FUGRO

Geophysical Survey and Shallow Hazards Report

South Fork Wind Farm and Export Cable
South Fork Wind Farm COP Survey
Offshore NY/RI/MA, Atlantic OCS

September 8, 2021
Fugro Report No.: 02.1803-1431-01

South Fork Wind, LLC

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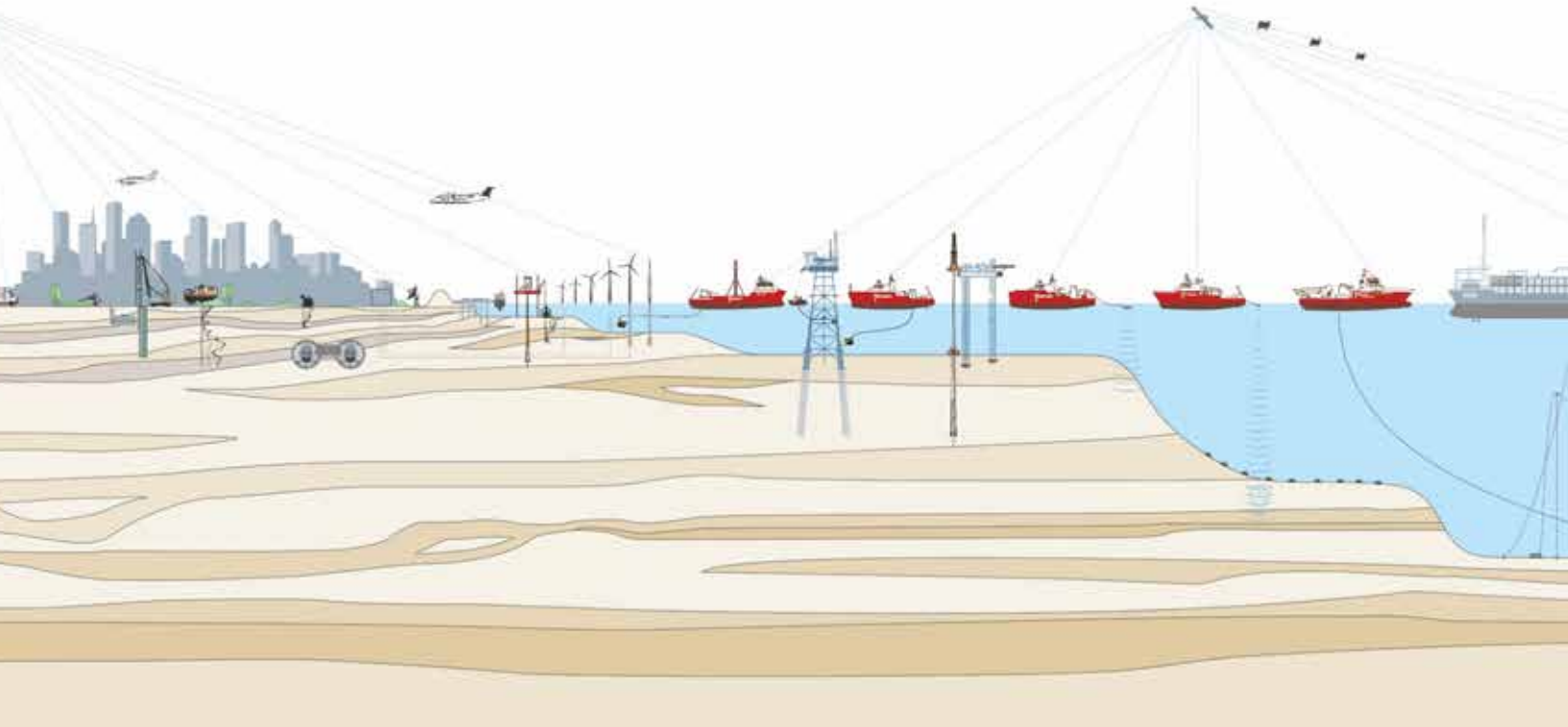

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Report No.: 02.1803-1431-01
Date: 8 September 2021

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Attention: Jesse Baldwin, Head of US Site Investigation

Geophysical Survey and Shallow Hazards Report,
South Fork Wind Farm and Export Cable,
South Fork COP Survey
Offshore NY/RI/MA, Atlantic OCS

Fugro USA Marine, Inc. (Fugro) is pleased to present this report describing the geophysical survey and our assessment of potential geologic and anthropogenic hazards that may impact the design, installation, and operation of the proposed South Fork Wind Farm (SFWF) and South Fork Export Cable (SFEC). The proposed SFWF is planned to be located in Rhode Island Sound on the federally-administered Atlantic Outer Continental Shelf (OCS) and is being developed by South Fork Wind, LLC (SFW). The SFWF is an offshore wind farm that will export power to Long Island, New York using the SFEC.

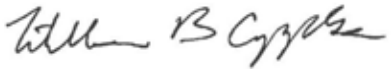
This report describes the geophysical survey and data processing methods used to acquire the data referenced in this study. The survey and information presented herein, are developed to support the preparation of a Construction and Operations Plan (COP) in pursuant to Title 30 of the Code of Federal Regulations Part 585 (CFR 585). The referenced geophysical survey, data evaluation, and reporting were conducted in general accordance with:

- Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585, prepared by the Bureau of Ocean Energy Management (BOEM) July 2015.
- Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585, prepared by BOEM July 2015 and March 2017.
- Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf prepared by BOEM November 2013.
- Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP), Version 3.0, prepared by BOEM April 2016.

The survey was conducted during two separate survey phases in 2017 and 2018. A Geophysical Survey and Shallow Hazards Report was prepared following the 2017 survey and submitted to BOEM. After the submittal of the 2017 survey report, the Maximum Work Area (MWA) for the SFWF was expanded to the east and surveyed in 2018. This report includes a comprehensive description of the 2017 and 2018 survey methodologies and results.

We appreciate the opportunity to be of service to you on this project. Please do not hesitate to contact us if you have any questions or if we can be of further assistance.

Regards,
FUGRO USA MARINE, INC.



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Distribution: One Final Digital (PDF) File

EXECUTIVE SUMMARY

Purpose and Scope

The purpose of this report is to describe the geophysical survey and our assessment of potential geologic and anthropogenic hazards that may impact the design, installation, and operation of the proposed South Fork Wind Farm (SFWF) and South Fork Export Cable (SFEC). The proposed SFWF is located approximately 31 kilometers (km) southeast of Block Island, Rhode Island in Rhode Island Sound on the Atlantic Outer Continental Shelf (OCS). The SFWF will include up to 15 wind turbine generators (WTG), offshore substation (OSS), and an inter-array cable network. The foundation concept being considered for the WTGs are monopile foundations.

The area surveyed for the SFWF is approximately 7-km (north-south direction) by 12-km (east-west direction) in size, comprises approximately 7,600 hectares, and covers portions of OCS Blocks 6965, 6966, 6967, 6968, 7015, 7016, 7017 and 7018 in the Providence (NK19-07) protraction area.

The SFEC is planned to connect from an OSS in the SFWF to the preferred landfall on Long Island near Beach Lane, or the alternate landfall location at Hither Hills, Long Island. Currently the cable is planned to be installed to a nominal depth of up to 2 meters below the seafloor using a trenching method. Cable installation at the shore crossing is anticipated to use a horizontally directional drilled (HDD) method to install the cable from a land-side entry point, pass beneath the shoreline and surf zone, and exit at the seafloor where the water depth is approximately 10 meters.

The SFEC corridor located on the OCS (outside of the 3-nautical mile limit) will be within OCS blocks, listed from east to west:

- 7013 to 7015, 7056 to 7063, and 7101 to 7106 of Providence protraction area (NK19-07)
- 6002 and 6003 of Block Island protraction area (NK19-10)
- 6031 to 6033 and 6080 to 6081 of New York protraction area (NK18-12)

This assessment is based on the interpretation of conventionally acquired Magnetometer (MAG), Gradiometer, (GRAD), Multichannel and Single channel Medium Penetration Seismic (MPS - Sparker), Multibeam Echo Sounder (MBES) bathymetry and backscatter, Side Scan Sonar (SSS), and Sub-Bottom Profiler (SBP) data that were collected in accordance with the approved Construction and Operations Survey Plan (COP). This report complies with the latest guidelines formulated by the BOEM for offshore wind development and also provides important information for archaeological resource interpretation and other purposes. Relevant BOEM Guidelines include:

- Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585, prepared by the Bureau of Ocean Energy Management (BOEM) July 2015.
- Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585, prepared by BOEM July 2015 and March 2017.
- Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf prepared by BOEM November 2013.
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The survey was conducted during two separate survey phases in 2017 and 2018. A Geophysical Survey and Shallow Hazards Report was prepared following the 2017 survey and submitted to BOEM. After the submittal of the 2017 survey report, the Maximum Work Area (MWA) for the SFWF was expanded to the east and surveyed in 2018. This report includes a comprehensive description of the 2017 and 2018 survey methodologies and results.

Water Depth and Seafloor Slopes

Measured water depths in the surveyed SFWF area are between approximately 27 and 45 meters referenced to the mean lower low water (MLLW) datum. With the exception of the shore approach segment, the water depth in the SFEC corridor is generally between 30 and 45 meters and the deepest water surveyed along the SFEC is approximately 48 meters (Re. MLLW).

Seafloor slopes generally vary from less than 1 degree to 3 degrees. The eastern limb of a trough in the north-central perimeter of the SFWF was observed to have a seafloor slope of approximately 5 degrees Areas with seafloor slopes greater than 10 degrees generally occur along the margins of megaripples and can exceed 30 degrees along the flanks of seafloor boulders.

Seafloor Conditions

Seafloor conditions in the SFWF area generally consist predominantly of sandy deposits with variable amounts of gravel, cobbles, and boulders. Concentrations of seafloor boulders vary across the SFWF area. Boulders range in size and are generally 1 to 8 meters but up to 12 meters in diameter. Areas devoid of boulders or widely scattered boulders were identified in the survey data and may represent viable locations for installation of inter-array cables and wind turbines.

Seafloor bedforms identified are either megaripples up to 0.5-meter tall (peak-to-trough) or ripples (less than 10 cm tall and between 0.1 to 0.3-meter tall). A mobility assessment of bedforms in the SFWF was performed by comparing 2017, 2018, and available 2020 bathymetric data. One-hundred eighty-nine (189) representative bedforms were evaluated in this study (Figures 4.1-7a-I and 4.1-7a-ii). Ripple-scale bedforms with typical heights of 0.1 to 0.3 meters were observed to exhibit the most change. The average rate of movement between 2017 and 2020 for 81 features evaluated is 0.9 m/yr (one standard deviation is 0.3 m/yr) and is in the north to northwest direction (Figure 4.1-7a-i). The ripple features are observed to be localized within the study area. The megaripple and sand accumulation area features are interpreted to be either stable or exhibiting minor re-shaping.

Seafloor conditions along the SFEC corridor are variable but consist primarily of sandy deposits and some areas contain cobbles and boulders. Fine-grained sediments are constrained to local channel infill areas. SFEC corridor from the OSS to approximately 10 km from the SFWF area is located on a moraine and moraine flank where boulders are present. The survey corridor was widened in this reach to allow for the cable to be routed around boulders. Westward (and landward) the corridor is largely devoid of boulders. Isolated boulders were identified in some areas but can be avoided.

Areas with megaripple bedforms were identified along the route. Bedform net migration direction and rates were estimated by comparing 2017 data and available 2020 data. Approximately 486 bedforms were evaluated and

predominantly range in size from approximately 0.2 to 0.7 meters tall (ripple to megaripple size). The surveys were conducted approximately 2.8 years apart (based on the mid-date of each survey). 360 features were interpreted to exhibit movement. Average rates of movement were interpreted to be approximately 1.1 m/yr and ranged from approximately 0.1 to 4.6 m/yr. Migration rates were generally faster for shallower water depths. 124 additional features evaluated did not exhibit any discernable movement (they are either stable or exhibit very low rates of movement). Net migration direction is predominantly in the northwest direction for the offshore area east of Long Island and in a west-northwest direction (shore-parallel) for the area offshore of Long Island. Inshore of the 11-meter water depth contour, seafloor elevation changes +/-0.5 meter were variable and likely a result of complex wave, alongshore current, storm and seasonal variations in oceanographic processes. The cable corridor avoids traversing steep slopes and areas anticipated to be subjected to exceedingly strong bottom currents (e.g. tidal inlets or constricted area between Block Island and the eastern tip of Long Island).

Subsurface Conditions and Stratigraphy

Subsurface geologic features interpreted include: potential buried boulders, buried paleo-channels, and areas of deformation. Stratigraphy across the study area includes recent marine deposits, Holocene and Pleistocene channels, glacial moraine and/or outwash deposits, and coastal plain sediments.

In the SFWF area, boulders are anticipated to be present and piled foundation designs and installation planning should take this into consideration. Inter-array cable planning and design should take into consideration the potential for shallow hard ground conditions and boulders.

SFEC installation planning should also take into consideration the potential for hard ground conditions and potential boulders. Those conditions are most likely to be encountered in the cable corridor within about 10 km of the SFWF area where the corridor is located on a moraine flank and moraine system.

Anthropogenic Features

Fifty-nine (59) sonar contacts were interpreted within the SFWF area. Four of the sonar contacts (Sonar Contact Nos. 28, 30, 32, and 112) represent possible shipwrecks and are located in the. One sonar contact, No. 218, is another potential shipwreck, but is located on the perimeter of Fugro's Maximum Work Area (MWA). In discussion with Gray & Pape (Qualified Marine Archeologist) this potential shipwreck falls approximately 130 meters outside their idealized MWA for the SFWF. NOAA charts and the AWOIS database indicates that one known/charted shipwreck is located in the SFWF area. Sonar Contact 32 may represent the NOAA/AWOIS shipwreck and is located approximately 600 meters from this charted location. No sonar contacts or magnetic anomalies were identified near the NOAA/AWOIS charted shipwreck location.

4,005 magnetic anomalies were identified in the SFWF area, although only 3,964 are within Fugro's SFWF MWA. Most correlate directly to discrete boulders, clusters of boulders, and other geologic features/trends (e.g. buried paleochannels). The boulders/cobbles/gravel are inferred to have been transported by glaciers that crossed areas where bedrock containing magnetite and iron-rich minerals are known to exist and therefore, most magnetic anomalies are believed to be related to geologic features. Several anomalies correspond to side scan sonar contacts.

Fifty-three (53) magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed SFEC route. Unidentified anomalies are presumed to represent articles of ferrous debris that are either buried below the mudline or too small to be acoustically detected with side scan sonar and are associated with fishing activities, prior construction activities or passing ship traffic. These anomalies should not impact cable installation activities; however, additional caution should be exercised if working in their vicinity

The proposed SFEC route will cross seven cables. Transatlantic cable “TAT-6” was found to deviate from its reported “as-built” position by over 500 meters, therefore the projected crossing is based on its “as-found” position. Caution should be exercised when working in the vicinity of all anthropogenic features, and proper protective material (sandbags/mats) should be employed during cable installation where applicable.

Summary

The geological environment of the SFWF area is complex due to the extensive glaciation and fluvial processes the study area has experienced. The identified features need to be appropriately considered and assessed when designing and installing infrastructure in the SFWF area. For example, seafloor and subsurface boulders are present across the SFWF and may create difficult conditions for driving piles or burying cables. Other possible hazards such as seafloor faults, gas seeps/expulsion features, seafloor slumping, ice scour, shallow buried gas, or hydrates were not identified in the SFWF or SFEC areas.

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1. INTRODUCTION

1.1 Purpose and Scope

South Fork Wind, LLC (SFW) is proposing to develop the South Fork Wind Farm (SFWF) project, an offshore wind energy project within the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0517) (the Lease) interconnecting with the Long Island Power Authority transmission system on Long Island, New York. The project includes plans for installing the South Fork Export Cable (SFEC) that will be used to export power from the wind farm to New York.

Fugro USA Marine, Inc. (Fugro) conducted the geophysical survey and prepared this report that describes potential geologic and anthropogenic hazards that may impact the design, installation, and operation of the proposed SFWF and SFEC project. This report also describes the geophysical survey and data processing methods used to acquire the data referenced in this study. The survey and information presented herein, are developed to support the preparation of a Construction and Operations Plan (COP) in pursuant to Title 30 of the Code of Federal Regulations Part 585 (CFR 585). The referenced geophysical survey, data evaluation, and reporting were conducted in general accordance with:

- Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585, prepared by the Bureau of Ocean Energy Management (BOEM) July 2015.
- Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585, prepared by BOEM July 2015 and March 2017.
- Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf prepared by BOEM November 2013.
- Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP), Version 3.0, prepared by BOEM April 2016.

1.2 Proposed South Fork Wind Farm

The proposed SFWF is located approximately 31 kilometers (km) southeast of Block Island, Rhode Island in Rhode Island Sound on the Atlantic Outer Continental Shelf (OCS). Currently the wind farm is being planned to install up to 15 wind turbine generators (WTG), offshore substation (OSS), and an inter-array cable network. Foundation concepts being considered in the design of the WTGs include monopile foundations.

The area surveyed for the SFWF is approximately 6-km (north-south direction) by 12-km (east-west direction) in size, comprises approximately 7,700 hectares, and covers portions of OCS Blocks 6965, 6966, 6967, 6968, 7015, 7016, 7017, and 7018 in the Providence (NK19-07) protraction area (Figures 1.1-1 through 1.1-3). The area surveyed is larger than the planned WTG footprint and is intended to encompass locations of potential seafloor disturbance associated with future SFWF construction and installation activities. The approximate bounding coordinates of the SFWF survey area are:

- Northwest Corner: N4,554,413, E315,878 (Latitude 41.120147 degrees, Longitude -71.193197 degrees)
- Northeast Corner: N4,553,726, E327,419 (Latitude 41.116500 degrees, Longitude -71.055622 degrees)

- Southeast Corner: N4,548,144 E326,709 (Latitude 41.066098 degrees, Longitude -71.062487 degrees)
- Southwest Corner: N4,548,808, E315,412 (Latitude 41.069595 degrees, Longitude -71.197052 degrees)
- Northing (N) and Easting (E) coordinates reference Universal Transverse Mercator (UTM), Zone 19 north, North American Datum 1983 (NAD83) and are in meters. Latitude and longitude coordinates reference NAD83.

Measured water depths in the surveyed SFWF area are between approximately 27 and 45 meters referenced to the mean lower low water (MLLW) datum.

1.3 Proposed South Fork Export Cable Corridor

The SFEC is planned to connect from an OSS in the SFWF to the preferred landfall on Long Island near Beach Lane, or possibly an alternate landfall location at Hither Hills (Figures 1.1-1 through 1.1-3). Currently the cable is planned to be installed to a nominal depth of up to 2 meters below the seafloor using a trenching method. Cable installation at the shore crossing is anticipated to use a horizontally directional drilled (HDD) method to install the cable from a land-side entry point, pass beneath the shoreline and surf zone, and exit at the seafloor where the water depth is approximately 10 meters. The planned length of the SFEC and end point locations are:

- OSS End Point in the Wind Farm: N4,549,444, E317,874, UTM Zone 19N, NAD83, meters; (Longitude -71.167965 degrees, Latitude 41.075870 degrees NAD83)
- Preferred Landfall End Point: N4,535,837, E227,548, UTM Zone 19N, NAD83, meters; (Longitude -72.2358 degrees, Latitude 40.9283 degrees NAD83)
- Alternate Landfall End Point: N4,544,279, E247,151, UTM Zone 19N, NAD83, meters; (Longitude -72.0068 degrees, Latitude 41.0105 degrees NAD83)
- Total Length: 99 km
- Length in NY state water: 5.8 km
- Length in OCS water: 93.1 km

The SFEC corridor located on the OCS (outside of the 3-nautical mile limit) will be within OCS blocks, listed from east to west:

- 7013 to 7015, 7056 to 7063, and 7101 to 7106 of Providence protraction area (NK19-07)
- 6002 and 6003 of Block Island protraction area (NK19-10)
- 6031 to 6033 and 6080 to 6081 of New York protraction area (NK18-12)

With the exception of the shore approach segment, the water depth in the SFEC corridor is generally between 30 and 45 meters and the deepest water surveyed along the SFEC is approximately 48 meters (Re. MLLW). For the purposes of this report, the portion of the SFEC located within federal waters will be referred to as South Fork Export Cable OCS (SFECOCS) and the portion of the SFEC located within New York State waters will be referred to as South Fork Export Cable NYS (SFECNYS).

1.4 2017 Geophysical and Geotechnical Survey Overview

During 2017, South Fork Wind, LLC commissioned a series of geophysical, geotechnical, archaeological, and benthic surveys to characterize site conditions in the proposed SFWF and SFEC development areas. Prior to performing the surveys, Fugro conducted a desktop study to build an initial understanding of the SFWF and SFEC site conditions (Fugro, 2017a). The desktop study provided an initial framework of the anticipated geologic and geotechnical conditions, geohazards, and natural and anthropogenic siting constraints. This information was assimilated into a preliminary ground model and used to develop potential export cable routes and shore landing locations (Figure 1.1-3). Potential cable routes and shore landing locations developed during the desktop study phase also incorporated input from other project partners (e.g. environmental consultants) and input received by Deepwater Wind from stakeholder engagement meetings.

Information regarding the site conditions developed during the desktop study were used to select equipment and design the 2017 geophysical and geotechnical surveys (G&G Surveys). A COP Survey Plan was prepared that described the planned survey and was submitted to BOEM for review on May 19, 2017 (Fugro, 2017b). A pre-survey meeting was conducted on April 18, 2017 at BOEM's office located in Sterling, Virginia to discuss the proposed COP Survey Plan.

The G&G surveys were conducted to collect data used to characterize shallow hazards, geological conditions, geotechnical characteristics, and to provide data for marine archaeological resources assessments and benthic studies.

The geophysical survey was conducted first and occurred from July to November 2017. Areas surveyed include the SFEC corridor and SFWF area (Figure 1.1-2). The SFEC survey investigated four shore landing options that include three options with landings on the southern shoreline of Long Island and one landing area on the northern shoreline of Long Island (Figure 1.1-3). Based on route conditions observed during review of the geophysical data and input from project stakeholders, route alternatives with shore landings near Beach Lane and Hither Hills were selected as the preferred and alternate options, respectively (Figure 1.1-2). This report summarizes results from the survey of the preferred route. During the survey period, a reconnaissance level investigation was conducted of the northern portion of the lease area located outside of the SFWF. Data from northern reconnaissance survey lines that extend into the SFWF have been incorporated into this SFWF and SFEC COP survey report.

A shallow geotechnical survey was conducted from October to December 2017 to investigate shallow subsurface conditions in the SFEC corridor and SFWF area. Geotechnical explorations include vibracores, cone penetration testing, grab sampling, and sediment profile imaging/plan view imaging. Geophysical data collected during the survey were evaluated and used to plan the locations of the geotechnical explorations.

1.5 2018 Geophysical and Geotechnical Survey Overview

During SFWF planning activities that occurred after completion of the 2017 survey, South Fork Wind, LLC (SFW) determined the Maximum Work Area (MWA) would be expanded approximately 5.5 km to the east. During 2018, SFW commissioned Fugro to perform a geophysical survey to encompass the expanded MWA. The geophysical survey was conducted from October 30 to December 31, 2018. The 2018

geophysical survey used the same line spacing and similar or equivalent survey equipment as the 2017 geophysical survey. Differences from the 2017 survey equipment include the use of a transverse gradiometer instead of a magnetometer, the use of a 4 by 4 array for the sub-bottom profiler, and the use of a longer multichannel streamer and a 1000 joule power level for the Sparker instead of the 500 joule power level used in 2017.

The 2018 geophysical survey included approximately 1,860 line-kilometers of survey lines and was designed to tie into the previous 2017 survey and provide a seamless dataset for the project team.

Geotechnical and marine archaeological vibracores and sediment profile imaging/plan view imaging were also conducted in the expanded MWA during the fall and winter of 2018. Those activities and results from those investigations are being summarized in separate reports.

1.6 Geophysical and Geotechnical Reporting

The G&G surveys and results from the surveys are presented in a series of reports. Those reports and general content include the following:

- Geophysical Survey and Shallow Hazards Report (*this report – updated to include the 2018 survey information*) – Provides a summary of the geophysical data acquisition and processing methodologies and results from the shallow hazards assessment of the geophysical data.
- Geotechnical Data Report – Provides a summary of the geotechnical exploration methodology for vibracore sampling, cone penetration testing (CPT), and grab sampling; vibracore and CPT logs, and results from the laboratory testing. This report will be updated to incorporate information obtained from vibracoring activities conducted in January 2019.
- Sediment Profile Imaging and Benthic Survey Report – Provides a summary of the sediment profile imaging and seafloor imagery collected. Report provides an assessment of seafloor material composition, morphology (e.g. bedforms), and benthic conditions. This report will be updated to incorporate information obtained from survey activities conducted in the winter of 2018.
- Integrated Geophysical and Geotechnical Site Characterization Report – Provides a characterization of SFEC and SFWF site conditions based on the integration of the geotechnical and geophysical data. This report will be updated to incorporate results for the 2017 and 2018/2019 geophysical and geotechnical investigations.

1.7 Geophysical Survey and Shallow Hazard Report Format

This report is presented in following sections:

- Section 1: Introduction to the project and overview of the G&G surveys
- Section 2: Summarizes the geophysical data acquisition and processing methodologies
- Section 3: Overview of the regional geology and oceanographic conditions
- Section 4: SFWF shallow hazard assessment
- Section 5: SFEC corridor shallow hazard assessment
- Section 6: Summary of the study

Figures that present data examples and summarize the results of the study are provided after the report text. Oversized charts of the SFWF area are presented after the figures. The SFWF charts present the:

- Navigation post-plot
- Seafloor rendering using a sun-illuminated hillshaded-relief
- Seafloor elevation contours
- Seafloor slope
- Multibeam backscatter
- Seafloor features
- Subsurface geologic features

Multi-panel alignment sheets at 1:8,000 scale of the SFEC corridor are presented after report text and figures. Panels on the alignment charts present vessel navigation tracklines, bathymetric contours, seafloor slope, side scan sonar data, interpreted side scan sonar contacts, interpreted magnetic anomalies, magnetic total field contours, sub-bottom profiler data, and medium penetration sparker data.

Oversize charts and alignment sheets include a prefix (e.g. SFWF or SFEC) that denote the project components they are related to (e.g. SFWF – South Fork Wind Farm and SFEC – South Fork Export Cable).

The proposed SFEC start point at the OSS location was modified slightly between Issue 6 and 7 of this report. The proposed SFEC route reported in Issue 7 of this report is referred to as the Version 4 route. The separation in the north-south direction between the two routes is less than 100 meters and the two routes converge at approximately KP 41+00. From KP 41+00 to landfall, the two routes are the same. Reporting descriptions and charting presented herein retain the initial KP references utilized in Issue 1 through 6 of this report, with exception of references to magnetic anomalies and boulder locations where the two routes differ. Where the two routes differ, the KPs and offset distances for magnetic anomalies and boulder locations reference the Version 4 route and are summarized in Tables 5.3 and 5.4. Tables 5.3 and 5.4 summarize the magnetic anomalies and boulders located within 10 meters of the proposed cable route (no side scan sonar contacts were identified within 10 meters along this route segment). Chart SFEC-1 presents both cable routes and their point of convergence.

Additional detailed supporting information are provided in the appendices at the end of this document.

- Appendix A – Fugro's service warranty
- Appendix B – Summary of interpreted magnetic anomalies
- Appendix C – Summary of interpreted side scan sonar contacts and detailed images of each contact
- Appendix D – Summary of conductivity, temperature and density profiles
- Appendix E – Survey line logs
- Appendix F – Seismic data processing methodology

1.8 Geodetic Mapping Parameters

Survey and navigation data are collected in the World Geodetic System (WGS) of 1984 coordinate system and projected in Universal Transverse Mercator (UTM) Zone 19 (North). Metric units were used for all projection coordinates, survey layouts, water depths, and subsurface feature measures.

Geodetic Datum

Datum:	NAD 83
Spheroid:	GRS 1980
Semi-major axis:	6,378,137.0 m
Inverse Flattening:	298.257222101

Projected Coordinate Reference System

Projection:	UTM
Zone:	19N
Latitude of Origin:	0.0°N
False Easting:	500,000 m
False Northing:	0 m
Grid Units:	Meter

1.9 Authorization

The 2017 work referenced herein was authorized by Task Order No. 2 dated July 17, 2017 issued under the Services Agreement dated February 27, 2017. The work was performed in general accordance with our proposal dated June 23, 2017. Work for the 2018 survey was authorized by Task Order No. 4 dated August 7, 2018.

2. GEOPHYSICAL DATA ACQUISITION AND PROCESSING

Geophysical surveys of the SFWF and SFEC MWAs were conducted during two separate survey campaigns. The survey data for the two campaigns have been incorporated into this report.

- 2017 Survey: *R/V Fugro Enterprise* conducted a survey of the SFWF and SFEC corridor. The shallow draft survey launch *R/V Harry Miller* conducted surveys of potential shore-landing areas.
- 2018 Survey: *R/V Fugro Discovery* conducted a survey of the SFWF MWA that had been extended approximately 5.5 km to the east.

2.1 2017 Survey Overview and Vessel Summary

The G&G surveys were conducted to collect data used to characterize shallow hazards, geological conditions, geotechnical characteristics, and to provide data for marine archaeological resource assessments and benthic studies. The geophysical survey utilized several types of sensors to conduct the high-resolution geophysical (HRG) survey of the SFWF area and SFEC corridor. Two survey vessels were utilized to conduct the survey.

The *R/V Fugro Enterprise* conducted most of the survey and collected all data offshore from approximately the 14-meter water depth contour which is located approximately 1 km from shore (Figure 2.1-1). The R/V Fugro Enterprise was built in 2007 and is designed for conducting high-resolution geophysical surveys. The vessel is 52 meters in length, with a beam of 12.2 meters and a maximum draft of 3.4 meters (Figures 2.1-2 through 2.1-4). Surveying operations on the R/V Fugro Enterprise were conducted on a 24-hour/day basis from July 19 to November 9, 2017.

Inshore surveying was conducted using a smaller, shallow draft purpose-built survey vessel named the R/V Harry Miller (Figure 2.1-5). The *R/V Harry Miller* is an aluminum catamaran owned by Miller Marine Services. The vessel is 9.8 meters in length, with a beam of 3.4 meters and a draft of 0.6 meters (Figure 2.1-6). Surveying operations on the R/V Harry Miller were conducted during daylight hours only from July 27 to August 16, 2017 and covered shore approach zones inshore of approximately the 14-meter water depth contour which was approximately 1 km from shore. All of the R/V Harry Miller surveying occurred in New York State water.

2.2 2018 Survey Overview and Vessel Summary

The *R/V Fugro Discovery* conducted the entire survey and collected all data offshore within the eastward extended area of the SFWF. The *R/V Fugro Discovery* was built in 1997 for the Norwegian Navy but has been converted to a multi-purpose vessel used for high-resolution G&G surveys and seafloor mapping. The vessel is 70 meters in length, with a beam of 12.6 meters and a maximum draft of 6 meters (Figures 2.1-7 through 2.1-9). Surveying operations on the *R/V Fugro Discovery* were conducted on a 24-hour/day basis from October 30 to December 31, 2018.

2.2.1 SFWF Survey Area

The SFWF survey area extends approximately 1,000 meters beyond the anticipated WTG positions to provide survey coverage of the area where vessels may come into contact and disturb the seafloor during

installation of the SFWF. This SFWF survey extent is denoted as the “Survey Area” on the figures and charts presented in this report. The HRG survey was conducted using a nominal 30-meter by 500-meter line spacing in this area, which resulted in the following track lines:

- Multibeam, side scan sonar, magnetometer (gradiometer for 2018 survey), sub-bottom profiler, and medium penetration (sparker) with a single-channel hydrophone receiver array systems run on:
  - 30-meter spaced primary lines and along inter-array cable centerlines that are not oriented in the primary or tie line directions.
  - The sparker source was operated at 300 joules (1000 joules for 2018 survey) with a single channel hydrophone along the 30-meter spaced primary lines. The intent of collecting single channel sparker data was to provide high resolution seismic data that can be used to characterize shallow stratigraphic conditions in the event that the sub-bottom profiler single achieves limited penetration,
- Multibeam, side scan sonar, magnetometer, sub-bottom profiler, and medium penetration (sparker) seismic operated at 500 joules (1000 joules for 2018 survey) with a multichannel hydrophone array systems run on:
  - 150-meter spaced primary lines and 500-meter spaced tie lines centered on the WTGs. In 2017 a 32-channel streamer with a 1.56 mgi and in 2018 a 48-channel streamer with a 1.56 mgi was utilized.

This survey achieved 100 percent overlapping coverage with the side scan sonar; 100 percent coverage of the multibeam system; and a thorough sampling of magnetometer and sub-bottom profiles. Survey vessel tracklines are presented on Chart 1.

2.2.2 SFEC Survey Corridor

The SFEC survey corridor is comprised generally of a centerline and three offset lines on either side that are spaced 30 meters apart and encompass a 180-meter wide corridor. There are three areas where this corridor was widened for various reasons. The corridor section within approximately 11 km of the SFWF was widened, while maintaining a 30-meter line spacing, to approximately 700 meters and 1,000 meters to allow room to route the cable through a boulder area. The shore approach at Hither Hills was widened to approximately 1.5 km from approximately 1 km offshore to the inshore survey limit. Survey tie lines along SFEC corridor are spaced approximately 500 meters apart.

A description of the systems used on the respective survey lines are:

- Multibeam, side scan sonar, magnetometer, sub-bottom profiler, and medium penetration (sparker) with a single-channel hydrophone receiver array systems run on:
  - 30-meter spaced primary lines and 500-meter tie lines.
  - The sparker source was operated at 300 joules with a single channel hydrophone along the 30-meter spaced primary lines. The intent of collecting single channel sparker data was to provide high resolution seismic data that can be used to characterize shallow stratigraphic conditions in the event that the sub-bottom profiler single achieves limited penetration. The sparker source and single channel hydrophone area were not run on shore approach lines conducted by the smaller vessel R/V Harry Miller. The R/V Harry Miller collected data on the shore approach that extend

approximately 1 km offshore from the shoreline and is approximately 1.5 km wide at the Hither Hills landing site.

- Multibeam, side scan sonar, magnetometer, sub-bottom profiler, and medium penetration (sparker) seismic operated at 500 joules with a multichannel hydrophone array systems run on the cable corridor centerline.

SFEC survey vessel tracklines are presented in the top panel in Sheet 1 of alignment Charts SFEC 1 through 14.

2.3 Navigation

Horizontal positioning of the primary survey vessel *Fugro Enterprise* was acquired with the Fugro Starfix Differential Global Positioning System (DGPS). The DGPS combines raw Global Navigation Satellite System (GNSS) pseudo-range observations with position corrections from a network of terrestrial Continuously Operating Reference Stations (CORS) uplinked to redundant satellites and broadcasted to survey vessels worldwide. The vessel is equipped with two redundant Trimble SPS551 Survey Grade GNSS receivers. The antennae for these receivers are mounted on the vessel antenna farm, aft of the wheelhouse, with a clear and unobstructed view of all four quadrants of the sky (Figure 2.1-3). Both raw pseudo-range observations and dual-frequency carrier-phase corrections from the Starfix.HP CORS network broadcasted by both Inmarsat and SpotBeam satellites are recorded by the Trimble SPS551 receivers, producing a position with extremely high accuracy. Further positional enhancements are undertaken in Fugro SPM5 software. The resulting position accuracies within a distance of 1,000 km from the nearest CORS station are 10 cm in the horizontal plane and 15 cm in the vertical plane, both at the 95% confidence interval.

The collected navigational data were downloaded to NavLab software (Kongsberg Navigational Laboratory). Anomalous points were removed and the data were smoothed. The resulting smoothed navigational data and attitude (pitch, roll, and heading) were then merged with raw sensor data in Starfix.PROC (Version 5.03.17). Navigational track lines were then created through Starfix.PROC in PPL formats and CAD post-plots.

Horizontal positioning for the *R/V Harry Miller* was also accomplished using the DGPS system based on the combination of GNSS and CORS signals and achieved a similar level of horizontal positional accuracy.

For the 2018 portion of the SFWF survey aboard the *R/V Fugro Discovery*, horizontal positioning of the vessel was acquired using Fugro's Global Navigation Satellite System (GNSS) positioning. The primary positioning was provided from the StarPack G2+ receiver. The antenna is installed on antenna mountings on the main mast top with clear and unobstructed hemispherical view. The system was interfaced directly to the online navigation system providing positional accuracies better than ±0.1 m horizontally and ±0.15 m vertically using the G2+ position solution, which is an improved G2 position achieved by combination of Precise Point Positioning (PPP) and Integer ambiguity resolution (IAR). The IAR is achieved by broadcasting an additional set of corrections known as Uncalibrated Phase Delays (UPDs) along with precise orbits and clocks.

The secondary GNSS positioning was provided from a Seapath 330+ unit which uses the same FUGRO corrections signals and outputs a G2 position solution to the QINSy software. The Seapath antenna is mounted on the main mast with clear and unobstructed hemispherical view. If the primary positional quality degrades past that of the secondary positioning system QINSy acquisition software will automatically swap to the secondary Seapath receiver.

All data on all three vessels are corrected for offset and laybacks (Figures 2.1-2 through 2.1-9)

2.4 Multibeam Echosounder

2.4.1 Data Acquisition

Water depth in the survey area is predominantly less than 48 meters. Therefore, in accordance with BOEM guidelines for sites with water depths shallower than 40 meters, multibeam data were acquired and processed to meet requirements for Special Order Surveys, as defined by the Standards for Hydrographic Surveys (IHO, 2008).

R/V Fugro Enterprise. Multibeam data were collected using a vessel mounted Reson Seabat 7125 Multibeam Bathymetric Systems with an operating frequency of 400 kHz and swath coverage of 128 degrees. The sonar has a 0.5-degree beam separation (across track), 50 Hz ping rate, and used 512 beams. The system is permanently mounted onto a gondola and has a draft of 4.4 meters.

Prior to commencing the survey, a patch test was conducted to calibrate different components of the multibeam bathymetry system in accordance with industry standards. This calibration procedure measures the angular mounting components of the correction sensors (roll, pitch, and yaw) as errors in these measurements can lead to an inaccurate survey. The calibration test is a data collection and processing procedure to calibrate these angles along with position system latency. Four elements of the patch test are calculated: positioning latency test (time), a pitch test (angle), a roll test (angle) and a yaw test (angle). The patch test involves two steps: the measurement of all relative sensor offsets which is carried out at time of sensor installation and a field sensor alignment. The patch test was conducted by surveying in opposite directions, using different speeds over a distinct feature. A flat area was surveyed to calibrate the roll bias.

Sound velocity measurements in the water column were performed three to four times a day and as conditions were observed by the multibeam operator to change. Sound velocity profiles were used to process the multibeam data and correct for refraction and ray bending caused by sound velocity variations in the water column. Sound velocity profiles were conducted using two different sensors. A Valeport MiniSVS Sound Velocity Sensor was also used in conjunction with the side scan sonar system anD deployed several times a day. The Valeport MiniSVS uses single pulse of sound, traveling over a known distance, to produce a sound velocity measurement using a digital signal processing technique that provides a high resolution, immediate response eliminating signal noise. The second sensor used measured several parameters in water column. A Sea-Bird Electronics SBE19plusV2 Conductivity, Temperature, and Density (CTD) profiler was utilized to produce water column profiles of electrical conductivity, temperature, salinity, and density in the survey area. A total of 27 CTD casts were acquired during the survey and are provided in Appendix D.

Multibeam backscatter data were also recorded during the survey.

R/V Harry Miller (NY State Water Only). Multibeam surveying was conducted from the R/V Harry Miller using a pole-mounted R2Sonic 2024 multibeam echosounder operating at 300 kHz. The R2Sonic 2024 has a 0.5-degree beam separation, an update rate of 60 Hz, and uses 256 beams. An Applanix Pos M/V was used as the inertial navigation system. Prior to surveying, a patch test was a patch test was conducted to calibrate different components of the multibeam bathymetry system in accordance with industry standards using the same method as described for *R/V Fugro Enterprise*. Based on the patch and performance tests, a swath width of 130 degrees was used. Tidal effects were corrected for by using real time kinematic/post processed kinematic methods.

Sound-velocity profile data were acquired using an Applied Microsystems Ltd. (AML) Smart Probe. The AML Smart probe measures at a maximum rate of 10 velocity and pressure observations per second. For each cast, the probe was held at the surface for approximately two minutes to reach temperature equilibrium. The probes were then manually lowered at the rate of about 1 m/s to the seafloor and raised to the surface at the same rate.

Sound-velocity casts were conducted regularly to ensure multibeam data could be corrected for refraction. Casts were spaced geographically and temporally to create an accurate model of the sound velocity profile for the water column across the survey area.

R/V Fugro Discovery. Multibeam echosounder data was collected aboard the *R/V Fugro Discovery* using a vessel-mounted Kongsberg EM712 Multibeam Bathymetric System. The system has a dual operating frequency of 40 to 100 kHz, a maximum ping rate of 30 Hz, and a swath coverage of 140 degrees. This system is permanently mounted on a hull-mounted gondola.

Prior to commencing the survey, a patch test was conducted in the survey area to calibrate different components of the multibeam bathymetry system. During the survey, a total of 64 CTD (conductivity, temperature, and density) measurements were taken to acquire sound velocities in the water column. A Valeport MIDAS SVX2-CTD velocity profiler was used to acquire the velocity profiles during the survey.

2.4.2 2017 Data Processing

Soundings were processed using CARIS HIPS software on Windows 7 workstations. CARIS was used to process, clean, and produce seafloor elevation models and finalized XYZ ASCII files.

Within CARIS HIPS, soundings were corrected for calibrated patch test results, vessel offsets, vessel motion, draft, sound velocity, and tide. Offsets established during the mobilization were used to correct bathymetry for differences between the transducer head and GPS antenna position. Offsets were entered in the Vessel Configuration File in CARIS HIPS to correct the bathymetry during processing.

Processed sound velocity profiles were used to correct bathymetry data for sound refraction, or ray bending. Sound velocity profiles were applied within CARIS. Fugro's Multibeam Survey Tools v 3.1.30 software was

used to process the sound velocity profile data set, generating a smooth interpolation curve that depicted the original profile at the finest resolution available in CARIS.

The sounding data files were converted to CARIS HIPS format for bathymetry processing. Prior to each survey line being converted to CARIS' HIPS format, the vessel offsets, patch test calibration values and static draft measurements were entered into the HVF. The SVP file was then loaded into each line, and the line was corrected for sound refraction. During SVP correction the bathymetry was also corrected for dynamic vessel heave, pitch and roll. The attitude, heading, navigation, and bathymetry data were examined for noise and gaps. Beam filters were used to reject data from the outer beams of the swaths. It should be noted that rejection does not mean deletion from the data set; soundings were simply flagged as 'rejected' and could be re-accepted if necessary.

