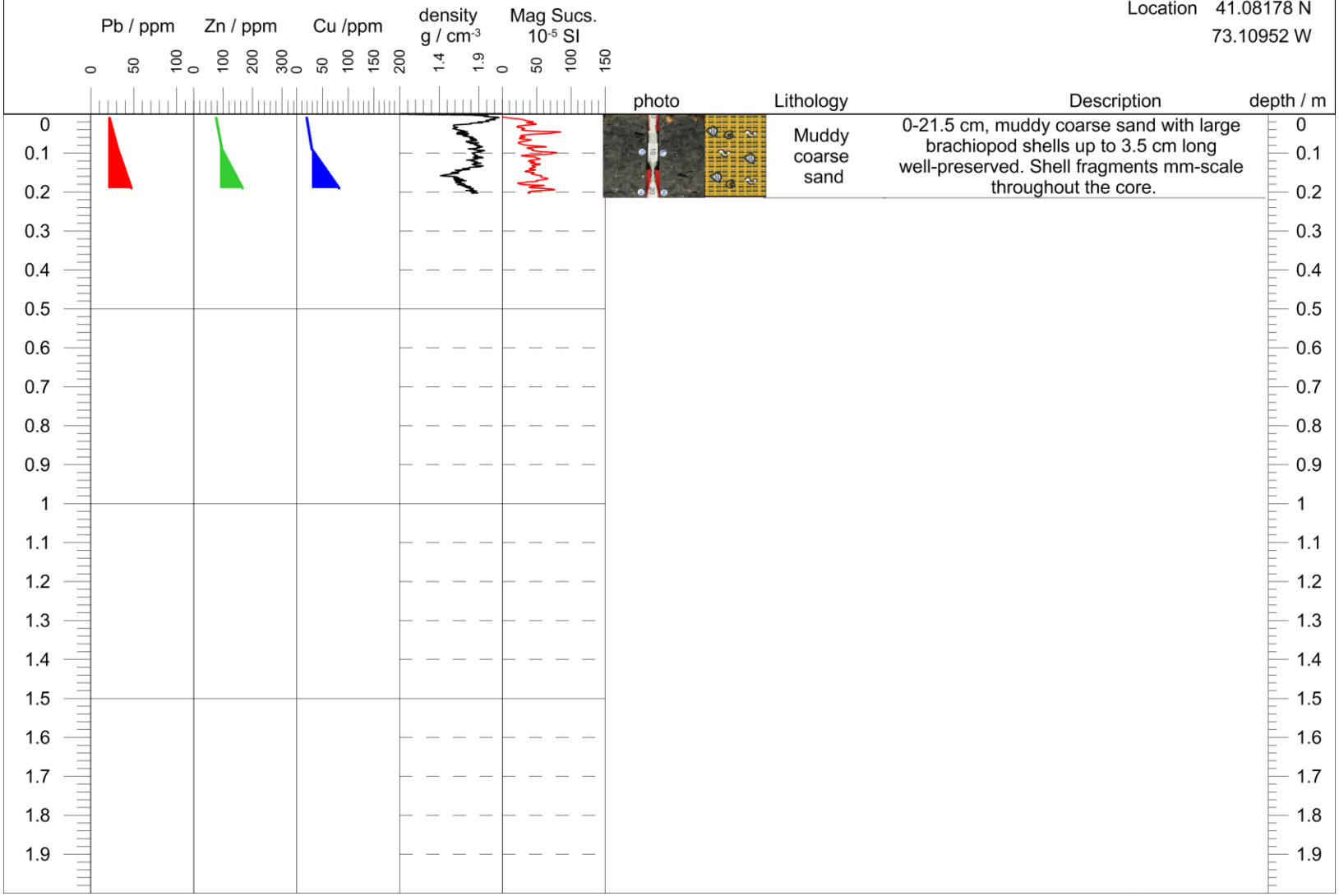
core ID: **HDC16**

Location 41.08178 N
73.10952 W

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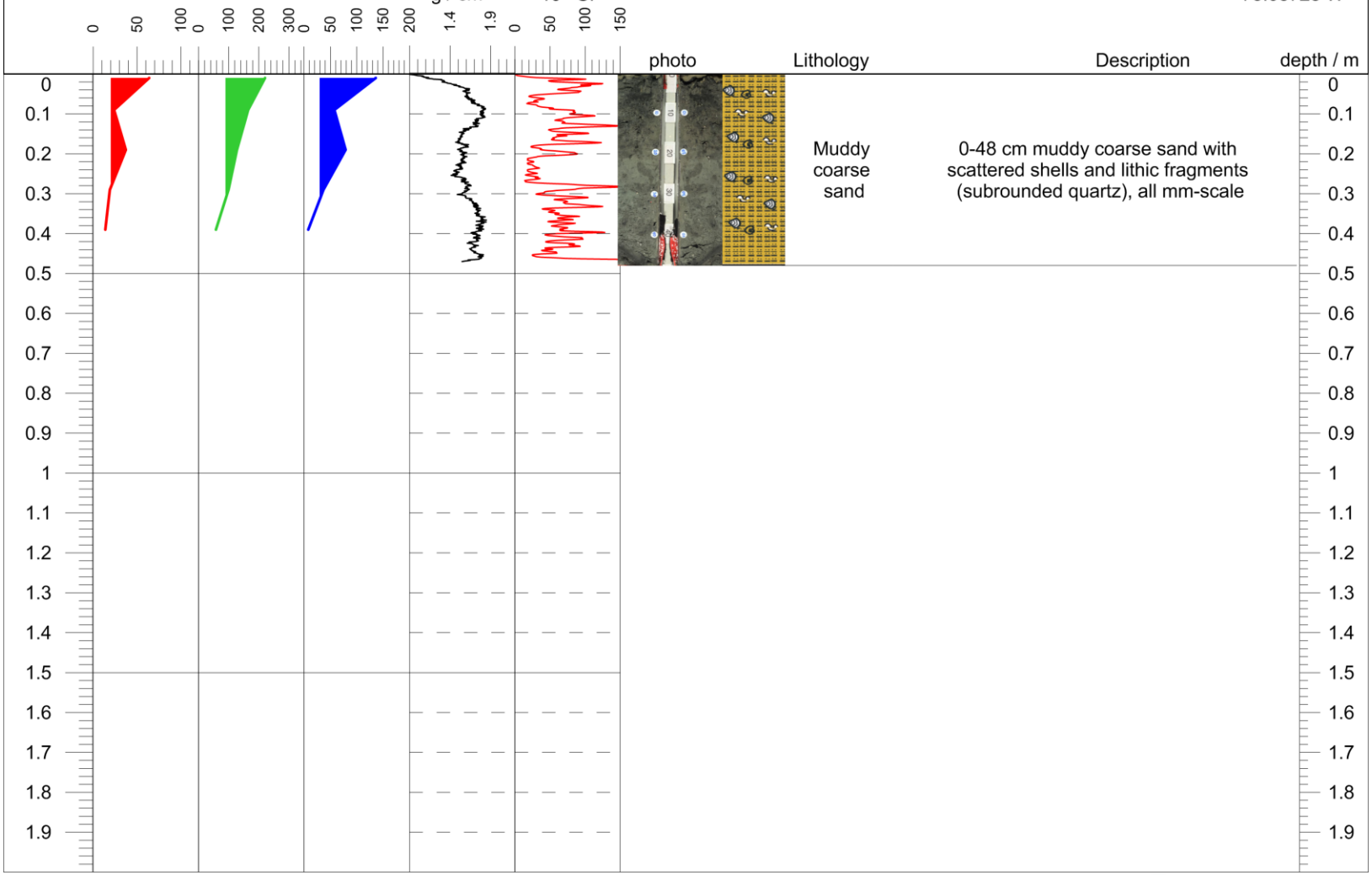
core ID: **HDC17**

Location 41.10042 N
73.08728 W

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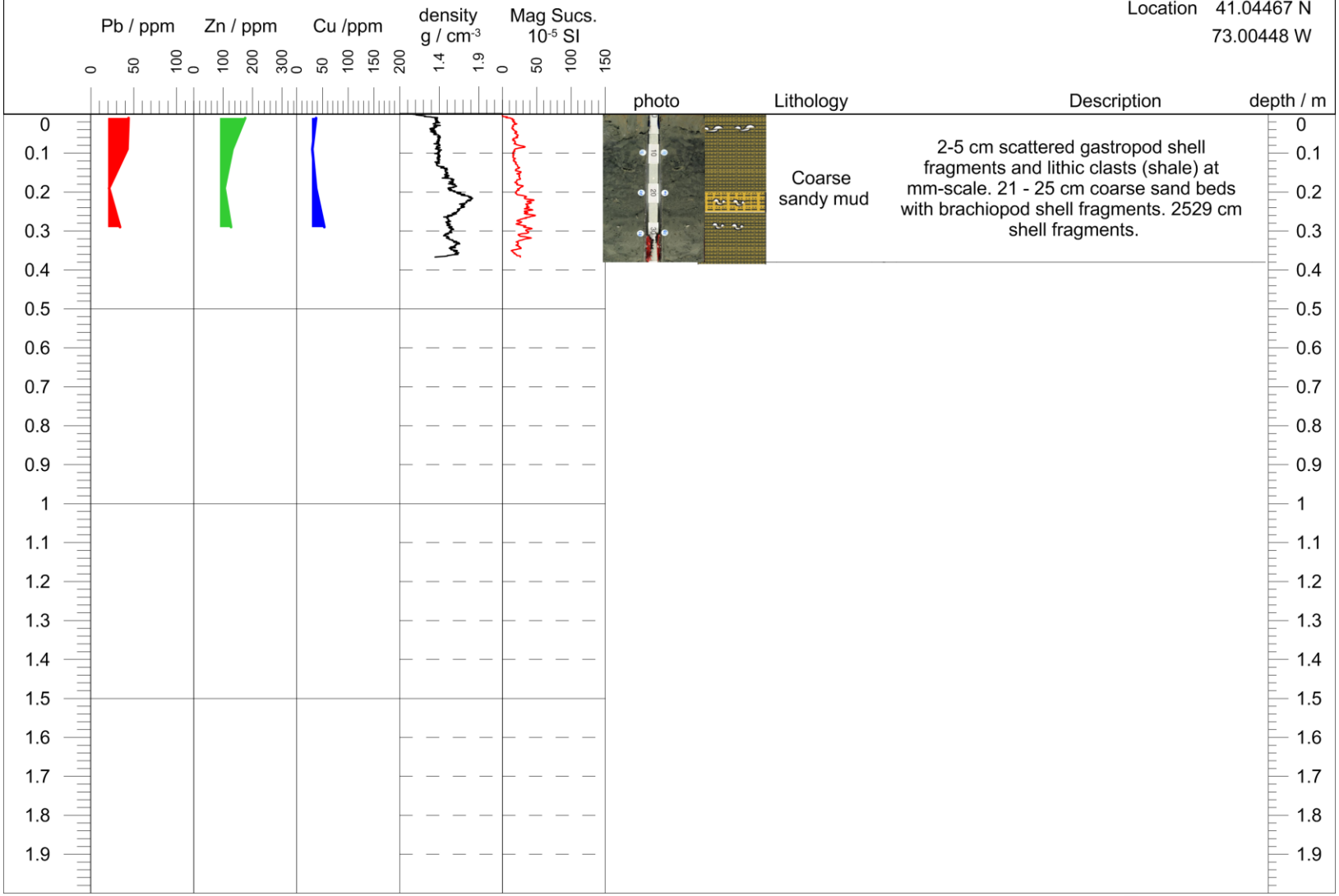
core ID: **HDC18**

Location 41.04467 N
73.00448 W

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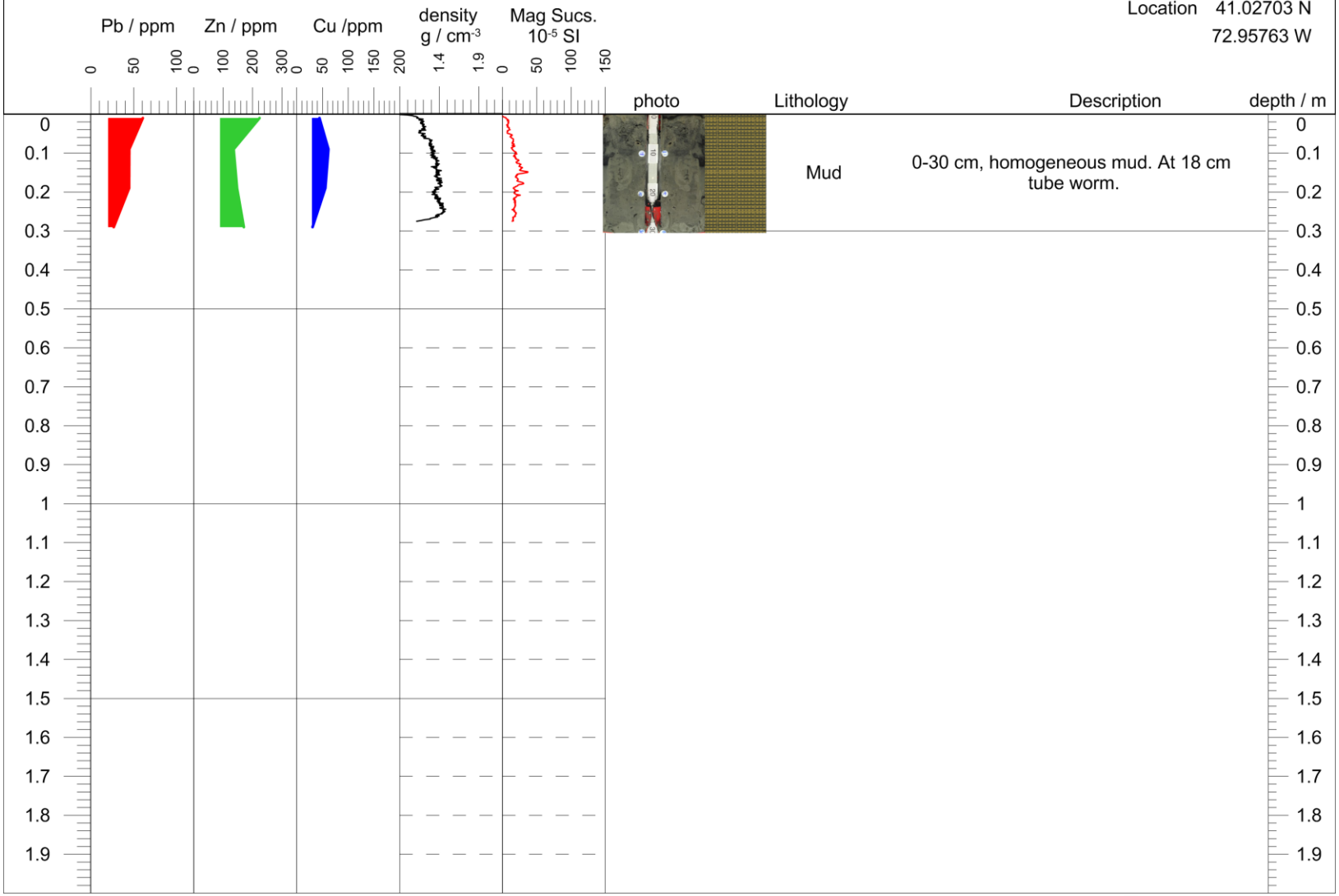
core ID: **HDC19**

Location 41.02703 N
72.95763 W

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core ID: **HDC20**

Location 41.02773 N
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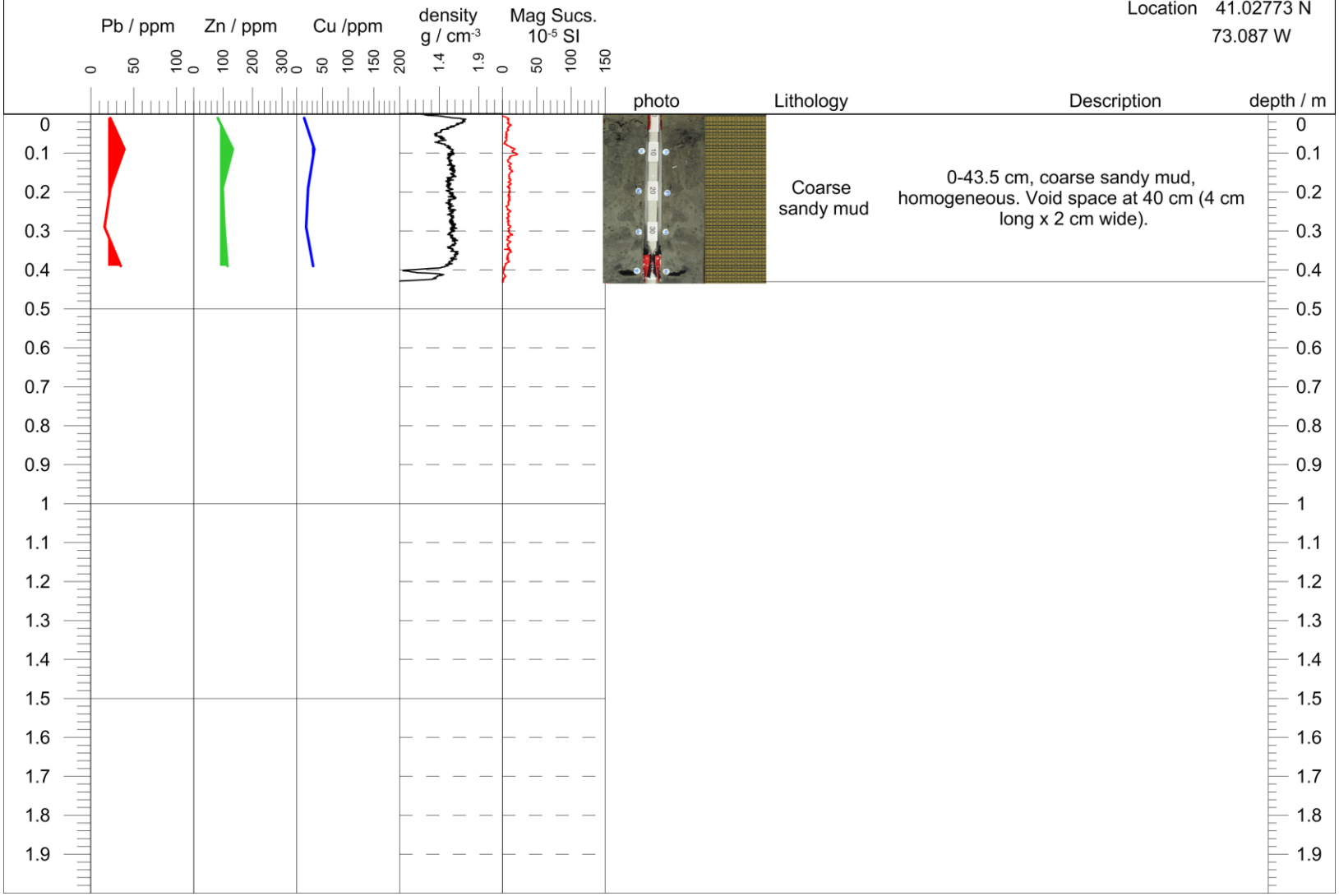


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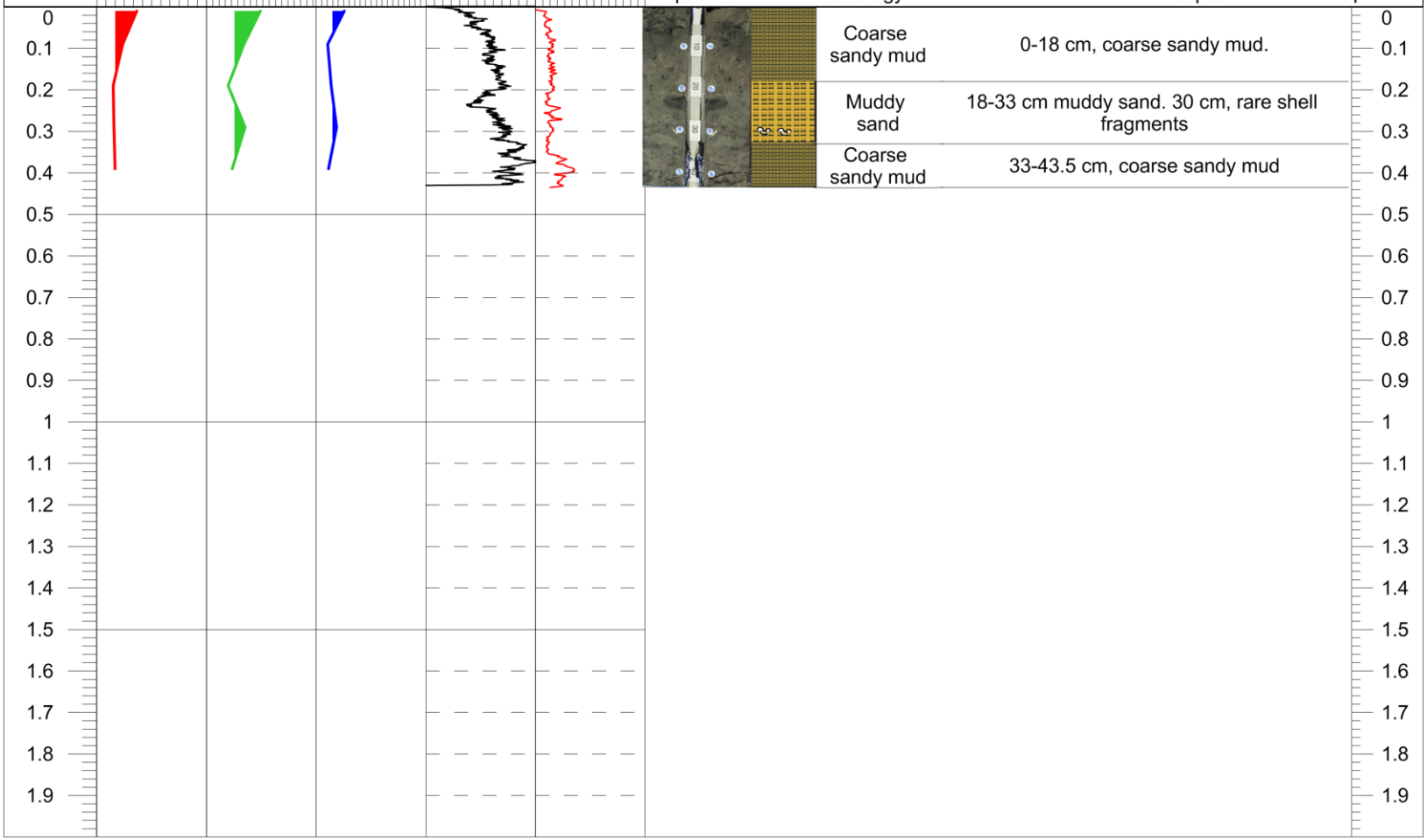
core ID: **HDC21**

Location 41.04043 N
73.08277 W

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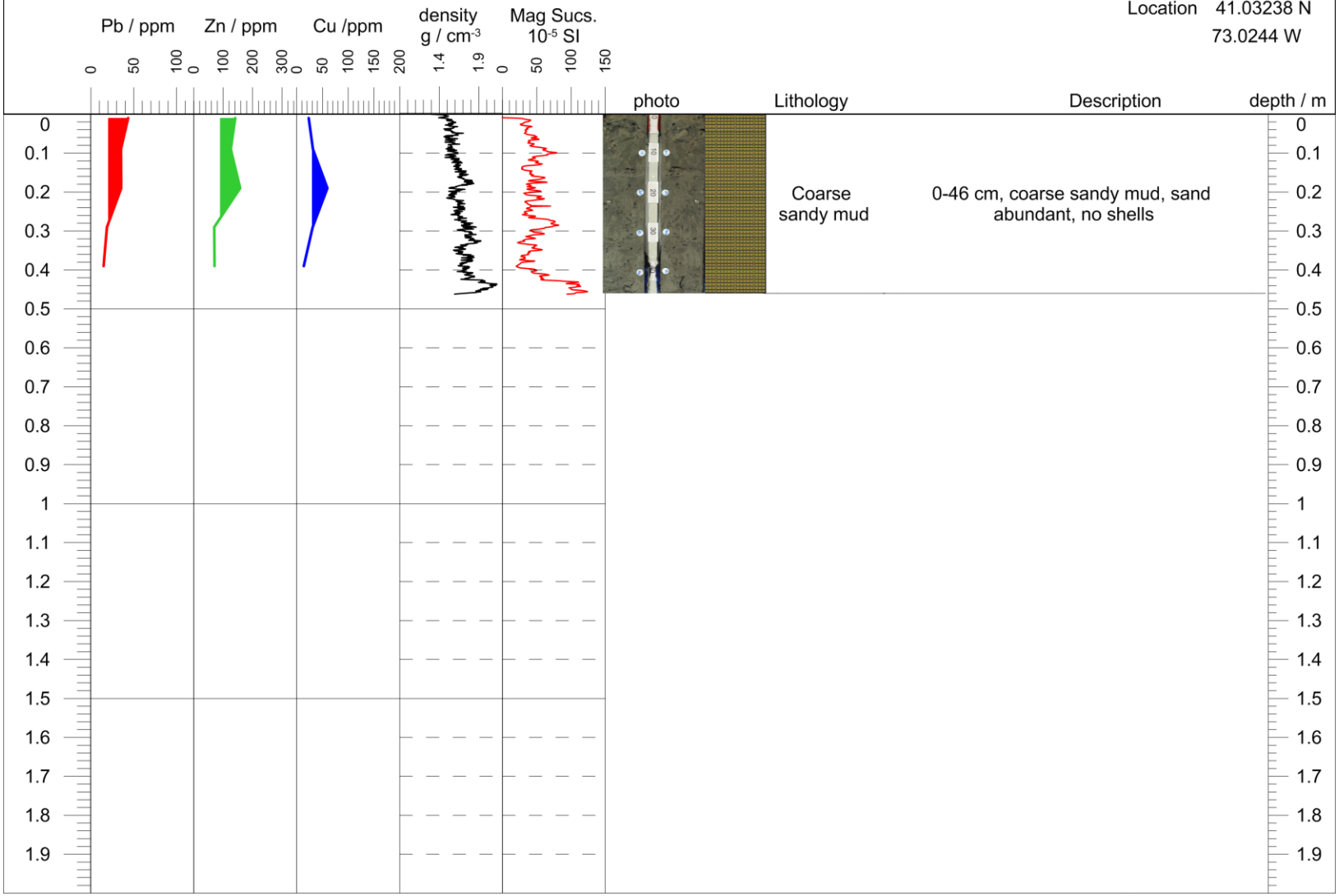
core ID: **HDC22**