After each individual line was examined and cleaned in CARIS' Swath Editor, the tide file was loaded, and the lines were merged. During merging, tide and draft corrections were applied. Subsets were then created in CARIS' Subset Editor mode, and adjacent overlapping lines of corrected bathymetry data were examined to identify any tidal busts, sound velocity errors, motion errors, or data gaps. Any residual noise in the data set was manually rejected at this time.

Once all cleaning and processing was completed, a seafloor elevation model was generated with CARIS' CUBE surface routine, thus depicting a mean seafloor. Final seafloor elevation grid size was 0.5 m and elevation values are referenced to mean lower low water (MLLW).

2.4.3 2018 Data Processing

Soundings were processed using CARIS HIPS software on Windows 7 workstations. CARIS was used to process, clean, and produce seafloor elevation models and finalized XYZ ASCII files.

Within CARIS HIPS, soundings were corrected for calibrated patch test results, vessel offsets, vessel motion, draft, sound velocity, and tide. Offsets established during the mobilization were used to correct bathymetry for differences between the transducer head and GPS antenna position. Offsets were entered in the Vessel Configuration File in CARIS HIPS to correct the bathymetry during processing.

Processed sound velocity profiles were used to correct bathymetry data for sound refraction, or ray bending. Sound velocity profiles were applied within CARIS. Daily processing used predicted tides and data was then GNSS post-processed in Inertial Explorer (IE) using a NOAA VDatum tide model.

2.5 Side Scan Sonar

2.5.1 Data Acquisition

R/V Fugro Enterprise. Side scan sonar data was acquired with an EdgeTech 4200 Side Scan Sonar System run at frequencies of 300 and 600 kHz, with a range of 50 meters per channel. The data were recorded in real-time with Chesapeake SonarWiz 6. Instrument positioning was monitored with an acoustic beacon utilizing the HiPAP USBL system. The beacon was mounted two meters forward of the sonar tow fish.

R/V Harry Miller (NY State Water Only). Side scan sonar data was acquired with an EdgeTech 4125 Side Scan Sonar System run at frequencies of 400 and 900 kHz. Sonar positioning was based on cable out from tow point position and offset and layback from GPS antenna position. EdgeTech Discovery Software was used to acquire the side scan sonar data. The data were then processed with Chesapeake Technology Inc.'s SonarWiz MAP software to produce a side scan sonar mosaic using the 900 kHz data.

R/V Fugro Discovery. Side scan sonar data was acquired with an EdgeTech 4200 Side Scan Sonar System run at frequencies of 300 and 600 kHz. Sonar positioning was based on USBL position. EdgeTech Discovery Software was used to acquire the side scan sonar data. The data were then processed with Chesapeake Technology Inc.'s SonarWiz 6 software to produce a side scan sonar mosaic using the 600 kHz data.

2.5.2 Data Processing

The acquired sonar data were written as *.xtf file format and imported into SonarWiz processing for bottom tracking and gain adjustments. During data processing, the individual sonar data files, each comprised of one sonar survey trackline, were first reviewed and corrected for towfish altitude. Navigation data for each file were edited for errant position fixes and velocity errors. Finally, the resulting files were processed to construct a side scan mosaic using the 600 and 900 kHz sonar data from the Fugro Enterprise and Harry Miller vessels, respectively, of the site. The system mosaics multiple overlapping survey lines using different blending options: direct overlay, shine through, or weighted selection. The mosaic provides a view of the seafloor in black and white similar to an aerial photograph. Final contrast adjustments, filtering and line editing were performed before the final mosaic image was produced. The complete mosaic image was geo-referenced to the local coordinate system for the final maps. Data processed aboard the Fugro Discovery was combined in a mosaic using the same methods as described above and the 600 kHz data was used for the mosaic.

2.6 Magnetometer

2.6.1 Data Acquisition

R/V Fugro Enterprise. A Geometrics G-882 Marine Magnetometer was utilized to accurately detect ferromagnetic material. The magnetometer recorded data at 100-gamma and 1,000-gamma scales at a sample rate of 2 Hz. The sonar and magnetometer systems were tethered to the same cable. Instrument positioning was monitored with an acoustic beacon utilizing the HiPAP USBL system. The beacon was mounted two meters forward of the sonar tow fish and the magnetometer was towed on a soft leader (10-13 meters behind the sonar tow fish). The magnetometer was instrumented with an altimeter and depth sensor and sensor altitudes above the seafloor were maintained between 4 and 6 meters.

R/V Harry Miller (NY State Water Only). A Marine Magnetics SeaSPY magnetometer (or equivalent) will be utilized to identify ferrous targets. The SeaSPY is an omni-directional pulsed Overhauser magnetometer that measures the ambient magnetic field using a specialized branch of nuclear Magnetic Resonance technology, applied specifically to hydrogen nuclei. The presence of a ferromagnetic object creates a local variation or anomaly in the magnetic field that are measured by the magnetometer. The shape of the

magnetic anomaly, intensity, and duration depend on the size of the ferrous object and distance from the sensor. The sensor altitude off the bottom will be digitally recorded from a factory installed altimeter located on the magnetometers. The SeaSPY is capable of recording up 10 times per second and with a sensitivity of 0.01nT (or 0.01 gamma). The magnetometer was instrumented with an altimeter and depth sensor and sensor altitudes above the seafloor were maintained between 2 and 6 meters.

R/V Fugro Discovery. Two Geometrics G-882 Marine Magnetometers in a frame-mounted transverse gradiometer (TVG) configuration were utilized to accurately detect ferromagnetic material. The magnetometer recorded data at 100-gamma and 1,000-gamma scales at a sample rate of 10 Hz. Instrument positioning was monitored with an acoustic beacon utilizing the HiPAP USBL system. The beacon was mounted two meters forward of the gradiometer frame. Both magnetometers were instrumented with an altimeter and depth sensor and sensor altitudes above the seafloor were maintained between 4 and 6 meters.

2.6.2 2017 Data Processing

The magnetometer gamma values are time tagged and recorded during the acquisition phase. The data was imported into Fugro processing software, Starfix VBA Proc. The gamma values are then married to positions calculated using the HiPAP position data. These files are then exported in a *.plr format to be utilized in downstream interpretation tools.

2.6.3 2018 Data Processing

Magnetometer data were processed using Geosoft Oasis Montaj software. The USBL navigation data were cleaned of significant spikes, and a rolling mean filter was applied to smooth the navigation track. The USBL positions were offset using measured distances from the beacon to each magnetometer.

Magnetic field data were cleaned of significant spikes and filtered using a series of beta-spline and non-linear filters, with decreasing width and tolerance, to calculate the background field. The background field was subtracted from the measured magnetic field to produce the magnetic residual. The residual was gridded for interpretation using a cell size of 0.5 m and a blanking distance of 2.5 m.

Targets were picked using the Blakely auto-picking algorithm, with a cut-off value of 2 nT/m. These were then manually reviewed to ensure that duplicates and targets below the peak-to-peak amplitude threshold of 5 nT were removed. Any targets that were missed by the Blakely algorithm were added. Target peak-to-peak amplitudes and wavelengths were measured for each target, and target positions were moved to the center of the dipole, where possible.

2.7 Sub-bottom Profiler

2.7.1 Data Acquisition

R/V Fugro Enterprise. The sub-bottom profiler system on the Fugro Enterprise is a four-transducer array system that uses Massa TR-1075D SBP transducers. The transducers are pole mounted in a 2 by-2 configuration, are deployed through a moonpool, are heave compensated, and operate in the 1 to 10 kHz

range. A 100ms record length was recorded. The system utilized an auto altitude tracker and implemented a 4-meter blanking. The topside processor was an EdgeTech 3200 that used to Edgetech's Discover software to acquire and process the data.

R/V Harry Miller (NY State Water Only). An EdgeTech 3200 SB-216s sub-bottom profiling (SBP) system was used for imaging the shallow subsurface conditions. The EdgeTech 3200 SBP is a wideband Frequency Modulated (FM) sub-bottom profiler utilizing EdgeTech's proprietary full spectrum CHIRP technology. The 3200 generates high-resolution images of the sub-bottom stratigraphy. The EdgeTech SB-216S sub-bottom profiler employs a swept frequency between 2 and 16 kHz with 8 cm vertical resolution.

The EdgeTech 3200 system included the SB-216S Towfish, the Model 3200 topside processor, and EdgeTech's Discover acquisition software. The system was triggered at an 8-Hz pulse rate with a swept frequency range between 2 to 15 kHz over 20 milliseconds (ms). All navigation information and sub-bottom data were time tagged and logged to a hard drive.

R/V Fugro Discovery. A Knudsen 3260 Chirp system mounted in a 4 by 4 Massa array were used aboard the Fugro Discovery to acquire sub-bottom profiler data in the SFWF. An operating frequency of 3.5 kHz was used for the SFWF survey and the data was recorded as full waveform data. Knudsen's Sounder Suite 4.05 software was used for acquisition.

2.7.2 Data Processing

R/V Fugro Enterprise. SBP data were loaded into Chesapeake SonarWiz software and reviewed to assess their quality. The files were then exported to *.sgy file formats and transferred to the interpretation group.

R/V Harry Miller. Chirp sub-bottom data processing included checking and de-spiking all navigation points using Starfix.Proc, an application for automated (batch) processing of navigation data. After the data are cleaned, verification was made that the corrected navigation files were referenced from the towed position (where the sub-bottom was towed from the vessel). The corrected navigation data were then inserted into a raw JSF file (Edgetech's Proprietary format) using Starfix.Gplot (Addxyz). The JSF files were replayed through the Discover software for TVG, swell filtering, and direct arrival removal. Following the data filtering, the JSF files were then converted to SEG-Y format and loaded into Kingdom Suite for interpretation.

The SBP data display an estimated vertical resolution of approximately 0.1 meters and typical penetration ranges from 3 meters to approximately 25 meters.

R/V Fugro Discovery. SBP data were written to .segy files during acquisition and then loaded into an IHS Kingdom 2016.1 project. There the data were checked and interpreted. SBP data from the 2018 survey achieved 10 to 15 meters of penetration in most areas and up to 25 meters in a few locations. The vertical resolution of the SBP data was approximately 10 centimeters.

2.8 MPS Sparker – Single Channel Geophysical Data

MPS sparker single channel data were collected to acquire high-resolution imaging of the shallow stratigraphy and provide an alternate data source in areas where the SBP signal penetration depth was limited due to geologic conditions. Based on past experience in the mid-Atlantic OCS and information from the desktop study, we identified a potential risk that the SBP signal penetration depth may be limited due to geologic conditions. The seafloor and shallow geology were anticipated to be comprised of dense sandy and gravelly deposits in some areas that we anticipated may reflect a large amount of the SBP seismic signal at the seafloor and also attenuate the signal, thus resulting in shallow SBP signal penetration. Therefore, we elected to use a sparker source due to its high frequency content and larger power signal power output that we were confident would be able to penetrate deep enough to meet marine archaeology resource survey objectives. The sparker source has a wide frequency band output with an upper bound (2.5 kHz) that is equivalent to SBP content.

2.8.1 Data Acquisition

R/V Fugro Enterprise. An Applied Acoustics Dura-Spark sub-bottom profiling system is a shallow seismic system with an 8-element, single channel streamer used to collect MPS sparker – single channel geophysical data. Data were acquired using a shot interval of 0.78 meters, record length of 200 milliseconds, 20 Hz sampling frequency, and the sparker fired at 300 joules. The source and streamer were towed approximately 50 cm below the sea surface and the source was towed at the midpoint of the streamer.

The equipment was calibrated along test lines with various towing geometry and power settings prior to commencing the survey. Based on tuning performed on the test lines, optimal parameters were selected for the acquisition and recording.

R/V Harry Miller (NY State Water Only). No MPS sparker single channel data were collected from the R/V Harry Miller.

R/V Fugro Discovery. A Geophysical Services Offshore (GSO) 360-Tip Sparker was used to collected high-resolution seismic data for the 2018 SFWF survey. The sparker used an Applied Acoustics Power Supply Unit (PSU) and a GSO 24-element single-channel streamer on the secondary (30-meter spaced) lines to compliment the sub-bottom profiler data in areas where the penetration was insufficient. For single-channel acquisition, the Sparker was fired at 750 joules at a 1.56 meter shot point interval.

The equipment was calibrated along test lines with various towing geometry and power settings prior to commencing the survey. Based on tuning performed on the test lines, optimal parameters were selected for the acquisition and recording.

2.8.2 2017 Data Processing

SBP data were loaded into Chesapeake SonarWiz software and reviewed to assess their quality during acquisition. The files were then exported to *.sgy file formats and transferred to the interpretation group. Amplitudes represent true amplitudes (data were not normalized).

2.8.3 2018 Data Processing

Once acquired, the raw single-channel data was brought into Geotrace 8.2 software for processing. Once in Geotrace, the seabed was picked automatically using an algorithm that picks the seafloor pulse in the data. Using the picked seabed, a swell filter was applied and a .segy file was output. If a line was determined to still be too noisy, a second swell filter was applied in Geotrace. The output .segy file then has auto gain control (AGC) applied. The data was loaded into Kingdom 2016.1 and checked for quality and navigation issues.

2.9 MPS Sparker – Multichannel Geophysical Data

2.9.1 2017 Data Acquisition

Medium penetration sparker (MPS) seismic data were collected using an Applied Acoustics Dura-Spark sub-bottom profiling system and a 32-channel streamer with a hydrophone group spacing of 1.56 meter.

MPS multichannel data were collected along the SFEC centerline and along 150-meter spaced primary and 500-meter spaced tie lines in the SFWF area.

The Starfix.NG Navigation software was used to determine the distance travelled over ground and trigger the source at a distance interval of 1.56 meters. Record length was 200 milliseconds to allow for 80 meters penetration beneath the seabed at the far offset and the sampling rate was 0.125 msec. Table 2.1 provides a summary of the acquisition parameters for the multichannel geophysical data collection.

The equipment was calibrated along test lines with various towing geometry and power settings. Quality checks performed on vessel following each completed trackline: acquisition parameters, brute stack with and without zoom, near trace gather with and without zoom, noise analysis display, noise and signal analysis after NMO, and streamer QC (depth and feather angle).

Table 2.1: MPS – 2017 Sparker Multichannel Acquisition Parameters

Streamer	
Active length	50 m
Number Seismic Groups	32
Maximum Fold	16
Group Spacing	1.5625 m
Group Length	1.5625 m
Streamer depth	0.5 m ± 0.25 m (front) 1.5 m ± 0.25 m (end)
Inline offset	5.06 m
Lateral offset	4.0 m
Source	Sparker 500 J,2.08 J per tip, 240 tips
Shot point interval	1.5625 m
Source Depth	0.30 m
Recording System	

Streamer	
Number of seismic channels	32
Sample interval	0.125 ms
Record length	200 ms
Format	SEG-D (demuxed)

R/V Harry Miller (NY State Water Only). No MPS sparker multichannel data were collected from the R/V Harry Miller.

2.9.2 2018 Data Acquisition

Medium penetration sparker (MPS) seismic data were collected using a Geophysical Surveys Offshore (GSO) 360-tip sub-bottom profiling system and a 48-channel streamer with a hydrophone group spacing of 1.56 meter. MPS multichannel data were collected along 150-meter spaced primary and 500-meter spaced tie lines in the SFWF area.

The QPS QINSy Navigation software was used to determine the distance travelled over ground and trigger the source at a distance interval of 1.56 meters. Record length was 200 milliseconds to allow for at least 80 meters of penetration beneath the seabed at the far offset and the sampling rate was 0.125 msec. Table 2.2 provides a summary of the acquisition parameters for the multichannel geophysical data collection.

Table 2.2: MPS – 2018 Sparker Multichannel Acquisition Parameters

Streamer	
Active length	75 m
Number Seismic Groups	48
Maximum Fold	24
Group Spacing	1.5625 m
Group Length	1.5625 m
Streamer depth	0.5 m ± 0.25 m (front) 1.5 m ± 0.25 m (end)
Inline offset	4.0 m
Lateral offset	4.0 m
Source	Sparker 1000 J,2.78 J per tip, 360 tips
Shot point interval	1.5625 m
Source Depth	0.30 m
Recording System	
Number of seismic channels	48
Sample interval	0.125 ms
Record length	200 ms
Format	SEG-D (demuxed)

2.9.3 MPS Sparker Multichannel Data Processing

In the first submission of this report after the 2017 multichannel acquisition, processed data were interpreted and used to create data examples for this report. Since then, the 2017 multichannel data has been reprocessed using the 2018 processing steps described below to enhance the data and to make it comparable with the 2018 multichannel data, thus processing described in Appendix F covers the processing of the 2018 data as well as the reprocessing of the 2017 data.

The initial data processing was carried out onboard the vessel, with the final processing taking place in Fugro's Aberdeen office, using Reveal. At each stage of the processing sequence the data quality was checked in accordance with the quality control work instructions, which comply with the ISO 9001:2000 standard. A QC of the data was conducted on-board so that any bad channels and noisy records that may have had an adverse effect on data quality could be identified immediately. Near trace gathers were used to interactively pick a direct arrival time and water bottom time for further use in processing. General data quality was assessed using Brute Stacks created with minimal processing. Shot analysis was conducted on a line by line basis along with checks for any inversions in trace polarity.

To begin, each sequence of raw field data was reformatted into a processing format. A bandpass filter (50 Hz/18 dB/Oct – 3500 Hz /18dB) was applied to the data in order to remove low frequency noise and instrument DC bias prior to processing. Note the spiked increase in low frequency noise below 100Hz on the raw spectrum displayed in Figure 2.1 in Appendix F.

There was significant multiple energy within the data, mainly associated with the water bottom. Surface related multiple elimination (SRME) uses the geometry of shot recording and water bottom interactive picking to estimate all possible multiples that can be generated by the surface. SRME was found to be effective in attenuating multiple energy while also preserving all primary events.

A 2D Kirchhoff post stack time migration was utilized to correctly position primary reflectors and collapse diffractions. This method maps traces using the double square root equation (see Appendix F). To improve quality and speed up imaging, the module oversamples the data, pre-filters traces for anti-aliasing, and batches of traces are migrated at the same time to optimize the run time. The data quality does not seem to be affected by this oversampling. The final stacks were the output in SEGY format.

The total processing work flow for this project was applied to all the lines as follows:

Steps	Description
1	Decode SEGD at 200ms Trace length and 0.125ms sample rate to internal format
2	Merge navigation and compute offset
3	Shot / Channel edits (if required)
4	Pick seabed guide
5	Apply low cut filter (50Hz – 18dB/Octave slope)
6	FXSwell (<120Hz) shot domain
7	FXSwell (<240Hz) chan domain

Steps	Description
8	Despike
9	FKfilter
10	Heave correction
11	Source receiver residual static corrections
12	Decon
13	SRME
14	Channel domain least squares matching and subtraction
15	Source & receiver side deghost
16	Additional linear denoise – Dip Attenuation in shot domain
17	Velocity analysis (500 m picking interval)
18	NMO with picked velocities
19	TrimStatics on NMO corrected CMPs
20	Stacking mute
21	T^2 spherical divergence compensation
22	Stack using 1/N compensation
23	Post stack migration
24	Zero phase & Whiten filter derivation and application (data derived)
25	Bandpass
26	Inverse Q compensation
27	Output to SEG-Y

The quality of the collected geophysical data was good and the data were adequate for interpretation. Vertical resolution of the MPS-Sparker datasets may be quantified by the limit of vertical separability (LS) of seismic reflectors (the bed thickness corresponding to minimum separation of two wavelets of a given bandwidth, still allowing for accurate seismic imaging), and is estimated by the one-quarter wavelength approximation ($\lambda/4$). Based on a power spectrum analysis, the MPS-Sparker multichannel dataset has a LS of about 0.4 meters, assuming a dominant frequency of 953 Hz and an average sediment velocity of 1,500 m/sec. Individual strata or other geologic features thinner than this limit may be detected but will not be resolved in true thickness or lateral extent.

3. REGIONAL SETTING

3.1 Physiographic Setting and Morphology

The project area is located in Rhode Island Sound, between Long Island, New York and Martha's Vineyard, on the Atlantic continental shelf. The continental shelf in this region is approximately 150 km wide and displays gentle southward slopes, generally less than 1 degree. Surrounding morphologic features include Long Island, Block Island, and Martha's Vineyard which represent the Harbor Hills and Ronkonkoma terminal moraines associated with late Wisconsin glaciation (Figure 3.1-1). Two prominent north-south trending paleo-drainages exist in the region along the eastern and western margins of Block Island (Figure 3.1-2).

The SFWF is located on Cox Ledge, along the Ronkonkoma moraine, approximately 30 km southeast of Block Island. The SFEC extends from the proposed OSS within the wind farm to the southwest. As the proposed route proceeds south of Block Island it crosses the two paleo-drainages. The two possible shore landings for the export cable are located at Beach Lane or Hither Hills, Long Island, New York.

3.2 Regional Geology

During the Quaternary period, glacial and post-glacial processes dramatically shaped the geology of the study area. Illinoian and Late Wisconsin glaciations are inferred to have advanced as far south as Martha's Vineyard, Nantucket Island, Block Island, and Long Island. End moraine deposits from the ice lobes on Nantucket-Martha's Vineyard-Block-Long Islands are inferred to represent the approximate southern limit of the Laurentide ice sheet during the Late Wisconsin approximately 23,000 years ago (ka) (Uchupi et al., 2001).

As the Laurentide glaciers began to melt, glacial outwash plains deposited a thick sequence of sandy deposits southward across Block and Rhode Island Sounds and the lease area. Pro-glacial lakes formed in front of the glaciers and behind the end moraines and deposited thick sequences of varved (laminated silt and fine sand) glacio-lacustrine deposits. Thick sequences of glacial lacustrine deposits have been mapped in Block and Rhode Island Sounds. Eventually, the sea level rose and transgressed across the continental shelf and inundated the area. During this transgression, fluvial-estuarine deposits covered much of the outwash plain and infilled low-lying areas. Transgressive fluvial deposits may be fine-grained or sandy.

As the shoreline transgressed across the Lease Area, the deposited environmental transitioned to a shallow marine environment similar to the shelf's current setting. In general, sandy sediments were deposited in higher energy environments and fine-grained deposits in quiet, deeper water areas.

3.3 Tectonic Setting and Seismicity

The study area is located along the Atlantic continental shelf and is considered to be a passive margin. The Atlantic continental shelf did not experience any major structural events during the Cenozoic (Sheridan, 1989). Most of the structural evolution in this region occurred during the Jurassic and earlier periods primarily in extensional and trans-tensional regimes. This region is not currently considered to be seismically active, although earthquakes can still occur in the northeastern region of the United States. Intraplate

earthquakes are generally believed to occur at or near pre-existing weaknesses formed from past geologic events. Based on a review of literature and historical seismicity (ANSS, 2017), there have been a total of 221 reported or recorded earthquakes that occurred within 200 km of the study area since 1783 (Figure 3.3-1). A majority of these earthquakes cluster along north-south trending faults across Connecticut, Rhode Island, and Massachusetts. The maximum magnitude earthquake observed in this area is 3.9 (M). Mapping presented by Reed et al. (2005) identified a north-south trending unclassified fault west of the SFWF area along the SFEC (Figure 3.3-1). Our 2017 survey data indicated that shallow deformation (faulting and folding) is present along the SFEC and within the SFWF. We inferred the mechanism related to the deformation to be related to be end moraine thrust sheets that formed during Late Wisconsin glacial advance. Deformation may also be related, in part, to glacial loading and isostatic rebound resulting from unloading following glacial retreat and we therefore interpret them not to be seismogenic. This is discussed further in Sections 4.2.1.3 and 5.2.2.

3.4 Regional Stratigraphy

Cenozoic-aged geologic units were generally deposited in marine or fluvial environments that formed in response to the cyclic rise and fall of the sea level. Cenozoic aged deposits generally thicken and dip gently seaward. During the Quaternary period, glacial and post-glacial processes dramatically shaped the geology of the area. Late Wisconsin glaciation is inferred to have into the study area. Moraine deposits on Martha's Vineyard, and extending to the southwest into the SFWF area, are inferred to represent the approximate southern limit of the Laurentide ice sheet approximately 20,000 years ago (ka) (Uchupi et al., 2001).

Bedrock. Consolidated sediments and crystalline bedrock in the region is inferred to be comprised of Paleozoic and Proterozoic rock units. Metasedimentary, metavolcanic and plutonic rocks of Proterzoic and early Paleozoic age outcrop along the southern Massachusetts coast and southeastern Rhode Island (Quinn, 1971).

Late Cretaceous/Tertiary age – Coastal Plain Deposits. Late Cretaceous to possibly Tertiary age deposits that represent the seaward extension of the Atlantic Coastal Plain are inferred to overlie basement bedrock. The Coastal Plain deposits are inferred to be primarily of marine origin with generally parallel beds that dip gently seaward. Limited information is available about the physical properties of the Coastal Plain deposits that underlie the survey area. However, they are inferred to be comprised of semi-consolidated to unconsolidated sand, silt, clay and gravel deposits. The elevation of the surface of the Coastal Plain deposits may be highly variable due to glacial and fluvial processes that occurred during the Tertiary-Pleistocene.

Pleistocene age – Glacial Drift and Post-Glacial Deposits. During the Pleistocene, glaciers advanced into the study area and then retreated as they melted. This depositional environment resulted in a wide variety of materials that were deposited. Glacial deposits underlying the site most likely include tills, moraine (stratified and unstratified), and/or outwash deposits (Veeger et. al, 1996). Seismically, the outwash or ice-contact stratified drift may be characterized by flay-lying to gently dipping internal reflectors and by acoustically well-layered sequences (O'Hara and Oldale, 1980). In contrast, some glacial moraine deposits may have a chaotic seismic character and with numerous parabolic diffractions associated with erratics.

Holocene age – Transgressive Deposits. In response to the melting of the Laurentide ice sheet, sea level rose and the shoreline transgressed across the continental shelf. As the emergent sound transitioned into a submerged environment, the Holocene age sediments were deposited onto the Late Pleistocene surface. The transgressive deposits typically exhibit a fining-upward sequence that commonly consist of gravel and basal sand deposits that transition into silt and clay. The materials may be interbedded or predominantly sand or fine-grained. They are generally thicker where they infill locations of former drainages incised into the Pleistocene surface.

Recent – Marine Deposits. After the sea level rose and submerged the sound, the area transitioned into the marine depositional environment that is present today. The marine deposits cover much of the seafloor and are inferred to be comprised of sand to silty sand where moderate to strong currents are present and silt to clay in deeper, quiet water areas.

3.5 Oceanographic Setting

The study area is located in the Mid-Atlantic Bight coastal oceanographic setting, which extends from Nantucket Shoals off southern New England southward to Cape Lookout off North Carolina. This region is influenced by cool waters flowing southward from New England and by the warm waters of the Gulf Stream, which flows northward farther offshore along the coast from Florida to North Carolina before heading northeasterly offshore of the Mid-Atlantic states (Stevenson et al. 2004). The Mid-Atlantic Bright is subject to occasional tropical storms during the summer and higher frequency nor'easter storms during the winter. Bottom currents associated with these storms can produce episodic sediment movement, especially during the winter storms (Dalyander et al, 2013). Ocean current direction within Rhode Island Sound can be variable with current directions generally ranging from southeast to northwest, north to south, and northwest to southeast. (Maracoos, 2017).

4. SOUTH FORK WIND FARM

4.1 Seafloor Conditions

This section summarizes the seafloor conditions within the SFWF area. Results are based on the interpretation of MBES bathymetry and backscatter, SSS, and seafloor slope.

4.1.1 Water Depth and Seafloor Morphology

The proposed SFWF area is located on Cox Ledge within the Rhode Island Sound and contains water depths that range from approximately El. -27 to -45 meters MLLW (Charts SFWF 2a and 2b). Cox Ledge represents a portion of a submarine ridge system that extends from Block Island to Martha's Vineyard Island and is inferred to represent the location of a terminal glacial moraine system. SFWF is located on the crest of the submarine ridge where the ridge axis is oriented in a west-northwest to east-southeast direction. The central region of the ridge is approximately 4 km wide and the seafloor elevation varies very little and is typically between El. -32 and -35 meters. The southern limb of the ridge deepens gently to approximately El. -36 meters at the southern limit of the SFWF. A shallow trough that parallels the ridge axis is present in the northeastern corner of SFWF area and represents the lowest surveyed seafloor elevation location. The trough is broad, approximately 1.5 km wide and the seafloor lowers from about El. -35 meters along the flank of the trough to about El. -45 meters at its deepest portion.

Seafloor slopes generally vary from less than 1 degree to 3 degrees (Chart SFWF 3). The eastern limb of the trough in the north-central perimeter of the SFWF was observed to have a seafloor slope of approximately 5 degrees (Chart SFWF 3 inset map). Areas with seafloor slopes greater than 10 degrees generally occur along the margins of megaripples and can exceed 30 degrees along the flanks of seafloor boulders (see red shaded features in Chart SFWF 3 inset map).

Table 4.1: Bedform Classification System

Name	Wavelength (meters)	Height (meters)
Sandwave	> 60	> 1.5
Megaripple	5 to 60	0.5 to 1.5
Ripple	< 5	< 0.5

4.1.2 Seafloor Features and Textures

Seafloor conditions in the SFWF area are characterized by the following types of features: seafloor and shallowly buried boulders, megaripples, and ripples (Table 4.1, and Figures 4.1-1 through 4.1-6). Interpreted seafloor features are shown on Chart SFWF 6. Seafloor features were interpreted from MBES bathymetry and backscatter, SSS, and seafloor slope.

The seafloor across the SFWF area is interpreted to be composed predominantly of coarse-grained sediment and possibly older glacial moraine sediments (sand, gravel, cobbles, and boulders), based on the highly variable MBES backscatter intensity and SSS reflectivity observed throughout the area (Charts SFWF 4 and 5).

4.1.2.1 Boulders

The SFWF is located on a terminal glacial moraine in an area we interpret as a high boulder hazard area (Fugro, 2016) (Figure 4.1-1). Sources for boulders typically include moraine deposits, glacial outwash, and glacial erratics transported by ice rafts in front of the glaciers and deposited when the ice rafts melt.

Seafloor and shallowly buried boulders with seafloor expression are observed throughout the SFWF area (Figure 4.1-2, Chart SFWF 6). Seafloor boulders were mapped from MBES bathymetry data using an in-house-developed GIS workflow to detect mound-like features with local positive relief using hydrologic drainage tools and local bathymetric position index (Lundblad et al., 2006). Mounds were digitized as polygons to calculate the approximate area of each boulder at the seafloor and converted to points at the centroid location of each polygon. Estimated diameter was calculated based on the assumption that the most common expression of a surface boulder is circular; however, we assume that this is an underestimate of the true diameter by approximately 30 percent. After correcting for this discrepancy, boulders generally measure 0.5 to 10 meters in diameter.

Bathymetric data resolution limits the ability to detect boulders smaller than about 0.5 meters in diameter. Many pixels identified as boulders were residual acquisition artifacts. The workflow identified many soundings along nadir and outer beams as peaks in the bathymetry. To eliminate the effect of noise, picks were manually removed by cross-checking against side scan sonar contacts. Some real boulders were removed during this process, and re-integrated to the dataset manually near the end of the project.

The highest density areas of seafloor boulders are located in the western and central portions of the study area and interpreted to represent similar Ronkonkoma moraine deposits observed onshore (Figure 4.1-3). Generally, the areas of fewer seafloor boulders correspond to the extents of mapped buried paleo-channels. It is inferred that these south-southeast to north-northwest trending paleo-channels eroded and down-cut into the glacial moraine deposit and removed boulders in that area. Buried paleo-channels are discussed further in Section 4.2.1.2. Generally, surficial boulders rise less than 1 meter to approximately 3.5 meters above the seafloor, with an unknown amount of boulder remaining buried. Using the automated boulder picking process described above, the length and width of the seafloor expression of each surface boulder can be calculated. Slope angles along the flanks of seafloor boulders range from about 3 to over 30 degrees, and scour around the boulders can be observed at some locations. Megaripples were also observed in the area and may mask boulders that underlie the megaripples.

Seafloor and subsurface boulders may create difficult conditions for driving piles. If a pile is overstressed during the driving process when it encounters a boulder it may bend and/or warp the pile tip and may increase the possibility of progressive collapse due to initial pile damage during installation.

4.1.2.2 Megaripples, Ripples, and Seafloor Scour

Megaripples were identified across the SFWF area (Figure 4.1-4; and Charts SFWF 4 and 5). Megaripples are migrating depositional features, generally understood to form from sediments that are transported and redeposited by bottom currents (Wynn and Stow, 2002). Megaripple crests generally trend north – south to northeast – southwest (Figure 4.1-4, Charts SFWF 4 and 5). The megaripples are observed up to 0.5 meters

high (trough-to-peak) and display a wavelength (peak-to-peak) ranging from approximately 20 meters to 50 meters or longer in various areas. Lower MBES backscatter intensity (blues and greens) indicate that the megaripples are most likely fine-grained sands overlain on denser reworked glacial till and/or glacial moraine (yellows and reds) (Figure 4.1-4 and Chart SFWF 5).

Ripples were identified in the relative lows between megaripple bodies (Figure 4.1-5 and Chart SFWF 5). The ripples are approximately 2 to 5 cm high (trough-to-peak) and display a wavelength (peak-to-peak) ranging from approximately 1 to 2 meters. The crests of the ripples display highly variable trends. The mobility of the ripples could not be estimated with the current data.

We infer that the megaripples and ripples may represent mobile seafloor sediments (Figure 4.1-6). Actively migrating megaripples could affect cable burial protection. Ripple bedforms observed in the SFWF area are not anticipated to pose a hazard to wind turbine and OSS foundations or cables.

4.1.2.3 Potential Seafloor Mobility

A seabed mobility assessment was performed to interpret bedform migration rate and direction using multibeam data collected in the fall of 2017, the fall of 2018, and available data from a 2020 survey of the SFWF. During this time period, 8 named tropical storms/hurricanes and 12 nor'easters passed through the New England region.

The mobility assessment was conducted by comparing bedform positions interpreted from the 2017, 2018, and 2020 surveys. Interpretation was conducted in GIS using sun-illuminated, hillshaded relief seafloor renderings of the multibeam data. Toe positions of the lee flank (steeper side) of bedforms were interpreted and used to estimate movement since they are the most distinct feature of the bedforms. Crestlines of the bedforms at this site predominantly are rounded, less distinct and deemed difficult to define accurately. Multiple measurements were made on each bedform since the bedforms did not migrate uniformly (e.g. some portions of the bedform may have migrated further than other portions). Measurements were generally made equally spaced along the bedform and selected at locations deemed to represent the maximum and minimum offsets between positions. Approximately 2 to 5 measurements were made on each bedform. The average of the measurements for each bedform were used to estimate the migration distance. Measurements were made in a direction perpendicular to the toe line and interpreted to represent the net migration direction. Bearings of those measurement lines were calculated, and the average of the bearing measurements was used to estimate net migration direction of each bedform. Net migration rates were estimated by dividing the average migration distance by the time span between the midpoint of the three surveys which is approximately 2.8 years in this case.

One-hundred eighty-nine (189) representative bedforms were evaluated in this study (Figures 4.1-7a-I and 4.1-7a-ii). The bedforms can be categorized in two general classes. Ripple-scale bedforms with typical heights of 0.1 to 0.3 meters were observed to exhibit the most change. The average rate of movement between 2017 and 2020 for 81 features evaluated is 0.9 m/yr (one standard deviation is 0.3 m/yr) and is in the north to northwest direction (Figure 4.1-7a-i). The ripple features are observed to be localized with the study area.

Slightly larger features considered to be ripples, megaripples and sand accumulation areas were also evaluated but are not interpreted to exhibit a net migration pattern of movement. Many features did not exhibit discernable movement while others appeared to exhibit re-shaping. The edges of the features may have exhibited some movement but not in a migratory pattern. This was more common for the sand accumulation features which are larger sand bodies with generally flat tops and an irregularly shaped perimeter to them. These features are not anticipated to pose a hazard to the cables and foundations.

Interpretive results are deemed to represent natural processes occurring as opposed to a horizontal offset between datasets. Interpreted migration distances of up to 3.6 meters were identified and were variable in magnitude. Migration directions of ripples exhibited some variability but were predominantly in the north to northwest direction (Figure 4.1-7a-i). Interpreted migration directions are consistent with bedform morphology (migrated toward the lee-side of the bedform; Figure 4.1-7a-i). Variation of migration direction and magnitude appears to be related to natural processes and not a horizontal (systematic) shift between multibeam datasets. Boulders, assumed to be stationary between surveys, were used to assess if assess potential offsets between surveys. Boulder positions in the 2018 and 2020 data were judged to be generally about 0.2 to 0.5 meter of the 2017 positions. To facilitate the analysis, the 2017 and 2020 data sets were adjusted to reference a common position, and this was verified using boulder positions. This apparent difference is less than most of the measured bedform movements.

Figure 4.1-8 illustrates the predicted migration of a megaripple over a 15-year period based on an average migration rate of 1.7 meters/year. The bedform profile shown in this figure is from the 2018 survey. The dashed line illustrates the approximate position where this feature would be after 15 years. The greatest amount of lowering of the seafloor as the bedform migrated north would be on the stoss side of the bedform (Figure 4.1-8). This lowering of the seafloor over this 30-meter section is estimated to be 0.2 to 0.3 meters which is deemed to not to be a significant amount and is a highly localized effect.

We also observed changes in the small ripple orientations in the two surveys. The ripples were approximately 0.02 to 0.08 meters tall. The lower left inset of Figure 4.1-7a shows examples of changes from east-west crest lines to northeast-southwest orientations of the ripple crestlines between the 2017 and 2018 surveys, respectively. The changes in ripple orientations are not anticipated to represent an increase in hazard to the future cables.

4.1.2.4 Potential Scour

Scour is the process of erosion that occurs when a structure is introduced into the water column and causes localized amplification of shear stresses at the water/sediment interface when currents interact with a structure. Amplified shear stresses may result in transportation of sediments away from the turbine foundation which could lead to scour if sediments are not being supplied (replenished) at an equal or greater rate.

The SFWF is not located in an area typically known to experience strong currents (e.g. tidal inlet or estuary mouth, area where land masses or islands constrict flow of water, tidal sand banks, etc.). However, the Mid-Atlantic and New England regions in the Atlantic OCS are prone to storm events that are considered to

be capable of transporting seafloor sediments and potentially causing scour and observations of seafloor conditions support this notion.

We observe some scour features around boulders in the SFWF area which suggests that the potential for scour may exist at this site. Seafloor megaripple and ripple geometries also suggest that bottom currents exist periodically that are capable of transporting sediments. Storm events are a likely forcing mechanism that drives sediment transport in this region and may be capable of developing scour at a WTG or OSS foundations. Scour hazard is commonly mitigated through the use of scour protection if scour is perceived to be a critical issue for the structure.

4.1.2.5 Potential Slope Instability Features

We reviewed seafloor morphology to identify features that may represent potential slope instability areas. The detailed bathymetric elevation model, seafloor slope gradient, side scan sonar data, and seismic data were reviewed to identify features such as scarps, scalloped terrain the may represent head scarps, slump bodies and blocks, debris flows, other diagnostic slope failure features, and oversteepened areas that may be potentially unstable. Our observations of the data indicate seafloor in the SFWF area is relatively flat, does not contain oversteepened slopes and did not exhibit slope failure features. The steepest seafloor slope area was identified in the northeast corner of the SFWF where the flank on the eastern limb of the trough is approximately 5 degrees (refer to inset map in Chart SFWF 3. We recommend avoiding placing structures sensitive to uneven ground or jacking-up a liftboat in this area.

4.1.2.6 Anthropogenic Features

During the desktop study, we reviewed publicly available information to evaluate the presence of anthropogenic features in the SFWF area. One shipwreck was identified on NOAA charts and in the Automated Wreck and Obstruction Information System (AWOIS) which is also maintained by NOAA. However, the location of the shipwreck differs by about 60 meters between the NOAA nautical chart and AWOIS positions. Therefore, we present both positions for the shipwreck on Charts 2 and 5. No other anthropogenic features were identified in the SFWF area during our desktop study.

Fifty-nine (59) side scan sonar contacts were noted within the SFWF survey area. Four of the sonar contacts (Sonar Contact Nos. 28, 30, 32, 112) that represent possible shipwrecks are located in the maximum work area. One other sonar contact, No. 218, is another potential shipwreck, but lies outside of the maximum work area. Sonar contact 32 is located 600 meters south of the NOAA/AWOIS charted wreck and may represent its accurate location. We did not identify sonar contacts (or magnetic anomalies) at the location of the NOAA/AWOIS charted shipwreck.

Most of the interpreted sonar contacts are located in the central and western portion of the SFWF area and are most likely fishing-related debris (e.g. traps, pots, or lost lines) (Appendix C). Features were picked based on appearance in the side scan sonar data. Items fitting the size and shape of known types of fishing gear, such as crab pots, or having an unnatural shape with straight edges or 90-degree angles were interpreted to be anthropogenic in origin. These features were compared against interpreted boulder fields to assess whether they have a geologic explanation or origin.

A total of 4,005 magnetic anomalies were detected within the SFWF area, although only 3,964 are within the maximum work area. Appendix B provides a summary of the magnetic anomalies and indicates side scan sonar contacts the anomalies are inferred to correspond to. Figure 4.3-1 presents example of where magnetic anomalies are inferred to be related to geologic features and trends. We note that a majority of the anomalies appear to be associated with inferred geologic features or trends. We observed magnetic anomalies that appear to be directly associated with a distinct boulder, or anomalies in areas with scattered boulders, and anomalies that correlate with shallowly buried paleochannels. We note the boulders, cobbles, and gravel inferred to be transported to the SFWF area by glaciers and meltwater streams are believed to be sourced primarily from Rhode Island and western Massachusetts where bedrock units scoured by glaciers are known to contain magnetite and iron rich minerals. The summary table in Appendix B indicates if the anomalies are inferred to be related to geologic features or trends.

No other potential anthropogenic objects were reported or identified within the SFWF survey area.

4.2 Subsurface Conditions

This section describes shallow subsurface geologic features and stratigraphy interpreted across the SFWF area. All depths and thicknesses in this section are based on an assumed constant sediment velocity of 1,600 m/s and a water column velocity of 1,500 m/s.

4.2.1 Subsurface Features

Subsurface geologic features interpreted to be present in the SFWF area include: potential buried boulders, buried paleo-channels, and areas of deformation. The Site Characterization Report will present the ground model for the SFWF that includes the interpreted top and bottom of the geologic units and inferred geotechnical properties of the materials in the geologic units.