Location 41.03238 N
73.0244 W

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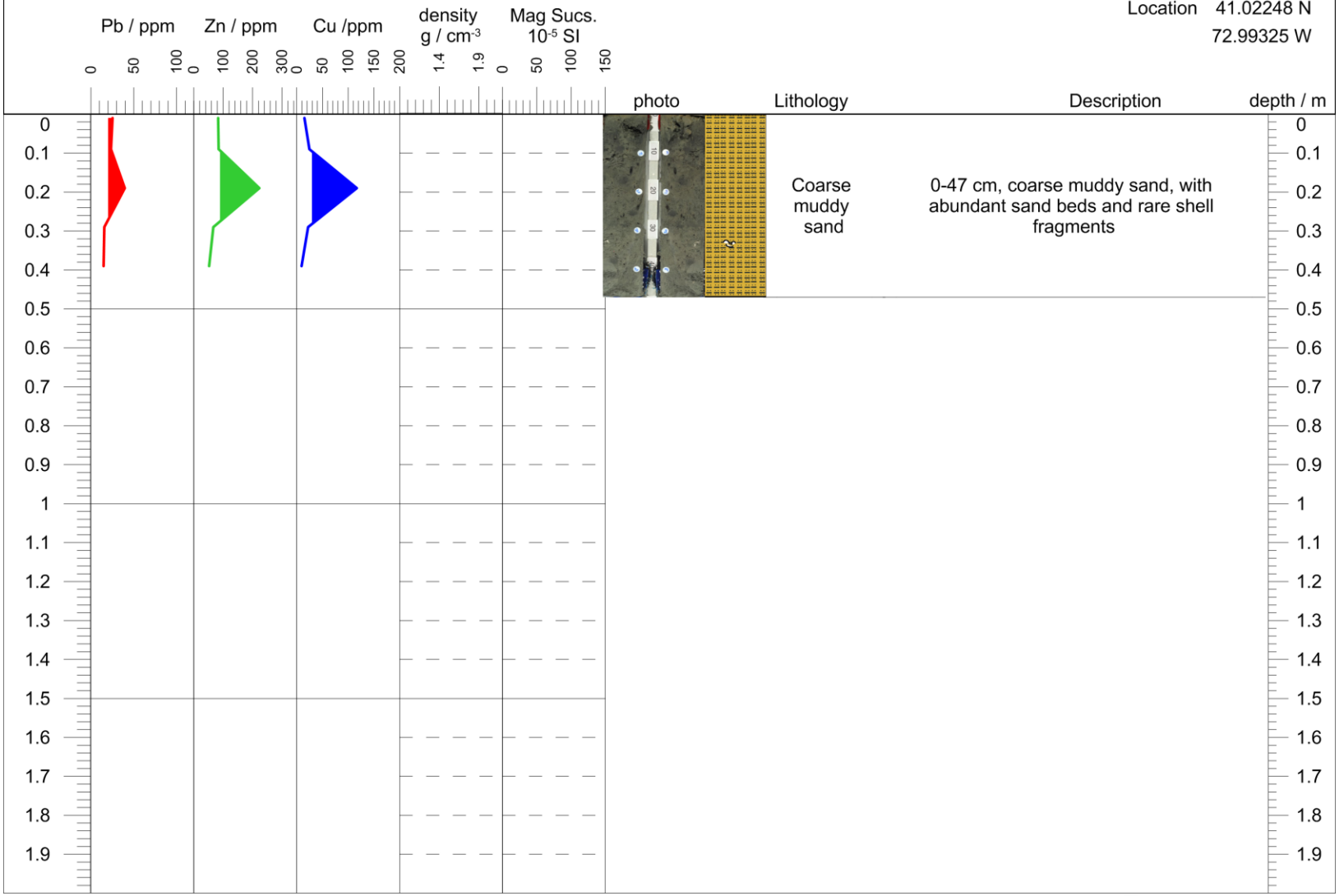
core ID: **HDC23**

Location 41.02248 N
72.99325 W

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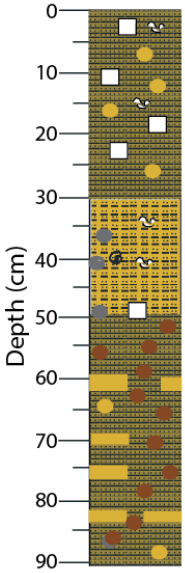
# Appendix 8 – Sediment Core Descriptions

As part of the pilot of the Long Island Sound mapping project we collected 46 sediment cores. The main text of the report (section 4.4) describes the details of the core analysis and presents examples of the findings of the sediment cores. In this appendix we present the descriptions.

SEAWOLF 13-03-GC01

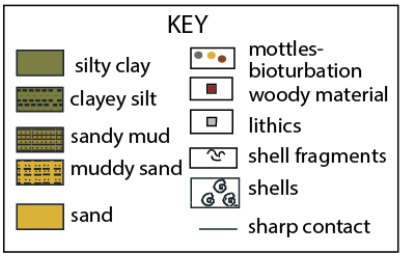
Latitude: 40° 59.533' N  Longitude: 73° 05.550' W
Core length: 90 cm  Water Depth: 28.8 m
Date taken: 06/05/13
Date described: 9/20/13
Described by: McHugh  Flow-in: no




0-30 cm [Medium sandy mud], heavily bioturbated (10Y3/1), with small (mm scale)shell fragments and floating lithic clasts. The lithic clasts are at 1, 13, 20, 27 cm, subrounded to subangular, mm's to 1 cm long (gray, beige, white).

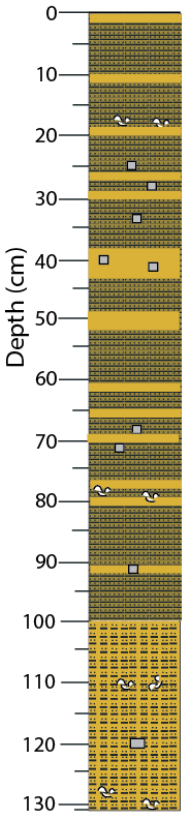
30-50 cm [Medium muddy sand], heavily bioturbated (10Y2.5/1) with floating clay cats, lithic clasts, shells and shell fragments. Gastropod shell 2 cm long at 40 cm. This interval contains fewer lithc clasts than 0-39 cm above but more clay clasts at 35 cm, 40 cm and 50 cm.

50 - 90 cm [Medium sandy mud], heavily bioturbated (10Y3/1) sandy mud with coarse grained sand beds, lenses and laminae up to 4 cm tick. Sand is coarse grained and contains shell fragments. The heavy bioturbation cross-cuts the sand beds.



SEAWOLF 13-03-GC02

Latitude: 41° 01.231' N
Longitude: 73° 07.762' W
Core length: 130.5 cm
Water Depth: 45.6m
Date taken: 06/05/13
Date described: 11/01/13
Described by: McHugh
Flow-in: no




0-131.5 cm [Moderately bioturbated mud containing coarse sand pockets and beds]

Coarse sand beds at 0-2 cm, 10-11 cm, 18-19 cm (contains shells and fragments up to 1.5 cm long.
26-28 cm contains several lithic clasts: 1 cm long, subrounded and angular.

34-36 cm, 1.5 cm long subrounded lithic clast.
38 - 44 cm, coarse sand bed with lithic clasts

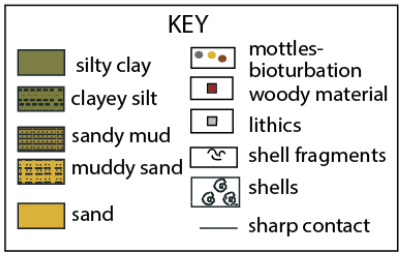
49- 52 cm, coarse sand

56 - 60 cm coarse sand lenses
63 - 66 cm, coarse sand bed with lithic clast
69 - 72 cm, coarse sand bed with angular lithic clasts
78 - 80 cm, coarse sand bed, shells some intact with two valves (clam), few shell fragments.
85 - 90 cm, coarse sand lense
91 - 93 cm coarse sand bed and lithic clast 0.5 cm long

From 100 - 131.5 cm, interbedded coarse sand and sandy mud.

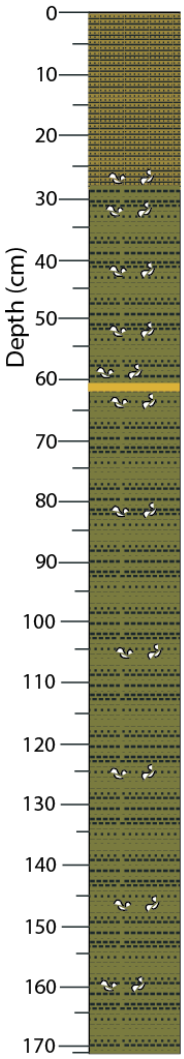
At 110 cm scattered red shells.

120 cm, 1 cm long angular lithic clast.
At 128 cm shell fragments.



SEAWOLF 13-03-GC03

Latitude: 41° 02.153' N  Longitude: 73° 09.283' W
Core length: 171.5 cm  Water Depth: 31.6 m
Date taken: 06/05/13
Date described: 11/01/13
Described by: McHugh  Flow-in: no

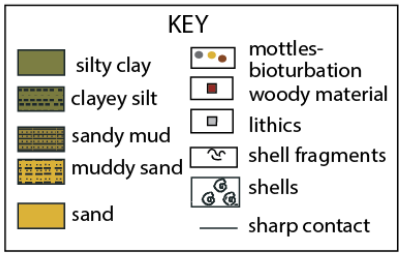



0 - 27 cm [Sandy mud]
Pockets of shells and shell fragments: 24 - 27 cm.

27 - 171.5 cm [Mud]
Scattered shells at: 33 cm, 42 cm, 50 cm, 55 cm, 58 cm, 63 cn, 83 cm, 105 cm, 125 cm, 160 cm.

V f. sand bed 62 - 63 cm

The core is mottled due to heavy bioturbation.

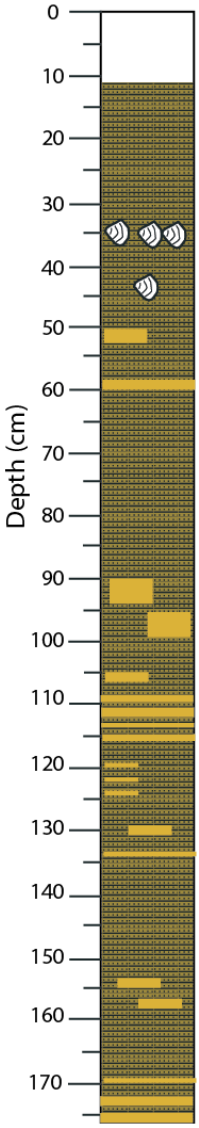


SEAWOLF 13-03-GC04

Latitude: 41° 03.520′ N
Core length: 175.5 cm
Date taken: 06/05/13
Date described: 12/17/13
Described by: McHugh

Longitude: 73° 09.489′ W
Water Depth: 23.2 m

Flow-in: no




0 - 12 cm Void

12 - 91 cm [Mud moderately bioturbated]

35 36 cm clam bed, clams with both valves.

At 43-44 cm a 3.5 long clam shell, well-preserved.

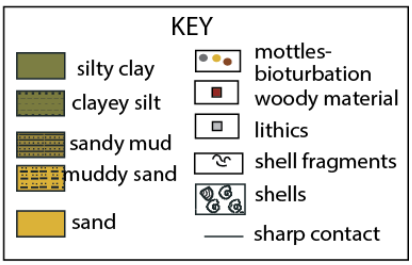
Rare medium sand lense (52-53 cm) laminae (59-60 cm).

91 - 175.5 cm [Mud with sand beds and lenses]
91 - 95 cm, coarse sand lense (rich in mica); 95-96 cm, 105-106 cm.

109-113 cm, five coarse sand beds

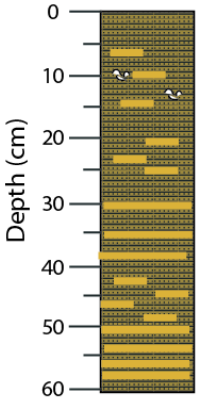
120 - 125 cm, three coarse sand laminae.
131-132 cm coarse sand lense
133 cm coarse sand laminae

157 - 158 cm coarse sand lenses
170 cm, coarse sand laminae
174 - 175.5 cm, coarse sand beds

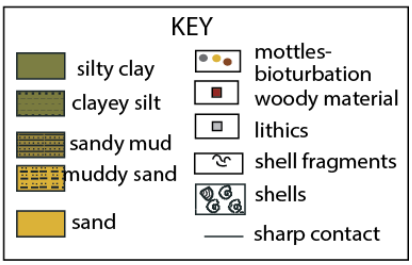


SEAWOLF 13-03-GC05

Latitude: 41° 03.018′ N
Longitude: 73° 08.349′ W
Core length: 60 cm
Water Depth: 26.7 m
Date taken: 06/05/13
Date described: 12/17/13
Described by: McHugh
Flow-in: no

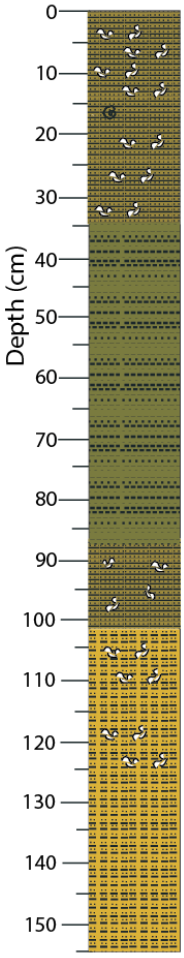



0 - 60 cm [Micaceous, coarse sandy mud]
Sand beds and lenses common
lenses: 7-8 cm, 10-11 cm, 14-15 cm, 20-21 cm, 23-24 cm, 26-27 cm, 44-50 cm
beds: 30-31 cm, 35-36 cm, 38-39 cm, 50-60 cm
laminae 40-44 cm
Rare scattered shell fragments at 11 and 13 cm, mm-scale



SEAWOLF 13-03-GC06

Latitude: 41° 04.813' N
Longitude: 73° 07.547' W
Core length: 155 cm
Water Depth: 35.0 m
Date taken: 06/05/13
Date described: 12/15/13
Described by: McHugh
Flow-in: no




0 - 18 cm [Shelly sandy mud]
Contains shell fragments (mm-scale) and shells.
There is a 2 cm long mussle shell.
18 - 35 cm shelly mud the shell fragments decrease in abudance towards 35 cm.

35 - 87 cm [Homogeneous mud]

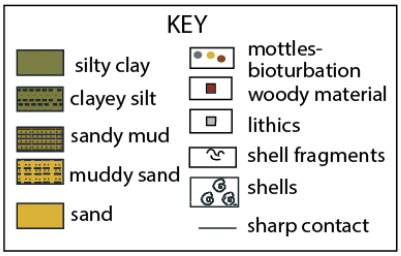
87 - 103 cm, shelly sandy mud. Shells are mosly fragments and constitute ~10% of the interval.

103- 110 cm, coarse sand beds.

110 - 123 cm, sandy mud with scattered shells and fragments. At 117 - 118 cm a clam shell well-preserved.

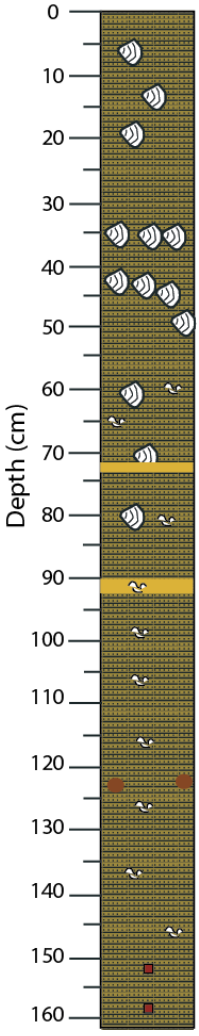
123 - 155 cm coarse sand beds and lenses.

147 - 153 cm a gastropod shell fragment.



SEAWOLF 13-03-GC07

Latitude: 41° 05.408' N
Longitude: 73° 08.402' W
Core length: 161 cm
Water Depth: 18.7 m
Date taken: 06/05/13
Date described: 9/23/13
Described by: McHugh
Flow-in: no




0 - 161 cm [Sandy mud]
0-30 cm, sandy mud, heavily bioturbated with scattered clam shells, well preserved and mm long.

30 - 60 cm shelly sandy mud, heavily bioturbated, with abundant well preserved clam shells, mm's to 1 cm long. This interval contains clam shell beds up to 10 cm long between 30 - 40 cm and 40 -50 cm. Part of the 40 - 50 cm bed apparently was dragged along the sides of the core and displaced downcore to 55 - 60 cm.

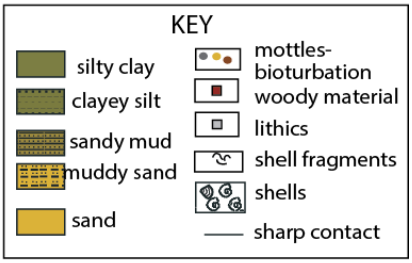
60 - 81 cm sandy mud with rare scattered clam shells and shell fragments.
72 - 73 cm coarse sand bed

81 - 161 cm, sandy mud, moderately bioturbated with scattered, rare shell frragments 1 mm to 1.5 cm long.

90-93 cm, coarse sand bed with shell fragments.

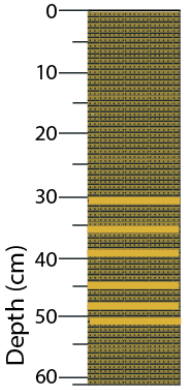
123 cm dark stain (10B2.5/1) possibly due to organic matter.

There is woody material at 152 cm and 160 cm



SEAWOLF 13-03-GC08

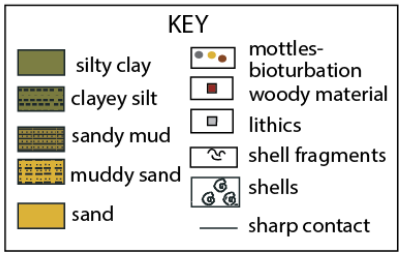
Latitude: 41° 01.975' N
Longitude: 73° 03.595' W
Core length: 61.5 cm
Water Depth: 39.4 m
Date taken: 06/06/13
Date described: 12/15/13
Described by: McHugh
Flow-in: no




0 - 61.5 cm [Coarse sandy mud]

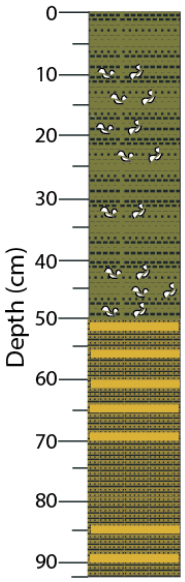
Sand beds at 31-32 cm, 37 cm, 39 cm, 44-53 cm.

Very rare scattered shells



SEAWOLF 13-03-GC09

Latitude: 41° 05.792' N
Longitude: 73° 03.040' W
Core length: 93.5 cm
Water Depth: 23.0 m
Date taken: 06/06/13
Date described: 12/15/13
Described by: McHugh
Flow-in: no

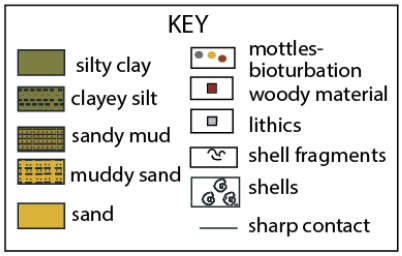



0 - 50 cm [Mud]

9 - 33 cm, mud with scattered shell fragments up to 2 cm long

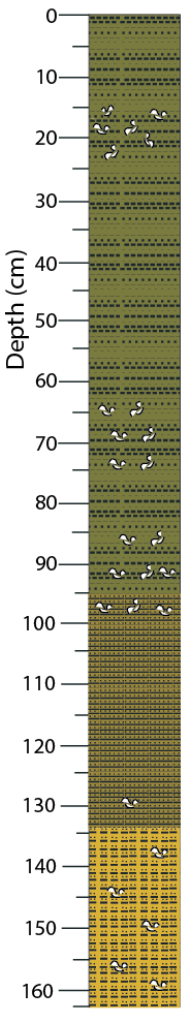
45 - 50 cm, mud with scattered shell fragments, mm-long

50 - 93.5 cm [Sandy mud with coarse sand bed and lenses]



SEAWOLF 13-03-GC10

Latitude: 41° 05.257' N  Longitude: 73° 04.454' W
Core length: 163 cm  Water Depth: 30.0 m
Date taken: 06/06/13
Date described: 12/15/13
Described by: McHugh  Flow-in: no



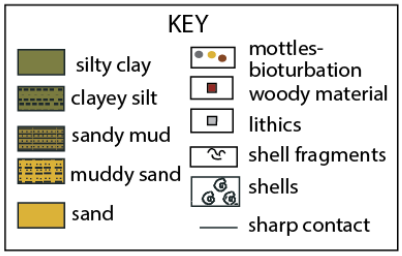

0 - 95 cm [Mud and shelly mud beds]
0-15 cm mud

15 - 22 cm shelly mud with mostly shell fragments mm-scale

64 - 74 cm, 85 - 99 cm, shelly mud with mostly shell fragments mm-scale

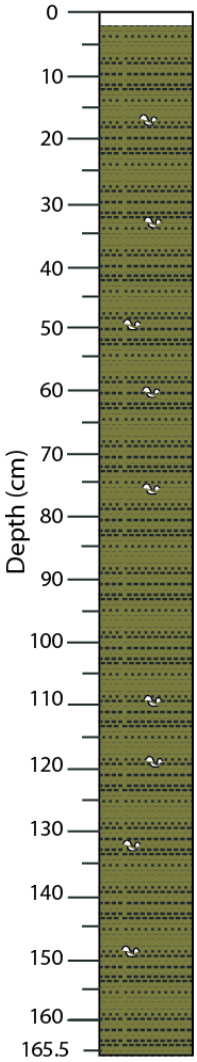
95 - 134 cm [Coarse sandy mud with scattered sand laminae, lenses and shell fragments]

134 - 163 cm [Muddy sand and laminae]
Laminae abundant, muddy sand contains scattered shell fragments mm-scale, rare shell fragments up to 1 cm long



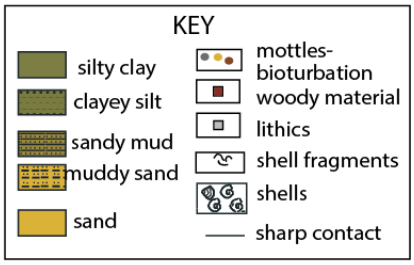
SEAWOLF 13-03-GC11

Latitude: 41° 04.411′ N
Longitude: 73° 02.657′ W
Core length: 165.5 cm
Water Depth: 27.4 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no



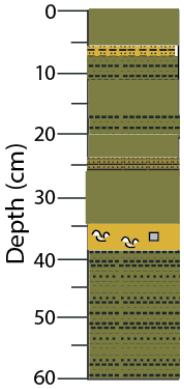

0-2 cm Void

2 - 165.5 cm [Mud]
Contains rare scattered shell fragments.
.



SEAWOLF 13-03-GC12

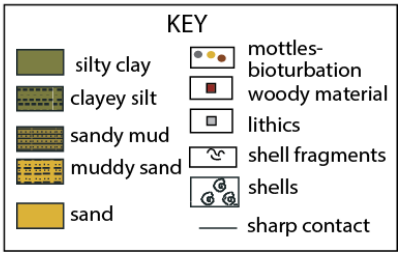
Latitude: 41° 07.731' N
Longitude: 73° 11.226' W
Core length: 60 cm
Water Depth: 12.1 m
Date taken: 06/10/13
Date described: 9/23/13
Described by: McHugh
Flow-in: no




0 - 60 cm [Clay, mud, sand beds]
6 - 8 cm, muddy sand bed
8 - 60 cm, mud

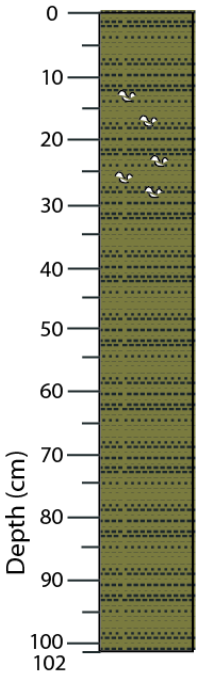
25 - 26 cm, sandy mud bed

36 - 39 cm, sand bed containing shell fragments (up to 2 cm long) and lithic clasts.
40 - 60 cm, homogeneous mud



SEAWOLF 13-03-GC13

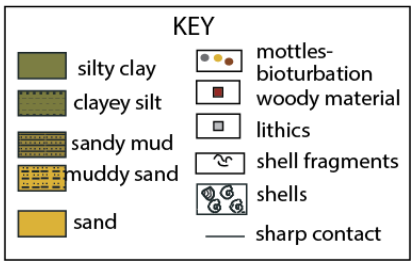
Latitude: 41° 06.533′ N
Longitude: 73° 09.953′ W
Core length: 102 cm
Water Depth: 14.2 m
Date taken: 06/10/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0-102 cm [Mud]

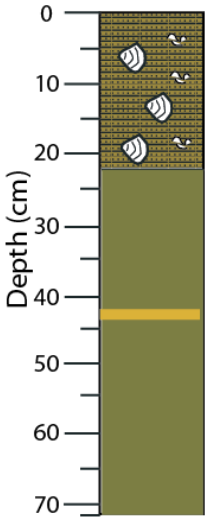
8-30 cm abundant clam shells and fragments.
Mostly well preserved, mm to 1 cm long Mullimina sp.

.



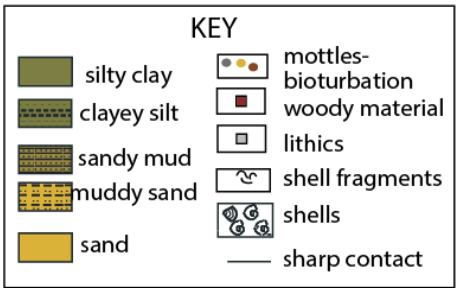
SEAWOLF 13-03-GC14

Latitude: 41° 06.012′ N
Longitude: 73° 09.013′ W
Core length: 72 cm
Water Depth: 15.5 m
Date taken: 06/10/13
Date described: 9/27/13
Described by: McHugh
Flow-in: no



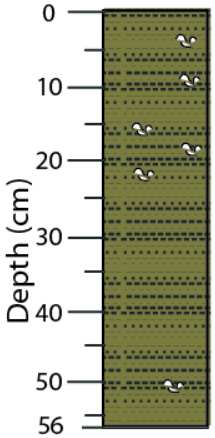

0 - 22 cm [Sandy mud]
Sandy mud contains abundant shells and shell fragments. Shells are dominated by M. lateralis. The shells range in size from a few mm's to1 cm long. Some are well preserved including two valves.

22 - 72 cm [Clay]
Clay beds 1 - 2 cm thick, variegated colors of gray.
Sand bed at 42 - 43 cm

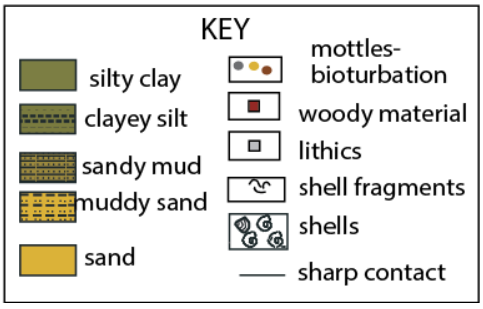


SEAWOLF 13-03-GC15

Latitude: 41° 04.958′ N
Longitude: 73° 10.015′ W
Core length: 56 cm
Water Depth: 19.8 m
Date taken: 6/10/13
Date described: 9/27/13
Described by: McHugh
Flow-in: no

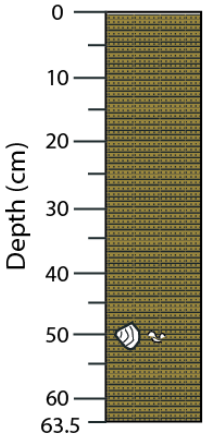



0 - 56 cm [Clayey silt]
Heavily bioturbated clayey silt with rare shell fragments.

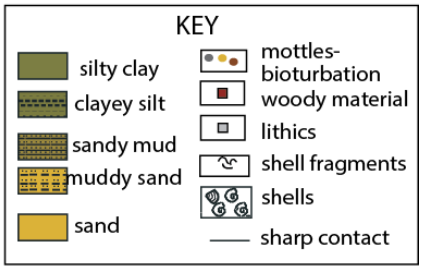


SEAWOLF 13-03-GC16

Latitude: 41° 00.661′ N
Longitude: 73° 08.324′ W
Core length: 63.5 cm
Water Depth: 40.2 m
Date taken: 06/11/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

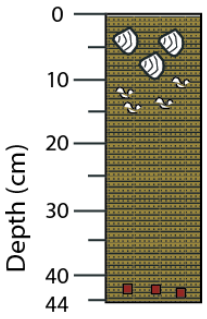



0 - 63.5 cm [Coarse sandy mud]. Sand is scattered in the mud.
Large (3 cm) mollusk shell at 50 cm.