4.2.1.1 Shallow Buried Boulders

The possibility of buried boulders exists across the SFWF and within the interpreted glacial units (between the seafloor/base of inferred Pleistocene paleo-channels and the top of the coastal plain. The density and distribution of boulders observed on the seafloor is inferred to be representative of the boulder quantity in the glacial units in the subsurface.

The Site Characterization Report will present the ground model for the SFWF that includes the interpreted top and bottom of the geologic units inferred to contain boulders.

Buried boulders may pose a hazard to piled foundation systems during pile driving or trenching equipment during installation of cables. Near-surface and subsurface boulders do present some unfavorable conditions for monopile foundations being considered for the WTGs.

4.2.1.2 Shallow Buried Channels

Large buried paleo-channels are common within the SFWF area. Three major inferred Pleistocene paleo-channel areas were mapped which trend south-southeast to north-northwest, are continuous across the

study area, sinuous to straight, and trough shaped. Where present, these channels range in thickness from less than 1 meter to approximately 31 meters. Channel infill material is most likely reworked glacial outwash deposits (sands and gravels) with interbedded clays. The extent of the mapped Pleistocene paleo-channels are presented on Chart SFWF 7 as 1st generation channels. Locally, these channels are inferred to have been eroded and infilled by Holocene channels, which range in thickness from less than 1 meter to approximately 13 meters. Holocene channel infill material is most likely sandy or interbedded sands and clays. The extent of the mapped Holocene channels is presented on Chart SFWF 8 as 2nd generation channels. Channel infill material properties are discussed in the Site Characterization Report.

4.2.1.3 Shallow Deformation (Faults and Folds)

Areas of subsurface glacial deformation, consisting of faults and folds are inferred to be related to compressional stresses associated with Wisconsin Age glacial advancement were identified in localized areas of the SFWF area. Their formation likely represents end moraine thrust sheets. Deformation observed generally includes tight folding, and generally is located below the buried Pleistocene paleo-channels (Figure 4.2-1). Deformation identified the SFWF area survey data are not inferred to offset or deform Holocene age sediments and are not believed to be active or associated with the identified regional seismicity (discussed in Section 3.3) (Figure 4.2-1).

Minor faults are inferred to be present but individual faults were not mappable within the SFWF area due to the complexity of the geology. However, the general axes of northwest-southeast trending folds were mapped and are presented on Chart SFWF 7.

Shallow faulting and folding is not inferred to be an active process in the SFWF and is not anticipated to be a hazard for WTGs, OSS, or inter-array cables. However, subsurface material properties may vary significantly over short horizontal or vertical distances in shallow deformation areas and planning and design studies should take this into consideration.

4.2.1.4 Shallow Gas

Shallow gas is typically identified by low-impedance, high-amplitude anomalies in 2D seismic data. No evidence was found in the geophysical data to suggest the presence of seeps/expulsion or gas hydrates. One area (approximately 100 meters by 300 meters) was identified at the southern margin of the MWA where shallow gas was identified in the SBP data. However, that location is outside the area where WTG and cables are planned to be installed and is not considered to be a hazard to the SFWF or SFEC (Chart SFWF 8).

4.2.2 Stratigraphy and Inferred Soils

4.2.2.1 Recent Marine Deposits

Recent marine deposits cover much of the seafloor and based on the variable MBES backscatter intensity are inferred to be comprised of fine-grained sand to silty sand (seafloor sand waves and minor ripples). The recent marine sands overlie inferred Holocene and Pleistocene channel deposits and Pleistocene glacial

moraine and outwash deposits. Generally, the recent marine deposits in the SBP data are low to moderate amplitude and display little to no obvious internal bedding (Figure 4.2-2 and Charts SFWF 8 and 9).

4.2.2.2 Holocene and Pleistocene Channel Infill Deposits

Below the recent marine deposits are widespread paleo-channels inferred to be of Holocene and Pleistocene ages. The base of the Holocene and Pleistocene channels are mapped on Figure 4.2-2 and Charts SFWF 8 and 9. The Holocene channels generally display low amplitude, discontinuous reflectors indicative of fine-grained deposits. The Pleistocene channels are highly variable. These channels display low to moderate amplitude, semi-continuous to chaotic reflectors indicative of coarser-grained fluvial deposits and/or reworked glacial outwash. The Pleistocene channel fill may have highly variable geotechnical soil properties.

4.2.2.3 Glacial Moraine and/or Glacial Outwash Deposits

Glacial drift deposits are present across the SFWF area. Glacial drift includes moraine, outwash, and till. During the Pleistocene, glaciers advanced into the study area and then retreated as they melted. This depositional environmental resulted in a wide variety of sediments that were deposited. Glacial deposits at the SFWF most likely include moraine (stratified and unstratified), till, and/or outwash deposits. These are present in the subsurface between the seafloor/base of Pleistocene channels and the top of Coastal Plain deposits.

In the study area the glacial drift is divided into upper and lower units (Figure 4.2-2). The upper unit (seafloor/base of Pleistocene channels to pink horizon) is inferred to represent Late Wisconsin moraine sediments. This unit displays semi-continuous to chaotic, low to moderate amplitude reflectors with numerous parabolic diffractions associated with boulders and erratics. The lower glacial unit (pink horizon to top of coastal plain) displays continuous to discontinuous, generally low amplitude reflectors. This unit also contains parabolic diffractions associated with boulders and erratics. The lower glacial unit is inferred to represent Illinoian outwash sediments or possibly a lower Wisconsin marine deposit (Moss, 2014). Imbricated reflectors, folding and faulting are also present in both glacial units.

4.2.2.4 Coastal Plain Deposits

The deepest horizon mapped in the SFWF is interpreted to represent the Late Cretaceous to possibly Tertiary age Coastal Plain (orange horizon) (Figure 4.2-2 and Charts SFWF 8 and 9). Reflectors within the coastal plain are generally low to moderate amplitude and flat to gently dipping. The Coastal Plain deposits are inferred to be primarily of marine origin and are inferred to be comprised of semi-consolidated to unconsolidated sand, silt, clay and local gravel deposits.

4.3 South Fork Wind Farm and Inter-Array Cables Conceptual Layout Discussion

The proposed SFWF will include up to 15 WTGs, OSS, and an inter-array cable network. Monopile foundations are currently being considered for the WTG locations. Based on review of the survey data (primarily MBES and SSS) during the initial line runs, we observed a large quantity of boulders in the western portion of the SFWF. Based on this preliminary information, Fugro and Deepwater Wind elected to focus

survey efforts on identifying areas where surface boulders were less frequent and may present viable areas to place wind turbines and cables. This resulted in shifting the SFWF area approximately 1.8 km to the east where north-south oriented corridors with few boulders were identified that may represent potential areas where turbines and cables may be place. Chart SFWF 6 presents conceptual locations where wind turbines and inter-array cables may be positioned to avoid surface boulders. However, we note there are surface and subsurface features identified and discussed in this report that should be taken into consideration when designing the structures and planning their installation. For example, buried channels and mapped megaripple bedforms are interpreted to be present at some of the conceptual WTG and OSS locations and surface boulders were mapped within approximately 200 meters of the conceptual WTG, OSS and inter-array cables locations presented on Chart 6.

5. SOUTH FORK WIND FARM EXPORT CABLE

This section of the report assesses seafloor and shallow subsurface conditions that may affect the installation and operation of the SFEC. The SFEC will connect the SFWF with the Long Island Power Authority (LIPA) on Long Island, New York. The SFEC will be located within Federal and New York State waters and will pass through OCS Blocks 6002 and 6003, Block Island Area; Blocks 6031–6033 and 6080–6081, New York Area; and Blocks 7013–7015, 7056–7063, and 7101–7106, Providence Area (Charts SFEC-1–14).

5.1 Seafloor Conditions

This section summarizes the seafloor conditions within the SFWFEC area. Results are based on the interpretation of MBES bathymetry and backscatter, SSS, and seafloor slope.

5.1.1 Water Depth and Seafloor Morphology

Surveyed seafloor elevation in the SFEC corridor range from approximately El. -2 meters MLLW near the south shore of Long Island, New York, to El. -50 meters MLLW within the northwest portion of Block 7062, Providence Area (Charts SFEC-1 through SFEC-14). Seafloor slopes generally vary from less than 1 degree to 3 degrees. Areas with seafloor slopes greater than 10 degrees generally occur along the margins of megaripples and can exceed 30 degrees along the flanks of seafloor boulders. Steep seafloor slopes and scarps are not present along the SFEC route.

5.1.2 Seafloor Features and Textures

Seafloor conditions in the SFWFEC area are characterized by the following types of features: seafloor boulders, megaripples, and ripples (Figures 4.2-1 through 4.2-6 and Chart SFWF 6). Interpreted seafloor features are shown on Charts SFEC-1 through SFEC-14. Seafloor features were interpreted from MBES bathymetry and backscatter, SSS, and seafloor slope.

The seafloor across the SFEC corridor is interpreted to be composed predominantly of coarse-grained deposits (e.g. sand) with variable amounts of gravel, cobbles and boulders. Seafloor sediments are inferred to be predominantly related to marine or glacial drift (e.g. outwash, moraine, etc.) deposits.

5.1.2.1 Boulders

The eastern end of the SFWF export corridor is located on a terminal glacial moraine in a high boulder hazard area (Fugro, 2016) (Figure 4.2-1).

Fourteen boulders ranging in average size from 1 to 5 meters were mapped within approximately 10 meters of the proposed cable route. These boulders may constrain the routing and installation of the planned export cable. Caution is advised when working in their vicinity.

5.1.2.2 Megaripples and Ripples

Megaripple to ripple scale-size bedforms are interpreted to be present in the SFEC (Table 4.1). Megaripples and ripples may represent migrating depositional features, generally understood to form from sediments

that are transported and redeposited by bottom currents (Wynn and Stow, 2002). Megaripple crests generally trend northeast to southwest (Figure 4.1-4, 4.1-6 and 4.1-7c). The megaripples are predominantly up to 0.5 meters high (trough-to-peak) and display a wavelength (peak-to-peak) ranging from approximately 20 meters to 50 meters.

Several megaripples were observed to be approximately 0.7 meters tall. Near the approach to shore, sorted bedforms orientated perpendicular to shore were up to 1.5 meters tall and have wavelengths of 500 to 800 meters. Bedform heights appear to increase slightly as water depth decreases. Figure 4.1-7d provides a summary of bedforms and water depths along the SFEC.

Net bedform migration direction and rate were interpreted by comparing bedform feature positions from the 2017 and 2020 multibeam surveys. During the time period evaluated, 8 named tropical storms/hurricanes and 12 nor'easters passed through the New England region. The interpretation methodology follows the same general procedure as described in Section 4.1.2.3. This assessment is based on available multibeam data from a SFEC project survey that was currently underway. Extent of available 2020 survey data is shown on Figures 4.1-7b and 4.1-7c. Figure 4.1-7b presents the interpreted net migration direction and rate for analyzed bedforms. Figure 4.1-7c presents the interpreted toe features of the bedforms. Figure 4.1-7d presents a summary of the net migration direction, rate and size of bedforms observed.

The surveys were conducted approximately 2.8 years apart (based on the mid-date of each survey). 360 features were interpreted to exhibit movement. Average rates of movement generally increased as water depth decreased (or increased closer to shore). Several sections along the SFEC did not have bedforms that exhibited discernable movement and those bedforms are considered immobile or have very low mobility. Figure 4.1-7d summarizes the mobility areas along the SFEC.

Migration rates generally increased from offshore to the shoreline. Notable areas with mobility include:

- KP 33+00 to 429+00 exhibited areas with migration rates of about 0.7 m/yr to 0.8 m/yr. Bedform heights were predominantly between 0.1 to 0.7 meters tall. Migration direction is predominantly in the northwest direction. Substantial sections along this portion of the SFEC did not contain bedforms deemed to be mobile.

- KP 562+00 to 577+00 exhibited areas with migration rates of approximately 1.4 m/yr and with bedform heights approximately 0.15 to 0.4 meters tall. Migration direction is predominantly in the north-northwest direction. This area corresponds to a bypass around a boulder outcrop offshore from the inlet to Block Island Sound.

- KP 687+00 to 860+00 exhibited areas with the second highest rate of movement that is approximately 2.3 m/yr and in the west-northwest direction. Migration direction is parallel to Long Island shoreline and is likely influenced by along-shore currents and wave patterns. Bedforms were typically between 0.1 and 0.7 meters tall.

- KP 805+00 to 917+00 exhibited sorted bedforms that appear to have migrated in a shore-parallel direction up to 3 m/yr. The bedforms are oriented perpendicular to shoreline, are approximately 0.5 to 1.5 meters tall with wavelengths of 500 to 800 meters (Figure 4.1-7d). Although these features appear to exhibit the highest mobility rates, due to the long wavelength relative to their height, their migration would likely not lead to cable exposure and only limited burial protection reduction and are deemed to be a low to very low potential hazard for cables.

- KP 964+00 to 967+50 and 976+50 to 980+00, bedforms 0.1 to 0.5 meters tall were interpreted to migrate parallel to shoreline at an average rate of 3.0 m/yr. Migration direction suggests they are largely influenced along-shore currents.

- Inshore of KP 982+00 and shallower than 11 meters of water, the seafloor appears to be exhibiting variable changes in elevation due to localized erosion and accretionary (depositional) processes. Elevation changes were typically between +/- 0.5 meter but localized erosion of up to 1 meter in one area was interpreted where the 2020 and 2017 surveys overlapped. Complex oceanographic processes related to waves, alongshore currents, storm events and seasonable variations are likely the reason for the complex pattern of erosion and accretion in this area.

Net migration directions are predominantly to the northwest for the area between the Lease and south of Block Island. In the area south of the Block Island Sound inlet, migration direction appears to be in a northerly direction. For the area offshore Long Island, migration direction appears to be predominantly parallel to shoreline and is likely influenced by shore-parallel currents and wave patterns (Figure 4.1-1b).

One-hundred and twenty-four (124) additional features evaluated did not exhibit any discernable movement (they are either stable or exhibit very low rates of movement). An approximately 15-km long section of route in the east-west section south of Block Island largely exhibited no discernable bedform changes (upper panel in Figure 4.1-7b).

Interpretive results are deemed to represent natural processes occurring as opposed to a horizontal offset between datasets. Approximately 2 to 5 measurements were made on each bedform identified to exhibit a change. For features interpreted to exhibit movement, approximately 1,845 measurements were conducted, and the average distance was 3.1 meters (1 standard deviation was 2.6 meters and the maximum measurement was 7.7 meters) which corresponds to a migration rate of 1.1 m/yr. Migration directions exhibited some variability but were predominantly in the northwest direction (Figure 4.1-7b). Interpreted migration directions are consistent with bedform morphology (migrated toward the lee-side of the bedform; Figure 4.1-7b). Variation of migration direction and magnitude appears to be related to natural processes and not a horizontal (systematic) shift between multibeam datasets. Boulders, assumed to be stationary between surveys, were used to assess for potential offsets between surveys. Prior to conducting the interpretation, the 2020 and 2017 data were adjusted reference a common horizontal relative reference system. This resulted in boulder positions that are generally within 0.1 to 0.3 meter of each other. The average offset value for each bedform interpreted to have migrated exceeded 0.3 meter.

The presence of megaripples and ripples indicate possible mobile seafloor sediments (Figure 4.1-6). Most bedforms evaluated in the SFEC are smaller than 0.5 meters tall and a few were interpreted to be up to 0.7 meters tall. South of Long Island, a few areas with sorted bedforms up to 1.5 meter tall were identified but exhibited no discernable movement to some movement. Seafloor slump blocks/sediments were not observed in the along the SFEC.

5.1.2.3 Potential Scour

Scour is the process of erosion that occurs when a structure is introduced into the water column and causes localized amplification of shear stresses at the water/sediment interface when currents interact with a structure. Amplified shear stresses may result in transportation of sediments away from the turbine foundation which could lead to scour if sediments are not being supplied (replenished) at an equal or greater rate. Wind turbine and OSS foundations, and cable scour protection (e.g. rock, concrete mats, etc.) are examples of structures introduced to the water column that may lead to scour. If scour develops at wind turbine or OSS foundations, the scour process can lead to cable spans between exit points form the structure (e.g. J-tubes) and the seafloor. As described in Section 4.1.2.3, bottom currents capable of transporting sediments and creating scour at foundations may occur in the SFWF and SFEC areas.

As described in Section 4.1.2.3, the SFEC and SFWF are not located in an area typically known to experience strong currents (e.g. tidal inlet or estuary mouth, area where land masses or islands constrict flow of water, tidal sand banks, etc.). During desktop phase of the SFEC routing study, strong currents and potential for scour and erosion were taken into consideration near areas such as the Block Island and Rhode Island Sound channels, but the proposed export cable route is well south of the deeper tidally influenced channels. Although the potential scour hazard is not anticipated to be high for the SFEC, scour hazards should be considered.

5.1.2.4 Potential Slope Instability Features

During the desktop study and export cable route planning phase of this program, the preferred cable route was selected to avoid areas with steep slopes and potentially unstable ground. We reviewed the 2017 route survey data and did observe potential features or conditions that indicate the presence of potentially unstable slopes along the route or that could impact the cable.

5.1.2.5 Seafloor Subsidence or Isostatic Adjustment

We understand that isostatic adjustment may have occurred and may still be occurring at very low rates in this area. As the Late Wisconsin glacier advanced southward, the load of the glacier depression the earth's crust and caused it to lower beneath the ice and flex upward in front of the ice sheet. As the glacier melted and retreated, thus reducing the load on the crust, isostatic adjustment occurred, and the crust rebounded upward. Studies onshore of New York estimate that ground at the ice contact margin (terminal moraine limit) is rebounding (rising) at a rate of approximately 3 to 9 cm/century (0.3 to 0.9 mm/yr; Mainville and Craymer, 2005). Over a 25-year period, this would equate to approximately 7.5 to 23 mm and would likely not have a significant effect on the SFWF.

During our literature search, we did not identify other processes (e.g. groundwater withdrawal, oil/gas withdrawal, mining activities) that could result in seafloor subsidence that could affect the SFWF. Additionally, we did not observe subsidence or isostatic rebound features in the 2017 data deemed to affect the SFWF.

5.1.2.6 Anthropogenic Features

Eleven contacts were mapped from the side scan sonar data within the export corridor and are displayed on the included study charts in green. Of those eleven, none were noted within ten meters of the proposed export cable route. Apart from the above-mentioned side scan sonar contacts, the seafloor within the study area appears to be clear of anthropogenic debris. However, undetected small articles of debris may still exist within the study area. Please see the route-specific assessment located within Section 6 of this report for more detailed information. The locations of all mapped side scan sonar contacts are displayed and listed on the included study charts as well as the Side Scan Sonar Contact Table located within Appendix C. The locations of all side scan sonar targets should be reviewed and considered prior to lease development activity, and additional caution should be exercised when working in the vicinity of these features.

Of the 5,208 magnetic anomalies identified in the survey, 1,203 were located along the export cable route. Of those 1,203 anomalies, 1,116 were unidentified and are displayed on the included study charts in red. Fifty-three of the unidentified anomalies were noted within ten meters of the proposed export cable route. Based on the interpreted data, the “as-built” location of Transatlantic Cable TAT-6 where it crosses the proposed export cable route was found to be offset by over 500 meters (Figure 6.2-3). Seventeen unidentified magnetic anomalies were noted within New York state waters. All other unidentified anomalies are presumed to represent articles of ferrous debris that are either buried below the mudline or too small to be acoustically detected and are associated with prior construction activities or passing ship traffic. While these anomalies are unlikely to present a hazard or constraint to cable installation or operation, additional caution should be considered with working in the vicinity of these features. Anthropogenic infrastructure reported to be within the SFWFEC area include telecommunications cables as shown in the Table 5.1.

Table 5.1: Reported Existing Telecommunication Cables

Name	Owner	Status
TAT-6 Transatlantic Cable	AT&T	Inactive
CB-1 Transatlantic Cable	Cable Co.	Inactive
TAT-12 Transatlantic Cable	AT&T	Active
TAT-5 Transatlantic Cable	AT&T	Inactive
TAT-10 Transatlantic Cable	AT&T	Inactive
FA-1 Transatlantic Cable	Global Cloud Xchange	Active
TAT12/13 Interlink Cable	AT&T	Active

The proposed SFEC route will cross the cables listed above as show in the Table 5.2.

Table 5.2: Cable Infrastructure Crossings

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
TAT-6 Transatlantic Cable	7014	308,768.59	4,547,758.54	92+22.78
CB-1 Transatlantic Cable	7014	308,096.47	4,547,157.00	101+66.76
TAT-12 Transatlantic Cable	7062	298,770.42	4,545,090.97	205+87.89
TAT-5 Transatlantic Cable	7061	294,400.17	4,545,142.34	249+58.44
TAT-10 Transatlantic Cable	7060	291,407.22	4,545,177.52	279+51.61
FA-1 Transatlantic Cable	7057	276,943.55	4,543,443.09	426+87.59
TAT12/13 Interlink Cable	7105	265,925.11	4,538,491.35	554+40.37

All known infrastructure is displayed on Charts SFEC-1 through SFEC-15, where applicable. Please see the route-specific assessment located within Section 5.3 of this report for more detailed information.

5.2 Subsurface Conditions

5.2.1 Shallow Buried Channels

Buried paleo-channels were noted at multiple locations within the SFEC corridor (Charts SFEC-1 through SFEC-15). Where present, these channels range in thickness from less than 1 meter to approximately 30 meters. Channel infill material is most likely reworked glacial outwash deposits (sands and gravels) with interbedded clays. The extent of the mapped Pleistocene paleo-channels are presented on the charts as 1st generation channels. Locally, these channels were eroded and infilled by inferred Holocene channels, which range in thickness from less than 1 meter to approximately 20 meters. Holocene channel infill material is most likely interbedded fine-grained sands and clays. The extent of the mapped Holocene channels are presented on the include study charts as 2nd generation channels.

5.2.2 Shallow Deformation (Faults and Folds)

Areas of subsurface glacial deformation, consisting of faults and folds are inferred to be related to compressional stresses associated with Wisconsin Age glacial advancement were identified in localized areas along the SFEC. Additionally, mapping performed by Reed et al. (2005) identified a north-south trending unclassified fault between KP 30 and 38 (Figure 3.3-1 and 5.2-1a). The unclassified fault was not

identified in the available geophysical data, although subsurface folding was observed in the general area. Generally, deformation in the area includes tight folding, and is located below the buried Pleistocene paleo-channels (Figures 5.2-1a and 5.2-1b). The subsurface deformation identified along the SFEC survey are not inferred to offset or deform Holocene age sediments and are not believed to be active or associated with the identified regional seismicity (discussed further in Section 3.3).

Shallow faulting and folding is not inferred to be an active process along the SFEC and is not anticipated to the export cables.

5.2.3 Shallow Gas

Shallow gas is typically identified by low-impedance, high-amplitude anomalies in 2D seismic data. No evidence was found in the geophysical data to suggest the presence of seeps/expulsion, shallow gas or gas hydrates.

5.3 Layout Discussion

This route-specific assessment and detailed discussion of the export cable route is divided into sub-sections (Sections 5.3.1, 5.3.2, etc.) below that correspond to the match lines annotated on the accompanying Archaeological, Engineering, and Hazard Charts (Charts SFEC-1 through SFEC–14).

Specifically, the proposed submarine export cable will originate at the proposed OSS within NK19-07 (X = 317,489.12, Y = 4,549,449.28, Longitude = 71° 10’ 21.163”W, Latitude = 41° 4’ 32.993”N) and extend to a transition vault at the preferred landfall location at Beach Lane, Long Island, New York (X = 227,548.68, Y = 4,535,837.27, Longitude = 21° 14’ 8.880”W, Latitude = 40° 55’ 41.770”N). The route is calculated to be 98,946.36 meters and the general direction of the route is to the west-southwest. Curve information for the proposed route is annotated on the accompanying charts with station values every 100 meters.

5.3.1 Kilometer Post 0+00 to 45+95.49

Water Depth and Seafloor Slope: Water depth ranges from -33.7 meters MLLW at KP 27+60 to -38.1 meters MLLW at KP 41+82 (Figure 5.3-1). Seafloor slope angles range from near-horizontal to 1.0 degree (Figure 5.3-1). Ripples to megaripples are present along this section of the cable route both in the wind farm area and along the cable route to the west. Bedform heights are approximately 0.1 to 0.7 meters. Few to no bedforms exhibited discernable movements between KP 0+00 and 33+00. Bedforms 0.1 to 0.7 meters tall between KP 33+00 to 80+00 were interpreted to migrate an average rate of 0.7 m/yr (Figure 4.1-7d).

Refer to Section 1.7 for a discussion of KP references utilized in this report. The offset values listed in Table 5.3 and 5.4 are based on Version 4 of the ECR. No side scan sonar contacts were noted within 10 meters of the route between KP 0+00 and KP 45+95.49. Four magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.3: Magnetometer Anomalies within 10 meters of Proposed Route (0+00 to 45+95.49)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post[a]
537	7015	317,099	4,549,580	5.2m	8+86.88
445	7015	316,279	4,549,056	0.5m	18+80.57
1427	7015	314,159	4,547,910	0.5m	35+04.57
1733	7015	314,885	4,548,224	8.5m	43+05.77

[a] = Kilometer post values are based on Cable Route (Version 4)

Scattered boulders are present in the area. Seven boulders were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.4: Boulders within 10 meters of Proposed Route (0+00 to 45+95.49)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post[a]
1590	7015	315,188.40	4,548,402.66	0.12m	2 - 5 m	7.9m	31+33.44
1591	7015	315,182.50	4,548,394.36	0.12m	2 - 5 m	3.6m	31+42.65
3182	7015	314,741.02	4,548,142.68	0.11m	2 - 5 m	0.5m	36+50.58
3201	7015	314,744.02	4,548,138.18	0.21m	2 - 5 m	6.1m	36+50.11
3496	7015	314,516.35	4,548,014.91	0.12m	> 5 m	2.3m	39+09.00
3723	7015	314,080.74	4,547,903.68	1.33m	> 5 m	9.3m	43+07.26
3736	7015	313,848.02	4,547,899.18	0.12m	2 - 5 m	2.5m	45+95.00

[a] = Kilometer post values are based on Cable Route (Version 4)

5.3.2 Kilometer Post 45+95.49 to 100+43.79

Water Depth and Seafloor Slope: Water depth ranges from -37.3 meters MLLW at KP 45+96 to -42.9 meters MLLW at KP 99+40 (Figures 5.3-1 and 5.3-2). Seafloor slope angles range from near-horizontal to 3.4 degrees (Figures 5.3-1 and 5.3-2). Ripples to megaripples are present in the survey corridor. Bedform heights range from approximately 0.1 to 0.7 meters and wavelengths of approximately 30 to 60 meters. Large sand accumulation bodies or isolated megaripples with approximate heights of 0.3 to 0.7 meters are present between approximately KP 80+00 and 100+00. Bedforms 0.3 to 0.7 meters were interpreted to migrate an average rate of 0.8 m/yr (Figure 4.1-7d).

No side scan sonar contacts were noted within 10 meters of the route between KP 45+95.49 and KP 100+43.79.

Transatlantic cable “TAT-6” was found to deviate from it reported “as-built” position by over 500 meters (Figure 5.3-3). The proposed cable will cross one existing cable based on its “as-found” location as shown in the following table:

Table 5.5: Proposed Cable Route Infrastructure Crossings (45+95.49 to 100+43.79)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
TAT-6 Transatlantic Cable	7014	308,768.59	4,547,758.54	92+22.78

Scattered boulders are present in the survey corridor. Two boulders were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.6: Boulders within 10 meters of Proposed Route (45+95.49 to 100+43.79)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
2316	7014	311,481.02	4,547,833.18	0.11m	2–5m	6.9m	64+97.47
2417	7014	310,683.02	4,547,767.18	0.12m	2–5m	9.5m	73+04.83

5.3.3 Kilometer Post 100+43.79 to 138+20.60

Water Depth and Seafloor Slope: Water depth ranges from -42.0 meters MLLW at KP 105+56 to -43.2 meters MLLW at KP 123+82 (Figure 5.3-2). Seafloor slope angles range from near-horizontal to 1.3 degrees (Figure5.3-2). No side scan sonar contacts were noted within 10 meters of the route between KP 100+43.79 and KP 138+20.60. Ripples to megaripples are present in the survey corridor between approximately KP 100+00 and 110+00. Large sand accumulation bodies or isolated megaripples with approximate heights of 0.3 to 0.7 meters are present between approximately KP 100+00 and 110+00 and are interpreted to migrate an average of 0.8 m/yr (Figure 4.1-7d). Small ripples less than 0.1m tall are present between approximate KP 110+ 00 and 138+20 and the is section is largely devoid of larger bedforms.

The proposed cable will cross one existing cable as shown in the following table (Figure 5.3-3):

Table 5.7: Proposed Cable Route Infrastructure Crossings (100+43.79 to 138+20.60)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
CB-1 Transatlantic Cable	7014	308,096.47	4,547,157.00	101+66.76

Scattered boulders are present in the survey corridor. One boulder was mapped within 10 meters of the proposed route, and is shown in the following table:

Table 5.8: Boulders within 10 meters of Proposed Route (100+43.79 to 138+20.60)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
3113	7013	307,846.69	4,546,715.84	0.18m	2–5m	9.9m	106+73.04

5.3.4 Kilometer Post 138+20.60 to 227+90.16

Water Depth and Seafloor Slope: Water depth ranges from -40.8 meters MLLW at KP 205+28 to -50.1 meters MLLW at KP 197+45 (Figures 5.3-2 and 5.3-4). Seafloor slope angles range from near-horizontal to 2.4 degrees (Figures 5.3-2 and 5.3-4). A bathymetric low exists between KP 180+00 and 200+10 where the seafloor deepens from approximately -42 to -50 meters. The bathymetric low is present above an interpreted buried channel. No side scan sonar contacts were noted within 10 meters of the route between KP 138+20.60 and KP 227+90.16. A few isolated sand accumulation features are interpreted to be present in the area. They

exhibit local relief on their edges of approximately 0.1 to 0.7 meters. This section of the corridor is largely devoid of bedform features taller than approximately 0.1 meters. Bedforms in this section predominantly did not exhibit discernable movement and is located in the deepest water along the route.

Potential structural deformation or folding of sediments in subsurface between approximate KP 155+00 and 165+00. Deformed layers are interpreted to be at least 7 meters deep. Interpreted Holocene age deposits are not interpreted to be deformed and deformation zone is interpreted to be inactive. Deformation is not anticipated to adversely affect installation or operation of the cable.

The proposed cable will cross one existing cable as shown in the following table (Figure 5.3-5):

Table 5.9: Proposed Cable Route Infrastructure Crossings (138+20.60 to 227+90.16)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
TAT-12 Transatlantic Cable	7062	298,770.42	4,545,090.97	205+87.89

Seven magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.10: Magnetometer Anomalies within 10 meters of Proposed Route (138+20.60 to 227+90.16)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
3548	7063	304,714.30	4,545,020.10	1.0m	146+43.59
3549	7063	304,616.00	4,545,021.40	0.9m	147+41.90
3550	7063	304,564.20	4,545,021.80	1.1m	147+93.70
3551	7063	304,467.70	4,545,022.40	1.6m	148+90.20
3552	7063	303,443.20	4,545,031.80	4.3m	159+14.74
3553	7062	303,055.00	4,545,038.10	2.5m	163+02.99
3554	7062	301,457.40	4,545,054.60	4.8m	179+00.67

One boulder was mapped within 10 meters of the proposed route, and is shown in the following table:

Table 5.11: Boulders within 10 meters of Proposed Route (138+20.60 to 227+90.16)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
1546	7063	303,593.45	4,545,039.56	0.18m	2–5m	6.2m	157+64.62

5.3.5 Kilometer Post 227+90.16 to 317+91.27

Water Depth and Seafloor Slope: Water depth ranges from -43.3 meters MLLW at KP 228+47 to -48.3 meters MLLW at KP 270+39 (Figures 5.3-4 and 5.3-6). Seafloor slope angles range from near-horizontal to 2.2 degrees (Figures 5.3-4 and 5.3-6). Ripples to megaripples approximately 0.2 to 0.6 meters tall are interpreted to be present from approximate KP 265+45 to KP 317+91.27. Ripple-scale bedforms 0.1 to 0.4 meters tall between KP 312+00 and 317+91.27 were interpreted to migrate an average of 0.8 m/yr (Figure 4.1-7d). Elsewhere in this section of the corridor bedforms predominantly exhibited no discernable movement. This section of the route contains some of the deepest water along the route.

No side scan sonar contacts were noted within 10 meters of the route between KP 227+90.16 and KP 317+91.27.

The proposed cable will cross two existing cables as shown in the following table (Figure 5.3-7 and 5.3-8):

Table 5.12: Proposed Cable Route Infrastructure Crossings (227+90.16 to 317+91.27)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
TAT-5 Transatlantic Cable	7061	294,400.17	4,545,142.34	249+58.44
TAT-10 Transatlantic Cable	7060	291,407.22	4,545,177.52	279+51.61

Two magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.13: Magnetometer Anomalies within 10 meters of Proposed Route (227+90.16 to 317+91.27)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
1919	7061	294,834.30	4,545,139.80	2.6m	245+24.31
3546	7059	288,378.90	4,545,206.30	6.8m	309+80.05

5.3.6 Kilometer Post 317+91.27 to 383+29.16

Water Depth and Seafloor Slope: Water depth ranges from -39.5 meters MLLW at KP 374+19 to -46.8 meters MLLW at KP 319+62 (Figure 5.3-6). Seafloor slope angles range from near-horizontal to 3.4 degrees (Figure 5.3-6). Ripples to megaripples approximately 0.1 to 0.5 meters tall are observed locally along this section of the cable route and were interpreted to migrate an average rate of 0.8 m/yr.

No side scan sonar contacts were noted within 10 meters of the route between KP 317+91.27 and KP 383+29.16.

One magnetometer anomaly representing possible debris was mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.14: Magnetometer Anomalies within 10 meters of Proposed Route (317+91.27 to 383+29.16)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
3547	7058	283,616.90	4,545,259.10	10.0m	357+42.34

5.3.7 Kilometer Post 383+29.16 to 474+19.20

Water Depth and Seafloor Slope: Water depth ranges from -39.6 meters MLLW at KP 397+77 to -47.0 meters MLLW at KP 432+85 (Figures 5.3-6 and 5.3-9). Seafloor slope angles range from near-horizontal to 2.3 degrees (Figures 5.3-6 and 5.3-9). Ripples to megaripples approximately 0.1 to 0.5 meters tall are interpreted to be present from KP 383+25 to KP 409+70 and from KP 422+58 to KP 428+25 and interpreted to migrate an average rate of 0.8 m/yr.

No side scan sonar contacts were noted within 10 meters of the route between KP 383+29.16 and KP 474+19.20.

The proposed cable will cross one existing cable as shown in the following table (Figure 5.3-10):

Table 5.15: Proposed Cable Route Infrastructure Crossings (383+29.16 to 474+19.20)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
FA-1 Transatlantic Cable	7057	276,943.55	4,543,443.09	426+87.59

Two magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.16: Magnetometer Anomalies within 10 meters of Proposed Route (383+29.16 to 474+19.20)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
126	7056	273,196.90	4,542,305.00	8.0m	466+03.07
3531	7056	282,684.90	4,541,967.40	0.8m	472+18.20

5.3.8 Kilometer Post 474+19.20 to 530+02.63

Water Depth and Seafloor Slope: Water depth ranges from -43.3 meters MLLW at KP 475+31 to -47.9 meters MLLW at KP 497+21 (Figures 5.3-9 and 5.3-11). Seafloor slope angles range from near-horizontal to 1.7 degrees (Figures 5.3-9 and 5.3-11). Localized seafloor relief related to edges of sand accumulation features and ripple scale bedforms approximately 0.1 to 0.4 meters tall are interpreted to be present in this area. Bedforms in this section predominantly exhibited no discernable movement and this section has some of the deepest water along the route.

No side scan sonar contacts were noted within 10 meters of the route between KP 474+19.20 and KP 530+02.63.

Two magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.17: Magnetometer Anomalies within 10 meters of Proposed Route (474+19.20 to 530+02.63)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
3532	7056	272,161.80	4,541,563.20	1.6m	478+79.27
3533	7106	270,525.20	4,540,288.20	0.8m	499+53.89

Scattered boulders are observed in the survey corridor. One boulder was mapped within 10 meters of the proposed route, and is shown in the following table:

Table 5.18: Boulders within 10 meters of Proposed Route (474+19.20 to 530+02.63)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
71	7106	270,721.31	4,540,427.02	0.26m	2–5m	9.4m	497+13.33

5.3.9 Kilometer Post 530+02.63 to 585+11.29

Water Depth and Seafloor Slope: Water depth ranges from -34.6 meters MLLW at KP 585+11 to -45.4 meters MLLW at KP 532+32 (Figure 5.3-11). Seafloor slope angles range from near-horizontal to 1.2 degrees (Figure 5.3-11). Localized and isolated ripple scale bedforms approximately 0.1 to 0.4 meters tall are interpreted to be present in this area. Bedforms between KP 562+00 and 577+00, approximately 0.15 to 0.4 meters, were interpreted to migrate an average of 1.4 m/yr. Elsewhere in this section of the route, bedforms were predominantly interpreted to exhibit no discernable movement.

No side scan sonar contacts were noted within 10 meters of the route between KP 530+02.63 and KP 585+11.29.

The proposed cable will cross one existing cable as shown in the following table (Figure 5.3-12):

Table 5.19: Proposed Cable Route Infrastructure Crossings (530+02.63 to 585+11.29)

Name	Block	X-Coordinate	Y-Coordinate	Kilometer Post
TAT12/13 Interlink Cable	7105	265,925.11	4,538,491.35	554+40.37

Sixteen magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.20: Magnetometer Anomalies within 10 meters of Proposed Route (530+02.63 to 585+11.29)

Anomaly ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
1479	7105	267,424.80	4,537,985.90	7.6m	538+25.48
1466	7105	267,420.90	4,537,983.80	8.8m	538+29.71
1508	7105	267,316.30	4,537,981.90	6.5m	539+33.13
1454	7105	266,997.20	4,537,982.80	7.5m	542+53.13
1531	7105	266,592.90	4,538,157.10	0.5m	546+93.60
1532	7105	266,325.00	4,538,288.60	2.0m	549+92.03
3527	7105	266,318.30	4,538,285.00	8.2m	549+96.40
1473	7105	265,250.50	4,538,834.30	4.2m	561+97.14
3529	7105	264,830.70	4,539,030.20	8.8m	566+60.22
1447	7104	264,574.30	4,539,175.90	6.5m	569+54.72
1471	7104	264,568.70	4,539,171.20	0.2m	569+57.62
1446	7104	264,470.30	4,539,227.60	6.1m	570+70.86
1445	7104	264,367.10	4,539,278.80	5.7m	571+86.07
1444	7104	264,341.00	4,539,292.30	6.0m	572+15.45
1443	7104	264,284.70	4,539,322.40	9.3m	572+78.78
3530	7104	264,224.70	4,539,322.10	6.2m	573+15.60

Scattered boulders are present in the survey corridor. One boulder was mapped within 10 meters of the proposed route, and is shown in the following table:

Table 5.21: Boulders within 10 meters of Proposed Route (530+02.63 to 585+11.29)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
407	7105	265,170.04	4,538,868.43	0.15m	2–5m	0.5m	562+84.81

5.3.10 Kilometer Post 585+11.29 to 677+41.58

Water Depth and Seafloor Slope: Water depth ranges from -30.6 meters MLLW at KP 677+28 to -34.6 meters MLLW at KP 585+17 (Figures 5.3-11 and 5.3-13). Seafloor slope angles range from near-horizontal to 0.5 degree (Figures 5.3-11 and 5.3-13). Seafloor is largely devoid of bedforms in this area. Small ripples less than 0.1 meters tall are observed in side scan sonar data. Bedforms were predominantly interpreted to exhibit no discernable movement.

No side scan sonar contacts were noted within 10 meters of the route between KP 585+11.29 and KP 677+41.58.

Three magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.22: Magnetometer Anomalies within 10 meters of Proposed Route (585+11.29 to 677+41.58)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
348	7103	256,939.80	4,537,323.00	0.2m	649+38.36
2013	7103	256,252.20	4,537,114.50	1.5m	656+56.88
351	7103	255,983.10	4,537,024.80	5.8m	659+40.44

Two boulders were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.23: Boulders within 10 meters of Proposed Route (565+11.29 to 677+41.58)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
565	7103	256,067.89	4,537,049.54	0.18m	1–2m	5.9m	658+51.88
572	7103	255,848.39	4,536,987.04	0.19m	1–2m	1.6m	660+80.07

5.3.11 Kilometer Post 677+41.58 to 767+79.45

Water Depth and Seafloor Slope: Water depth ranges from -28.3 meters MLLW at KP 762+38 to -30.7 meters MLLW at KP 689+68 (Figures 5.3-13 and 5.3-14). Seafloor slope angles range from near-horizontal to 3.0 degrees (Figures 5.3-13 and 5.3-14). Ripples to megaripples approximately 0.2 to 0.7 meters tall are present from KP 717+88 to KP 722+19 and KP 723+98 to KP 740+66 and were interpreted to migrate an average rate of 2.3 m/yr.

No side scan sonar contacts were noted within 10 meters of the route between KP 677+41.58 and KP 767+79.45. From KP 757+60.00 to KP 767+79.45, the route parallels a possible existing, inactive cable (Charts SFEC-11 through SFEC-14, Figure 5.3-15). The cable is projected to be offset approximately 80 meters to the south except where it encroaches onto the planned route at KP 766+80.00. The projected

location is based on interpreted discontinuous exposed segments and may not accurately reflect its true position. Caution is advised when working in close proximity of this feature.

Seven magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.24: Magnetometer Anomalies within 10 meters of Proposed Route (677+41.58 to 767+79.45)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
2015	6003	251,107.90	4,535,547.60	4.3m	710+34.52
2016	6003	251,044.60	4,535,531.40	7.3m	710+99.79
2017	6003	250,980.20	4,535,512.90	8.4m	711+66.78
2018	6003	250,631.50	4,535,402.30	4.4m	715+32.58
2019	6003	250,490.70	4,535,354.30	0.4m	716+81.26
2020	6002	249,142.50	4,534,942.80	0.5m	730+90.86
2021	6033	246,853.40	4,534,239.10	5.4m	754+85.68

5.3.12 Kilometer Post 767+79.45 to 857+34.71

Water Depth and Seafloor Slope: Water depth ranges from -27.3 meters MLLW at KP 776+85 to -31.8 meters MLLW at KP 854+80 (Figures 5.3-14 and 5.3-16). Seafloor slope angles range from near-horizontal to 2.3 degrees (Figures 5.3-14 and 5.3-16). Ripples to megaripples approximately 0.2 to 0.7 meters tall are present from KP 775+60 and KP 788+50 and KP 816+10 to KP 857+34 and were interpreted to migrate an average rate of 2.3 m/yr.