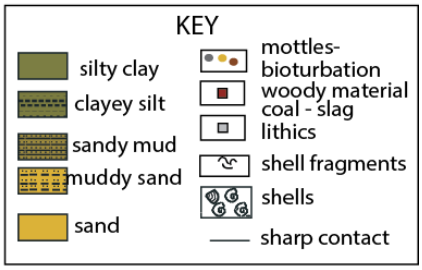


SEAWOLF 13-03-GC17

Latitude: 40° 57.588′ N
Longitude: 73° 04.852′ W
Core length: 44 cm
Water Depth: 7.8 m
Date taken: 06/11/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

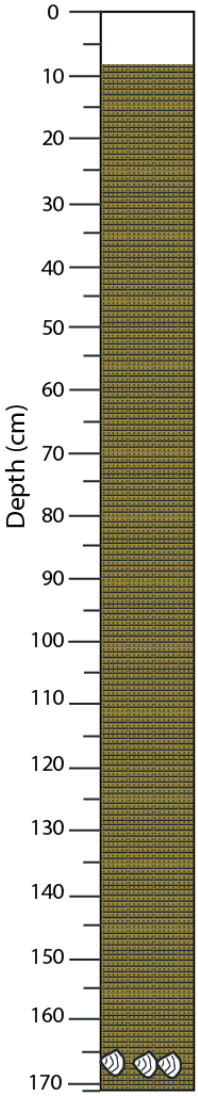



0 - 15 cm [Medium sandy shelly mud].
0- 7 cm, abundant clam shells well preserved (2 valves) up to 1 cm
7 - 15 cm mostly clam shell fragments mm-scale
15 - 39 cm mud
39 - 44 cm [Mud with coal and coal byproducts (slag)]
Coal up to 3 cm long.



SEAWOLF 13-03-GC18

Latitude: 41° 05.157′ N
Longitude: 73° 04.461′ W
Core length: 171.4 cm
Water Depth: 34.1 m
Date taken: 6/11/13
Date described: 12/17/13
Described by: McHugh
Flow-in: no




0 - 8 cm void

8 - 171.4 cm [Mud moderately bioturbated]

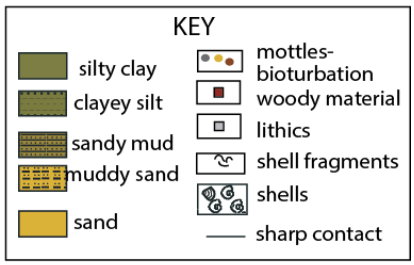
8 - 100 cm rare scattered shell fragments, mm scale, also whole clam shells including < mmm clams with two valves

55 - 90 cm heavy bioturbation

100 - 130 cm, color banding light and dark olive green

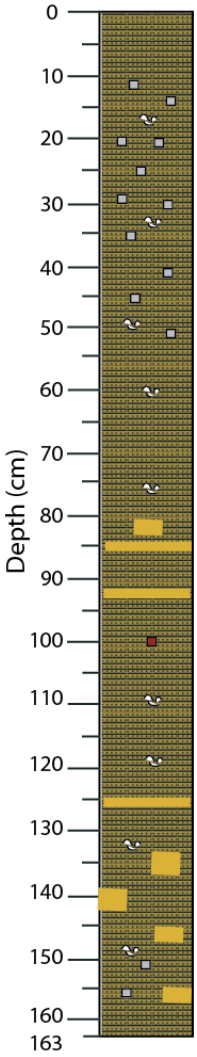
130 - 150 cm abundant gas escape features

168 - 169 cm clam bed, shells mm-scale



SEAWOLF 13-03-GC19

Latitude: 41° 04.327′ N
Longitude: 73° 04.475′ W
Core length: 163 cm
Water Depth: 25.8 m
Date taken: 6/11/13
Date described: 9/26/13
Described by: McHugh
Flow-in: no




0 - 10 cm [Sandy mud, moderate bioturbation and mottling]

0 - 10 cm sandy mud disturbed during either coring or splitting of core.

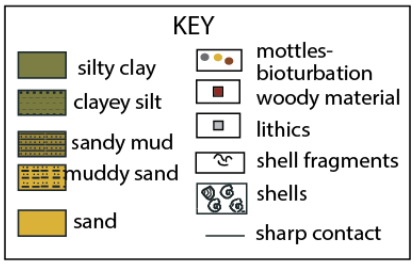
10 - 52 cm [Gravelly sandy mud]

Contains floating lithic clasts, subangular
to subrounded and mainly composed of quartz
Some intervals contain more lithic clasts than others:
10 - 20 cm less abundant and only a few mm in size.
20 - 52 cm lithic clasts more abundant than 10-20 cm and up to 2 cm long.
20 - 52 cm scattered shell fragments.

52 - 163 cm [Mud with coarse sand beds and lenses]
Contains scattered a few mm's long shell fragments, moderate bioturbation and mottling.

Disseminated lenses of coarse sand (80-82 cm, 134 - 137 cm, 139 - 149 cm)
Coarse sand beds (85-86 cm, 93-98 cm, 125 - 130 cm)

Woody material at 98 cm

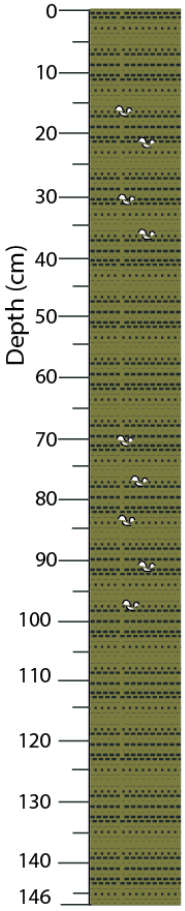



Gravel-size lithic clasts at 150 and 155 cm

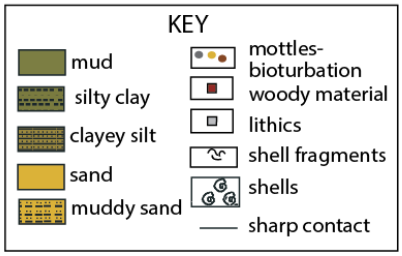
Pebbly, coarse sand pocket at 158 - 160 cm.

SEAWOLF 13-03-GC20

Latitude: 41° 03.920′ N
Longitude: 73° 02.759′ W
Core length: 146 cm
Water Depth: 30.4 m
Date taken: 6/11/13
Date described: 9/26/13
Described by: McHugh
Flow-in: no

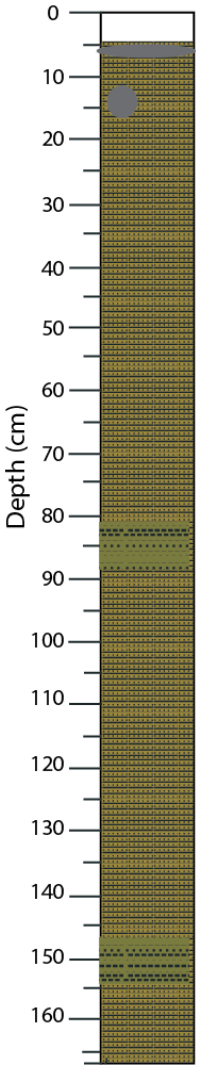



0-146 cm [Heavily to moderately bioturbated mud scattered with shells and shell fragments]
0 - 60 cm heavy bioturbation
60 - 146 cm modearte bioturbation
18 - 20 cm, 30 - 35 cm, 70 - 100 cm shells and shell fragments most abundant



SEAWOLF 13-03-GC21

Latitude: 41° 03.509′ N
Longitude: 73° 01.622′ W
Core length: 167 cm
Water Depth: 35.4 m
Date taken: 06/11/13
Date described: 12/17/13
Described by: McHugh
Flow-in: no




0 - 4 cm void

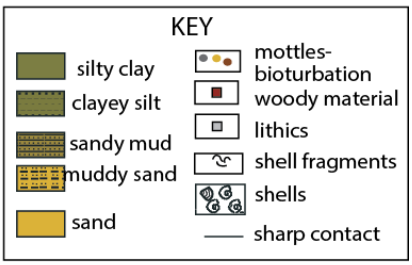
4- 167 cm [Mud, very rare scattered shell fragments mm-scale]

Dark gray mottles 5 - 6 cm and 11-17 cm

Rare scattered shell fragments at 42 cm, 54 cm, 64 cm

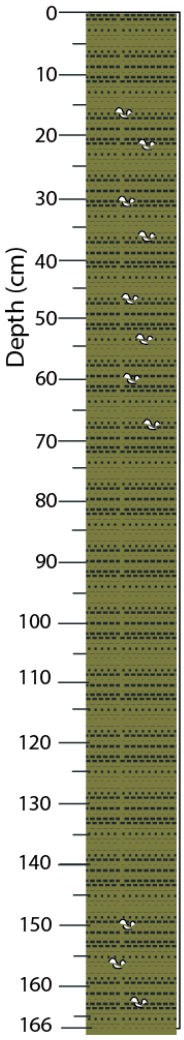
83 - 96 cm, coarse silt mud interval

147 - 155 cm, coarse silt mud interval



SEAWOLF 13-03-GC22

Latitude: 41° 00.589' N  Longitude: 73° 01.472' W
Core length: 166.5 cm  Water Depth: 29.0 m
Date taken: 6/12/13
Date described: 10/2//13
Described by: McHugh  Flow-in: no



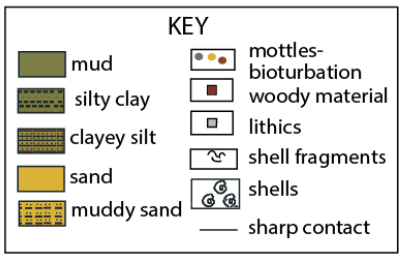

0-166.5 cm [Mud, heavily to moderately bioturbated with scattered shell fragments]

0 - 60 cm moderate bioturbation

60 - 166 cm heavy bioturbation

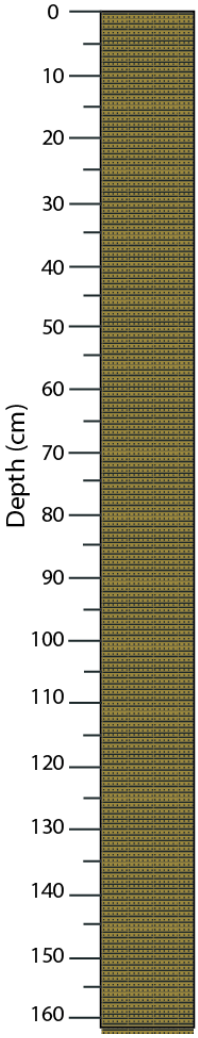
Shell fragments at 19 cm, 30 - 40 cm, 50 cm, 60 - 65 cm, 152 - 164 cm

Sand pocket 110 cm

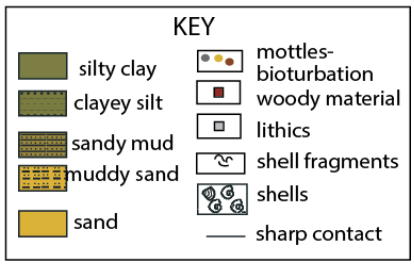


SEAWOLF 13-03-GC23

Latitude: 40° 59.762′ N
Longitude: 73° 02.218′ W
Core length: 128 cm
Water Depth: 24.1 m
Date taken: 6/12/13
Date described: 9/26/13
Described by: McHugh
Deformation: upper 20 cm due to splitting

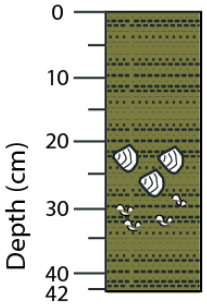



0 - 128 cm [Sandy mud]
0-20 cm, sandy mud, disturbed due to extrusion and/or splitting.
Sandy mud contains scattered shell fragments most common at 15-25 cm,
65 - 70 cm.
At 35 cm a clam a few mm long in life position with two valves.
At 39 cm, 9 cm long clam shell.
From 30 to 128 cm heavy bioturbation, mud has been homogenized by bioturbation.
Dark mottling possibly due to organics at 82-83 cm, 98 - 103 cm, 115 - 120 cm, 127-128 cm.

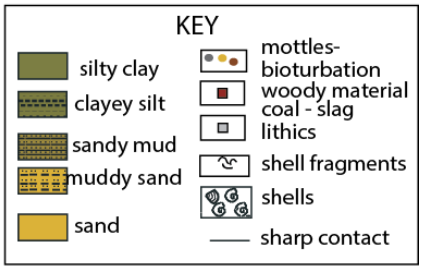


SEAWOLF 13-03-HDC-01

Latitude: 41° 03.586′ N
Longitude: 73° 09.549′ W
Core length: 42 cm
Water Depth: 22.7 m
Date taken: 06/05/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

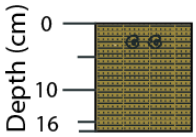



0 - 42 cm [Mud, rich in coarse silt].
0 - 10 cm, gas escape features, worm track
10 - 23 m, mud
23-35 cm scattered clam shells up to 1 cm long wome with two valves, most well-preserved. Although shell fragments are also present
35 - 42 cm mud

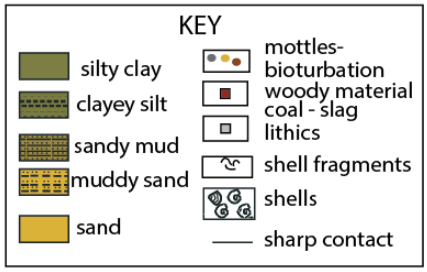


SEAWOLF 13-03-HDC-02

Latitude: 41° 04.215' N
Longitude: 73° 04.656' W
Core length: 16 cm
Water Depth: 22.5 m
Date taken: 06/06/113
Date described: 12/27/13
Described by: McHugh
Flow-in: no

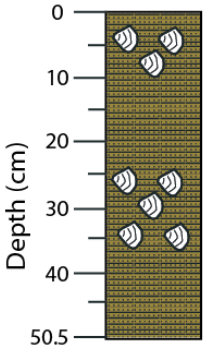



0 - 16 cm [Medium sandy mud]
Abundant gas escape features
1 to 2 cm long, well-preserved gastropod tests, no clams

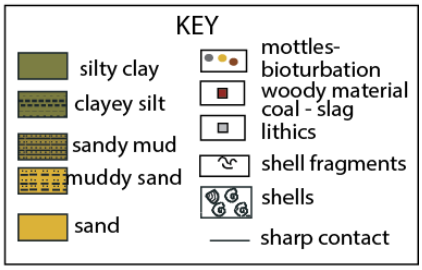


SEAWOLF 13-03-HDC03

Latitude: 41° 06.711′ N
Longitude: 73° 04.791′ W
Core length: 50.5 cm
Water Depth: 17.2 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

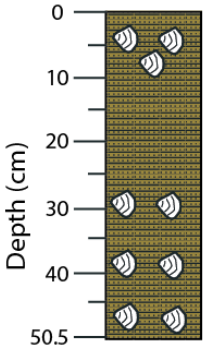



0 - 50.5 cm [Medium, sandy shelly mud].
Shells form beds at 0 - 12 cm and 26 - 37 cm
Shells are dominated by clams

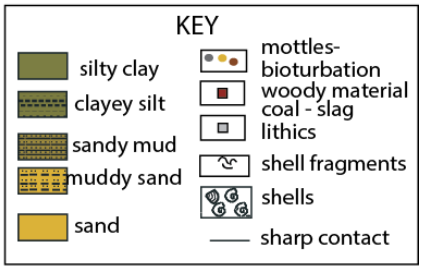


SEAWOLF 13-03-HDC04

Latitude: 41° 07.804′ N
Longitude: 73° 05.526′ W
Core length: 50.5 cm
Water Depth: 13.7 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

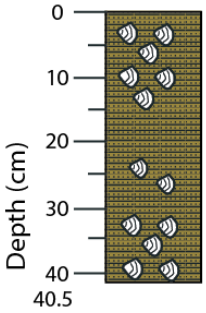



0 - 50.5 cm [Medium, sandy shelly mud]
Shells are dominated by clams (mm-scale), well-preserved, and form beds at
0 - 12 cm, 30-31 cm, 39-40cm, 42-44 cm, and 46-49 cm

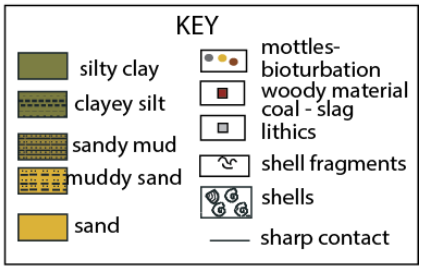


SEAWOLF 13-03-HDC05

Latitude: 41° 08.303′ N
Longitude: 73° 05.148′ W
Core length: 40.5 cm
Water Depth: 13.2 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

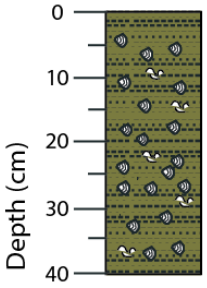



0 - 40.5 cm [Medium, sandy shelly mud].
Shells are dominated by clams, mostly mm-scale but up to 2.5 cm long.
Shells are well-preserved and form beds at
0 - 20 cm (very abundant), 20-30 cm (scattered), 30-40 cm abundant

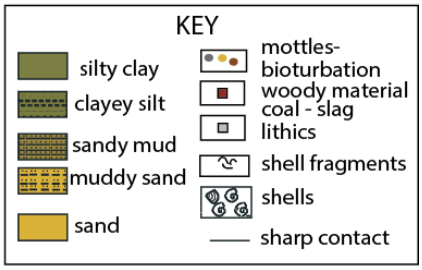


SEAWOLF 13-03-HDC06

Latitude: 41° 08.702′ N
Longitude: 73° 04.353′ W
Core length: 40 cm
Water Depth: 13.2 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

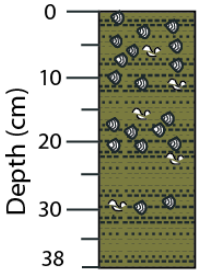



0 - 40 cm [Shelly mud].
Shells are dominated by clams, mostly mm-scale and well-preserved.
Shells and shell fragments are scattered throughout
and constitue 20% of the core

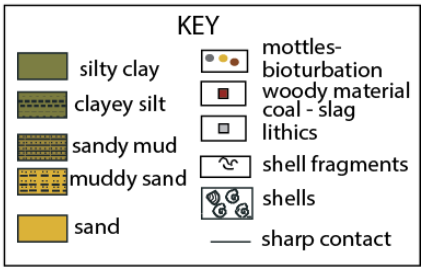


SEAWOLF 13-03-HDC07

Latitude: 41° 10.150′ N
Longitude: 73° 04.446′ W
Core length: 38 cm
Water Depth: 9.2 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

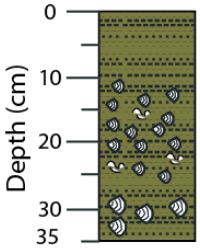



0 - 38 cm [Mud and shell beds].
Shell beds at 0 -10cm, 17-23 cm
Shells are dominated by clams, mostly mm-scale and well-preserved. Shell fragments also present

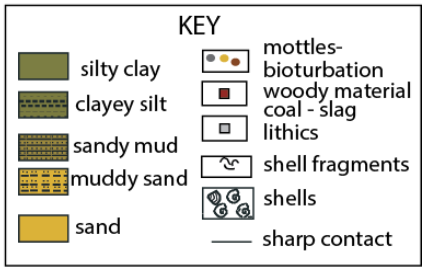


SEAWOLF 13-03-HDC08

Latitude: 41° 07.540′ N
Longitude: 73° 03.508′ W
Core length: 35 cm
Water Depth: 16.0 m
Date taken: 06/06/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

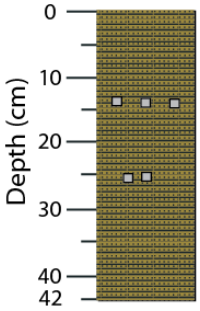



0 - 13 cm [Mud with gas escape features and worm tracks]
13 - 25 cm [Mud and shell bed]
Shells are dominated by clams, mostly mm-scale and well-preserved. Shell fragments also present
25 - 35 cm [Mud]
Contains rare large (2 cm) clams with two valves

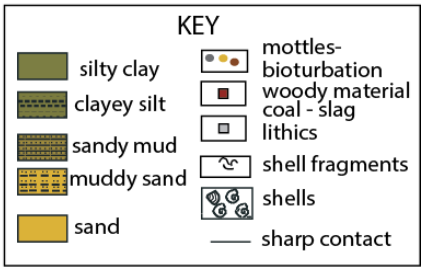


SEAWOLF 13-03-HDC09

Latitude: 41° 00.353′ N
Longitude: 73° 05.713′ W
Core length: 42 cm
Water Depth: 39.6 m
Date taken: 06/07/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

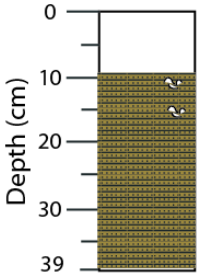



0 - 42 cm [Coarse sandy mud]
Gravel at 14 cm and 26 cm

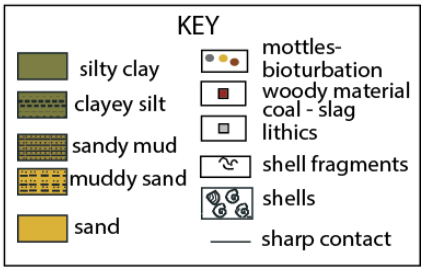


SEAWOLF 13-03-HDC10

Latitude: 41° 02.952′ N
Longitude: 73° 03.372′ W
Core length: 39 cm
Water Depth: 36.4 m
Date taken: 06/07/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

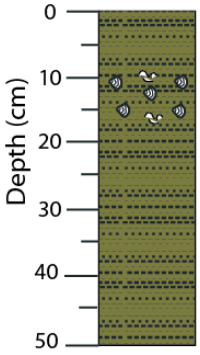



0 - 14 cm [Void]
Pssibly due to core deformation during extrusion.
Upper part contained a 10 cm long worm
14 - 39 cm [Medium sandy mud]
Few scattered shell fragments 10 - 15 cm.

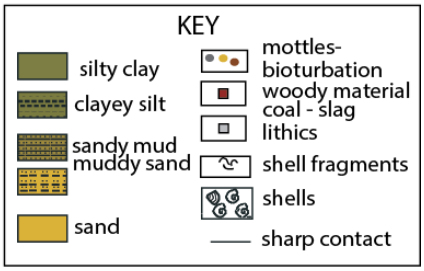


SEAWOLF 13-03-HDC11

Latitude: 41° 01.773′ N
Longitude: 73° 07.487′ W
Core length: 50 cm
Water Depth: 38.5 m
Date taken: 6/10/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0 - 50 cm [Mud]
0 - 15 cm, gas escape features
10 - 15 cm, clam shells and fragments

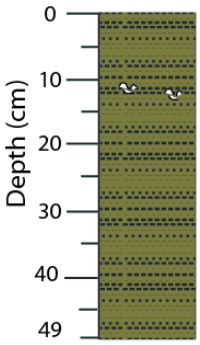


SEAWOLF 13-03-HDC12

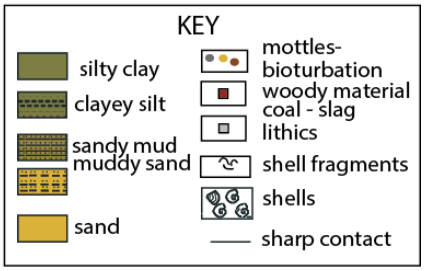
Latitude: 41° 03.500′ N
Core length: 49 cm
Date taken: 06/10/13
Date described: 12/27/13
Described by: McHugh

Longitude: 73° 07.456′ W
Water Depth: 22.0 m

Flow-in: no

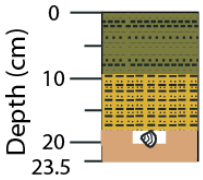



0 - 49 cm [Mud]
12 cm shell fragments

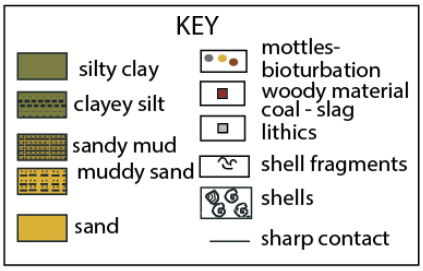


SEAWOLF 13-03-HDC13

Latitude: 41° 05.103′ N
Longitude: 73° 06.321′ W
Core length: 23.5 cm
Water Depth: 46.1 m
Date taken: 6/10/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

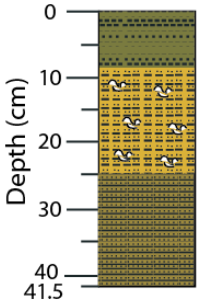



0 - 9 cm [Mud]
9 - 18 cm [Coarse muddy sand]
18 - 23.5 cm [Reddish pink clay]
Clay contains scour surface on top and a
large (few centimeters long) shell fragment in scoured surface, a razor clam.

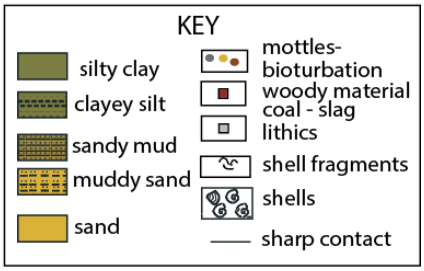


SEAWOLF 13-03-HDC14

Latitude: 41° 05.667′ N
Longitude:73° 07.699′ W
Core length: 41.5 cm
Water Depth: 19.6 m
Date taken: 6/10/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

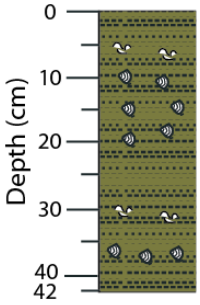



0 - 8 cm [Mud]
8 - 25 cm [Muddy coarse sand with shell fragments mm scale]
25 - 41.5 cm [Sandy mud with abundant mica]

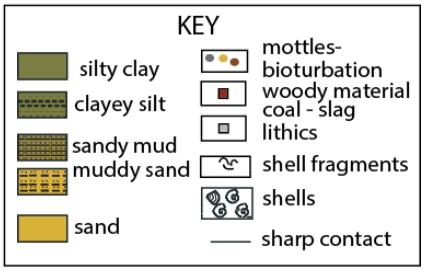


SEAWOLF 13-03-HDC15

Latitude: 41° 04.066′ N
Longitude:73° 08.634′ W
Core length: 42 cm
Water Depth: 22.4 m
Date taken: 06/11/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no

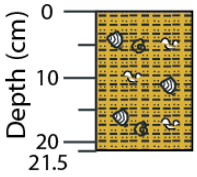



0 - 42 cm [Shelly mud]
Shells are from clams at mm scale and well preserved
Most abundant at:10 - 20 cm, 36 - 39 cm
Shell fragments at 5 cm and 30 cm

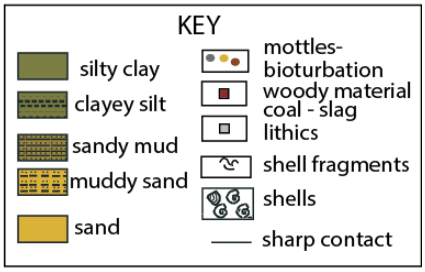


SEAWOLF 13-03-HDC16

Latitude: 41° 04.907′ N
Longitude:73° 06.571′ W
Core length: 21.5 cm
Water Depth: 54.4 m
Date taken: 06/11/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0 - 21.5 cm [Muddy coarse sand]
Large brachiopod shells up to 3.5 cm long, well-preserved. Shell fragments mm-scale throughout the core.