No side scan sonar contacts were noted within 10 meters of the route between KP 767+79.45 and KP 857+34.71. From KP 767+79.45 to KP 857+34.71, the route parallels a possible existing, inactive cable (Charts SFEC-11 through SFEC-14, Figure 5.3-17). The projected offset of the interpreted cable position varies from eighty meters down to zero where it crosses the planned route at KP 838+20. The projected location is based on interpreted discontinuous exposed segments and may not accurately reflect its true position. Caution is advised when working in close proximity of this feature.

Three magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.25: Magnetometer Anomalies within 10 meters of Proposed Route (767+79.45 to 857+34.71)

ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
2022	6032	241,860.80	4,532,712.70	8.1m	807+06.40
2023	6032	241,609.60	4,532,636.90	7.3m	809+68.79
2024	6081	238,736.90	4,531,766.60	1.2m	839+70.42

Two boulders were mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.26: Boulders within 10 meters of Proposed Route (767+79.45 to 857+34.71)

ID	Block	X-Coordinate	Y-Coordinate	Height	Class	Distance	Kilometer Post
620	6032	242,069.55	4,532,782.22	0.46m	2–5m	1.6m	804+86.21
621	6032	242,019.98	4,532,773.82	0.12m	1–2m	4.8m	805+36.08

5.3.13 Kilometer Post 857+34.71 to 924+76.26

Water Depth and Seafloor Slope: Water depth ranges from -28.2 meters MLLW at KP 924+76 to -32.1 meters MLLW at KP 878+25 (Figures 5.3-16 and 5.3-18). Ripples to megaripples approximately 0.1 to 0.5 meters tall are present from KP 857+34.71 to KP 860+44.77 and KP 877+34.51 to KP 910+28.82. Large sorted bedforms oriented perpendicular to shoreline were observed to be 0.5 to 1.5 meters tall with wavelengths of 500 to 800 meters between KP 895+00 and 917+00. Those larger bedforms are oriented perpendicular to the shoreline and likely related to alongshore current and wave patterns. Some of the large sorted bedforms were interpreted migration rates of up to 3 m/yr and a few exhibited no discernable movement. Interpreted migration direction is parallel to the shoreline. Seafloor slope angles range from near-horizontal to 2.5 degrees (Figures 5.3-16 and 5.3-18).

No side scan sonar contacts were noted within 10 meters of the route between KP 857+34.71 and KP 924+76.26. From KP 857+34.71 to KP 914+00.00, the route parallels a possible existing, inactive cable (Charts SFEC-11 through SFEC-14, Figure 5.3-19). The projected offset of the interpreted cable position varies from fifty meters down to zero where potentially intersects the planned route at KP 914+00.00. The projected location is based on interpreted discontinuous exposed segments and may not accurately reflect its true position. Caution is advised when working in close proximity of this feature.

One magnetometer anomaly representing possible debris was mapped within 10 meters of the proposed route, and are shown in the following table:

Table 5.27: Magnetometer Anomalies within 10 meters of Proposed Route (857+34.71 to 924+76.26)

Anomaly ID	Block	X-Coordinate	Y-Coordinate	Distance	Kilometer Post
2038	6080	231,168.90	4,529,791.20	2.0m	918+75.44

5.3.14 Kilometer Post 924+76.26 to 989+46.36

Water Depth and Seafloor Slope: Measured water depth ranges from -14.2 meters MLLW at KP 976+77 to -28.2 meters MLLW at KP 924+81 (Figure 5.3-18). Ripples to megaripples approximately 0.1 to 0.6 meters tall are present from KP 935+97.90 to KP 967+54.80. The larger bedforms are oriented perpendicular to the shoreline and likely related to alongshore current and wave patterns. With the exception of two localized areas between 924+76.26 and 981+00, the large bedforms may represent sorted bedforms or relict features and did not exhibit discernable movement. From KP 964+00 to 967+50 and 976+50 to 980+00, bedforms 0.1 to 0.5 meters tall were interpreted to migrate parallel to shoreline at an average rate of 3.0 m/yr. Migration direction suggests they are largely influenced along-shore currents.

Inshore of approximate KP 981+00 (area shallower than about 11 meters of water), the seafloor conditions appear to be influenced by a variety of oceanographic processes that may include waves, currents, storm events and seasonal variations. Bedforms are approximately 0.1 to 0.5 meters tall but do not appear to exhibit discernable migratory directions. Instead, seafloor elevation changes appear to reflect erosion and

depositional (accretionary) processes related to reworking of sediment in response to the complex oceanographic processes. A comparison between the 2017 and 2020 surveys revealed localized areas where erosion or accretion occurred (inset map in Figure 4.1-7b-ii). Localized erosion areas were interpreted to exhibit changes typically between 0.25 and 0.5 meters, however, localized areas off the cable route were interpreted to be up to 1 meter. Accretion areas where the seafloor elevation increased typically 0.25 to 0.5 meters were also interpreted in this area.

Seafloor slope angles range from near-horizontal to 2.1 degrees (Figure 5.3-18). Beyond KP 987+00, no MBES data exists due to shallow water survey constraints. No side scan sonar contacts or magnetic anomalies were noted within 10 meters of the route between KP 924+76.26 and KP 989+46.36.

At KP 931+97.44, the proposed cable route crosses into New York State waters.

6. SUMMARY

Table 6.1 lists seafloor and subsurface features, the potential hazard associated with the features, and the potential impact associated with each feature/hazard that should be considered when planning development across the SFWF and SFEC.

Table 6.1 SFWF and SFEC Geohazard Summary

Feature	Potential Hazard/Constraint	Potential Impact on Wind Farm Development
Seafloor Features		
Seafloor Slopes	Steep slopes, boulders, megaripples, erosional scarps	Destabilization may occur if structure or installation vessel if positioned on the edge of steep slope or boulder. Steep slopes are only present and associated with boulders in SFWF area. A small area with seafloor slope of 5 degrees was identified in the north-central perimeter of the SFWF. Seafloor generally appears stable with no observed past slope failures in SFWF and SFEC corridor. Seafloor slump blocks/sediments, slope failures, debris flows were not observed in the SFWF, SFEC corridor or location that may impact the SFWF/SFEC.
Boulders	Steep slopes Variable geotechnical conditions Stronger material	Cable/pile installation issues due to stronger material. May create difficult conditions for driving piles.
Sediment Waves (Megaripples up to 0.5 meters tall)	Steep slopes Reduction in cable burial protection or exposure of cables	Mobile megaripples may result in change (increase or decrease) of cable burial protection. Actively migrating features may bury a feature or cause sand flooding of J-tube or result in lowering of seafloor.
Seafloor Ripples	Variable soil conditions Possible mobile seafloor sediments	Mobile ripples may result in change in cable burial protection Burial of facilities if active sed. wave deposition (e.g. sand flooding of J-tube).
Seafloor Scour	Scour can impact foundation performance, vibrational response of structure, or lead to exposed or spanning cables	Bottom currents capable of removing seafloor soils and generating scour at turbine and OSS locations could be present. Scour effects where cable protection (e.g. rock dump, concrete mats, etc.) are used should be considered, as appropriate.
Expulsion Features/Gas Seeps	Not anticipated to be present	Not observed or expected to impact the study area.
Ice Scour	Ice scour or gouge can damage cables or impart forces onto foundations	Not observed or expected to impact the SFEC or SFWF. SFEC is anticipated to be buried >5 meters in the HDD interval where water depth is less than 10 meters and the area where ice may accumulate along the coast. However, due to the cable burial via HDD, ice gouge is not anticipated to be a hazard

Feature	Potential Hazard/Constraint	Potential Impact on Wind Farm Development
Anthropogenic Features		
Sonar Contacts/Magnetic Anomalies	Unknown debris, utilities, shipwrecks, hard-bottom areas, UXO/MEC	Sensitive areas that may require avoidance. SFEC will cross active cables.
Subsurface Conditions		
Buried Channels	Variable geotechnical conditions	Installation vessels should consider potential for punch-through or soft channel infill materials. Cables: Channel infill may contain soft materials that could affect stability of cable installation equipment. Channel infill may contain lag gravels that represent harder ground conditions.
Buried Boulders	Variable geotechnical conditions Stronger material/buried obstruction	May present a buried obstruction for cable installation equipment. Report identifies areas where they may be encountered in cable zones May create difficult conditions for driving piles
Shallow Deformation (Faults and Folds)	Variable geotechnical conditions	Faulting and folding is not inferred to be an active process in the SFWF, although installation issues could be possible due to shallow stronger sediments or thicker boulder deposits where folding has occurred.
Shallow Gas/Gas Hydrates	Not anticipated to be present	Not observed or expected to impact the study area
Seafloor Subsidence	Isostatic rebound following glacial retreat has been document onshore at the ice contact margin. Fluid withdrawal/mining and other activities related to subsidence are not anticipated to be present	Isostatic rebound rates are anticipated be very small during the life cycle of the SFWF/SFEC and are not expected to impact the study area.

6.1 South Fork Wind Farm

- The seafloor across the SFWF is interpreted to be composed of predominantly of coarse-grained sediment, and possibly older glacial moraine sediments. MBES backscatter intensity, and SSS reflectivity, seafloor sediment sampling indicate that the sediments are predominantly fine-grained sand and medium-grained sand with variable amounts of gravel, cobbles, and boulders observed throughout the area.
- Seafloor and subsurface boulders are present across the SFWF and may create difficult conditions for driving piles and providing safe locations for lift-boats to set legs down and jack-up.
- The presence and geometry of megaripples and ripples indicate possible mobile seafloor sediments. A mobility assessment, which measured the horizontal shift of bedform features was conducted using the 2017, 2018, and 2020 bathymetric data. One-hundred eighty-nine (189) representative bedforms were evaluated in this study (Figures 4.1-7a-I and 4.1-7a-ii). The bedforms can be categorized in two general classes. Ripple-scale bedforms with typical heights of 0.1 to 0.3 meters were observed to exhibit the most change. The average rate of movement between 2017 and 2020 for 81 features evaluated is 0.9

m/yr (one standard deviation is 0.3 m/yr) and is in the north to northwest direction (Figure 4.1-7a-i). The ripple features are observed to be localized with the study area.

- The second class of bedforms evaluated were comprised of slightly larger ripples, megaripples and sand accumulation areas. This class of bedforms are not interpreted to exhibit a net migration pattern of movement. Many features did not exhibit discernable movement while others appeared to exhibit re-shaping. The edges of the features may have exhibited some movement but not in a migratory pattern. This was more common for the sand accumulation features which are larger sand bodies with generally flat tops and an irregularly shaped perimeter to them. These features are not anticipated to pose a hazard to the cables and foundations.
- Stationary features such as boulders were used to confirm no apparent horizontal offset between the datasets, so the confidence in the positioning of the data is high.

- Seafloor scour was observed around surface boulders in the wind farm area, predominantly on boulders within a megaripple field. The predominance of scour around boulders in megaripple fields suggests that the sediments found in the megaripple fields are more prone to movement than the surficial materials outside the fields. On average the depth of the scour was 5 to 10 centimeters and was more pronounced on the west and northwest faces of the boulders. The depth of the scour is related to the diameter of the foundations used for the WTG and OSS structures and this should be taken into account when assessing the need for scour protection.
- 59 sonar contacts were noted within the SFWF area. Four of the sonar contacts (Sonar Contact Nos. 28, 30, 32, 112) represent possible shipwrecks and are located in the western portion of the area. One other sonar contact, No. 218, is a potential shipwreck, but is located outside the maximum work area.
- The geological environment of the SFWF area is complex due to the extensive glaciation and fluvial processes the study area has experienced. The identified features need to be fully considered and assessed when designing and installing infrastructure in the SFWF area.
- Shallow deformation (folding and faulting) of shallow materials inferred to be Pleistocene or older in age and appear to be related to glaciation. Materials inferred to be Holocene in age that overlie the deformation areas to not appear to be deformed which suggests the deformation is not active.

6.2 South Fork Wind Farm Export Cable

- The seafloor across the SFEC corridor is interpreted to be predominantly of coarse-grained sediment, and possibly older glacial moraine sediments.
- Fifty-three (53) magnetometer anomalies representing possible debris were mapped within 10 meters of the proposed SFEC route. Unidentified anomalies are presumed to represent articles of ferrous debris that are either buried below the mudline or too small to be acoustically detected with side scan sonar and are associated with prior construction activities or passing ship traffic. These anomalies should not impact cable installation activities; however, additional caution should be exercised if working in their vicinity
- Fourteen mapped boulders representing glacial erratics were noted within 10 meters of the proposed SFEC route. The position of these boulders may influence the design, routing, and installation of the proposed SFEC. The SFEC survey corridor was widening within 10 km of the SFWF to allow room to navigate the cable installation equipment through areas with boulders. Caution should be exercised if working in their vicinity.

- The presence of megaripples and seafloor ripples indicate possible mobile seafloor sediments. Seabed mobility was evaluated using available 2017 and 2020 multibeam bathymetric data. Bedform sizes, net migration direction and rates were estimated by comparing 2017 and 2020 data. Approximately 486 bedforms were evaluated that predominantly range in size from approximately 0.2 to 0.5 meters tall (ripple to megaripple size). Several megaripples were observed to be approximately 0.7 meters tall. Near the approach to shore, sorted bedforms orientated perpendicular to shore were up to 1.5 meters tall and have wavelengths of 500 to 800 meters. Bedform heights appear to increase slightly as water depth decreases. Figure 4.1-7d provides a summary of bedforms and water depths along the SFEC.

  The surveys were conducted approximately 2.8 years apart (based on the mid-date of each survey). 360 features were interpreted to exhibit movement. Average rates of movement generally increased as water depth decreased (movement rates increased closer to shore). Several sections along the SFEC did not have bedforms that exhibited discernable movement and those bedforms are considered immobile or have very low mobility. Figure 4.1-7d summarizes the mobility areas along the SFEC.

  Migration rates generally increased from offshore to the shoreline. Notable areas with mobility include:

  - KP 33+00 to 429+00 exhibited areas with migration rates of about 0.7 m/yr to 0.8 m/yr. Bedform heights were predominantly between 0.1 to 0.7 meters tall. Migration direction is predominantly in the northwest direction. Substantial sections along this portion of the SFEC did not contain bedforms deemed to be mobile.
  - KP 562+00 to 577+00 exhibited areas with migration rates of approximately 1.4 m/yr and with bedform heights approximately 0.15 to 0.4 meters tall. Migration direction is predominantly in the north-northwest direction. This area corresponds to a bypass around a boulder outcrop offshore from the inlet to Block Island Sound.
  - KP 687+00 to 860+00 exhibited areas with the second highest rate of movement that is approximately 2.3 m/yr and in the west-northwest direction. Migration direction is parallel to Long Island shoreline and is likely influenced by along-shore currents and wave patterns. Bedforms were typically between 0.1 and 0.7 meters tall.
  - KP 805+00 to 917+00 exhibited sorted bedforms that appear to have migrated in a shore-parallel direction up to 3 m/yr. The bedforms are oriented perpendicular to shoreline, are approximately 0.5 to 1.5 meters tall with wavelengths of 500 to 800 meters (Figure 4.1-7d). Although these features appear to exhibit the highest mobility rates, due to the long wavelength relative to their height, their migration would likely not lead to cable exposure and only limited burial protection reduction and are deemed to be a low to very potential hazard for cables.
  - KP 964+00 to 967+50 and 976+50 to 980+00, bedforms 0.1 to 0.5 meters tall were interpreted to migrate parallel to shoreline at an average rate of 3.0 m/yr. Migration direction suggests they are largely influenced along-shore currents.
  - Inshore of KP 982+00 and shallower than 11 meters of water, the seafloor appears to be exhibiting variable changes in elevation due to localized erosion and accretionary (depositional) processes. Elevation changes were typically between +/- 0.5 meter but localized erosion of up to 1 meter in one area was interpreted where the 2020 and 2017 surveys overlapped. Complex oceanographic

processes related to waves, alongshore currents, storm events and seasonable variations are likely the reason for the complex pattern of erosion and accretion in this area.

One-hundred and twenty-four (124) additional features evaluated did not exhibit any discernable movement (they are either stable or exhibit very low rates of movement). An approximately 15-km long section of route in the east-west section south of Block Island largely exhibited no discernable bedform changes (upper panel in Figure 4.1-7b). Other notable areas along the route were also identified to exhibit very low to no discernable seabed mobility based on the analysis and are summarized in Figure 4.1-7d.

- Seafloor scour along the cable route was not easily observed due to the lower boulder density than the wind farm area. In areas where boulders were present, megaripples and ripples were not present. In shallower water depths along the cable route, scour could be more pronounced due to wave interaction during strong storm event and cable burial protection may be needed.
- The proposed SFEC route will cross six cables. Transatlantic cable “TAT-6” was found to deviate from it reported “as-built” position by over 500 meters, therefore the projected crossing is based on its “as-found” position. Caution should be exercised when working in the vicinity of all anthropogenic features, and proper protective material (sandbags/mats) should be employed where applicable.

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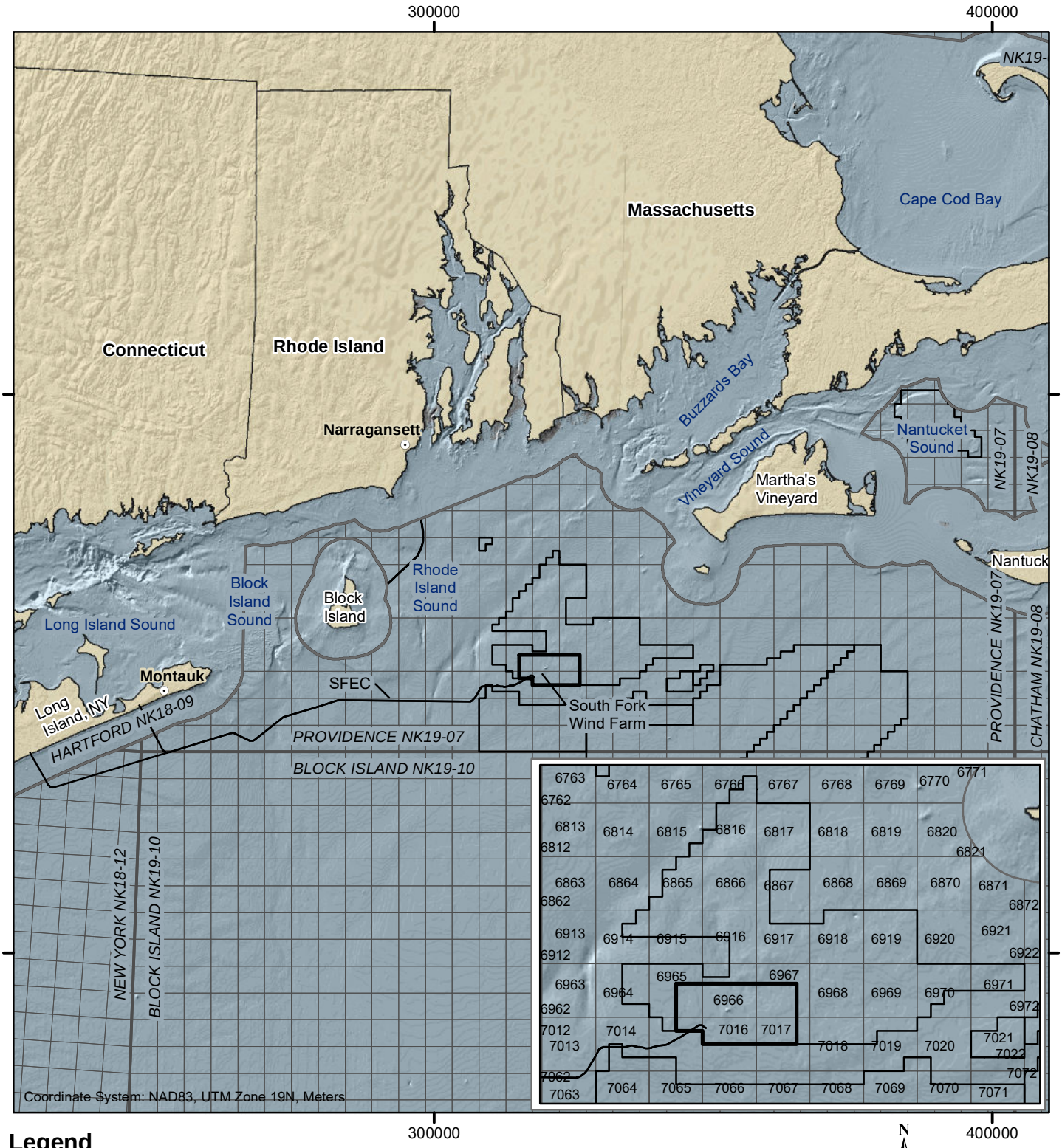

Legend

- 3-Nautical-Mile-Limit
- OCS-A 0517 Lease
- 6965 OCS Block
- SFEC = South Fork Export Cable

OCS-A 0517 LEASE LOCATION
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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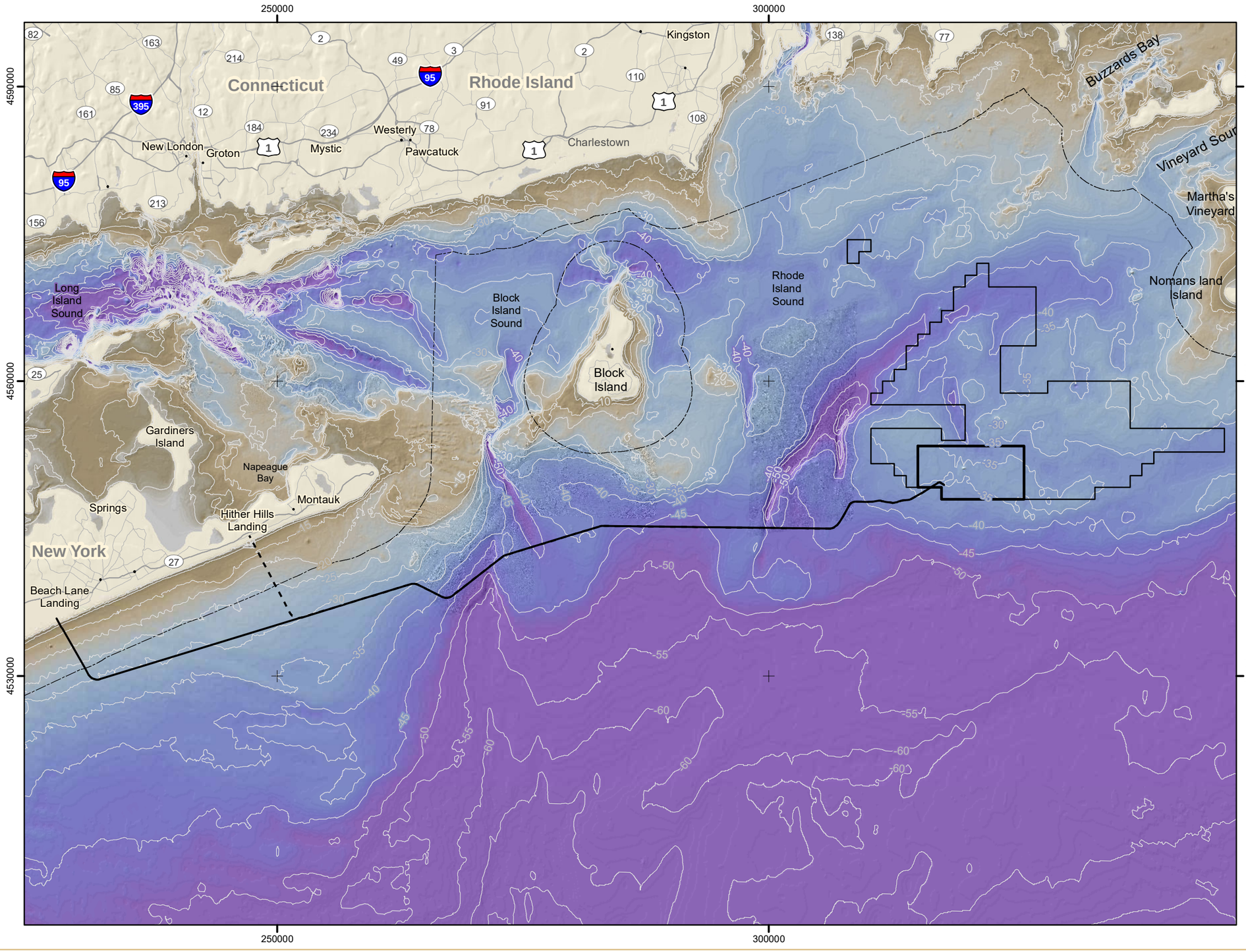

LEGEND

- Proposed South Fork Export Cable Route
- Proposed South Fork Export Cable Route Alternate Shore Landing
- OCS-A 0486 Lease Boundary
- OCS-A 0517 Lease Boundary
- -10- Bathymetric Contour (Meters, Re. MLLW) Contour interval is 5 meters.
- 3 Nautical Mile Limit

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters

N
W E
S

0 5 10 Nautical Miles

0 5 10 Kilometers

PROPOSED SOUTH FORK WIND FARM AND SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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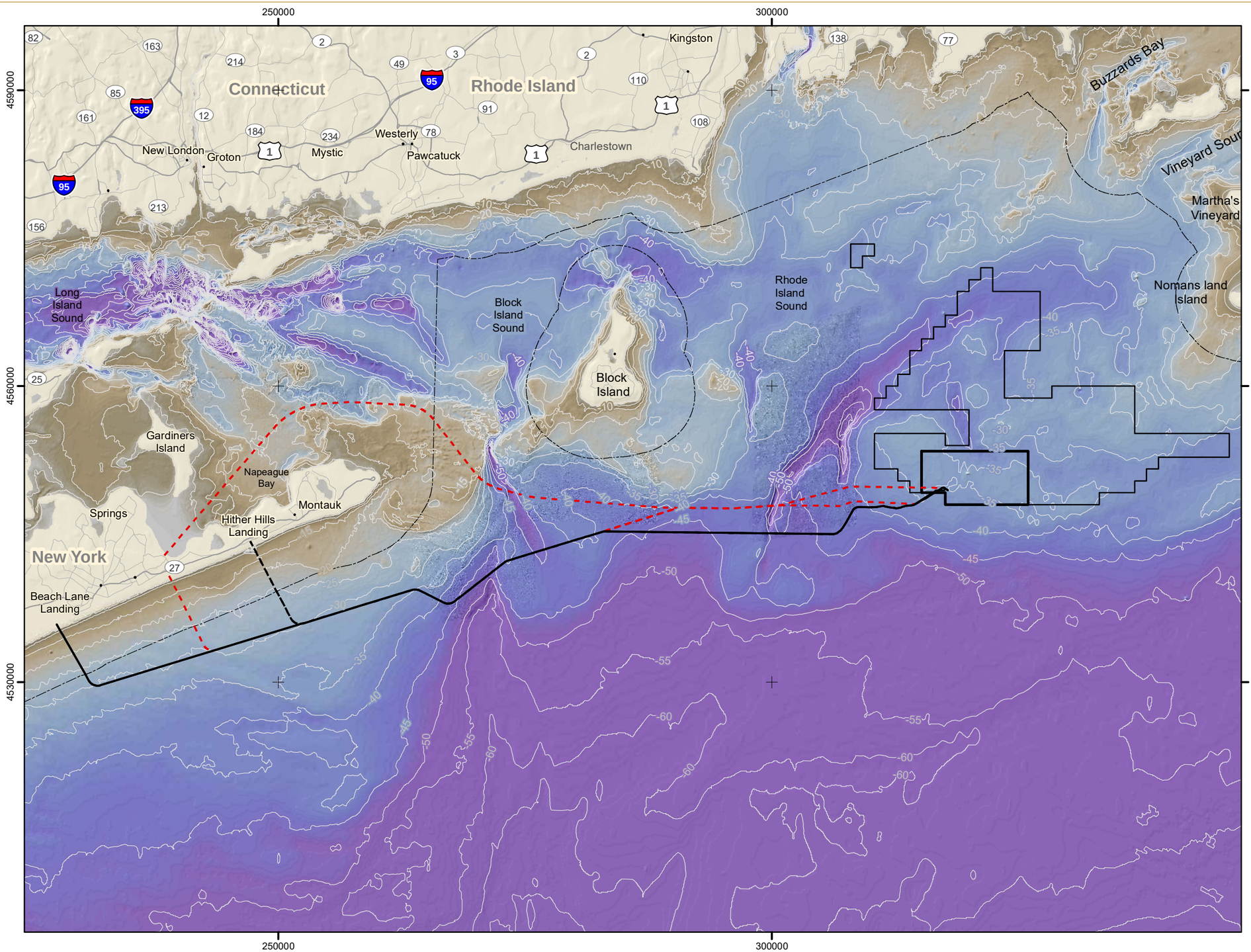

LEGEND

- Proposed South Fork Export Cable Route
- Proposed South Fork Export Cable Route Alternate Shore Landing
- Proposed South Fork Export Cable Route Alternatives Considered but Removed from Consideration
- OCS-A 0486 Lease Boundary
- OCS-A 0517 Lease Boundary
- Bathymetric Contour (Meters, Re. MLLW) Contour interval is 5 meters.
- 3 Nautical Mile Limit

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters

N
W E
S

0 5 10 Nautical Miles

0 5 10 Kilometers

PROPOSED SOUTH FORK WIND FARM AND SOUTH FORK EXPORT CABLE ROUTE ALTERNATIVES CONSIDERED
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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FUGRO
FUGRO ENTERPRISE

General

Name	*Fugro Enterprise*
Owner	Fugro
Built	2007
Port/Flag	Patterson, LA - USA
MMSI No.	366336000
Call Sign	WDD9388
IMO No.	9473585

Dimensions

Length	170'
Beam	40'
Maximum draught	11'
Depth	13'
Clear deck space	11'
Tonnage	grt <67, gt itc 874

Accomodations

Forecastle deck	26-11, 2-man; 1x 4-man
Storage	10'x30'
Main deck	8-4, 2-man
Below decks	None

Machinery

Main engines	2x3508 CAR ABS AMS (200 HP total)
Main gears	2xZF 4.5 to 1 trolling gear, 2x78" DIA ABS SMI nicoal
Generators	2x250 kw CAT ABS AMS, 1x75 kw CAT ABS AMS, 75 kw emergency generator
Switch board	Full parallel 500 kw available
Steering	Hydraulic
Propellers	2 x 78" 4 nicoal
Bowthruster	Brunvoll variable pitch 250 hp electric
Speed	11.5 kts
Fuel consumption	100 gal/hr max, 80/gal hr cruise, 55 gal/hr data collection (estimated)
Range	6,500 nm (estimated)
Endurance	28 days

Capacities

Fuel oil	54,000 gallons
Hydraulic oil	
Lube oil	
Waste	
Potable water	60,000 gallons
Fresh water	Water maker; Village Marine PW-1600 R.O

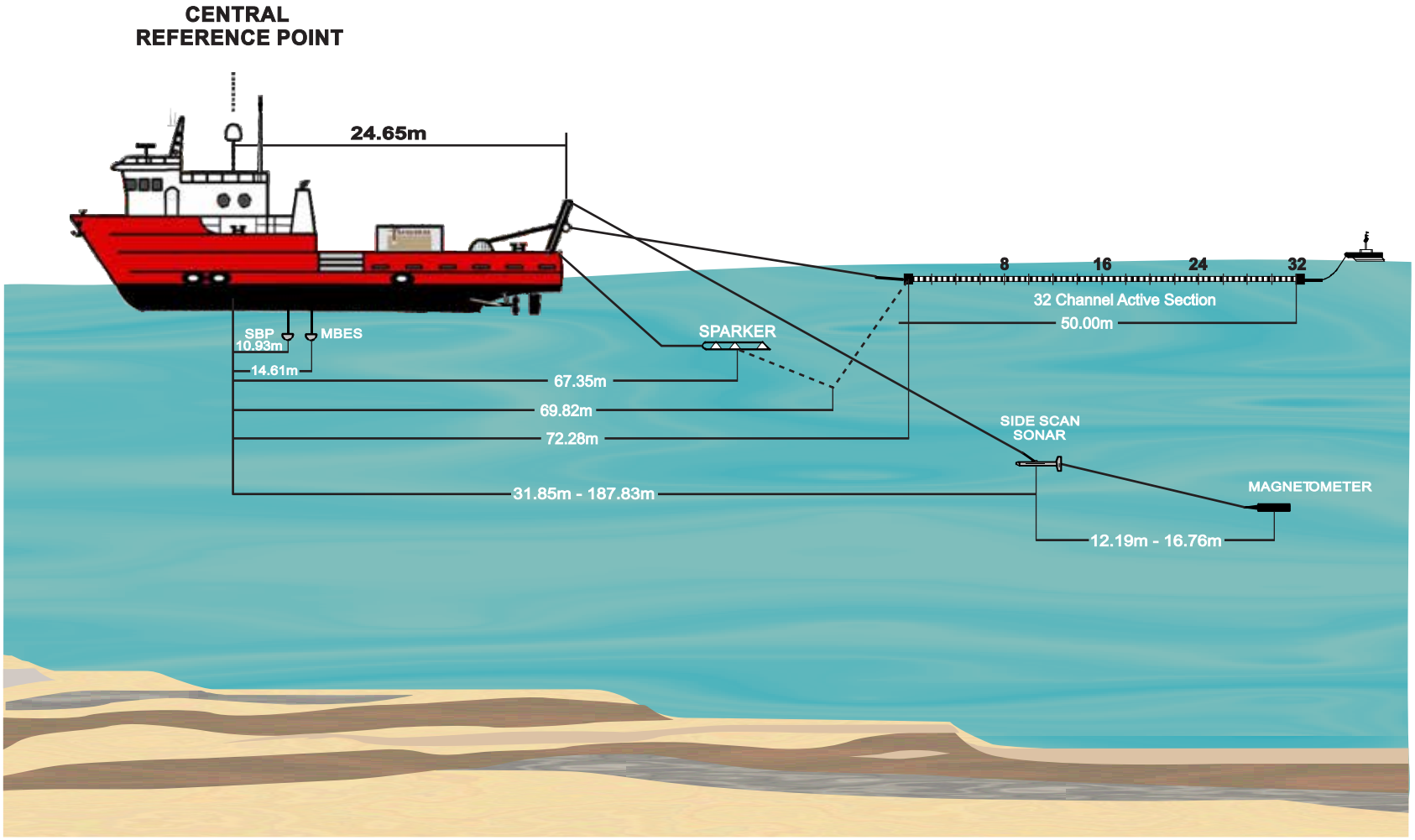
Communications

Loud hailer	LF 3000 Furuno
VHF	2 - M-504 Icom
Satellite phone	Orbit AL7103 KU-8 V-Sat
Cellular phone	Petro Comm
Intercom	Sound powered phones & Panasonic, 24-line phone system

Navigation

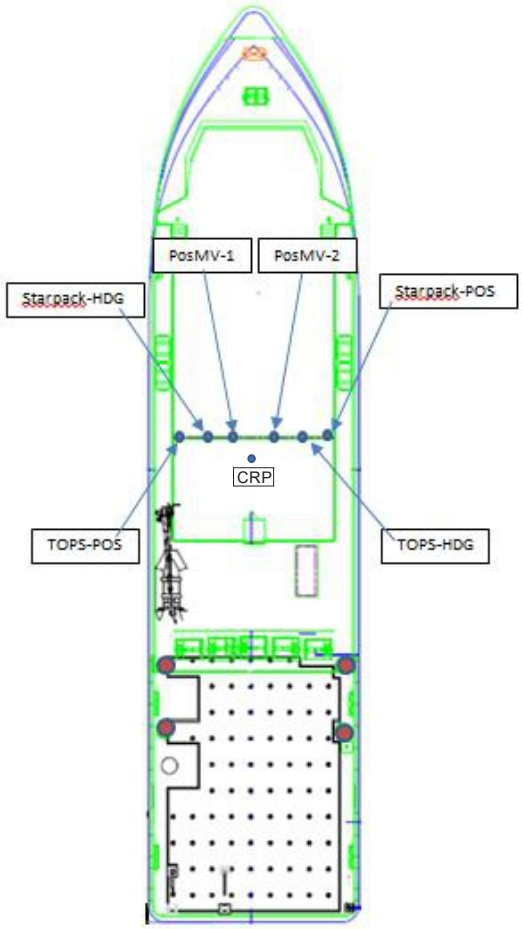
GPS	2-GP 150 Furuno
RADAR	FR2117-FR8122 Furuno
Auto pilot	AP 50 Simrad
Fathometer	FE 700 Furuno
Speed log	DS 80 Furuno
Gyro	GC80 Expanded Simrad
Chart plotter	Garmin
Sound surveillance	VSS-111 Zenithal
Weather station	RD 30 Furuno

GEOPHYSICAL SURVEY VESSEL FUGRO ENTERPRISE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



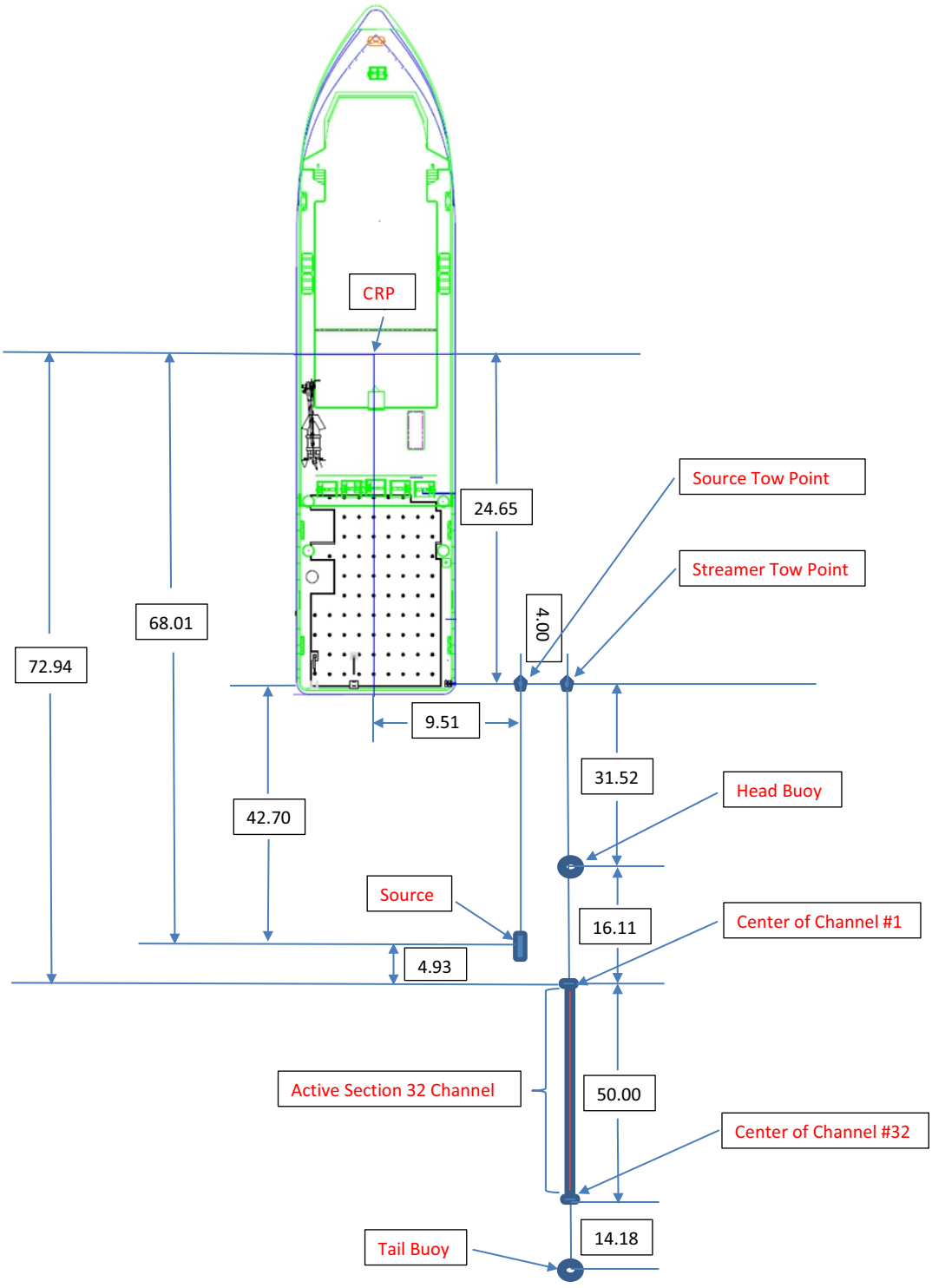
FUGRO ENTERPRISE GEOPHYSICAL SURVEY EQUIPMENT
LAYOUT SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

Figure 2.1-2



Fugro Enterprise Offsets			
Description	Y	X	Z
ANTENNA OFFSETS			
Ant1 (TOPS-POS)	0.678	-4.561	8.057
Ant2 (SP-HDG)	0.681	-2.945	8.071
Ant3 (PosMV-1)	0.679	-1.621	8.065
Ant4 (Empty)	0.680	0.002	8.066
Ant5 (PosMV-2)	0.673	1.685	8.057
Ant6 (TOPS-HDG)	0.674	2.955	8.062
Ant7 (SP-POS)	0.675	4.569	8.060
STATIC OFFSETS			
Center Bow	26.530	0.000	0.000
Center Stern	-25.310	0.000	0.000
Center of Gravity	0.000	0.000	-1.158
Coring Sheave	-25.310	-2.869	0.000
EchoTrac_200kHz	-10.930	-5.170	-4.330
EchoTrac_24kHz	-10.930	-5.170	-4.330
HiPAP Deployed	-4.823	3.030	-7.061
IMU in SS Moonpool	-14.606	5.169	-3.941
Mag Sheave	-25.310	-0.340	0.000
MBES Rx	-14.472	5.169	-4.423
MBES Tx	-14.472	5.170	-4.420
Middle Sheave	-25.310	-3.173	0.000
Seatex MRU	-4.059	3.088	0.261
PB Moonpool	-10.932	-5.172	0.000
PS Moonpool	-14.565	-5.166	0.000
SBP	-10.932	-5.172	-4.330
SB Moonpool	-10.942	5.224	0.000
SS Moonpool	-14.587	5.170	0.000
Sparker Towpoint	-24.654	9.517	0.000
Streamer Towpoint	-24.654	13.517	0.000
SSS Sheave	-25.310	-3.508	0.000
Towfish Sheave	-25.310	-3.509	0.000
APPLICABLE Z-VALUE OFFSETS			
Seatex MRU to Lowered HiPAP			7.322
CRP to Waterline			-1.158
Waterline to Lowered HiPAP			5.903

FUGRO ENTERPRISE FIXED VESSEL OFFSETS
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

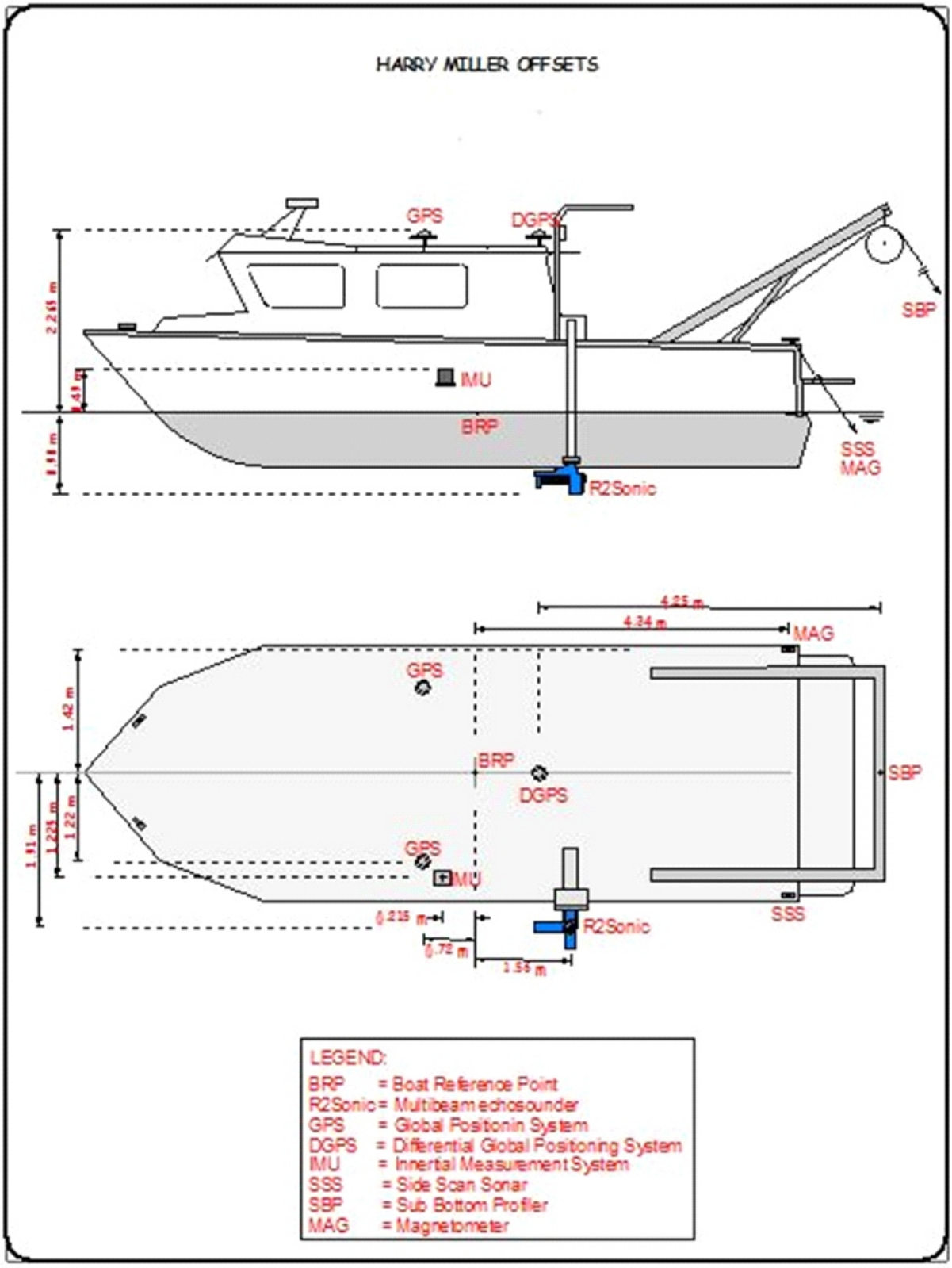


FUGRO ENTERPRISE VESSEL OFFSET DIAGRAM
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

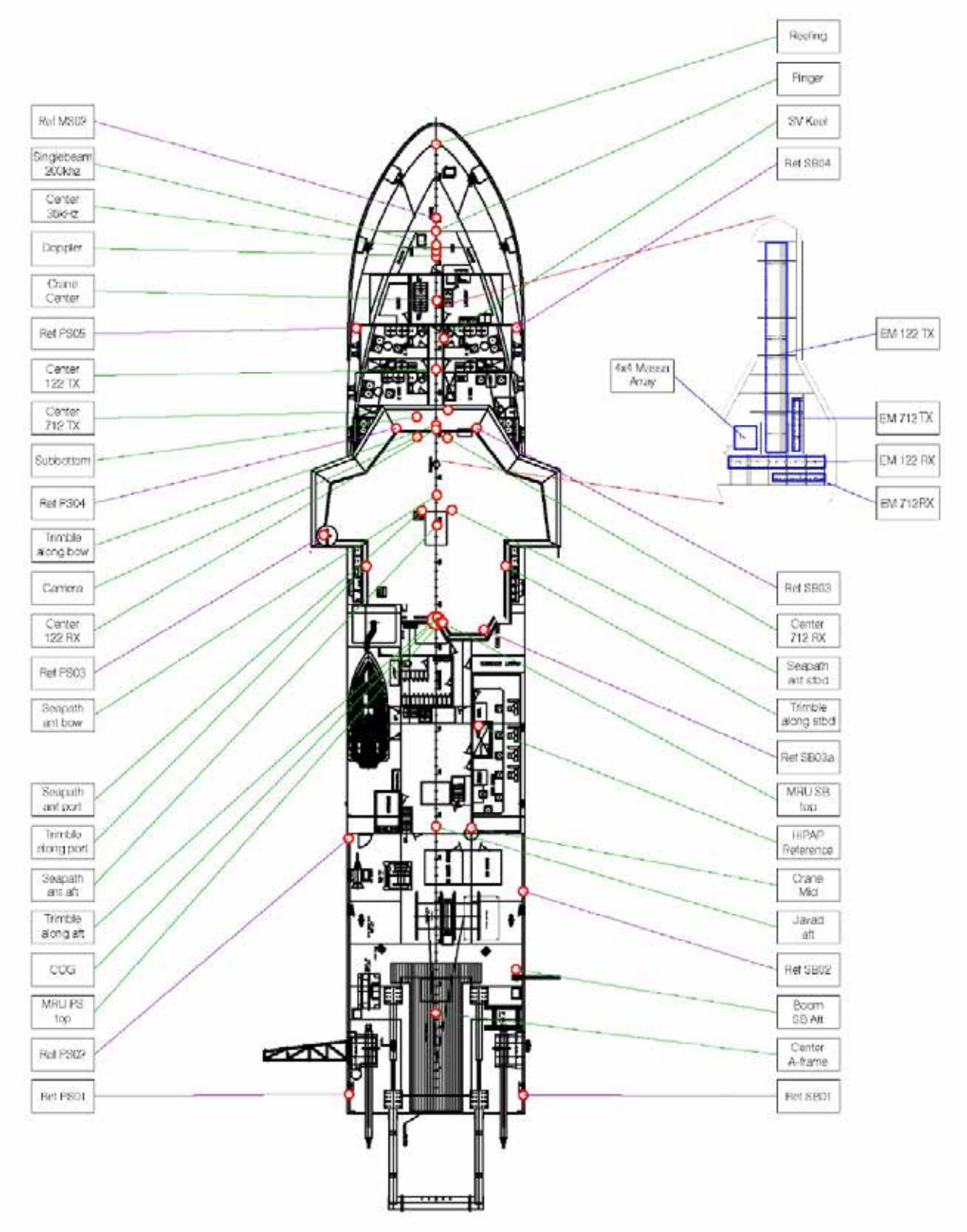
Harry Miller

Home Port	Staten Island, NY
Registry #	NY 1387 GN
Type of Vessel	Research Survey Vessel
Hull Construction	Aluminum Catamaran
Length	32'
Beam	11'
Draft	2'
Range	24 Hours
Cruising Speed	30 KTS
Top Speed	38 KTS
Fuel Capacity	150 Gallons
Total Horsepower	700
Navigation Equipment	(2) VHFs, GPS, Radar, Depth finder
Special Equipment	Tier 3 compliant, 1,500# A-frame, 1,200# Winch, 200# Davit, Solar Panel, and 6000w inverter, Trimble with Hypack software, Water jet-propelled, Shallow water capabilities, Enclosed heated cabin, Head, 2 Burner stove top, refridgerater, and Strobe lights

GEOPHYSICAL SURVEY VESSEL HARRY MILLER
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



HARRY MILLER OFFSET DIAGRAM
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



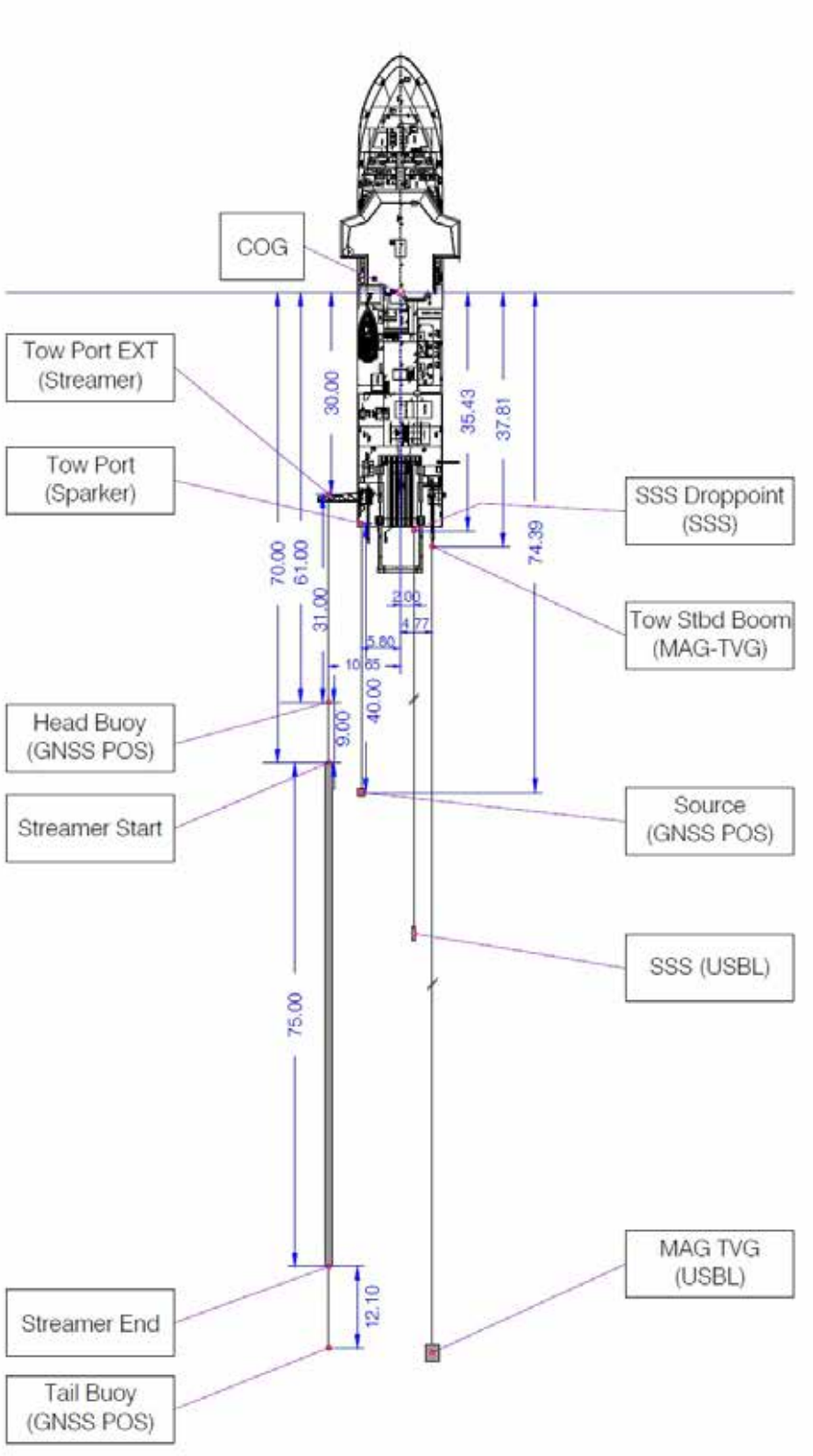
FUGRO DISCOVERY FIXED VESSEL OFFSETS DIAGRAM

SFWF COP Survey

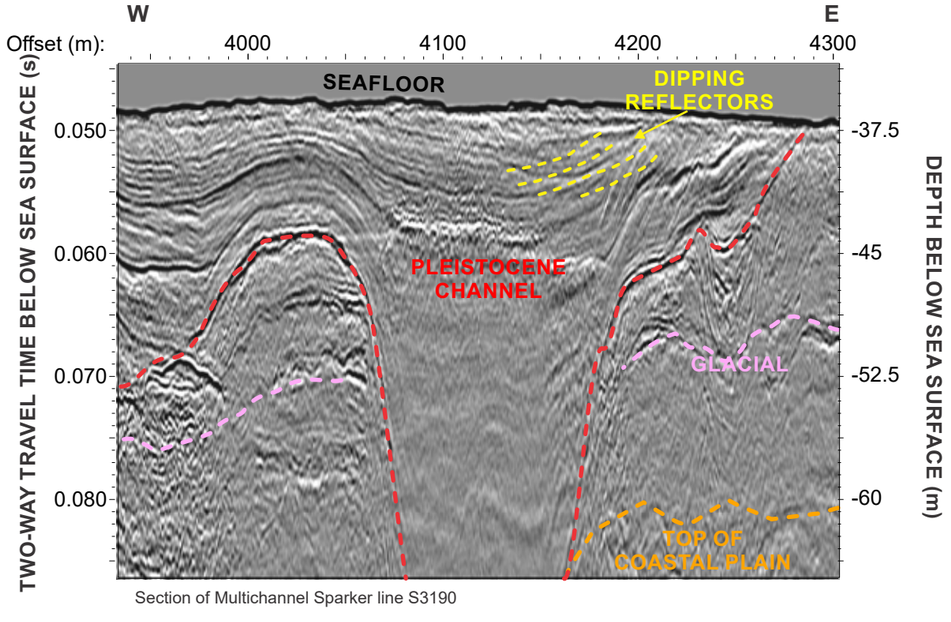
Offshore NY/RI/MA, Atlantic OCS

Sensor	Y [+FWD]	X [+STBD]	Z [+UP]	σY	σX	σZ
Ref. MS02	28.4842	0.0119	5.6362	0.0005	0.0007	0.0009
Ref. PS01	-33.5515	-6.1980	0.9058	0.0007	0.0007	0.0012
Ref. PS02	-15.4145	-6.2242	0.9811	0.0006	0.0007	0.0010
Ref. PS03	6.0420	-7.9964	10.8878	0.0011	0.0012	0.0021
Ref. PS04	13.5888	-2.8294	11.5860	0.0007	0.0008	0.0009
Ref. PS05	20.6733	-5.6802	6.0463	0.0006	0.0007	0.0008
Ref. SB01	-33.6087	6.2217	0.8677	0.0007	0.0009	0.0016
Ref. SB02	-19.1398	6.2068	0.9315	0.0008	0.0009	0.0013
Ref. SB03	13.6103	2.8817	11.6014	0.0013	0.0019	0.0025
Ref. SB03a	-0.6483	3.3923	10.8255	0.0007	0.0010	0.0017
Ref. SB04	20.6922	5.7145	6.0328	0.0004	0.0003	0.0008
Reference point of survey grid in reeling	33.6785	-0.0078	6.1134	0.0014	0.0017	0.0021
Seapath_ant_aft	6.7223	0.0717	22.9874	0.0018	0.0023	0.0020
Seapath_ant_bow	8.8671	0.0513	23.0099	0.0018	0.0023	0.0019
Seapath_ant_port	7.7786	-1.0156	23.0145	0.0018	0.0023	0.0019
Seapath_ant_stbd	7.8098	1.1249	22.9969	0.0018	0.0023	0.0020
Trimble_Along_01	0.2096	0.0742	13.1315	0.0012	0.0013	0.0020
Trimble_Along_02	13.8158	0.0009	12.6555	0.0008	0.0010	0.0011
Trimble_Across_01	3.8346	-4.9487	12.5581	0.0014	0.0013	0.0027
Trimble_Across_02	3.8666	4.9681	12.5477	0.0012	0.0013	0.0022
Javad Aft	-14.5556	-0.0046	5.7690	0.0013	0.0012	0.0020
SV Keel	19.9545	-0.5467	-6.9052	0.0016	0.0016	0.0019
A-Frame Center (Position in)	-27.7848	-0.0284	9.2099	0.0017	0.0022	0.0029
Little boom on working deck	-24.6952	5.6872	2.2691	0.0017	0.0019	0.0032
Camera on gondola	12.9658	-1.3506	-7.8703	0.0017	0.0017	0.0024
Crane front	22.6269	0.0554	8.2863	0.0013	0.0018	0.0019
Crane on A-Deck	-14.6572	2.5055	5.2217	0.0015	0.0019	0.0021
doppler sonar (keel)	25.7725	-0.0005	-6.6625	0.0018	0.0014	0.0020
Winch on aft in working pos	-37.4483	4.6578	3.2037	0.0018	0.0015	0.0023
Reference of MRU (Top of Sensor) port	-0.1400	0.3200	0.6300	0.0020	0.0030	0.0044
Reference of MRU (Top of Sensor) stbd	-0.1403	0.4824	0.6313	0.0020	0.0030	0.0043
Center 122 RX	13.5057	-0.0136	-7.7721	0.0009	0.0014	0.0016
Center 122 TX	17.7532	-0.0049	-7.7171	0.0008	0.0016	0.0018
Center 712 RX	12.9146	0.8109	-7.7821	0.0008	0.0014	0.0016
Center 712 TX	14.8979	0.8493	-7.7524	0.0010	0.0013	0.0016
Center 38kHz (EA400)	26.1620	0.0046	-6.6363	0.0018	0.0014	0.0020
Center 200khz (EA400)	26.5644	0.0056	-6.6320	0.0018	0.0014	0.0020
Center 4x4 Massa Array	14.4167	-1.3758	-7.7162	0.0018	0.0016	0.0023
HiPAP_Reference in working position	-7.4267	3.0192	-9.7362	0.0018	0.0025	0.0043
SBES Bridge	27.5420	0.0048	-6.6316	0.0018	0.0014	0.0020
COG	0.0000	0.0000	0.0000	0.0020	0.0030	0.0044
Waterline			-2.3176			

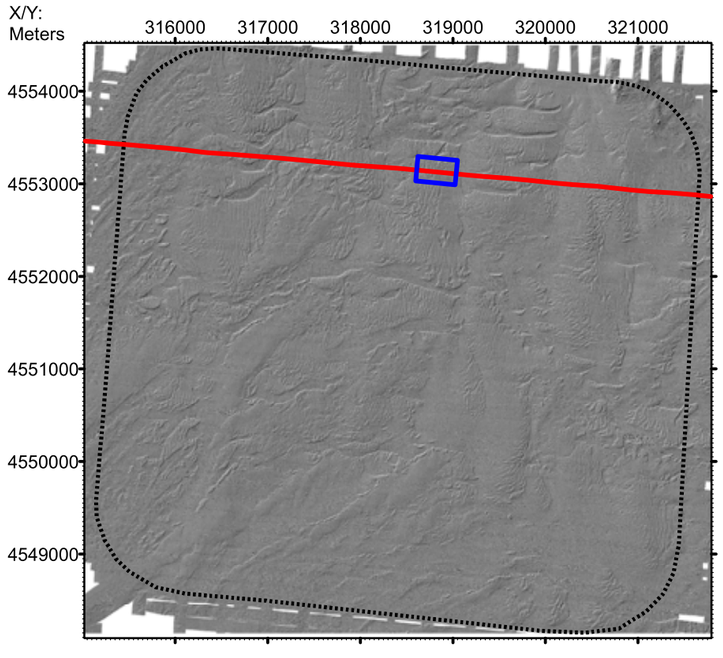
FUGRO DISCOVERY FIXED VESSEL OFFSETS TABLE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



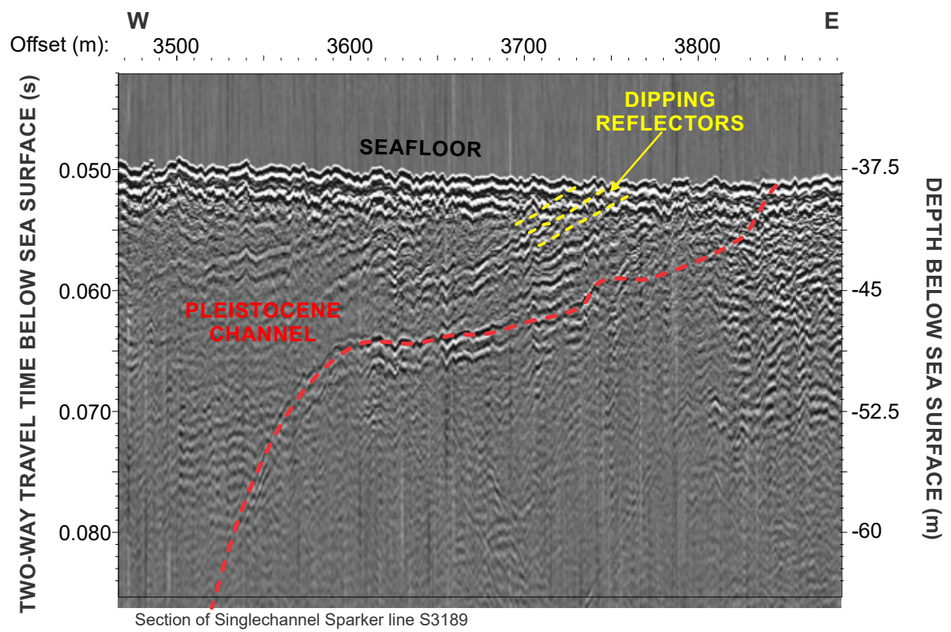
FUGRO DISCOVERY VESSEL OFFSET DIAGRAM
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



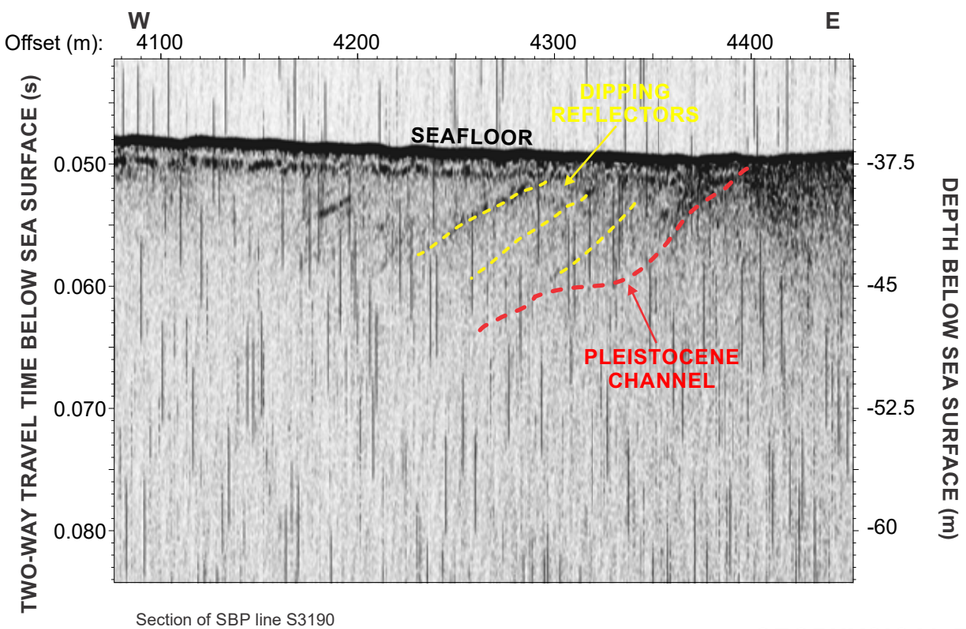
Section of Multichannel Sparker line S3190



NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Base map image is MBES bathymetry hillshade: 315 Azimuth, 45 Altitude

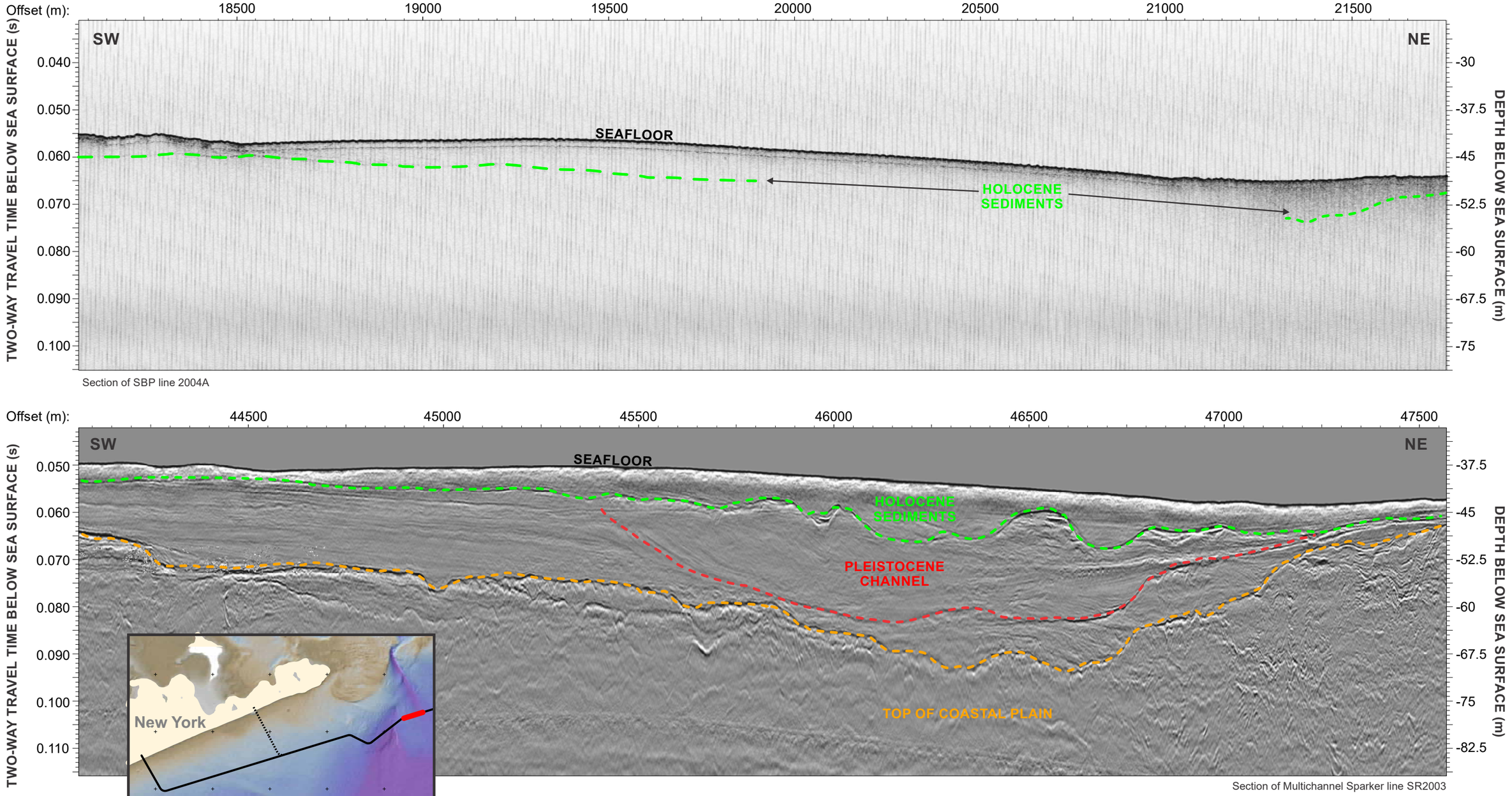


Section of Singlechannel Sparker line S3189



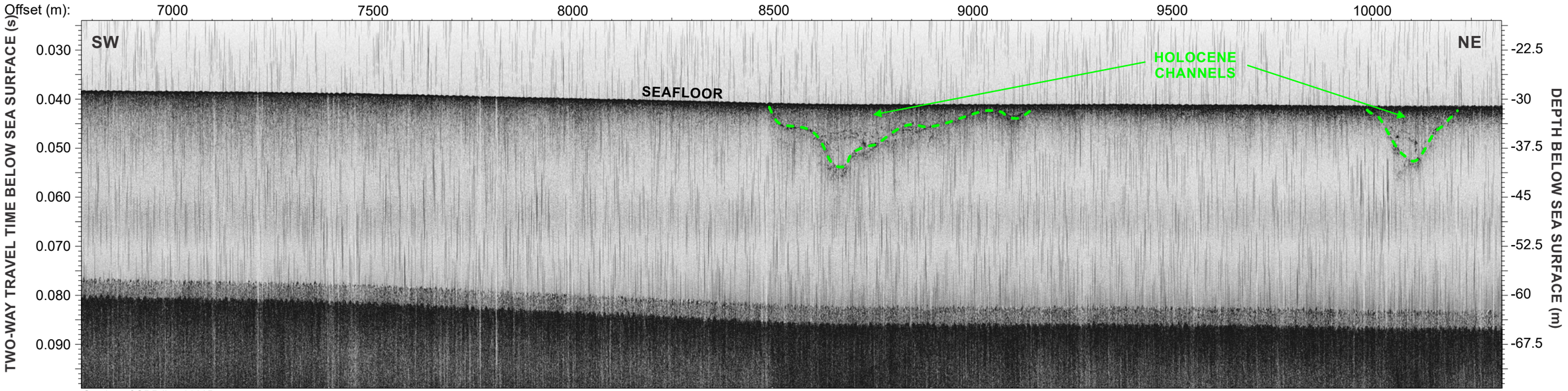
Section of SBP line S3190

GEOPHYSICAL DATA COMPARISON
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

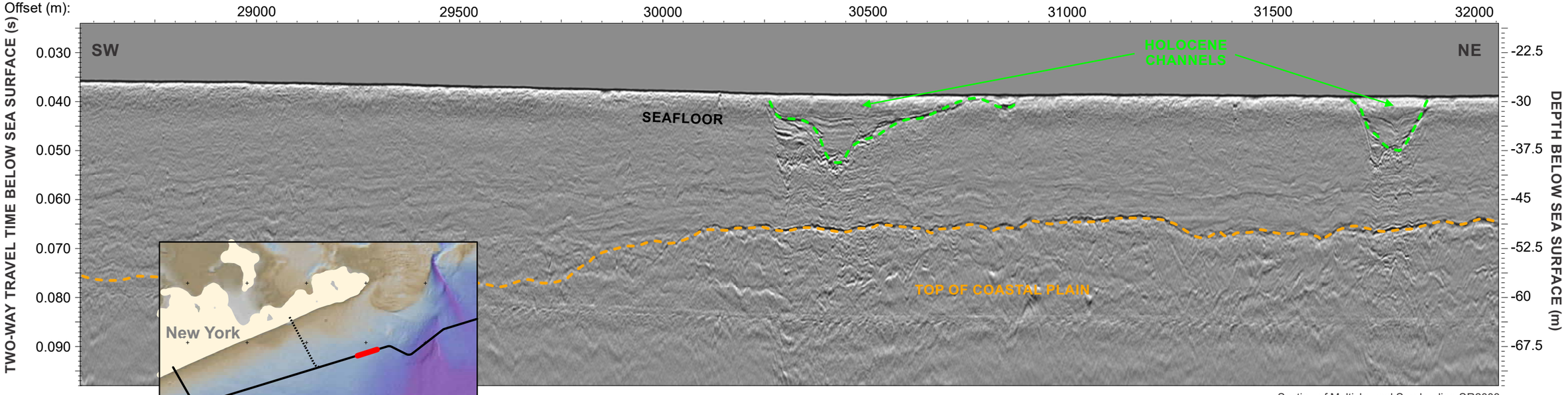


NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.

DATA COMPARISON ALONG THE EASTERN PORTION OF THE SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



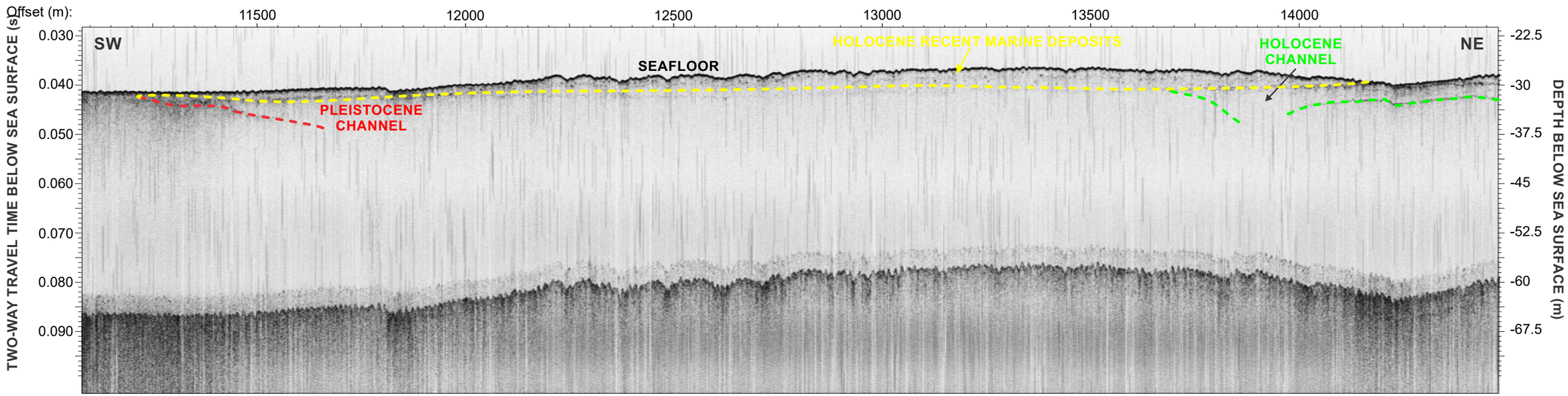
Section of SBP line 2002B



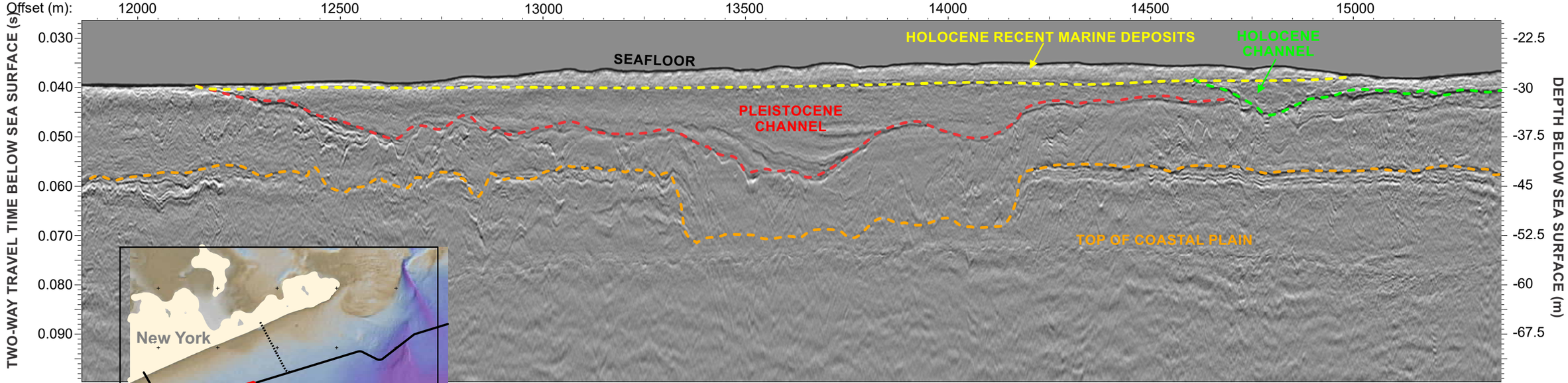
Section of Multichannel Sparker line SR2003

NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.

DATA COMPARISON ALONG THE CENTRAL PORTION OF THE SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



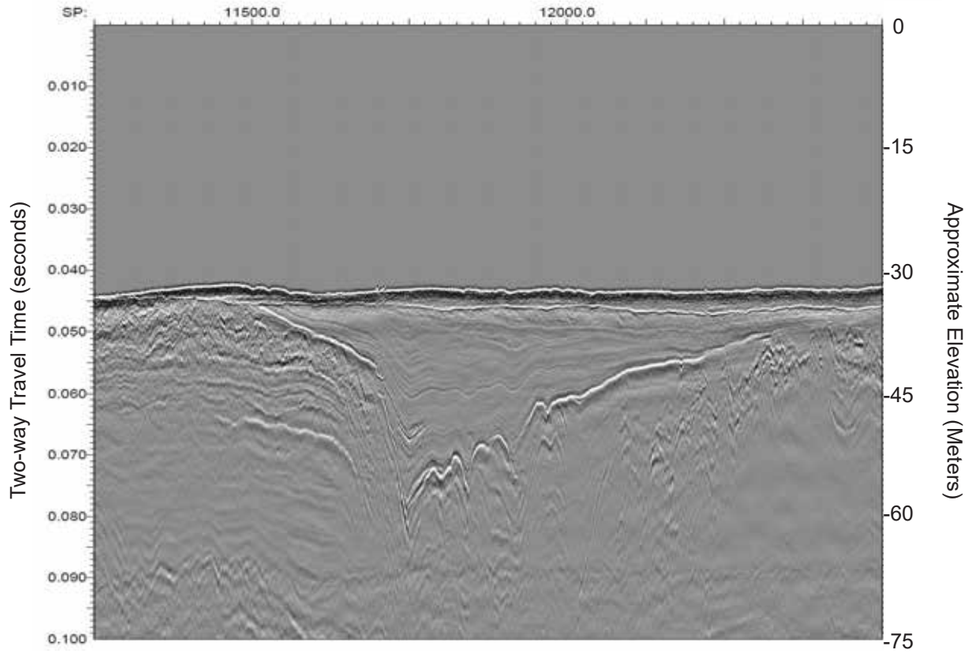
Section of SBP line 2001



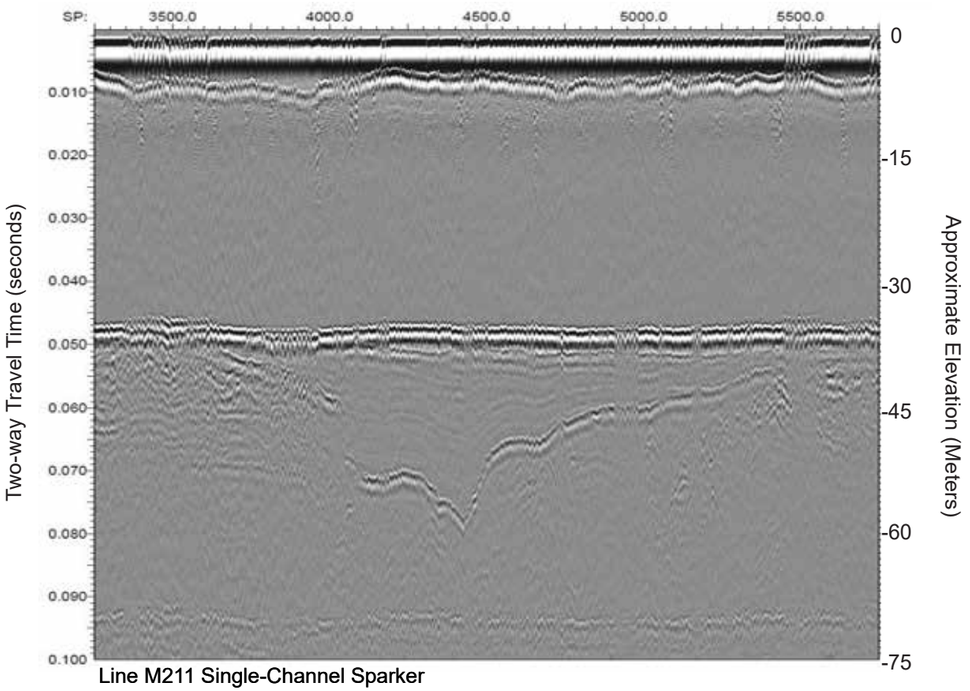
Section of Multichannel Sparker line SR2003

NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.