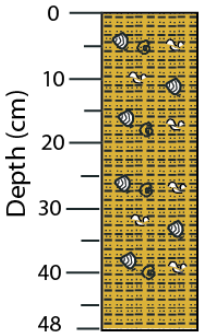


SEAWOLF 13-03-HDC17

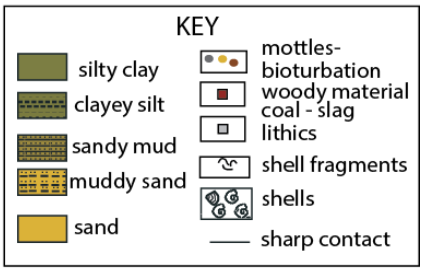
Latitude: 41° 06.025′ N
Core length: 48 cm
Date taken: 06/11/13
Date described: 12/27/13
Described by: McHugh

Longitude: 73° 05.237′ W
Water Depth: 18.5 m

Flow-in: no

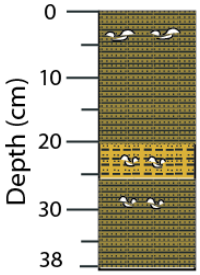



0 - 48 cm [Muddy coarse sand]
Scattered shell and lithic fragments
(i.e., subrounded quartz), mm scale.



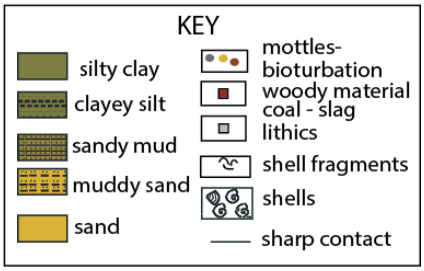
SEAWOLF 13-03-HDC18

Latitude: 41° 02.680′ N
Longitude: 73° 00.269′ W
Core length: 38 cm
Water Depth: 40.3 m
Date taken: 11/12/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0 - 38 cm [Coarse sandy mud]
2-5 cm scattered gastropo shell fragments and lithic clast (shale) at mm scale

21 - 25 cm [Coarse sand beds]
Brachiopod and other shell fragments from 25 to 29 cm.

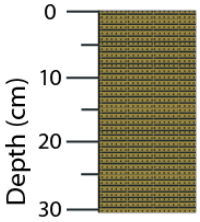


SEAWOLF 13-03-HDC19

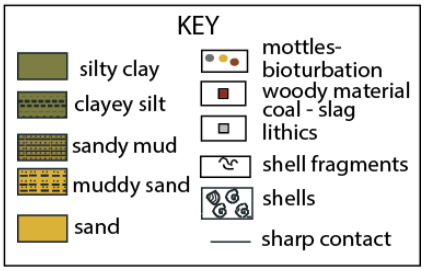
Latitude: 41° 01.622′ N
Core length: 30 cm
Date taken: 11/12/13
Date described: 12/27/13
Described by: McHugh

Longitude: 72° 57.458′ W
Water Depth: 42.1 m

Flow-in: no

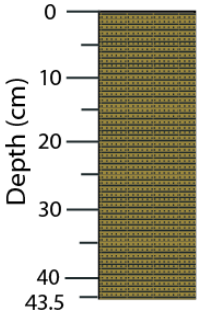



0 - 30 cm [Mud]
Tube worm at 18 cm



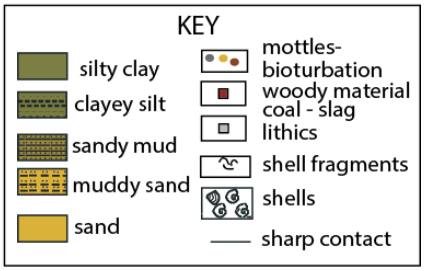
SEAWOLF 13-03-HDC20

Latitude: 41° 01.664′ N
Longitude: 73° 05.220′ W
Core length: 43.5 cm
Water Depth: 39.9 m
Date taken: 11/12/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no



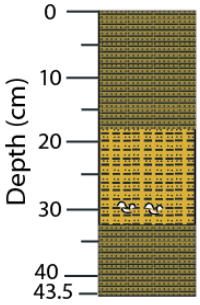

0 - 43.5 cm [Coarse sandy mud]

At 40 cm, void space 4cm long x 2 cm wide



SEAWOLF 13-03-HDC21

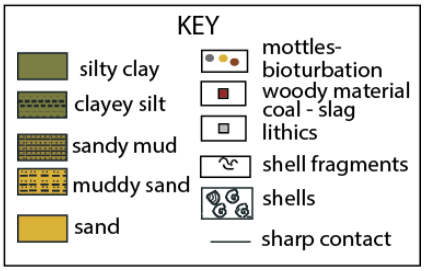
Latitude: 41° 02.426′ N
Longitude: 73° 04.966′ W
Core length: 43.5 cm
Water Depth: 33.6 m
Date taken: 11/12/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0 - 18 cm and 33 - 43.5 cm [Coarse sandy mud]

18 - 33 cm [Muddy sand]

Muddy sand contains rare shell fragments at 30 cm

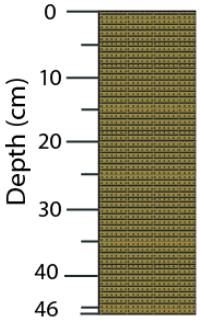


SEAWOLF 13-03-HDC22

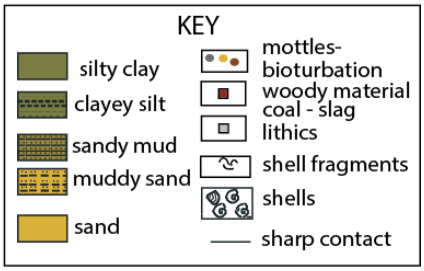
Latitude: 41° 01.943' N
Core length: 46 cm
Date taken: 11/12/13
Date described: 12/27/13
Described by: McHugh

Longitude: 73° 01.464' W
Water Depth:

Flow-in: no

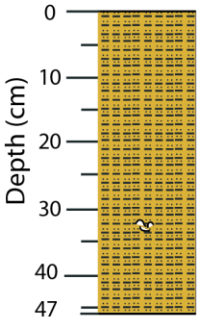



0 - 46 cm [Coarse sandy mud]
No shells

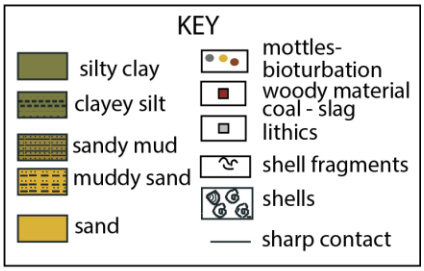


SEAWOLF 13-03-HDC23

Latitude: 41°1.349′
Longitude: 72°59.595′
Core length: 47 cm
Water Depth: 33.9 m
Date taken: 6/11/13
Date described: 12/27/13
Described by: McHugh
Flow-in: no




0 - 47cm [Coarse muddy sand]
Sand beds abundant containing angular lithic quartz fine gravel
Shell fragments at 33-34 cm



# Appendix 9:  Ecological Species Lists

Stony Brook Infaunal Ecological Assessment:

**Faunal data tabulated by sample and by species. Values are the number of individuals per sample.**

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| **ANNELIDA** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Oligochaeta** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Oligochaeta spp. | | | | | | | | | | | | | 1 | | | | 1 | | | 1 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Polychaeta** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Ampharete arctica* | 27 | 21 | 26 | 23 | 52 | 29 | 21 | 24 | 29 | 47 | | | | | | | | | | | | | | | | | | | | |
| *Amphitrite cirrata* | | | | | | | | | | | | | 1 | | | | | | | | 2 | 6 | | 2 | 3 | 2 | 2 | 4 | 2 | |
| *Ancistrosyllis groenlandica* | 2 | | 1 | 3 | | 4 | 3 | 1 | 9 | 2 | | | | | | | | | | | | | | | | | | | | |
| *Aricidea catherinensis* | 14 | 8 | 24 | 31 | 58 | 38 | 16 | | 26 | 1 | | | | | | | | | | | | 1 | | | | | | | | |
| *Asabellides oculata* | 1 | | 1 | | 4 | | | | 3 | 5 | | | | | | 2 | | | | | | | | | | | | | | |
| *Asychis elongata* | | | | | | | 1 | | | | | | | | | | | | | | 1 | 3 | | 1 | | | 1 | | | |
| *Brada* sp. | | | | | | | | | 5 | 1 | | | | | | | | | | | | | | | | | | | | |
| *Brania wellfleetensis* | | | | | | | | 2 | 3 | | 1 | | | | | | | | | | | | | | | | | | | |
| Capitellidae spp. | | | | 1 | 1 | | | | | | | | 2 | | 1 | | 4 | | | 5 | | | | | 1 | | 3 | | | |
| *Clymenella zonalis* | | | | | 1 | | | | 3 | 1 | | | | | | | | | | | | | 1 | | 1 | 1 | | 1 | 1 | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| *Cossura longocirrata* | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | |
| *Drilonereis longa* | | | | | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| *Eteone heteropoda* | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *Exogone dispar* | 1 | | | | | | | | 5 | 3 | | | | | | | | | | | | | | | | | | | | |
| *Glycera americana* | | | 2 | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| *Gyptis vittata* | | | | | | | | | | | | | 1 | | 1 | | | 3 | | | | | | | | | | | | |
| *Harmothoe* sp. | 2 | 8 | 19 | 9 | 16 | 13 | 17 | | 1 | 1 | | | | | | | | | | | | | | | | | | | | |
| *Lumbrineris fragilis* | | 1 | | | | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Maldanidae sp. (juveniles) | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | |
| *Melinna cristata* | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | 3 | 1 | |
| *Minuspio* sp. | | | | | | | | | | | 9 | 3 | 1 | | | 2 | 2 | 1 | 3 | 3 | | | | | 2 | | 6 | | | 1 |
| *Nephtys incisa* | | | | | | | 1 | | 3 | | 10 | 13 | 15 | 16 | 12 | 11 | 10 | 10 | 8 | 8 | 5 | 6 | 4 | 5 | 11 | 8 | 18 | 10 | 10 | 4 |
| *Nephtys picta* | 2 | 1 | 3 | 5 | 4 | 1 | 6 | 3 | 6 | 5 | | | | | | | | | | | | | | | | | | | | |
| *Nereis grayi* | | | | | | | | | | | | | | | | | | | | | 1 | | | | | 1 | | | | |
| *Orbinia swani* | | | | 1 | | | | | 3 | | | | | | | | | | | | | | | | | | | | | |
| *Paranaitis speciosa* | 1 | | 1 | | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Paraonis gracilis* | | | | | | | | 1 | | | 12 | 5 | 13 | 16 | 23 | 19 | 32 | 34 | 42 | 42 | | | 10 | 2 | 13 | 16 | 25 | 15 | 11 | |
| *Parapionosyllis longicirrata* | 14 | 1 | | 1 | | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| *Phyllodoce arenae* | | 1 | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| *Polydora* spp. | 3 | | | 1 | | | 2 | | 1 | 5 | 1 | | 23 | 1 | | 1 | | | | | | | | | | | | | | |
| *Polygordius spp.* | 204 | 88 | 92 | 240 | 280 | 120 | 142 | 108 | 192 | 228 | | | | | | | | | | | | | | | | | | | | |
| *Potamilla reniformis* | 3 | 3 | 6 | 3 | 3 | 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | |
| *Sabellaria vulgaris* | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Scalibregma inflatum* | | 3 | | | | 1 | 1 | | 5 | | | | | | | | | | | | | | | | | | | | | |
| *Schistomeringos caecus* | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Scolelepis squamata* | | | | | | | | | | | 3 | 1 | 1 | | | | | 1 | 2 | 3 | | | | | | | | | | |
| *Sigambra* sp. | | | | | | | | | | | 3 | 8 | 3 | 11 | 9 | 5 | 12 | 10 | 5 | 39 | 2 | 1 | 3 | 13 | 16 | 16 | 25 | 8 | 7 | |
| *Sphaerosyllis erinaceous* | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Spiochaetopterus oculatus* | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| *Spiophanes bombyx* | 5 | 7 | 1 | 4 | | 6 | 5 | 1 | 19 | 7 | | | | | | | | | | | | | | | | | | | | |
| Terebellidae spp. | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Tharyx* sp. | | | 12 | 19 | 23 | 11 | 9 | | 1 | | | 1 | | 1 | 2 | | 1 | | | 1 | | | | 1 | | | 1 | 1 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **ARTHROPODA** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Amphipoda** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| *Ampelisca vadorum* | 9 | 96 | 81 | 102 | 26 | 59 | 62 | | 53 | 11 | 1 | | 1 | 4 | | 1 | | 3 | 1 | | | | | | | 1 | | | | |
| *Corophium* sp. | | 1 | | | | | | | 12 | 5 | | | | | | | | | | | | | | | | | | | | |
| *Dulichia* sp. | | | 1 | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| *Erichthonius brasiliensis* | | | 1 | 4 | | 3 | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| *Leptocheirus pinguis* | 9 | 69 | 2 | 67 | 21 | 18 | 41 | 5 | 259 | 65 | | | | | | | | | | | | | | | | | | | | |
| *Luconacia incerta* (Caprellid) | | | | 10 | 1 | 4 | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| *Metopella* sp. | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Parametopella cypris* | | | | 1 | | | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *Paraphoxus spinosus* | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| *Phoxocephalus holbolli* | 6 | 4 | 4 | 20 | 8 | 4 | 9 | | | | | | | | | | | | | | | | | | | | | | | |
| *Stenothoe minuta* | 1 | 3 | 3 | 5 | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| *Unciola irrorata* | 4 | 11 | 4 | 4 | 3 | 5 | 2 | 2 | 25 | 5 | | | | | | 1 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Cephalocarida** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cephalocarida sp. (possibly H. macracantha) | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | 1 | 2 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Cirripedia** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Balanus amphitrite* | 10 | 3 | | | 110 | 25 | 7 | | | 1 | | | | | | | | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Cumacea** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Oxyurostylis smithi* | | | | | | | | | | | | | | 1 | | | | 2 | | | | | | 1 | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Decapoda** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Brachyuran (true crabs) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Panopeus herbstii* | 1 | 1 | 6 | 4 | 2 | 4 | 3 | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | |
| *Pinnixa* sp. | | 5 | | 1 | | 2 | | 1 | 4 | 4 | 1 | | 5 | | | 1 | | | | | 1 | 2 | | | | | 1 | | |
| *Portunidae* sp. (juv: *C. maenas/O.cellatus*) | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| crab megalops | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Caridean (shrimp) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Crangon septemspinosa* | | | 1 | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ghost Shrimp | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Gilvossius setimanus* | | | | | | | 1 | | | | | | | | | | | | | | | | | 1 | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| Shrimp (juvenile) | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Isopoda** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Cyathura polita* | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | 1 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Mysidacea** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Heteromysis formosa* | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Neomysis americana* | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Tanaidacea** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Leptochelia savignyi* | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **CHORDATA** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Ascidiacea** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Molgula* sp. (probably *M. manhattensis)* | | 2 | | | | | | | 7 | | | 1 | | | | | 1 | 1 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **CNIDARIA** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| Actinaria spp. | | | | | | | | | | | | | 1 | 1 | 1 | | 1 | | | | | 2 | | | | | | | 1 | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **MOLLUSCA** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Bivalvia** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Anadara transversa* | 2 | 3 | 2 | 4 | 1 | 2 | 3 | 2 | 6 | | | | | | | | | | | | | | | | | | | | | |
| *Astarte undata* | | 4 | 2 | 2 | 2 | 2 | 7 | 1 | 1 | 3 | | | | | | | | | | | | | | | | | | | | |
| Bivalvia juvenile (possibly *Crassinella* sp) | 1 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | |
| *Ensis directus* | | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| *Lyonsia hyalina* | | 6 | 1 | 3 | 2 | 1 | 1 | 5 | 8 | 1 | | | | | | | | | | | | | | | | | | | | |
| *Macoma tenta* | | | | | | | | | 2 | | | | | 1 | | | | | | | | | | | | | | | | |
| *Mulinia lateralis* | | | | | | | | 2 | | | 4 | | 2 | 1 | 1 | | | | | 1 | | | 1 | | | | | | | |
| *Mytilus edulis* | 1 | 3 | 2 | 6 | 3 | 18 | 7 | | | 3 | | | | | | | | | | | | | | | | | | | | |
| *Nucula annulata* | | | | | | | | | | | 14 | 34 | 44 | 36 | 2 | 2 | 1 | 2 | 2 | 6 | | | | | | | 1 | | | |
| *Pandora gouldiana* | | | | | | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *Pitar morrhuanus* | | 4 | | | | | 3 | 1 | 8 | 3 | 7 | 3 | 3 | 1 | 1 | 1 | | | | 3 | 3 | | 3 | 1 | 2 | | | 1 | | 1 |
| *Tellina agilis* | 2 | 2 | | | | | | 5 | | 2 | | | | | | | | | | | | | | | | | | | | |
| *Yoldia limulata* | | | | | | | | | | | 10 | 3 | 5 | 2 | 1 | 1 | 1 | 2 | 1 | 6 | | 1 | | | | 1 | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Gastropoda** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Acteocina canaliculata* | | | | | | | | | | | 5 | | 4 | 1 | 6 | 4 | 2 | 4 | 5 | 6 | | | | | 1 | | | 1 | | |
| *Anachis avara* | | | | | | 1 | | | | | 1 | 1 | | | | | | | | | | | | | | | | | | |
| *Crepidula fornicata* | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Crepidula plana* | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Gastropoda* juveniles | 118 | | | | 12 | 8 | | 5 | | | | | 1 | | | | | | | | | | | | | | | | | |
| *Ilyanassa trivittata* | | 1 | | 1 | | | | | 2 | | | 4 | 1 | 1 | | 3 | | 1 | 4 | 3 | | | 1 | | | | 4 | 2 | | |
| Naticidae spp. | | 1 | | 2 | | 1 | | | | | | 3 | | 1 | 1 | | | | | | | | | | | | | | | 1 |
| *Turbonilla* sp. | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| *Urosalpinx cinerea* | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **PLATYHELMINTHES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *Stylochus ellipticus* | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **ECHIUROIDEA/SIPUNCULA** | | | | 5 | | 6 | 2 | | 8 | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Number of Species** | 28 | 30 | 28 | 32 | 28 | 35 | 31 | 24 | 33 | 28 | 17 | 14 | 21 | 16 | 14 | 14 | 14 | 14 | 10 | 14 | 7 | 11 | 7 | 10 | 13 | 8 | 11 | 13 | 9 | 5 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 17 | 18 | 19 | 20 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | S | S | S | S | S | S | S | S | S | M | M | M | M | M | M | M | M | M | M | SM | SM | SM | SM | SM | SM | SM | SM | SM | SM |
| **Sample ID** | **L001** | **L002** | **L003** | **L004** | **L005** | **L006** | **L017** | **L018** | **L019** | **L020** | **L007** | **L008** | **L009** | **L010** | **L011** | **L012** | **L013** | **L014** | **L015** | **L016** | **L021** | **L022** | **L023** | **L024** | **L025** | **L026** | **L027** | **L028** | **L029** | **L030** |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Notes:** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. sp. = single species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. spp. = multiple species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. S=Sand, M=Mud, SM=Sandy Mud | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