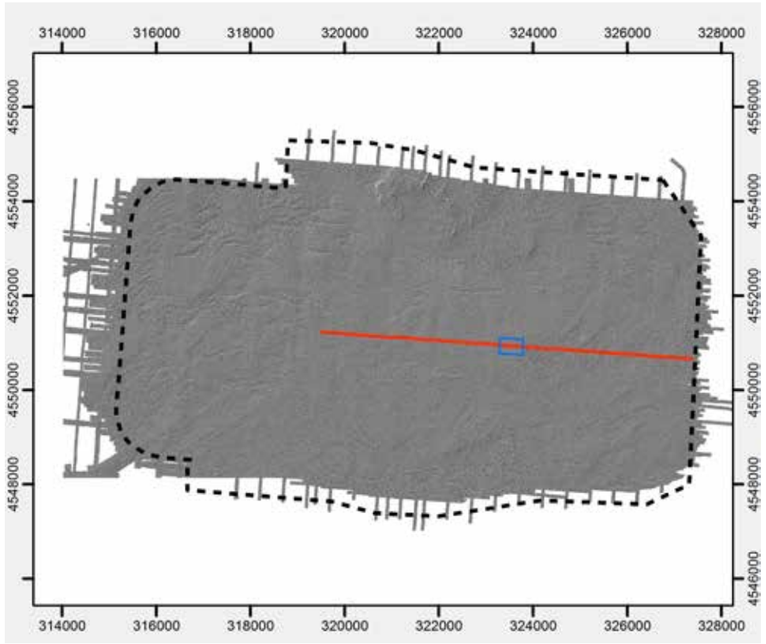
DATA COMPARISON ALONG THE WESTERN PORTION OF THE SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

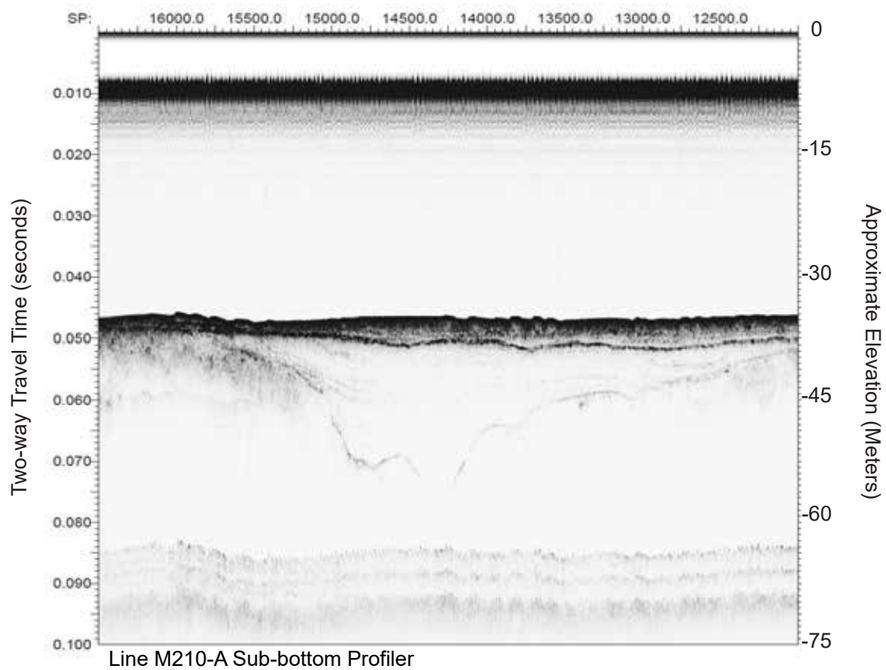


Line M213 Multichannel Sparker



Line M211 Single-Channel Sparker

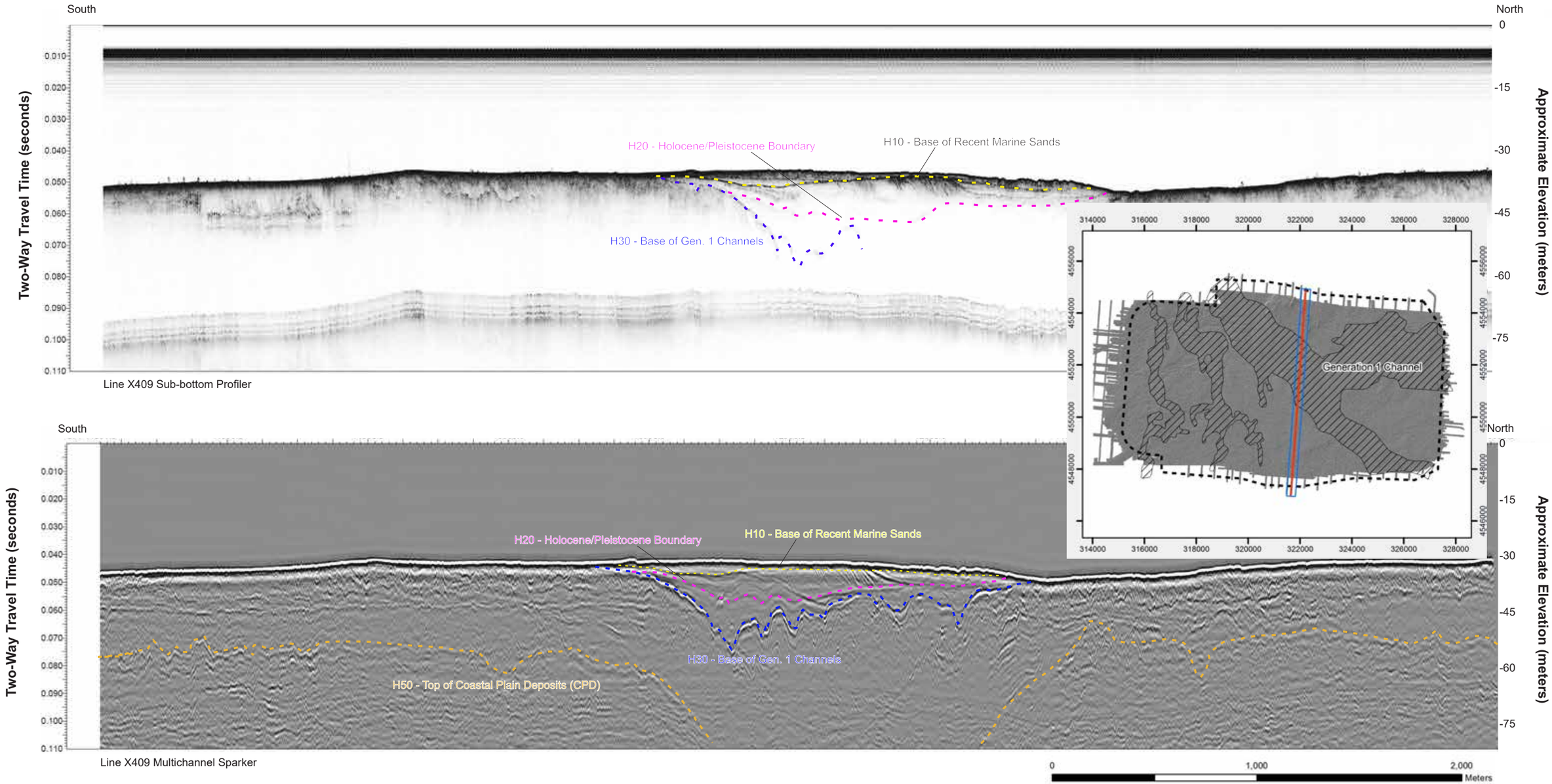




Line M210-A Sub-bottom Profiler

NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Base map image is MBES bathymetry hillshade: 315 Azimuth, 45 Altitude

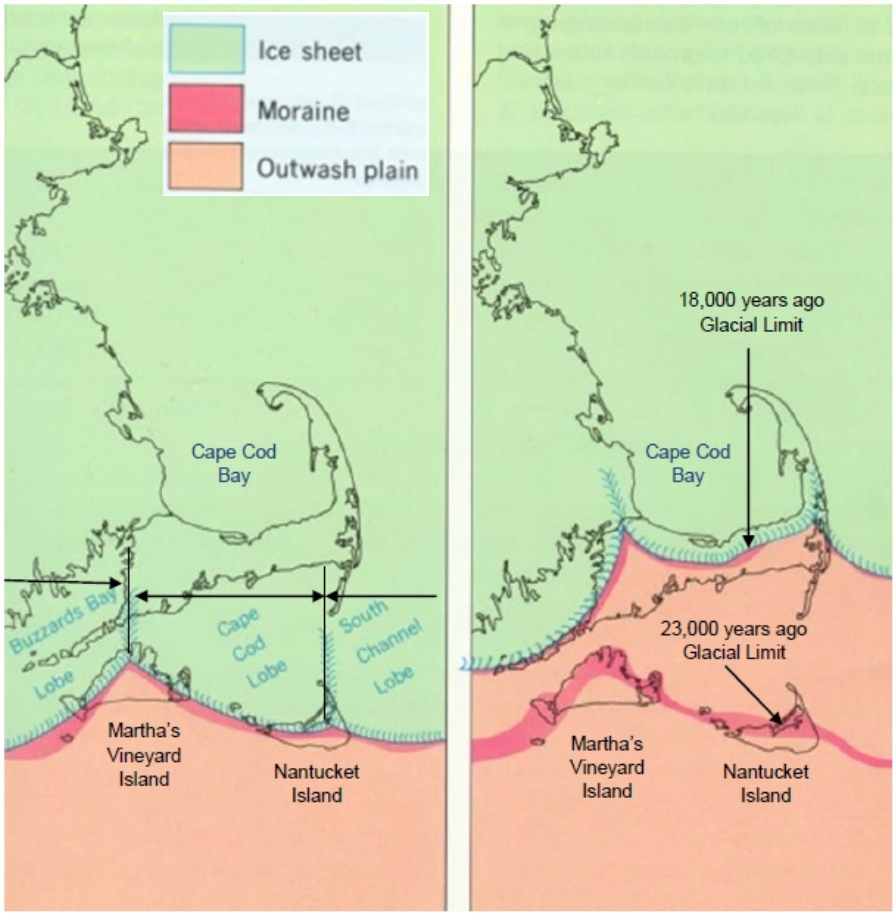
2018 GEOPHYSICAL DATA TYPE COMPARISON
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



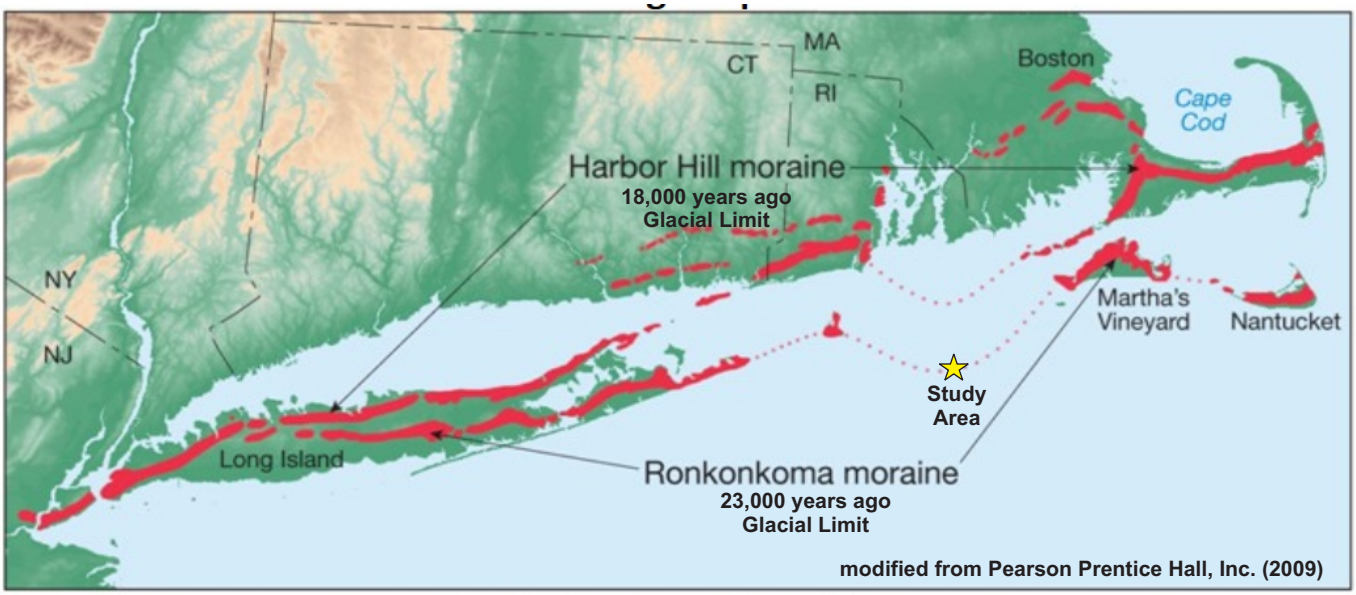
Line X409 Multichannel Sparker

NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.

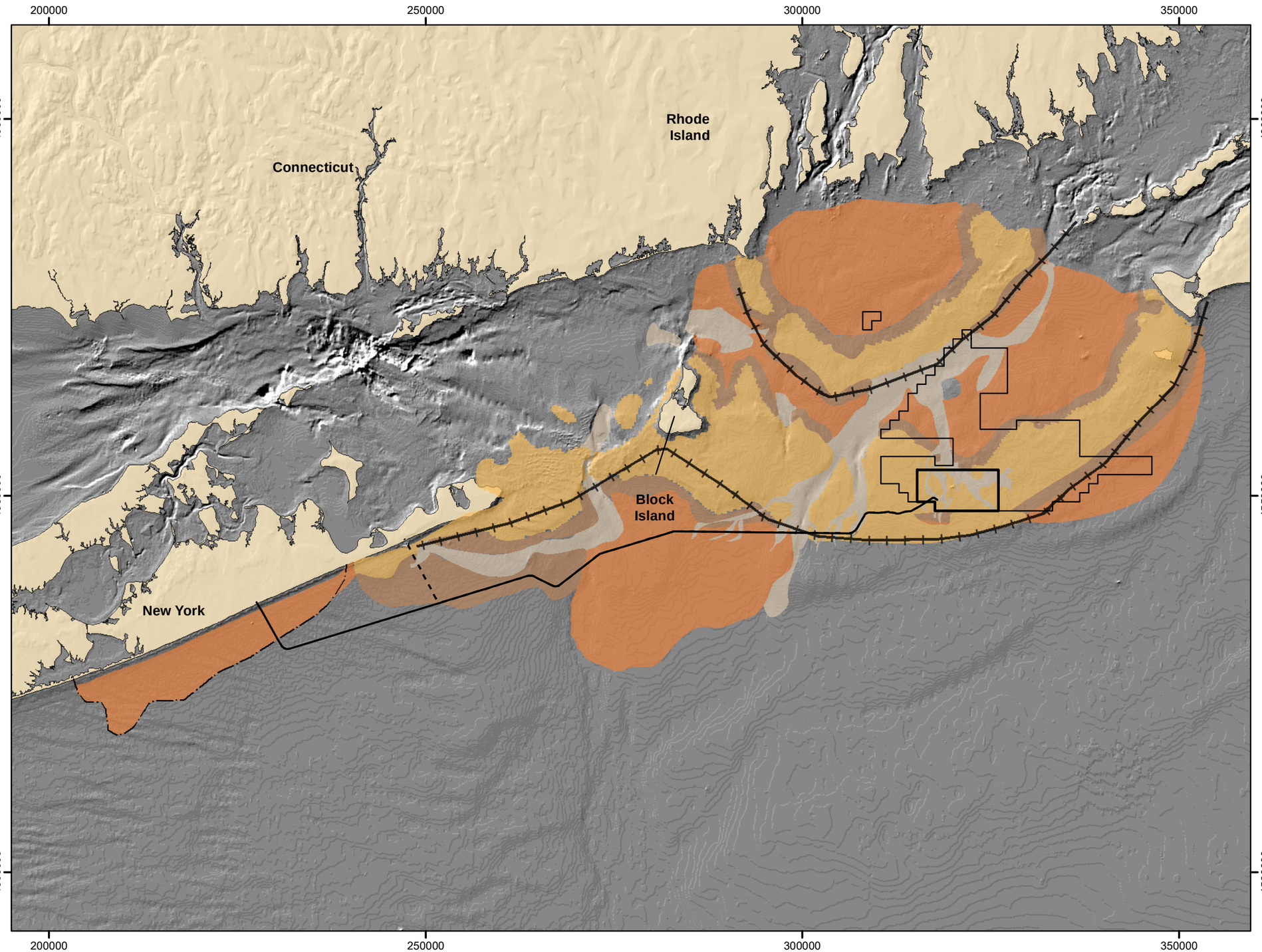
2018 DATA COMPARISON NORTH-SOUTH THROUGH THE SFWF
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



The images above show the inferred locations of the glacial lobes (left image) of the Laurentide ice sheet and outwash plains. The moraine locations represent the glacial advance limits. The southern moraine (Ronkonkoma) represents the glacial maximum advance at approximately 23,000 years ago. The northern moraine (Harbor Hill) represents the maximum advancement about 18,000 years ago. Modified from Oldale (1996).



GLACIAL LOBES AND TERMINAL MORAINES
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



LEGEND

Proposed Wind Farm and Export Cable

- Proposed Export Cable
- OCS-A 0486 Lease Boundary
- OCS-A 0517 Lease Boundary

Glacial Features

- Inferred Outer Limit of Wisconsin/Illonian Glacial Advance
- Inferred Southern Extent of Proximal Outwash Unit

Interpreted Regional Geomorphologic Zones

- Zone 1 - Proximal Outwash Fan
- Zone 2 - Regional Channeling
- Zone 3 - Moraine Flank
- Zone 4 - Moraine Ridge

Notes:

1. Glacial Features were digitized from interpretations for the Outer Limit of Glacial Advance (USGS OFR 2014-1220) and the southern extent of the Proximal Outwash Unit (USGS OFR 1999-599).
2. Coordinate Grid: NAD83, UTM Zone 19 North, Meters

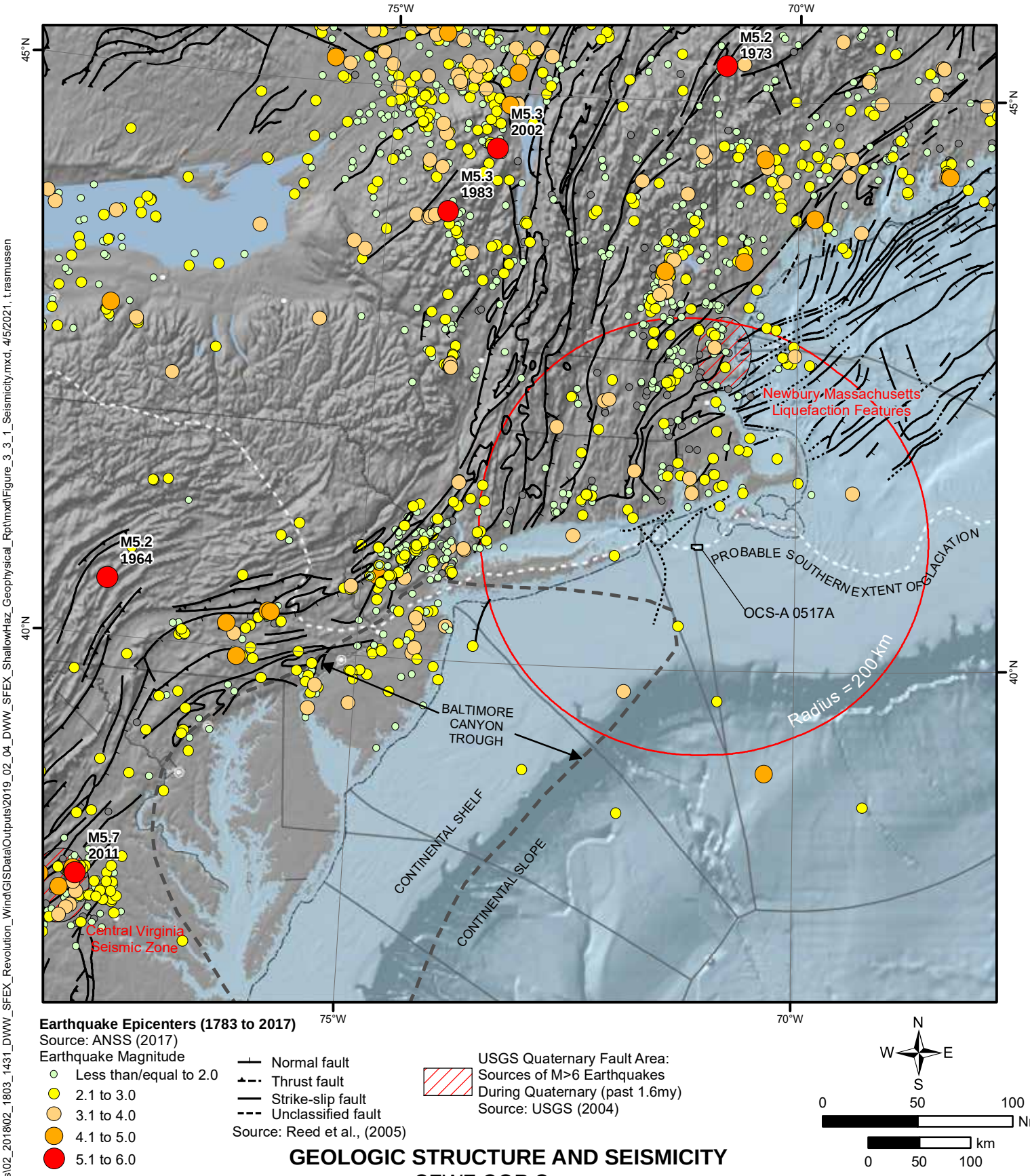
N
W E
S

0 5 10 Nautical Miles

0 5 10 Kilometers

REGIONAL GEOMORPHIC ZONES
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

N:\Projects\02_2017\02_1702_1080_DWW_RIMA_Survey\Outputs\DWW_SFWF_Hazard_Study_Rev1\mxd\Figure_3_1_2_Geomorphic_Zones.mxd, 3/29/2021, t.rasmussen



GEOLOGIC STRUCTURE AND SEISMICITY

SFWF COP Survey

Offshore NY/RI/MA, Atlantic OCS

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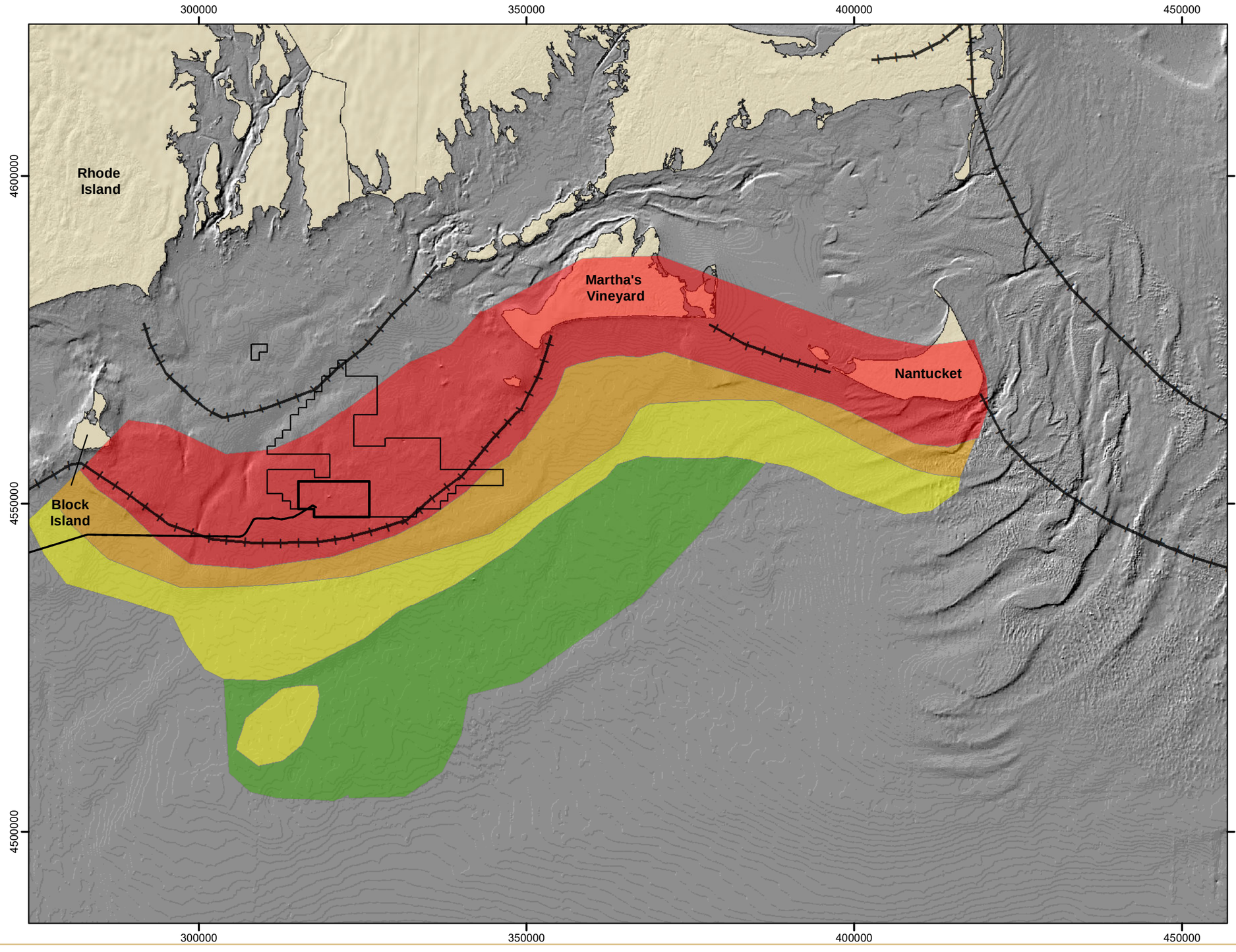
Figure 3.3-1



LEGEND

Proposed Wind Farm and Export Cable

- Proposed Export Cable
- OCS-A 0517 Lease Boundary
- OCS-A 0486 Lease Boundary

Glacial Features

- Inferred Outer Limit of Wisconsin/Illonian Glacial Advance

Interpreted Potential Boulder Hazard

- High
  Mapped Moraine Feature
- Moderate
  Near Mapped Moraine Feature - Surface Samples indicate gravelly substrate. Seafloor morphology suggests may contain outwash from moraine.
- Low to Moderate
  Distal Area from Moraine - Seafloor morphology suggests may contain outwash from moraine. Isolated boulders may be present.
- Low
  Far from Moraine - Seafloor sediment samples do not indicate gravel and material is predominantly sand or silt.

Notes:

1. Glacial Features were digitized from interpretations for the Outer Limit of Glacial Advance (USGS OFR 2014-1220).
2. Coordinate Grid: NAD83, UTM Zone 19 North, Meters

N
W E
S

0 5 10 Nautical Miles

0 5 10 Kilometers

POTENTIAL BOULDER ZONES
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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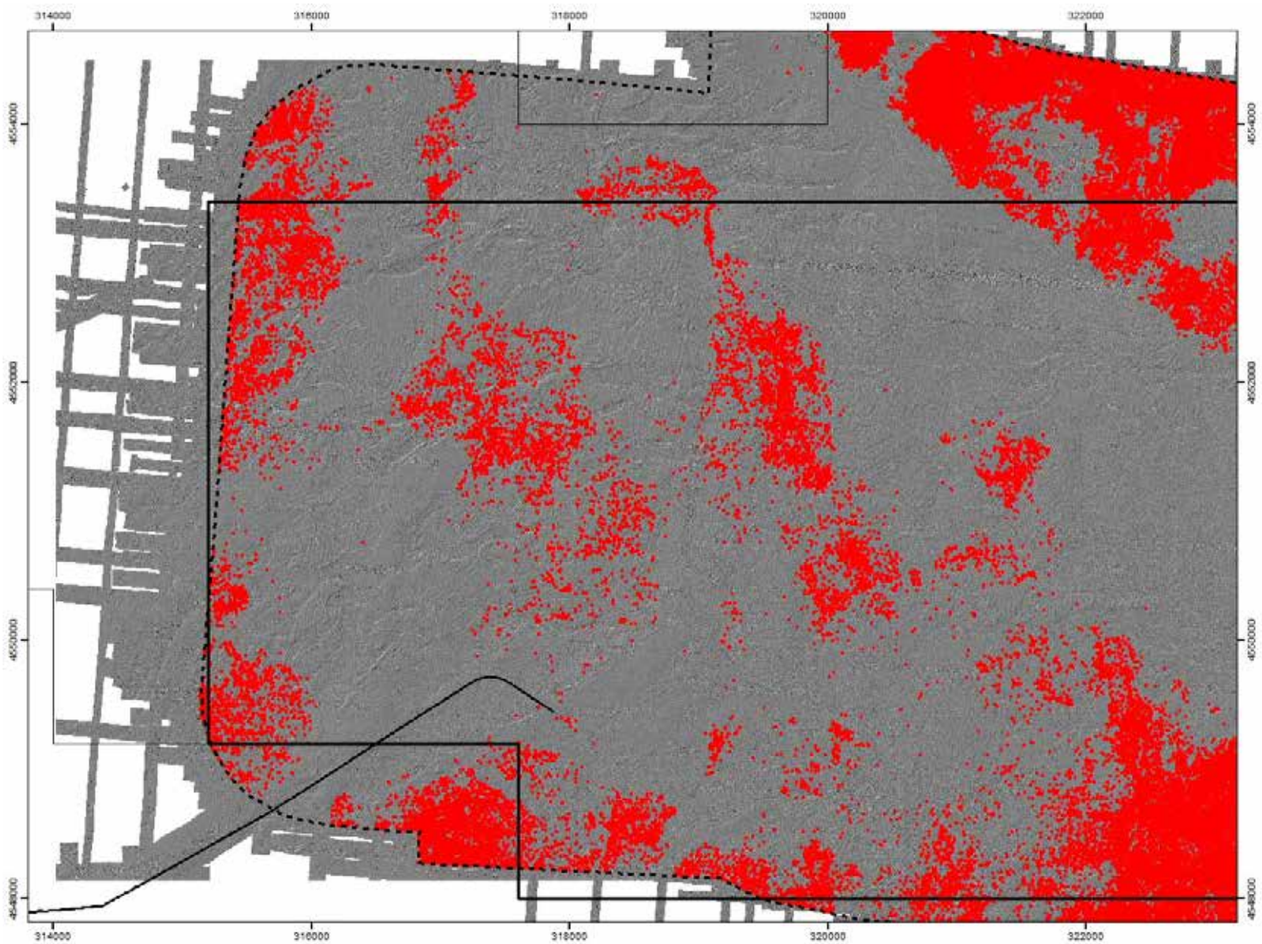
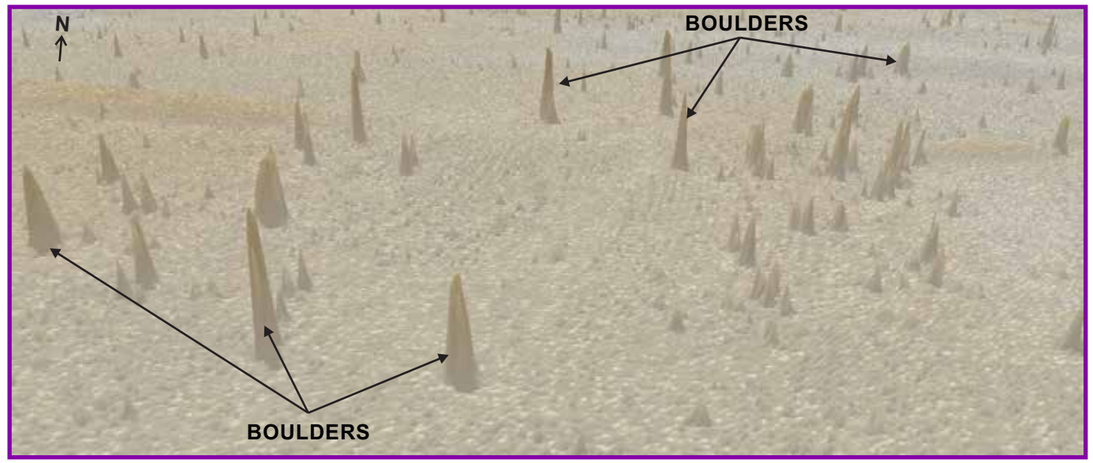


NOTES
1. Base map image is MBES bathymetryic hillshade: 315 Azimuth, 45 Altitude.



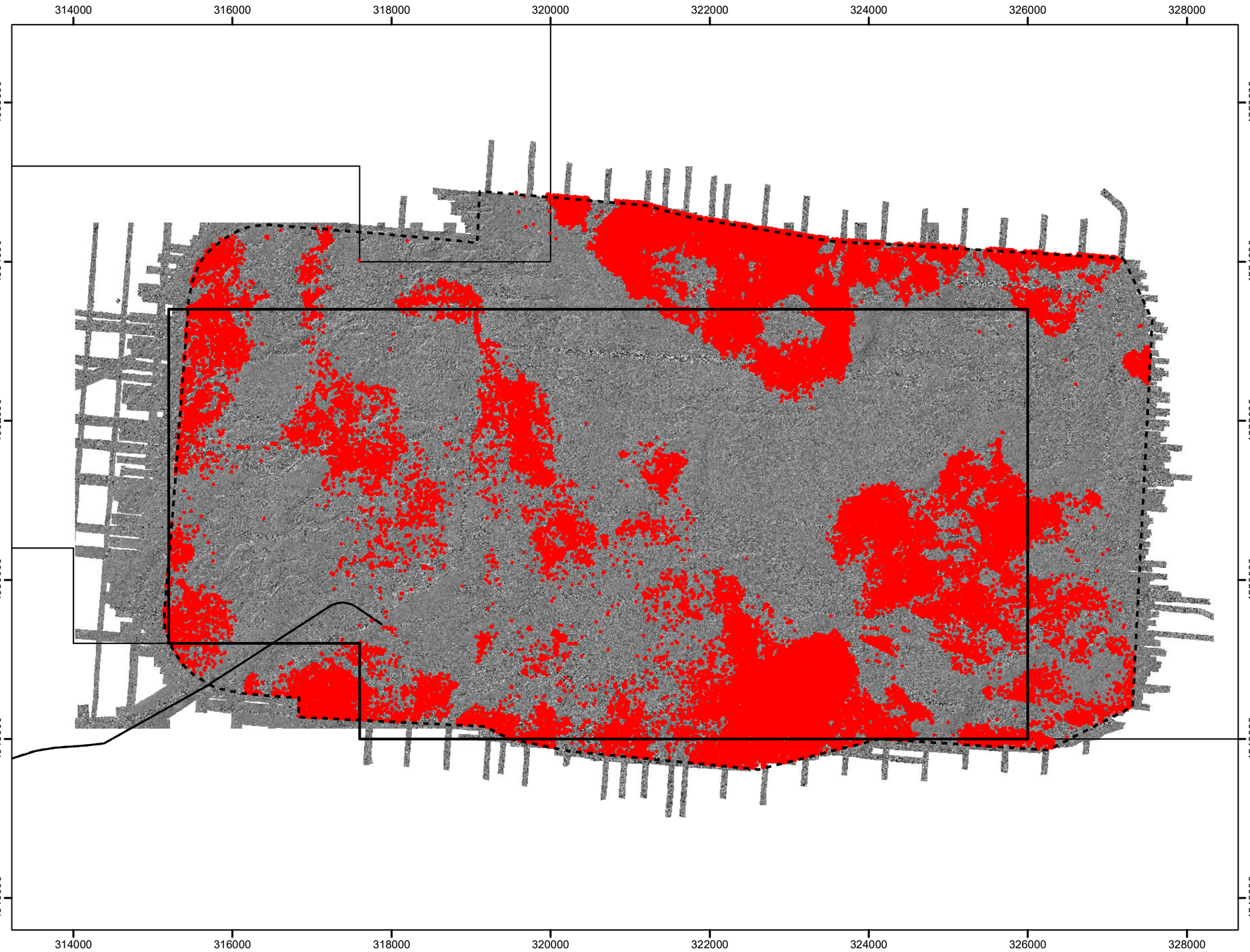
PERSPECTIVE VIEW NOTES
1. Vertical Exaggeration (V.E.) = 10x
2. Scale is variable in this perspective.

EXAMPLES OF MORAINE DEPOSITS (BOULDERS) ON LONG ISLAND, NEW YORK

Ronkonkoma Moraine (boulder beach) at Montauk Point. (from Garveis Point Museum & Preserve)

Harbor Hill Moraine near Creedmoor. (from Fuller, 1914)

SEAFLOOR BOULDERS
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



LEGEND

Proposed Wind Farm and Export Cable

- Maximum Work Area
- Proposed South Fork Export Cable Route
- OCS-A 0486 Lease Block
- OCS-A 0517 Lease Block
- Seafloor Boulders

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters

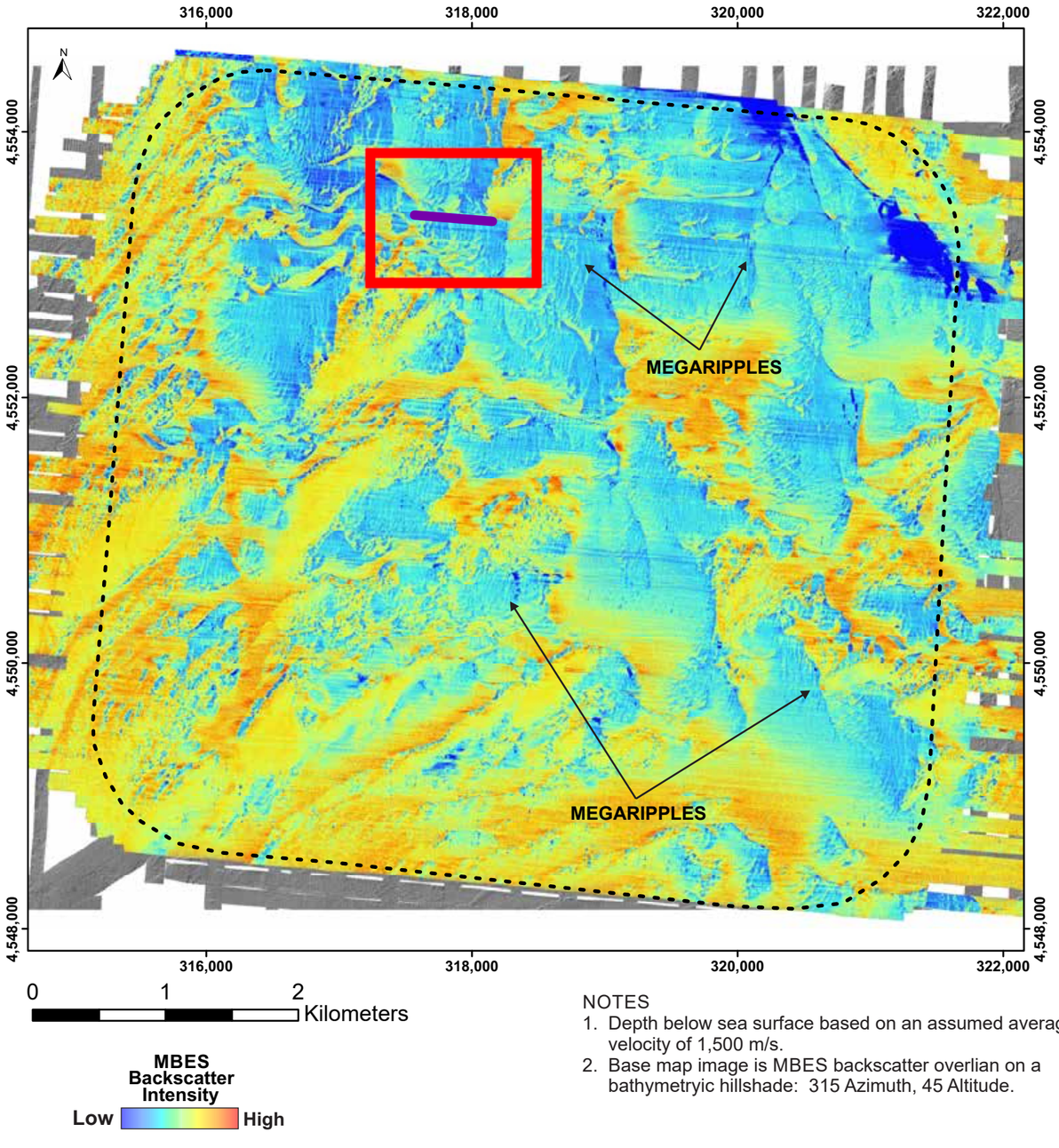
N
W E
S

0 0.5 1 Nautical Mile

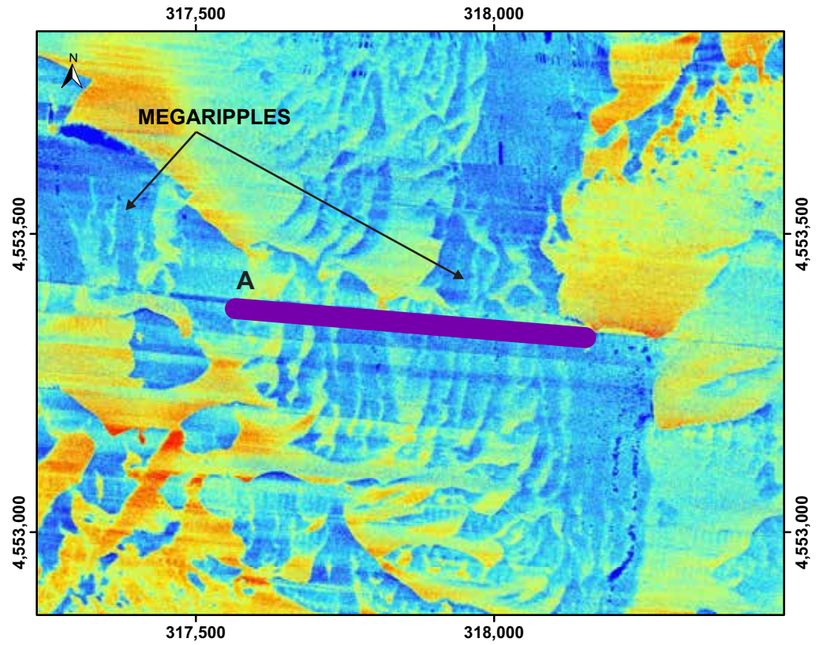
0 1 2 Kilometer

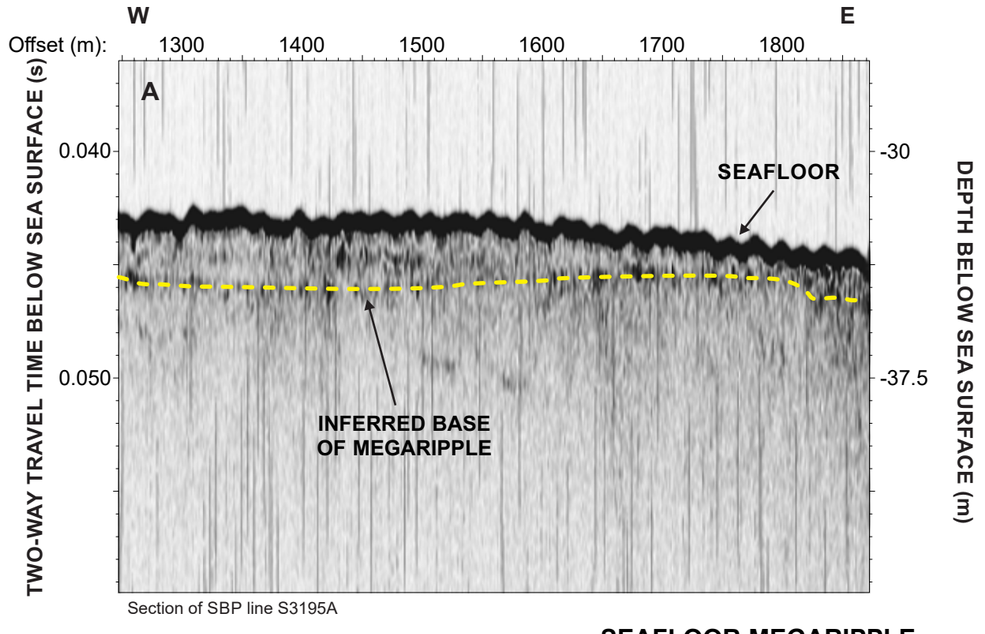
SEAFLOOR BOULDER DENSITY
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

N:\Projects\02_2018\02_1803_1431_DWW_SFEX_Revolution_WindGISData\Outputs\2019_02_04_DWW_SFEX_ShallowHaz_Geophysical_Rpt\mxd\Figure_4_1_3_BoulderDensity_HazardMap.mxd, 3/30/2021, t.rasmussen



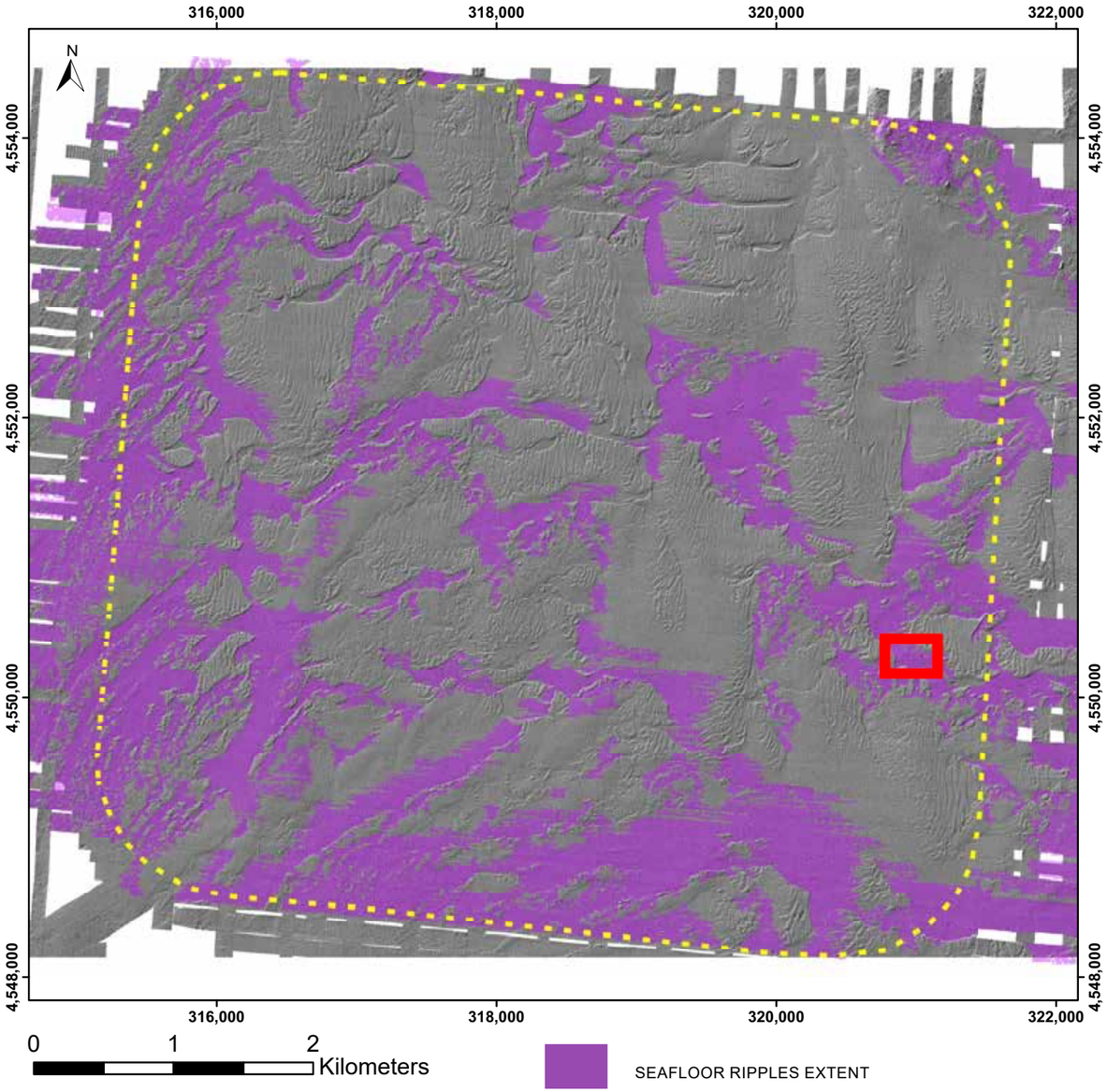
NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Base map image is MBES backscatter overlian on a bathymetryic hillshade: 315 Azimuth, 45 Altitude.

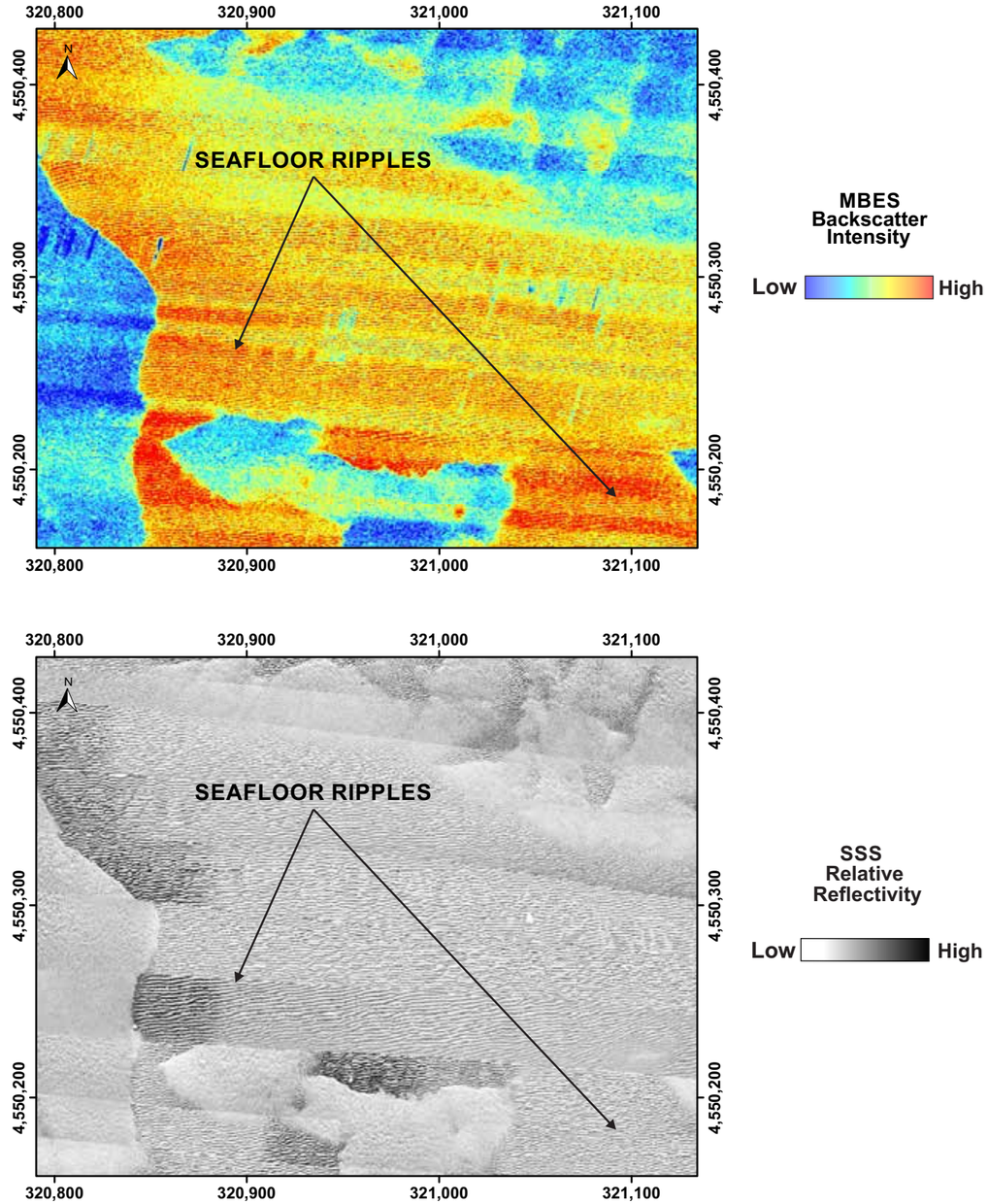




Section of SBP line S3195A

SEAFLOOR MEGARIPPLE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS





NOTES
1. Base map image is MBES backscatter overlian on a bathymetryic hillshade: 315 Azimuth, 45 Altitude.

MINOR SEAFLOOR RIPPLES
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

316000 318000 320000 322000 324000 326000

4554000 4552000 4550000 4548000

LEGEND

Proposed Wind Farm and Export Cable

- Maximum Work Area
- OCS-A 0517 Lease Block
- Boulder Field
- Megaripples (refer to Note 2)
- Ripples
- Interpreted Ripple/Megaripple Bedform Features

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters
2. Megaripple areas may include sand accumulation features. Processes that form sand accumulation features may differ from those that form megaripples. Sand accumulation features may be broad, have flat tops and are irregular in spatial extent.

N
W E
S

0 0.5 1 Nautical Mile

0 0.5 1 Kilometer

SEDIMENTARY SEAFLOOR FEATURES

SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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316000 318000 320000 322000 324000 326000

4554000 4552000 4550000 4548000

LEGEND

- 2017 SFWF Survey Area
- 2018 SFWF Survey Area
- 2020 SFWF Survey Area

Interpreted Ripple Feature
Bedform height is typically between 0.1 and 0.3m.
(Refer to Note 2)

- Feature Delineated from 2017 Bathymetry
- Feature Delineated from 2018 Bathymetry
- Feature Delineated from 2020 Bathymetry

Interpreted Rate of Net Migration (m/yr)
Arrow direction indicates net migration direction.
Refer to Note 2 for information.

- < 0.5
- 0.6 - 1.0
- 1.1 - 1.5
- 1.6 - 2.0
- No Discernable Change in Position

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters
2. Overlapping bathymetry data were collected in the South Fork Wind Farm survey area during 2017, 2018 and 2020. Interpreted apparent migration rates are estimated using the position changes between 2017 and 2020. Selected bedforms deemed to be representative of the area have been digitized and interpreted in this figure.

N
W E
S

0 1 2 Kilometers

SEABED MOBILITY SFWF
Ripples (Height between 0.1 and 0.3m)
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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316000 318000 320000 322000 324000 326000

4554000 4552000 4550000 4548000

LEGEND

- 2017 SFWF Survey Area
- 2018 SFWF Survey Area
- 2020 SFWF Survey Area

Interpreted Ripple/Megaripple/Sand Accumulation Area Feature
Bedform height is typically between 0.4 and 0.7m. (Refer to Note 2)

- Feature Delineated from 2017 Bathymetry
- Feature Delineated from 2018 Bathymetry
- Feature Delineated from 2020 Bathymetry

Interpreted Rate of Net Migration (m/yr)
Arrow direction indicates net migration direction or apparent movement of a portion of the feature. Refer to Note 2 for information.

- < 0.5
- 0.6 - 1.0
- Feature Appears to Exhibit Re-shaping Along the Edges and Does not Exhibit a Net Migration Movement or Feature Does not Exhibit a Discernable Change

Notes:

1. Coordinate Grid: NAD83, UTM Zone 19 North, Meters
2. Overlapping bathymetry data were collected in the South Fork Wind Farm survey area during 2017, 2018 and 2020. Interpreted apparent migration rates are estimated using the position changes between 2017 and 2020. Selected bedforms deemed to be representative of the area have been digitized and interpreted in this figure.

N W E S

0 1 2 Kilometers

SEABED MOBILITY SFWF
Ripples/Megaripples/Sand Accumulation Areas
(Height between 0.4 and 0.7m)
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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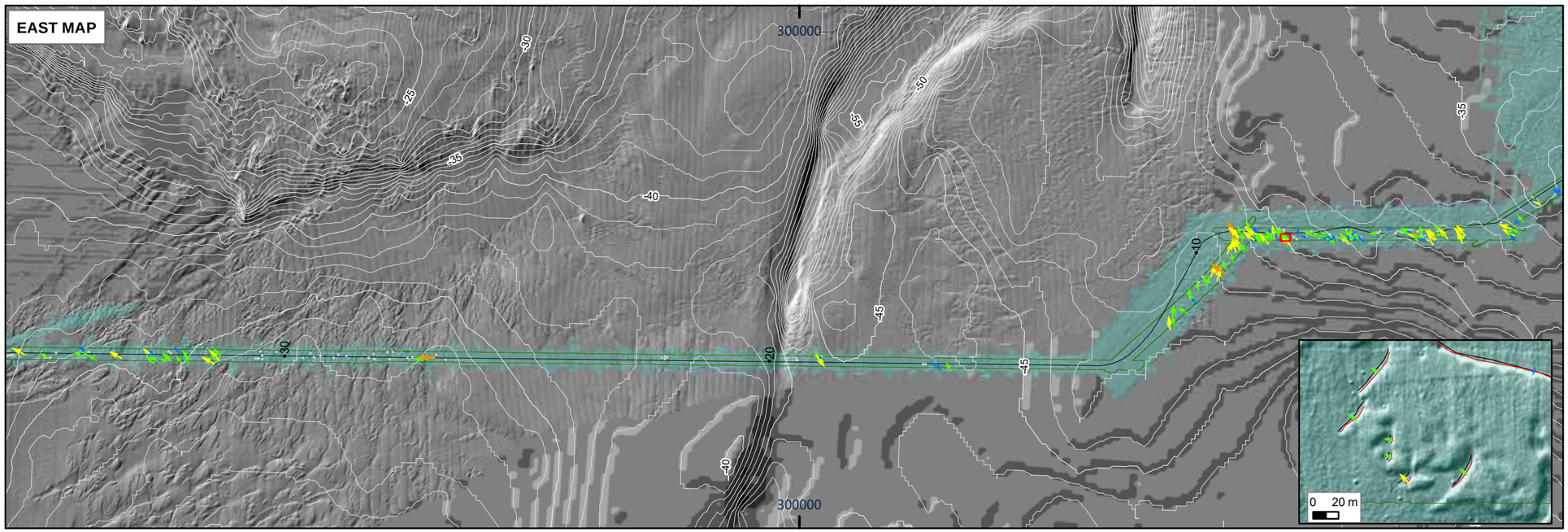
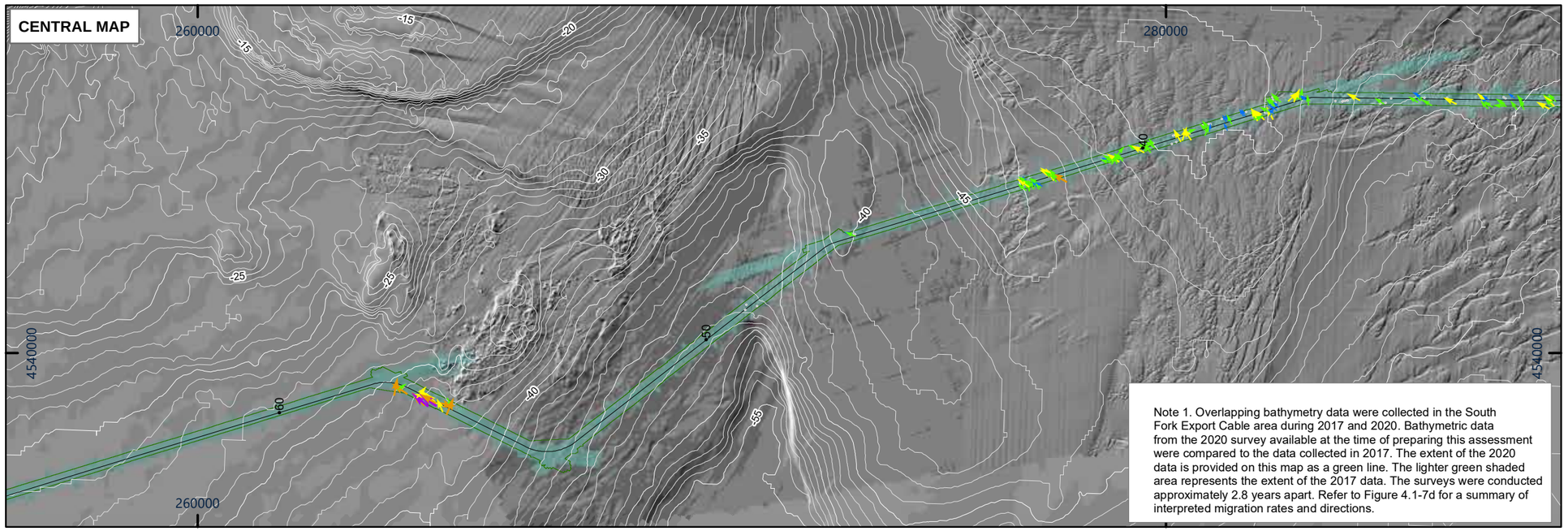




Note 1. Overlapping bathymetry data were collected in the South Fork Export Cable area during 2017 and 2020. Bathymetric data from the 2020 survey available at the time of preparing this assessment were compared to the data collected in 2017. The extent of the 2020 data is provided on this map as a green line. The lighter green shaded area represents the extent of the 2017 data. The surveys were conducted approximately 2.8 years apart. Refer to Figure 4.1-7d for a summary of interpreted migration rates and directions.

LEGEND

2017 SFWF Survey Area

2020 SFEC Survey Area
(Extent of Survey Completed at Time of Preparing this Assessment)

Seafloor Features

Feature Delineated from 2017 Bathymetry

Feature Delineated from 2020 Bathymetry

Interpreted Rate of Net Migration (m/yr)
Arrow direction indicates net migration direction.
Refer to Note 1 for information.

- < 0.5
- 0.6 - 1.0
- 1.1 - 1.5
- 1.6 - 2.0
- 2.1 - 3.0
- 3.1 - 4.7
- No Discernable Change in Position

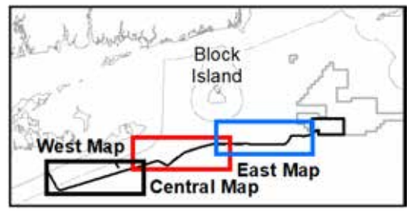
10 — Proposed South Fork Export Cable Route
Kilometer posts are labeled.

3 Nautical Mile Limit

OCS-A 0517 Lease Boundary

-10- Bathymetric Contour (Meters, Re. MLLW)
Contour interval is 5 meters.

Coordinate Grid: NAD83, UTM Zone 19 North, Meters



N

0 2,000 4,000 Meters

SEABED MOBILITY SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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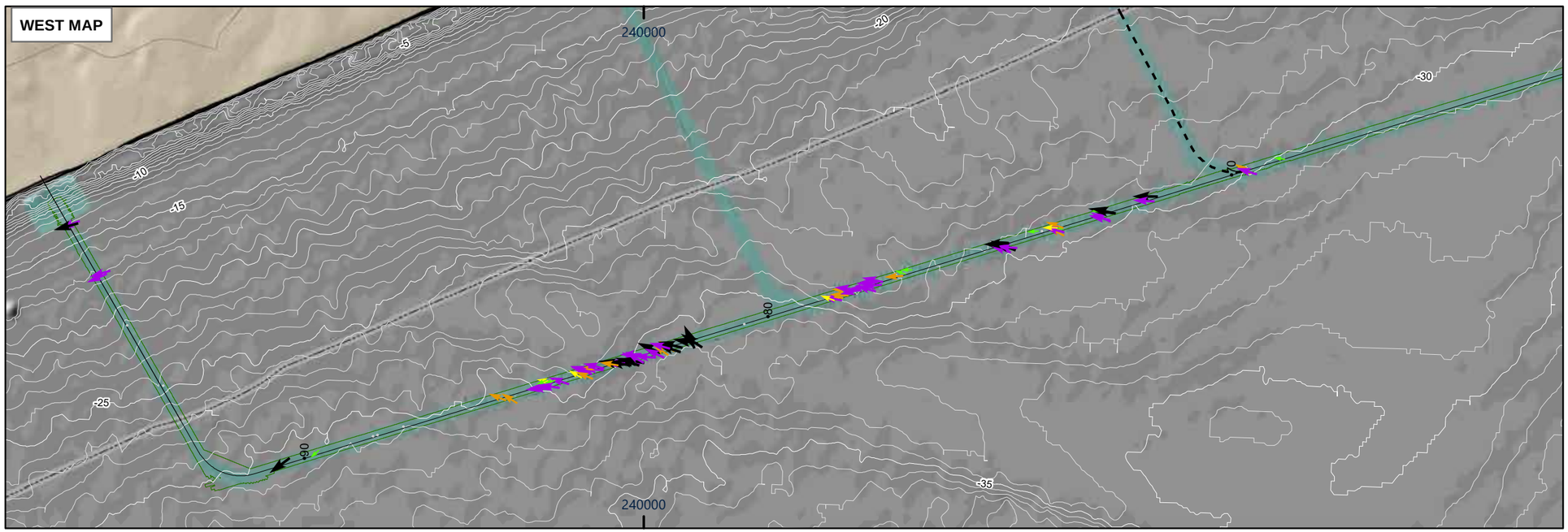
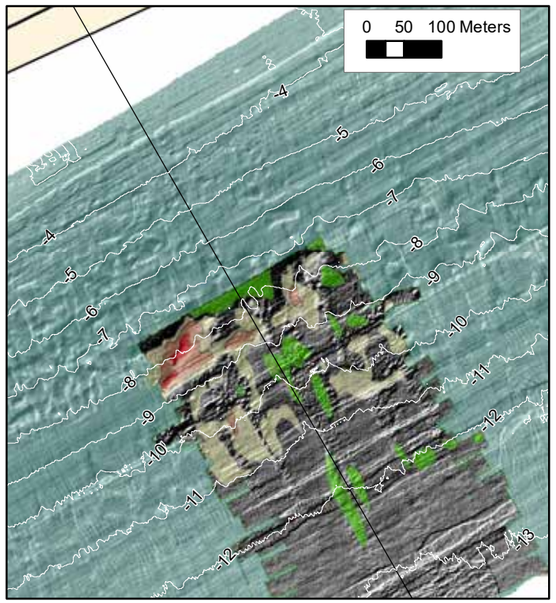




Landfall Area Map Legend
Interpreted Process and Seabed Elevation Change from 2017 to 2020
(Elevation changes below are considered to be approximate)

- Accretion, 0.25 to 0.5m
- Erosion, -0.25 to -0.5m
- Erosion, -0.5 to -0.75m
- Erosion, -0.75 to -1.0m

Bathymetric contours are displayed at 1m intervals, reference MLLW, and are based on the 2017 survey.

Note 1. Overlapping bathymetry data were collected in the South Fork Export Cable area during 2017 and 2020. Bathymetric data from the 2020 survey available at the time of preparing this assessment were compared to the data collected in 2017. The extent of the 2020 data is provided on this map as a green line. The lighter green shaded area represents the extent of the 2017 data. The surveys were conducted approximately 2.8 years apart. Refer to Figure 4.1-7d for a summary of interpreted migration rates and directions.

LEGEND

- 2017 SFWF Survey Area
- 2020 SFEC Survey Area (Extent of Survey Completed at Time of Preparing this Assessment)

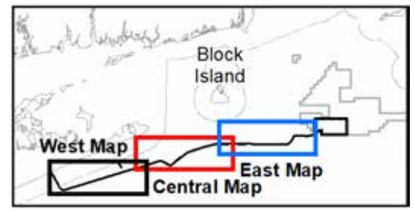
Seafloor Features

- Feature Delineated from 2017 Bathymetry
- Feature Delineated from 2020 Bathymetry

Interpreted Rate of Net Migration (m/yr)
Arrow direction indicates net migration direction.
Refer to Note 1 for information.

- < 0.5
- 0.6 - 1.0
- 1.1 - 1.5
- 1.6 - 2.0
- 2.1 - 3.0
- 3.1 - 4.7
- No Discernable Change in Position
- 10 — Proposed South Fork Export Cable Route Kilometer posts are labeled.
- 3 Nautical Mile Limit
- OCS-A 0486 Lease Boundary
- -10- Bathymetric Contour (Meters, Re. MLLW) Contour interval is 5 meters.

Coordinate Grid: NAD83, UTM Zone 19 North, Meters



N

0 2,000 4,000 Meters

SEABED MOBILITY SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

Figure 4.1-7b-ii

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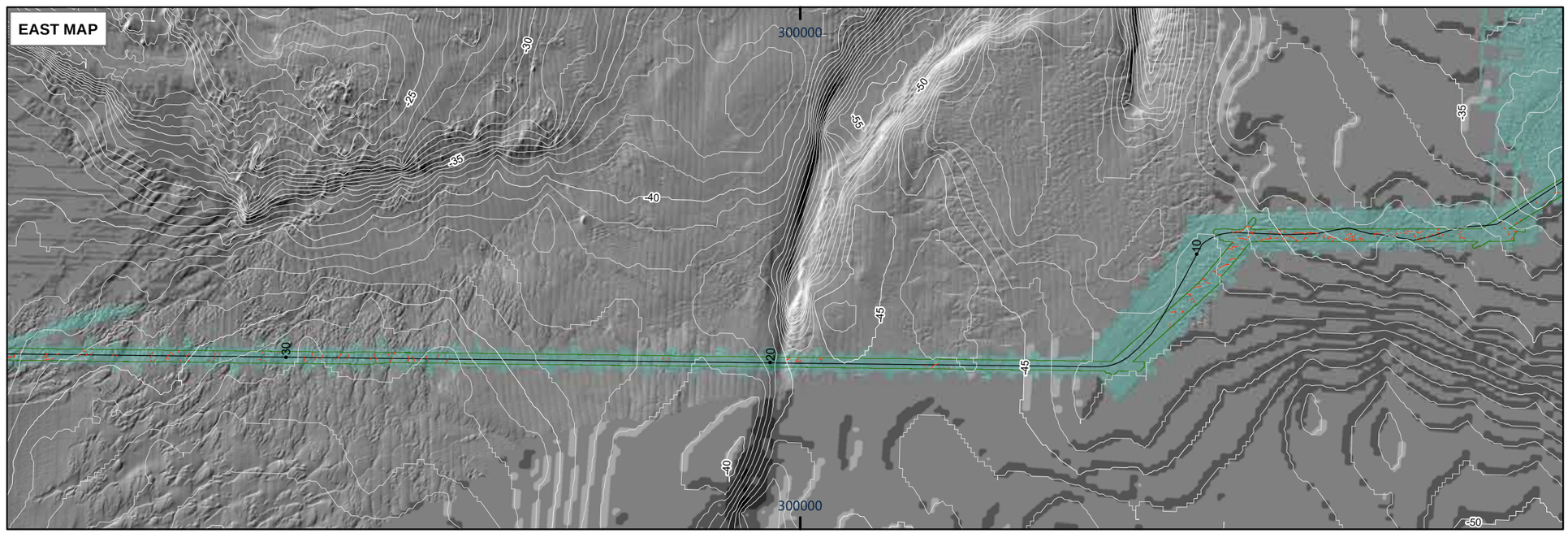
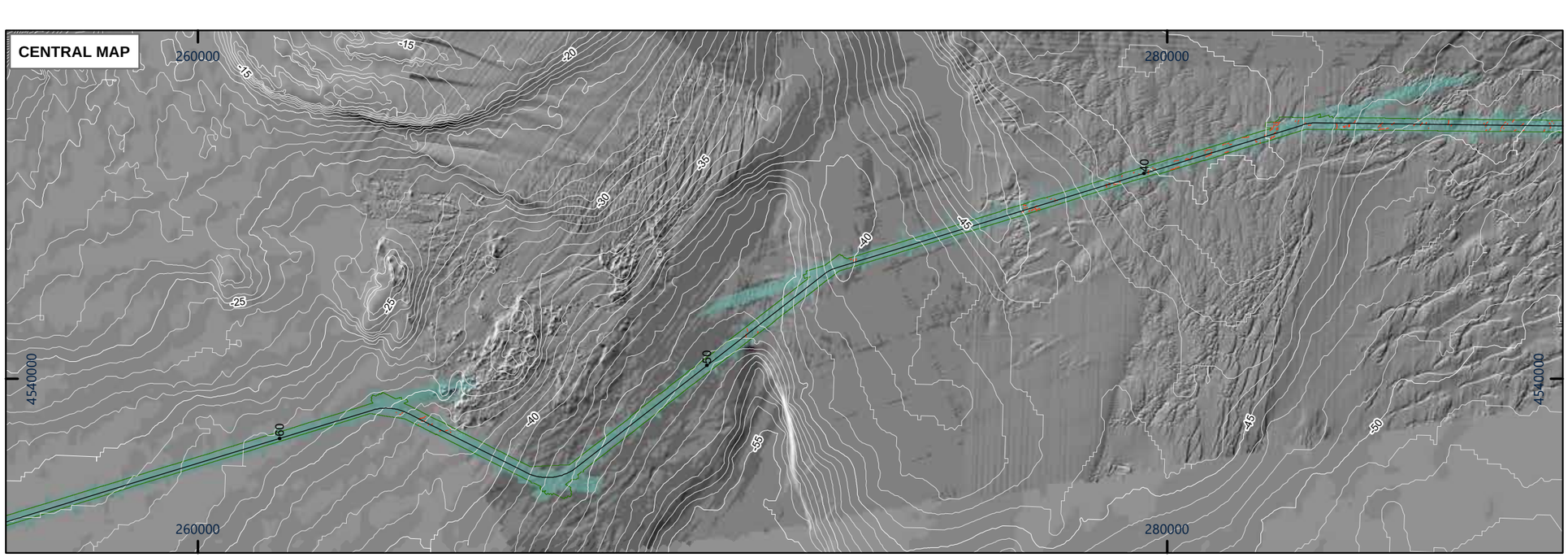




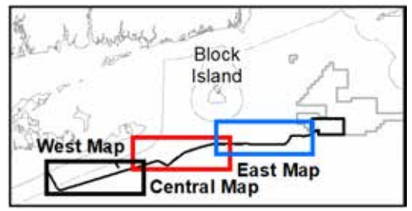
LEGEND

- 2017 SFWF Survey Area
- 2020 SFEC Survey Area (Extent of Survey Completed at Time of Preparing this Assessment)

Seafloor Features

- Feature Delineated from 2017 Bathymetry Bedforms range in height from approximately 0.2 to 0.5 m.
- 10 — Proposed South Fork Export Cable Route Kilometer posts are labeled.
- 3 Nautical Mile Limit
- OCS-A 0486 Lease Boundary
- -10 — Bathymetric Contour (Meters, Re. MLLW) Contour interval is 5 meters.

Coordinate Grid: NAD83, UTM Zone 19 North, Meters



N

0 2,000 4,000 Meters

SEABED MOBILITY SFEC BEDFORMS
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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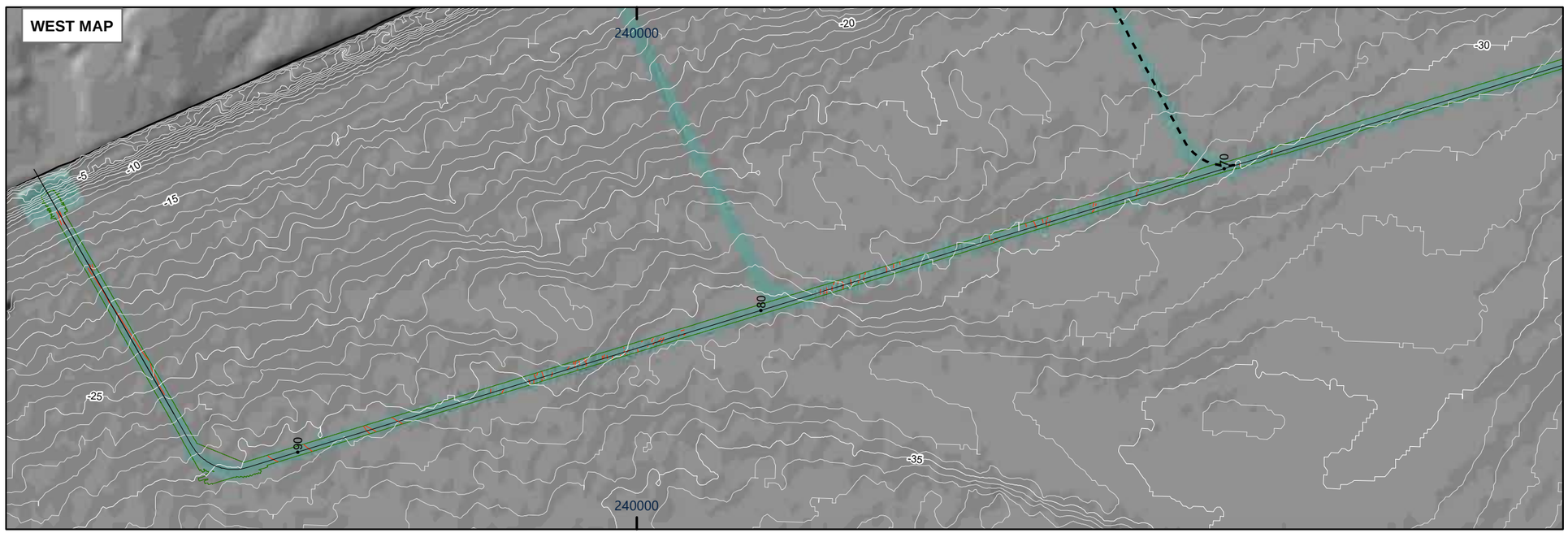
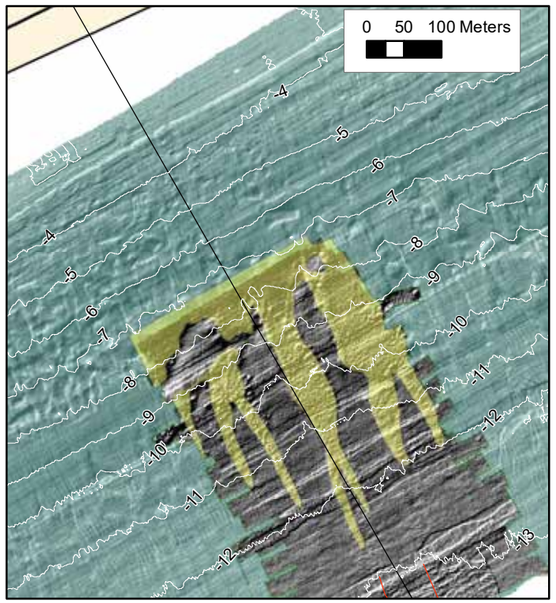




Landfall Area Map Legend

Surficial Sand Bodies

Bathymetric contours are displayed at 1m intervals, reference MLLW, and are based on the 2017 survey.

LEGEND

2017 SFWF Survey Area

2020 SFEC Survey Area
(Extent of Survey Completed at Time of Preparing this Assessment)

Seafloor Features

Feature Delineated from 2017 Bathymetry
Bedforms range in height from approximately 0.2 to 0.5 m.

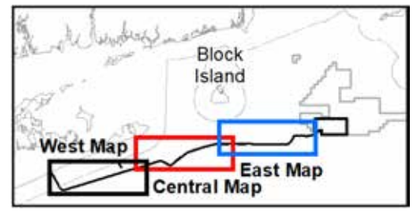
10 Proposed South Fork Export Cable Route
Kilometer posts are labeled.

3 Nautical Mile Limit

OCS-A 0486 Lease Boundary

-10- Bathymetric Contour (Meters, Re. MLLW)
Contour interval is 5 meters.

Coordinate Grid: NAD83, UTM Zone 19 North, Meters



N

0 2,000 4,000 Meters

SEABED MOBILITY SFEC BEDFORMS
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

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Kilometer Post	Bedforms Interpreted to be Mobile	Predominant Bedform Height Range (m)	Bedform Wavelength Range (m)	Interpreted Net Migration Rate (m/yr), (1 σ)	Interpreted Net Migration Direction** (1 σ)	Water Depth Range (m, Re. MLLW)	No. of Migratory Measured Bedforms	Area
0+00 to 33+00	Few to none	*	*	*	*	34.5 to 37.2	*	Lease area to Z-approach
33+00 to 80+00	Ripples to megaripples	0.1 to 0.7	30 to 50 and 60 to 200	0.7 (0.4)	N44W (33)	37.2 to 40.4	90	Northern E-W limb of Z-approach
80+00 to 117+00	Ripples to megaripples	0.3 to 0.7	30 to 50 and 60 to 200	0.8 (0.3)	N33W (26)	40.2 to 42.7	78	Turn area in Z-approach
117+00 to 312+00	Few to none	*	*	*	*	42 to 49.4, predominantly deeper than 46	*	Long E-W segment
312+00 to 429+00	Ripples	0.1 to 0.4	20 to 60	0.8 (0.3)	N40W (29)	40 to 45	118	Offshore from Block Island Sound
429+00 to 562+00	Few to none	*	*	*	*	37 to 48	*	
562+00 to 577+00	Ripples	0.15 to 0.4	40 to 60	1.4 (0.4)	N6W (65)	35 to 37	21	Bypass around boulder mound
577+00 to 687+00	Few to none	*	*	*	*	32 to 35	*	Shore-parallel section offshore Long Island
687+00 to 860+00	Ripples to megaripples	0.1 to 0.7	50 to 100 and 140 to 150	2.3 (0.8)	N78W (15)	27.5 to 31	51	
860+00 to 895+00	Few to none	*	*	*	*	29.5 to 31	*	
895+00 to 910+00	Sorted bedforms perpendicular to shoreline, megaripple to sandwave in scale	0.5 to 1.5	500 to 800	<3 (some features exhibited no discernable change)	S40W (***)	29 to 30	2 (~3 exhibited no discernable changes)	Likely change in response to shore-parallel currents and waves
910+00 to 964+00	Relict features(?) perpendicular to shoreline, megaripple in scale	*	*	*	*	30 to 18	*	Features appear to exhibit little to no change; may be relict instead of modern mobile features
964+00 to 980+00	Ripples to megaripples	0.1 to 0.5	60 to 80	3.0 (0.4)	N22W (5)	11 to 18	5	Shore approach
980+00 to 987+00 (inshore survey limit)	Heterogenous sediment reworking area	0.1 to 0.5	Indeterminate	Indeterminate	Indeterminate	3 to 11	Indeterminate	Inshore area: influenced by waves, alongshore currents, seasonal processes and storms

Notes:

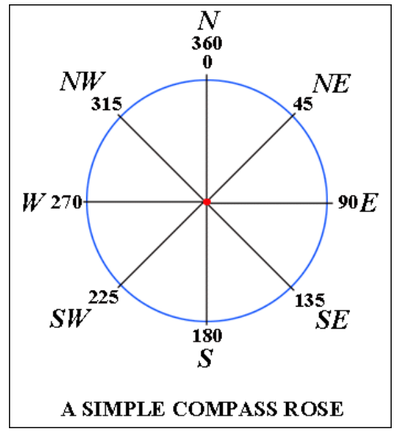
* Indicates no bedforms were observed to migrate between to the two surveys. Bedforms may be present in the area but did not appear to exhibit discernable movement and are considered immobile or very low mobility.

** Direction is based on quadrant bearing system and units are in degrees. Refer to graphics on the right for explanation of system.

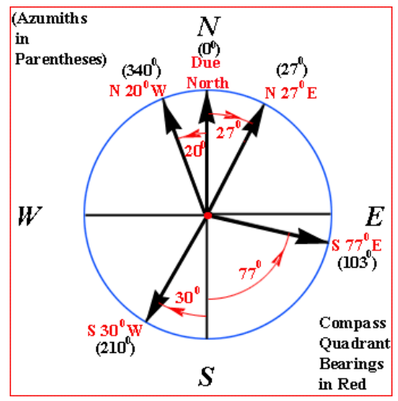
*** Not enough data points to determine standard deviation.

σ = standard deviation

MLLW = Mean Lower Low Water

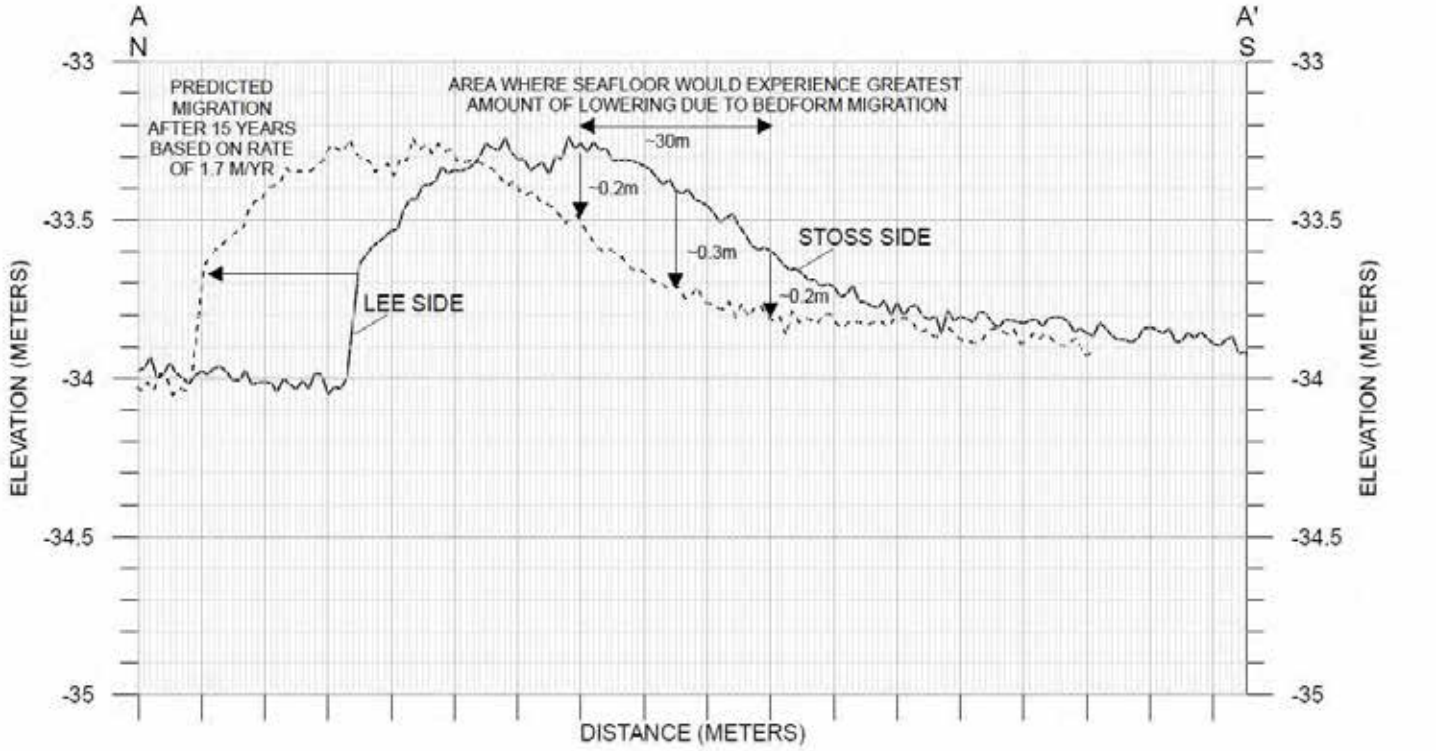


A SIMPLE COMPASS ROSE



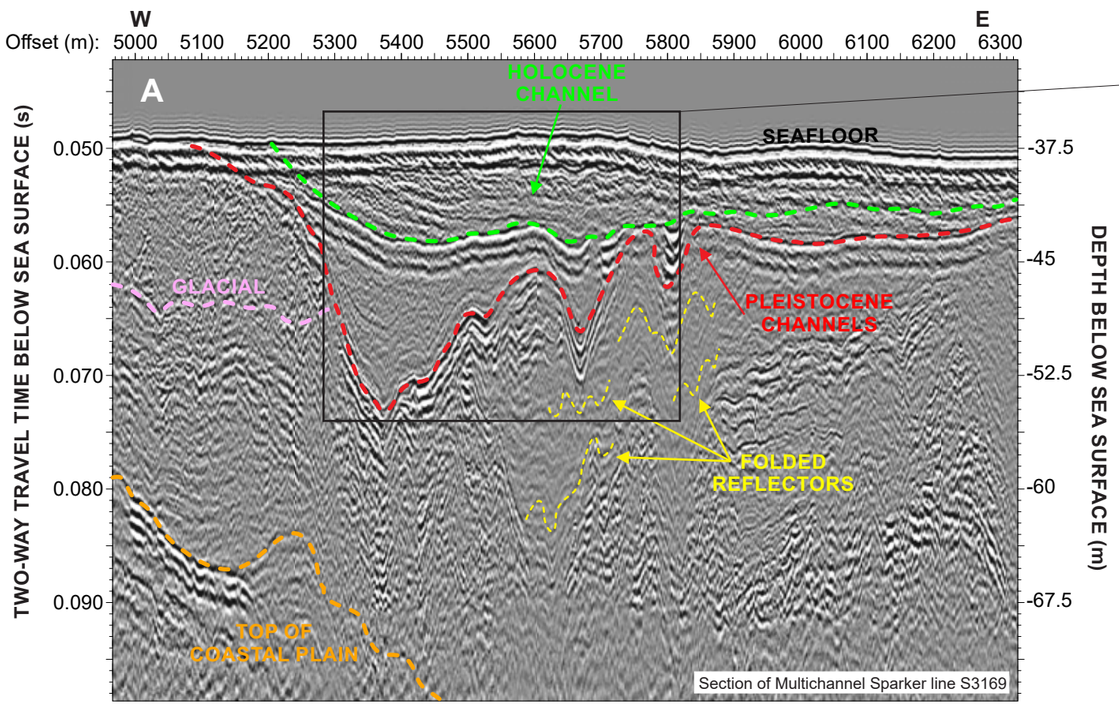
Quadrant bearing system and azimuth system (upper image). Quadrant bearing examples shown in red in lower image.