LISMARC Infaunal Ecological Assessment

**Summary species lists from Fall 2012 and Spring 2013 infaunal acoustic patch Similarity Tables**

## Fall 2012

*Polydora cornuta*
*Sigambra tentaculata*
*Pinnixa rectinens*
*Amphitrite ornata*
*Pinnixa sayana*
*Levinsenia gracilis*
*Gilvossius setimanus*
*Hutchinsoniella macracantha*
*Nephtys incisa*
*Ceriantheopsis americanus*
*Sabaco elongatus*
*Nucula proxima*
*Owenia fusiformis*
*Yoldia limatula*
Oligochaeta
*Pitar morrhuanus*
*Acteocina canaliculata*
*Prionospio steenstrupi*
*Clymenella mucosa*
Nemertia
*Mediomastus ambiseta*
*Turbonilla spp.*
*Corophium spp.*
*Ampharete acutifrons*
*Nephtys* spp.
*Cossura longocirrata*
*Mytilus edulis*
Phoronida
*Stenopleustes inermis*
*Polydora spp.*
*Rithropanope harrisi*
*Anadara transversa*
*Crepidula plana*
*Tellina agilis*
*Erichthonius brasiliensis*
*Parapionosyllis longicirrata*
*Spiophanes bombyx*
*Nephtys picta*
*Spiochaetopterus oculatus*
*Caprellidae*
*Ilyanassa trivittata*
*Mulinia lateralis*
*Ampelisca vadorum*
*Ampelisca macrocephala*
*Ancistrosyllis groenlandica*
*Astarte undata*
*Leptocheirus pinguis*
*Paraonis fulgens*
*Ampelisca abdita*
*Maldane sarsi*
*Turbellaria*
Mollusca
*Macoma tenta*
*Polychaeta spp.*
*Aglaophamus verrilli*
Amphipoda spp
*Clymenella torquata*
*Cirratulus grandis*
*Scalibregma inflatum*
*Ampharete spp.*
*Aricidea spp.*
Spionidae
*Diopatra cuprea*
*Spio setosa*
*Harmothoe imbricata*
*Glycera americana*
*Orbinia ornata*
*Tharyx acutus*
*Ampharete americana*
*Epitonium spp*
*Crepidula fornicata*
*Ampelisca spp.*
*Ensis directus*
*Pherusa affinis*
*Cancer borealis*
*Exogene spp.*
*Trichophoxus epistomus*

***Spring 2012***

*Nucula proxima*
*Nephtys incisa*
*Sigambra tentaculata*
*Levinsenia gracilis*
*Yoldia limatula*
*Acteocina canaliculata*
*Bostrichobranchus pilularis*
*Phoronis spp.*
*Pitar morhuanna*
*Nephtys spp.*
*Amphitrite spp.*
*Pinnixia sayanna*
*Mulinia lateralis*
*Amphitrite spp*
*Ampelisca abdita*
*Turbonilla elegantula*
*Unciola irroata*
*Oligochaeta*
*Asychis elongata*
*Owenia fusiformis*
*Nemertea*
*Gilvossius setimanus*
*Archiannelida*
*Tellina agilis*
*Leptocheirus pinguis*
*Ampharete americana*
*Ampelisca spp.*
*Paradoneis lyra*
*Spiophanes bombyx*
*Anadara transversa*
*Mollusca*
*Naissarius trivitattus*
*Nephtys picta*
*Lyonsia hyalina*
*Aricidia spp.*
*Panopeus herbstii*
*Harmothoe extenuata*
*Leptocherius pinguis*
*Mytilus edulis*
*Acmira catherinae*

LISMARC Emergent and Epifaunal Ecological Assessment

**Lists of all benthic invertebrates and biogenic features, based on lowest identifiable taxon, enumerated from seafloor images. Habitat forming species are a subset of all invertebrates.**

| Invertebrates | Biogenic features | Habitat forming species |
|---|---|---|
| Arbacia_punctulata | Crepidula fornicata (Dead) | Astrangia_poculata |
| Astrangia_poculata | Ilyanassa trivittata (dead) | Balanomorpha_Barnacle |
| Balanomorpha_Barnacle | Mercenaria shells (Dead) | Cliona spp. |
| Cancer irroratus | Euspira_spp_dead | Crepidula fornicata (Live) |
| Cliona spp. | Mytilus edulis (dead shell) | Demospongiae_1 |
| Crab_Brachyura | Ensis_directus | Hydroides_dianthus |
| Crepidula fornicata (Live) | Mud_tube | Hydroidolina_Cheilostomatidae |
| Demospongiae_1 | Worm_mound | Mytilus edulis |
| Pagurus_spp_small | Worm_castings | Diopatra_cuprea |
| Pagurus_spp_large | Carapace_fragment | Demospongiae_2 |
| Hydroides_dianthus | Crassostrea_virginica_dead | Bivalve_siphons_1 |
| Hydroidolina_Cheilostomatidae | Mud_tube_on_surface | Bivalve_siphons_2 |
| Libinia spp | Andara_spp_dead | Ceriantheopsis_americana |
| Mytilus edulis | Astarte_undata_dead | Diadumene_leucolena |
| Demospongiae_2 | Mucus_strands | Demospongiae_3 |
| Bivalve_siphons_1 | Astrangia_poculata_dead | Crassostrea_virginica |
| Bivalve_siphons_2 | Aoridae_tubes | Bostrichobranchus_pilularis |
| Ceriantheopsis_americana | Terrestrial_vegetation | Corymorpha_pendula |
| Diadumene_leucolena | Anomia_spp_dead | Bryozoa_encrusting |
| Demospongiae_3 | Algal_debris | Halichondria_sp |
| Limulus_polyphemus | Libinia_spp_dead | Worm_pink |
| Crassostrea_virginica | Shell_hash | Astarte_undata |
| Henricia_sanguinolenta | Shells_intact | Styela_canopus |
| Bostrichobranchus_pilularis | Biogenic_depression | Rhodophyta_filamentus |
| Polychaeta_tentacles | Burrow_medium | Perophora_sp |
| Corymorpha_pendula | Burrow_large | Ectopleura_spp |
| Crustacea_shrimp | Burrow_wide | |
| Aoridae_amphipod | Burrows_small | |
| Nudibranchia_1 | | |
| Bryozoa_encrusting | | |
| Halichondria_sp | | |
| Worm_pink | | |
| Astarte_undata | | |
| Pycnogonida | | |
| Styela_canopus | | |
| Euspira_spp | | |
| Perophora_sp | | |
| Euspira_spp_egg_case | | |

| |
|---|
| Asterias_forbesi |
| Busycotypus_canaliculatus |
| Nudibranchia_2 |
| Ectopleura_spp |
| Gastropoda_small |

**List of all taxa and biogenic features enumerated from seafloor imagery during fall 2012 and spring 2013 surveys.**

| Taxon | Taxon |
|---|---|
| Arbacia_punctulata | Astrangia_poculata_dead |
| Astrangia_poculata | Crassostrea_virginica |
| Balanomorpha_Barnacle | Henricia_sanguinolenta |
| Cancer irroratus | Bostrichobranchus_pilularis |
| Cliona spp. | Polychaeta_tentacles |
| Crab_Brachyura | Corymorpha_pendula |
| Crepidula fornicata (Dead) | Aoridae_tubes |
| Crepidula fornicata (Live) | Crustacea_shrimp |
| Demospongiae_1 | Aoridae_amphipod |
| Pagurus_spp_small | Nudibranchia_1 |
| Pagurus_spp_large | Bryozoa_encrusting |
| Hydroides_dianthus | Halichondria_sp |
| Hydroidolina_Cheilostomatidae | Terrestrial_vegetation |
| Ilyanassa trivittata (dead) | Worm_pink |
| Libinia spp | Astarte_undata |
| Mercenaria shells (Dead) | Pycnogonida |
| Euspira_spp_dead | Styela_canopus |
| Mytilus edulis | Anomia_spp_dead |
| Mytilus edulis (dead shell) | Euspira_spp |
| Ensis_directus | Rhodophyta_filamentus |
| Prionotus_spp. | Algal_debris |
| Loligo_pealeii | Perophora_sp |
| Menidia_spp_juvenile | Pleuronectes_americanus |
| Urophycis_spp | Euspira_spp_egg_case |
| Stenotomus_chrysops_juvenile | Asterias_forbesi |
| Centropristis_striata_juvenile | Libinia_spp_dead |
| Tautogolabrus_adspersus | Busycotypus_canaliculatus |
| Actinopterygii_unidentified | Nudibranchia_2 |
| Diopatra_cuprea | Ectopleura_spp |
| Mud_tube | Shell_hash |
| Worm_mound | Shells_intact |
| Worm_castings | Biogenic_depressino |
| Carapace_fragment | Burrow_medium |
| Demospongiae_2 | Burrow_large |

| Taxon | Taxon |
|---|---|
| Bivalve_siphons_1 | Burrow_wide |
| Bivalve_siphons_2 | Shells_intact_all |
| Crassostrea_virginica_dead | Burrows_small |
| Mud_tube_on_surface | Gastropoda_small |
| Andara_spp_dead | Mucus_strands |
| Astarte_undata_dead | Limulus_polyphemus |
| Ceriantheopsis_americana | |
| Diadumene_leucolena | |
| Demospongiae_3 | |