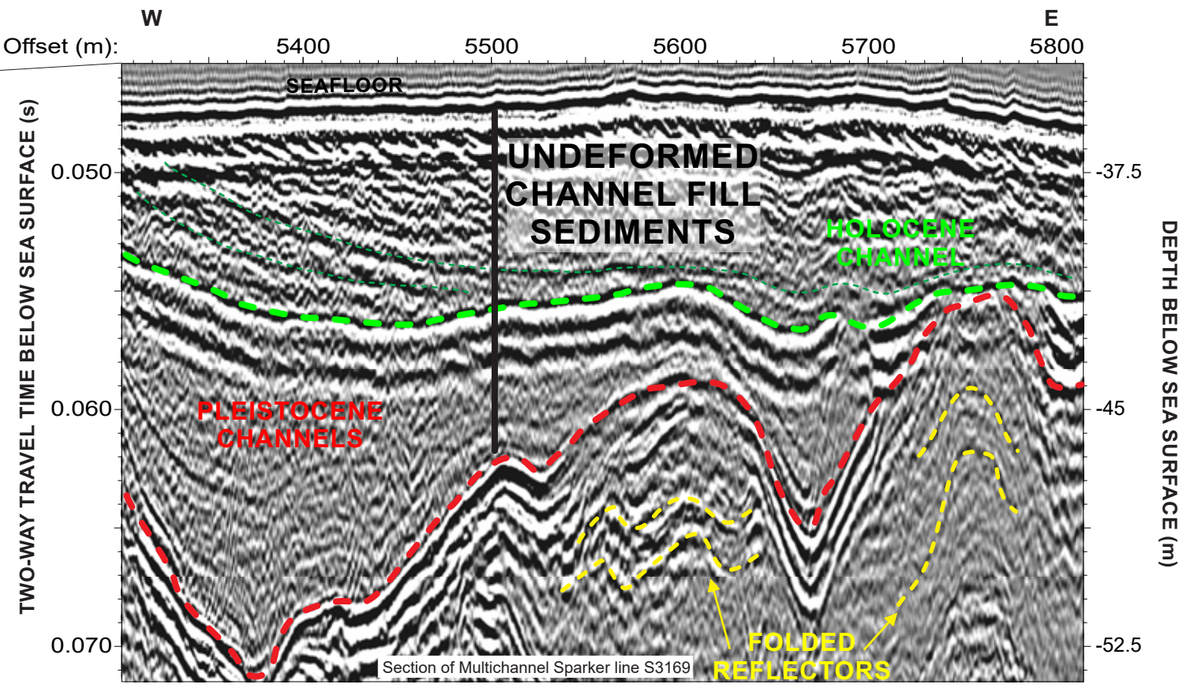
SEABED MOBILITY SFEC SUMMARY
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

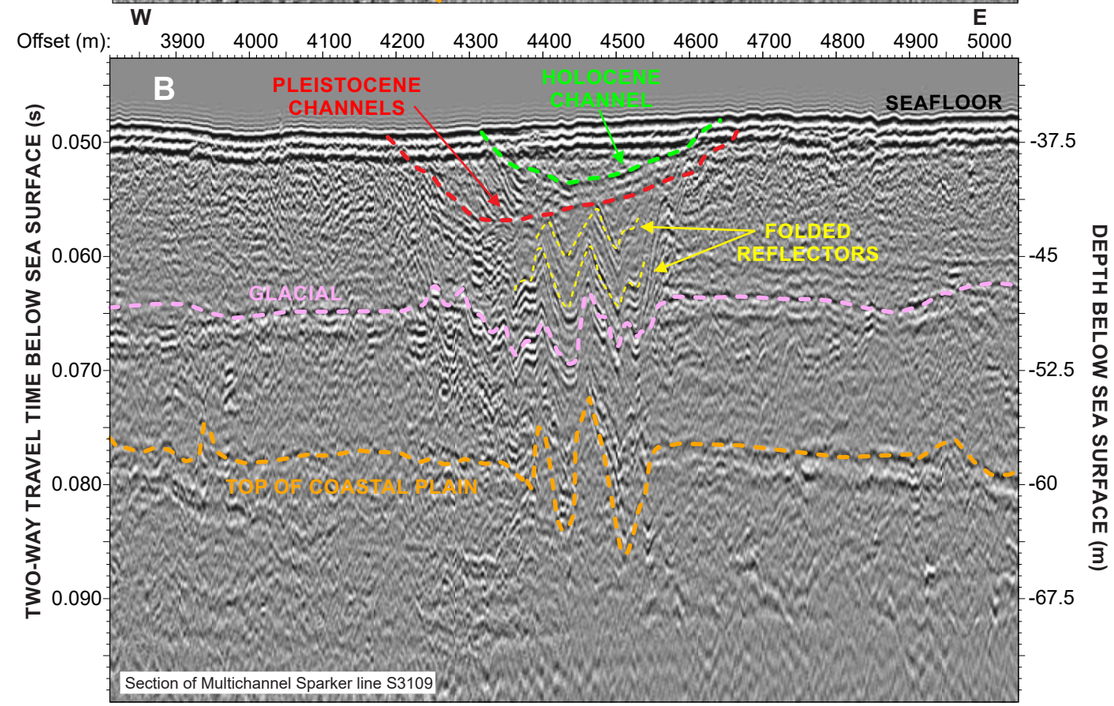


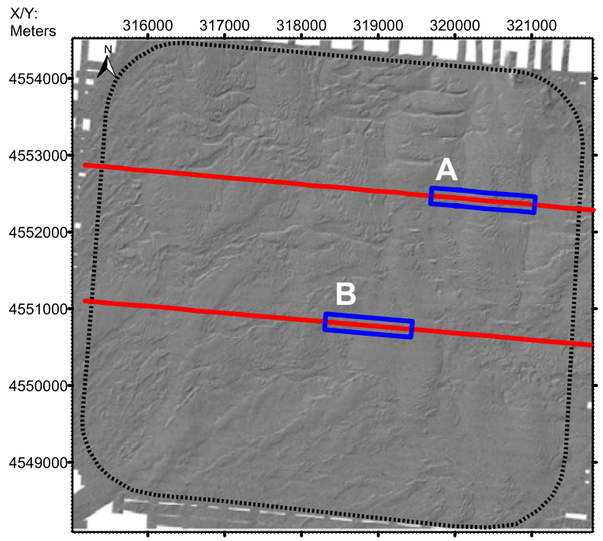
Multibeam surveys conducted in the fall of 2017 and fall of 2018 were used to assess bedform migration rates and direction in the SFWF. Fifty representative megaripples were evaluated using the data and average migration rates are estimated be approximately 1.7 m/yr and net migration direction is to the north. The bedform profile shown in this figure is from the 2018 survey. The dashed line illustrates the approximate position where this feature would be after 15 years. The greatest amount of burial protection due to lowering of the seafloor as the bedform migrated north would on the stoss side of the bedform. This lowering of the seafloor over this 30m section is estimated to be 0.2 to 0.3m. This lowering of the seafloor is not anticipated to result in exposure of the cable and would result in a small reduction in burial protection over a very small area (30m section) and thus is not expected to significantly increase hazard potential to the cable.

PREDICTED MIGRATION
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



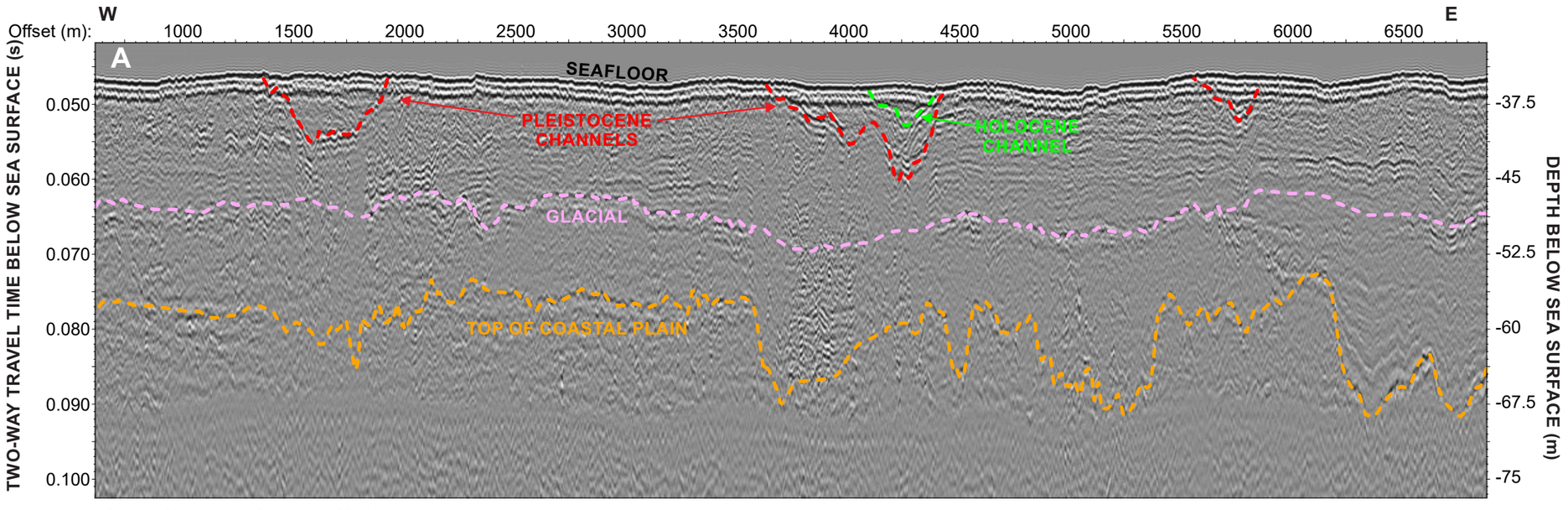




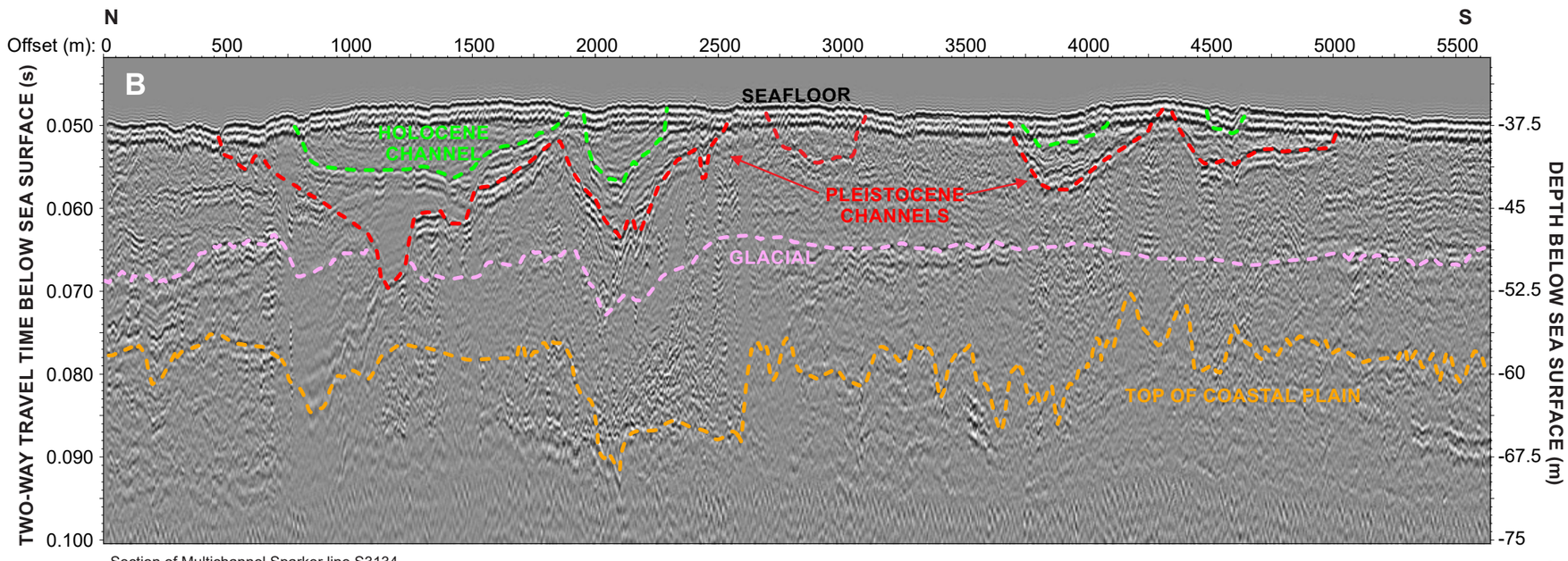


NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Base map image is MBES bathymetry hillshade: 315 Azimuth, 45 Altitude
3. Subsurface deformation identified within the SFWF are not inferred to offset or deform Holocene age sediments and are not believed to be active.

EXAMPLES OF DEFORMED SUBSURFACE STRATIGRAPHY
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

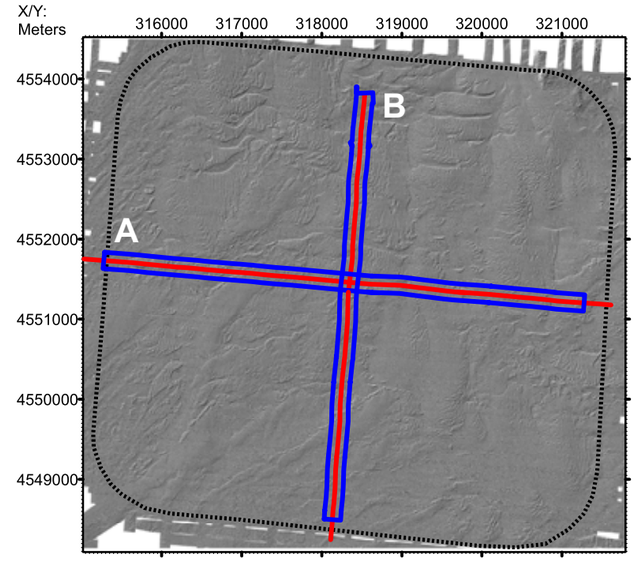


Section of Multichannel Sparker line SR3412

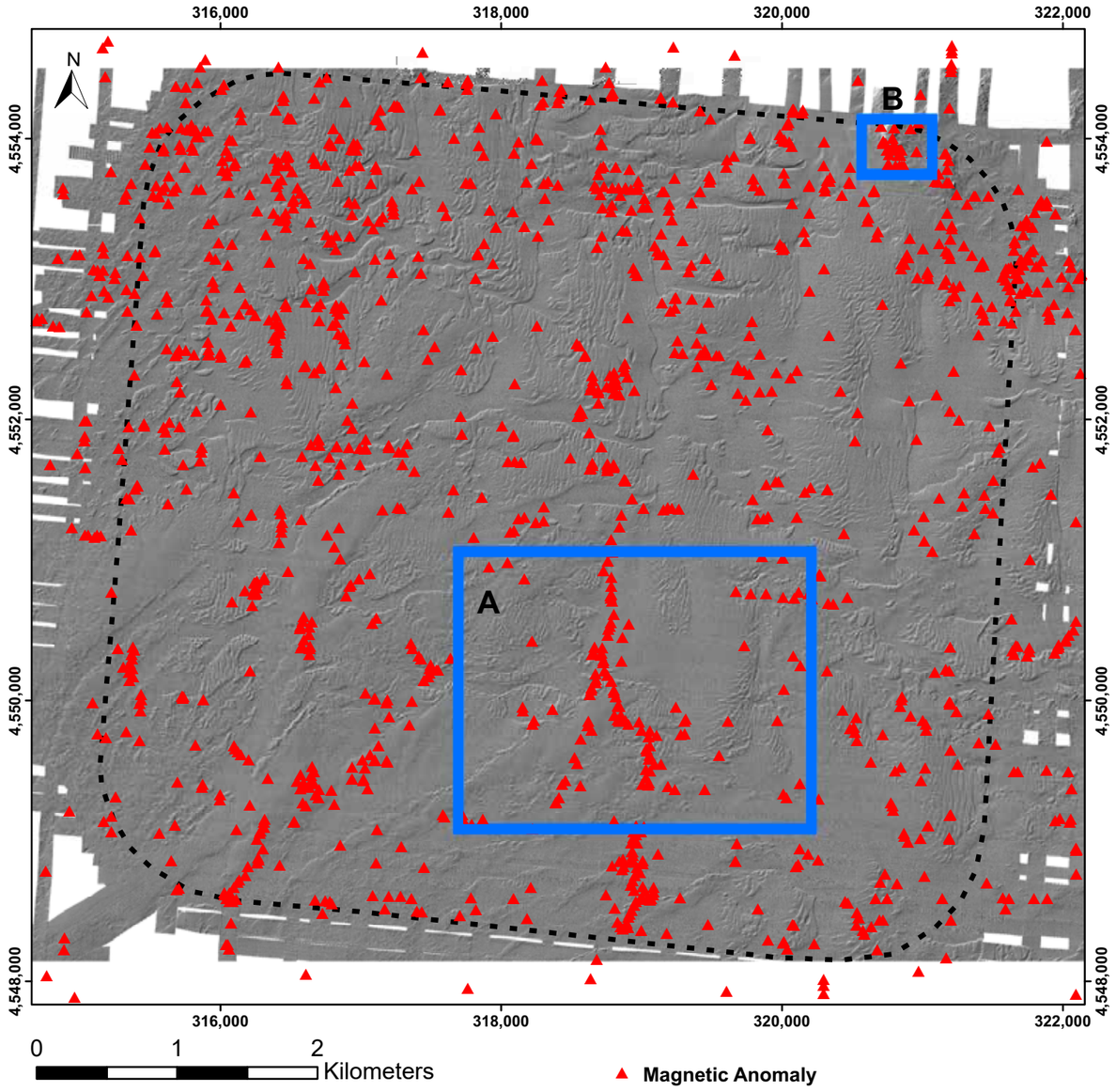


Section of Multichannel Sparker line S3134

NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Base map image is MBES bathymetry hillshade: 315 Azimuth, 45 Altitude

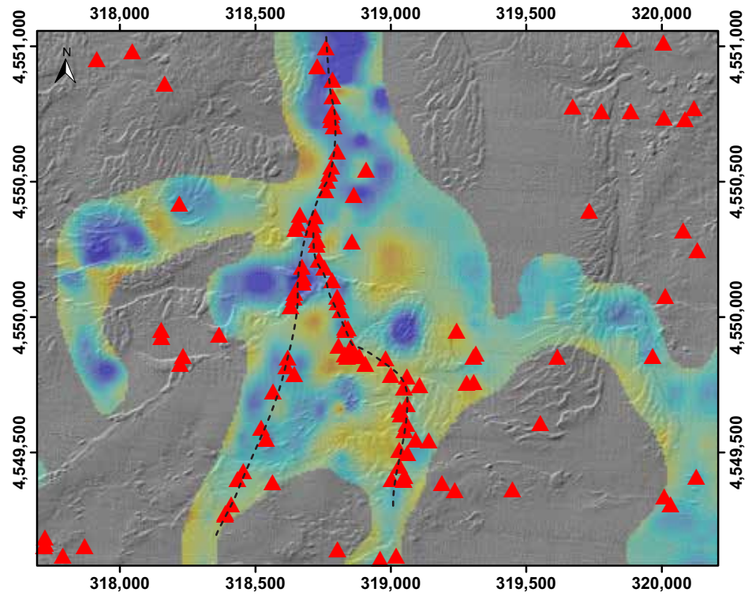


GENERAL SOUTHFORK WINDFARM STRATIGRAPHY
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

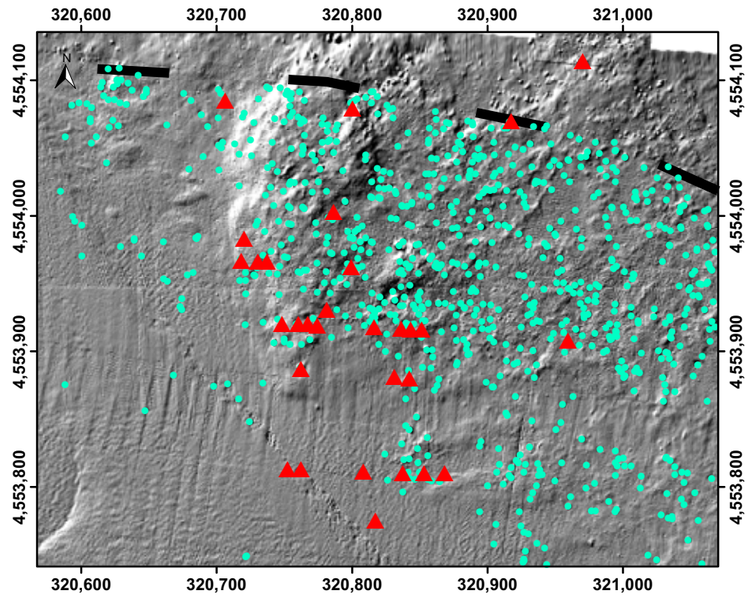


NOTES
1. Base map image is MBES backscatter overlian on a bathymetryic hillshade: 315 Azimuth, 45 Altitude.

A)

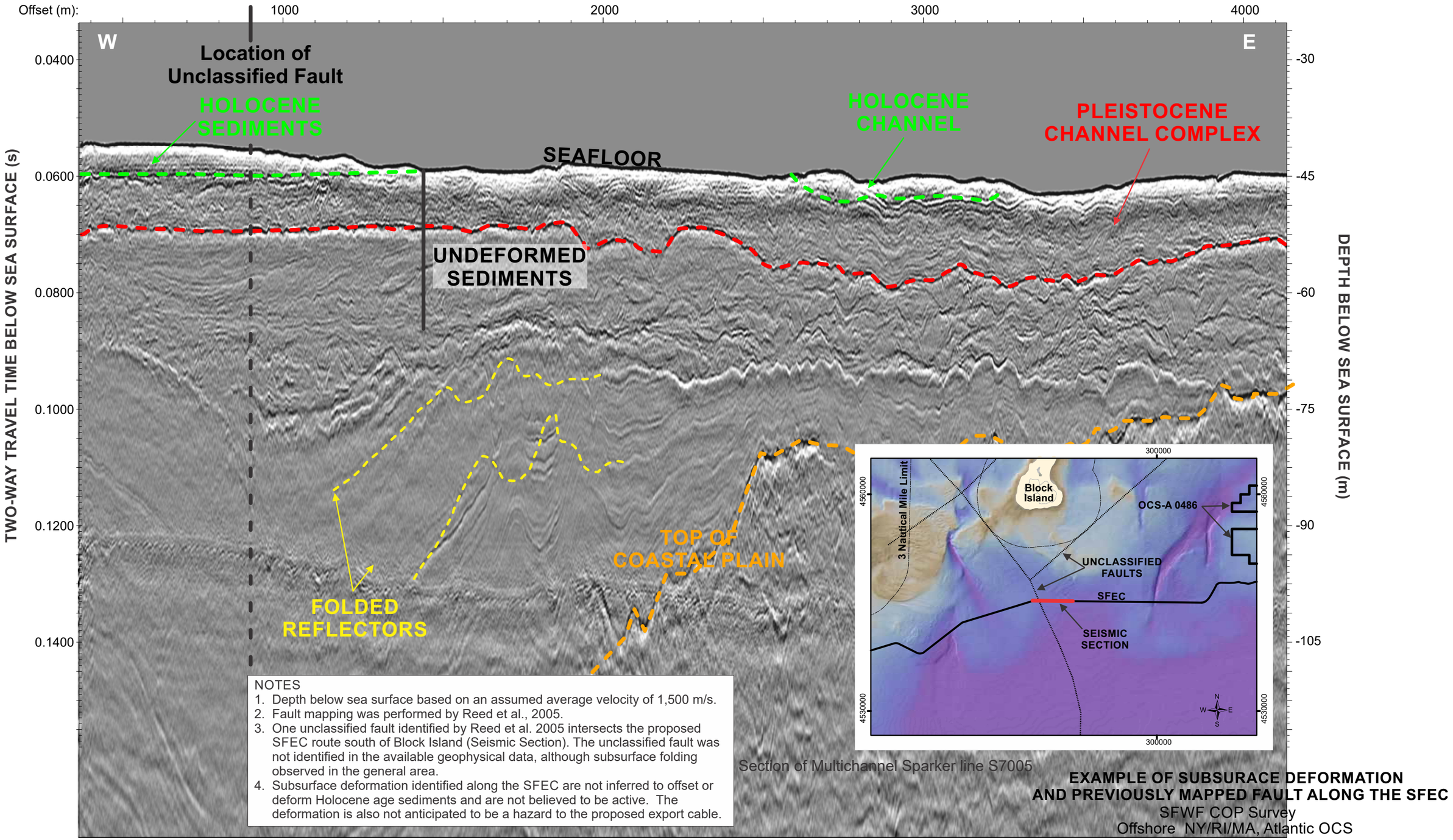


B)



NOTES
1. Only seafloor boulders within the SFWF survey area are displayed.

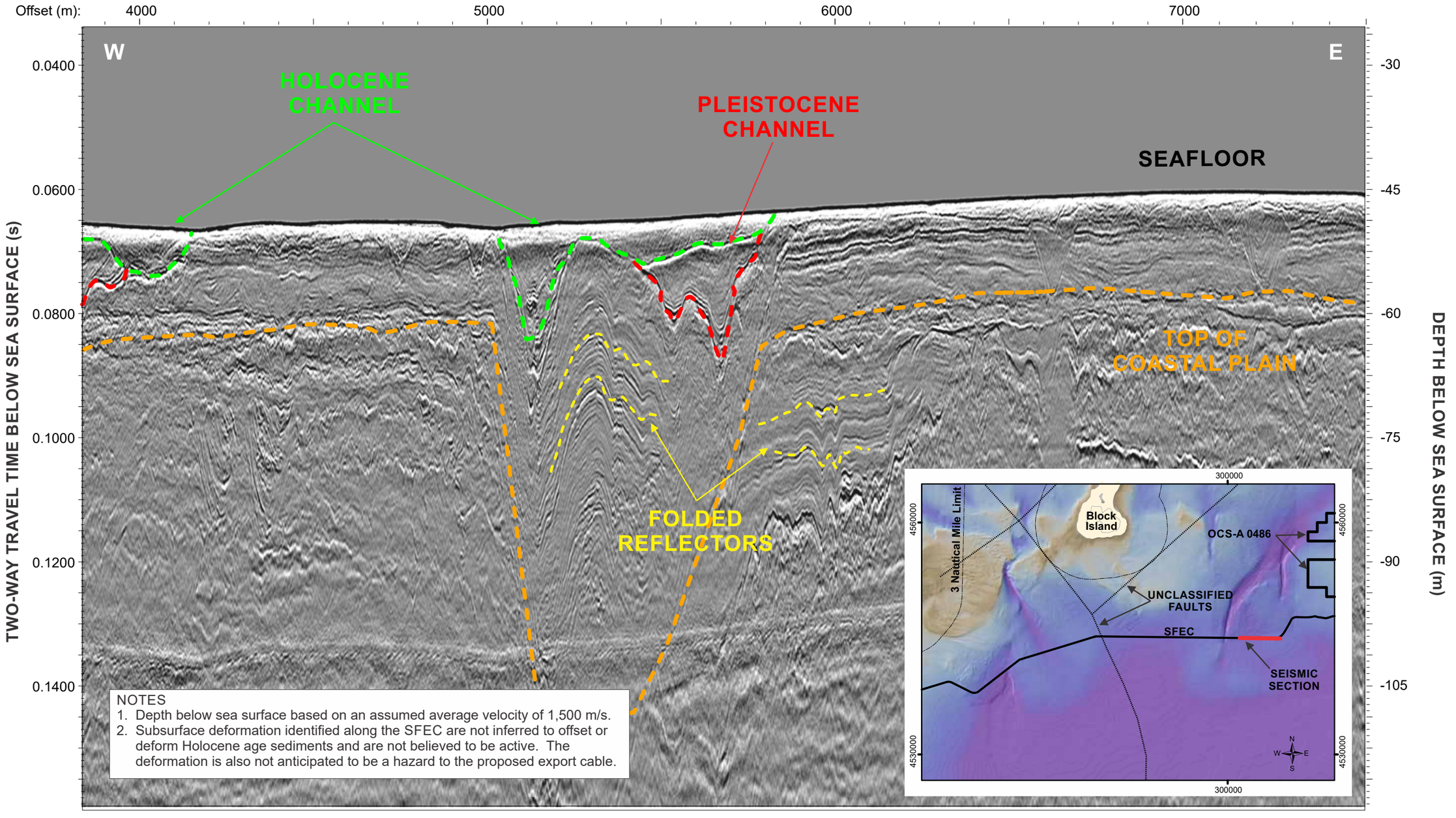
MAGNETIC ANOMALIES AND GEOLOGIC FEATURES
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



NOTES
1. Depth below sea surface based on an assumed average velocity of 1,500 m/s.
2. Fault mapping was performed by Reed et al., 2005.
3. One unclassified fault identified by Reed et al. 2005 intersects the proposed SFEC route south of Block Island (Seismic Section). The unclassified fault was not identified in the available geophysical data, although subsurface folding observed in the general area.
4. Subsurface deformation identified along the SFEC are not inferred to offset or deform Holocene age sediments and are not believed to be active. The deformation is also not anticipated to be a hazard to the proposed export cable.

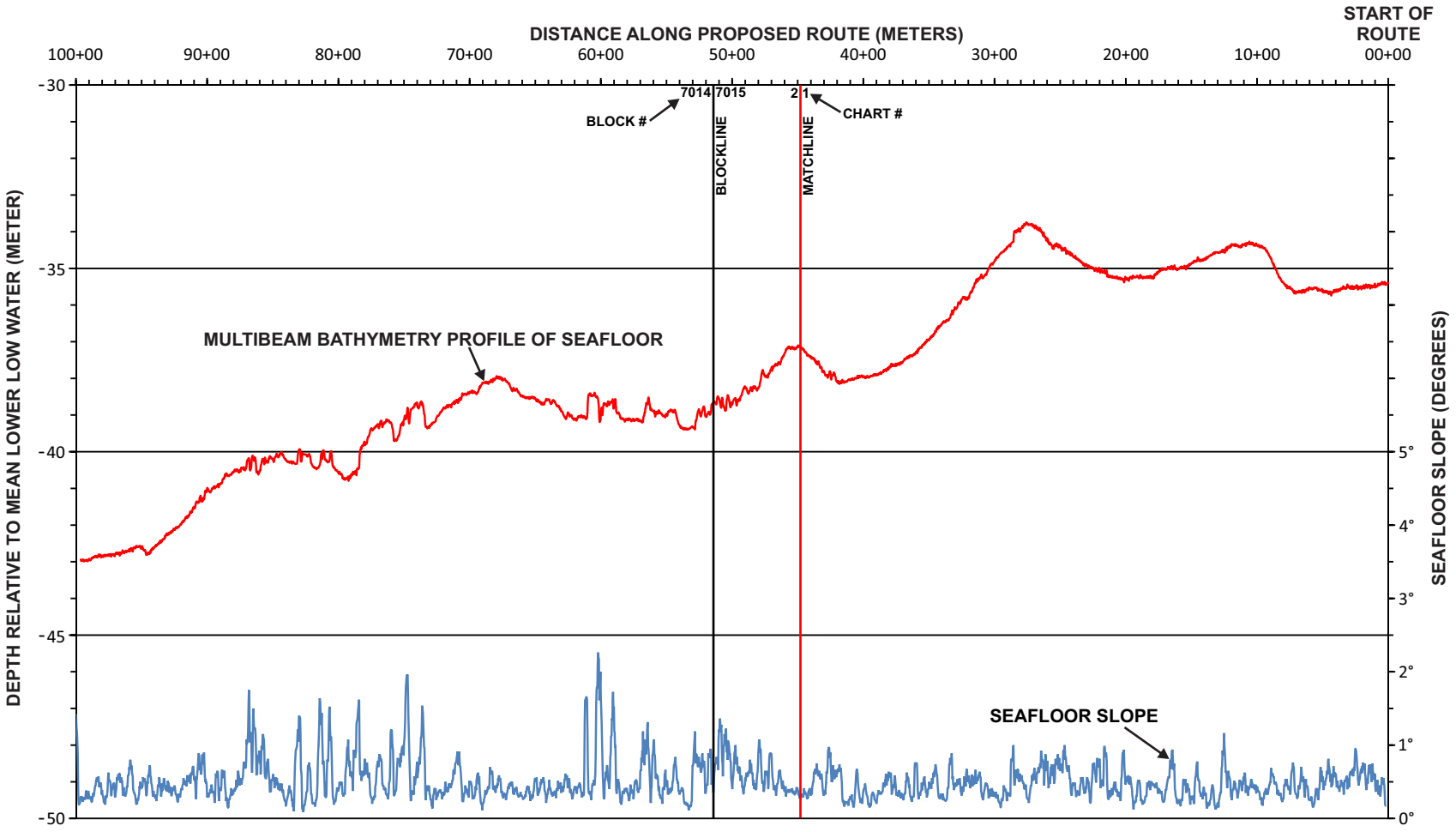
Section of Multichannel Sparker line S7005

EXAMPLE OF SUBSURACE DEFORMATION AND PREVIOUSLY MAPPED FAULT ALONG THE SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS

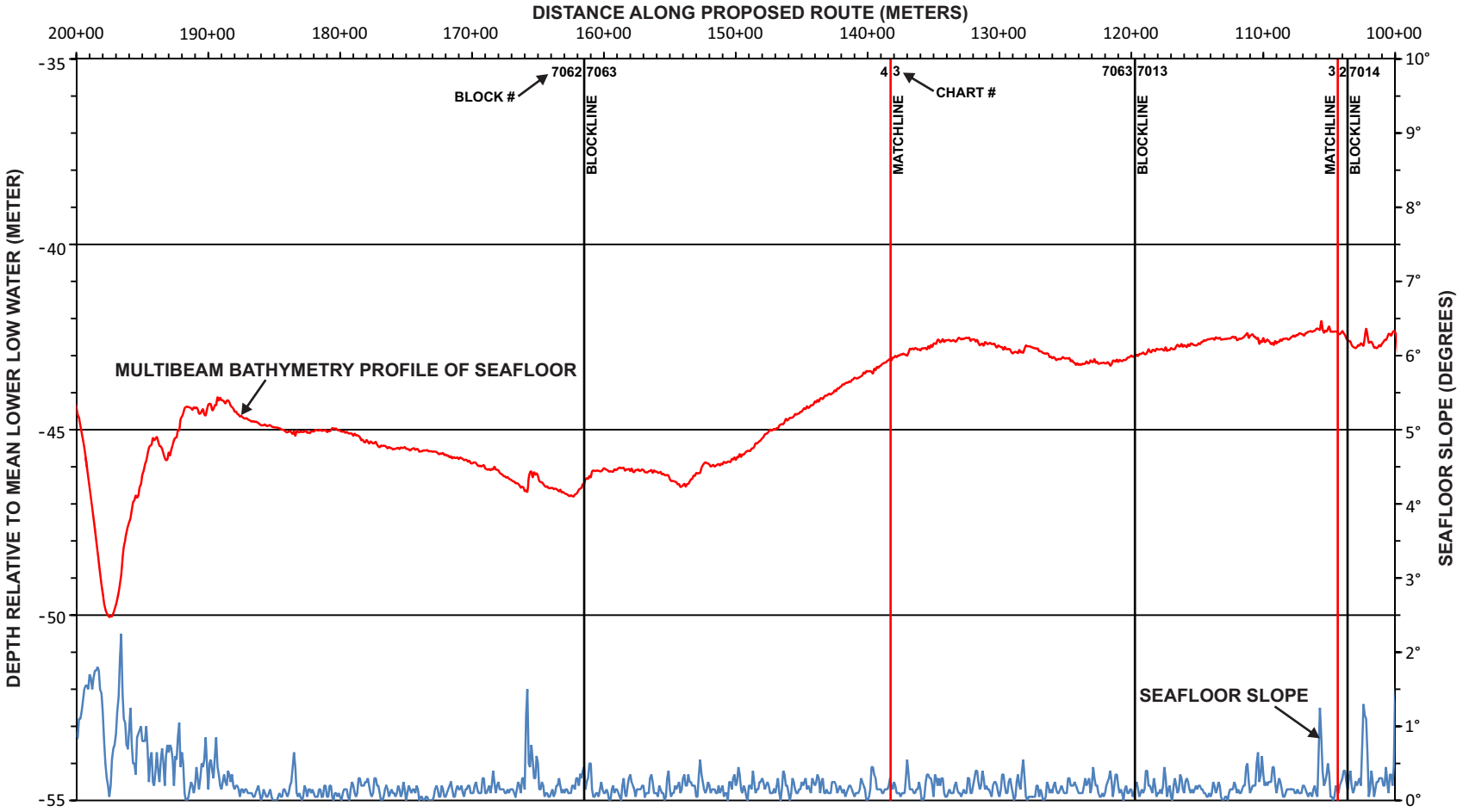


Section of Multichannel Sparker line S7005A

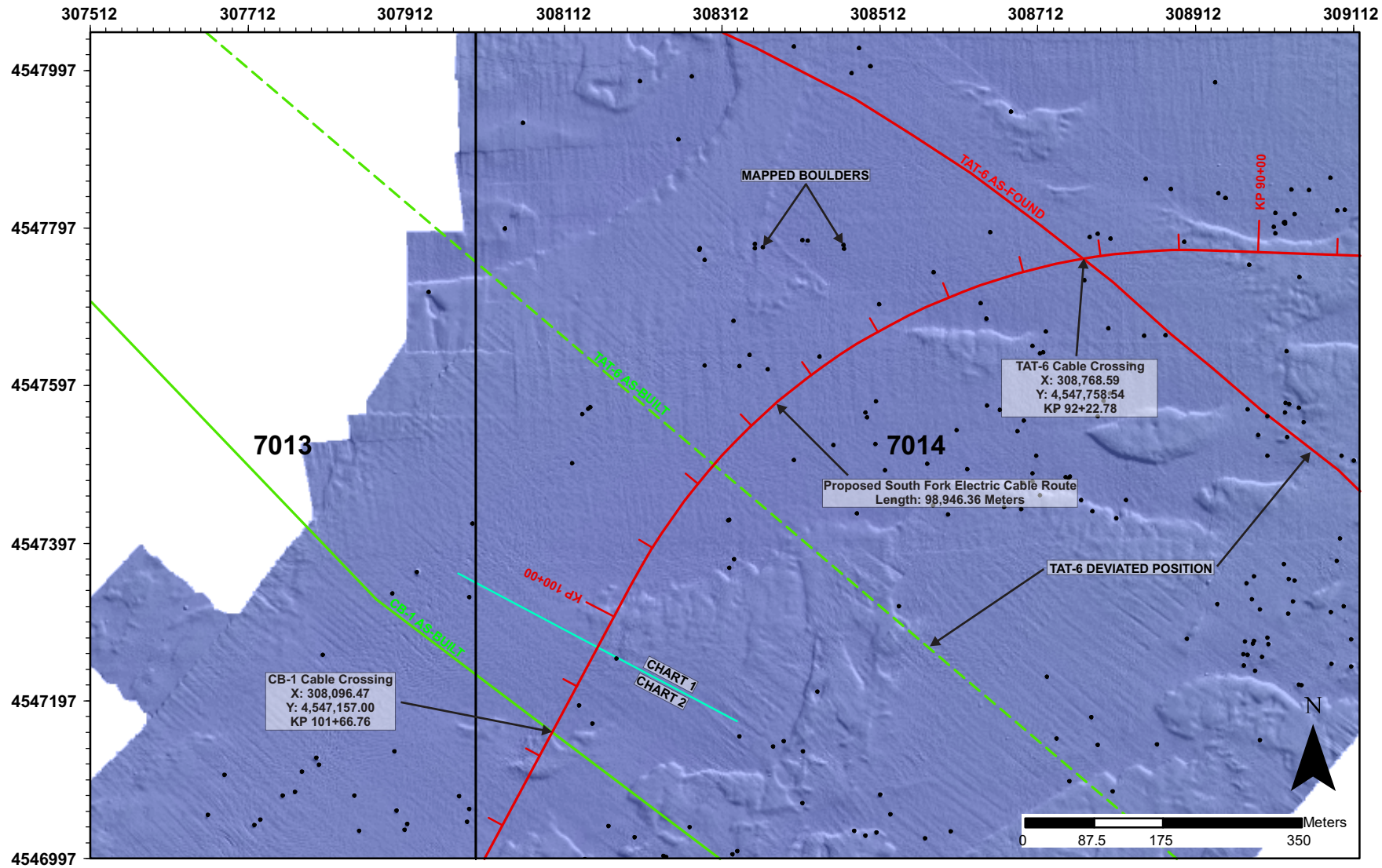
EXAMPLE OF SUBSURACE DEFORMATION ALONG THE SFEC
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



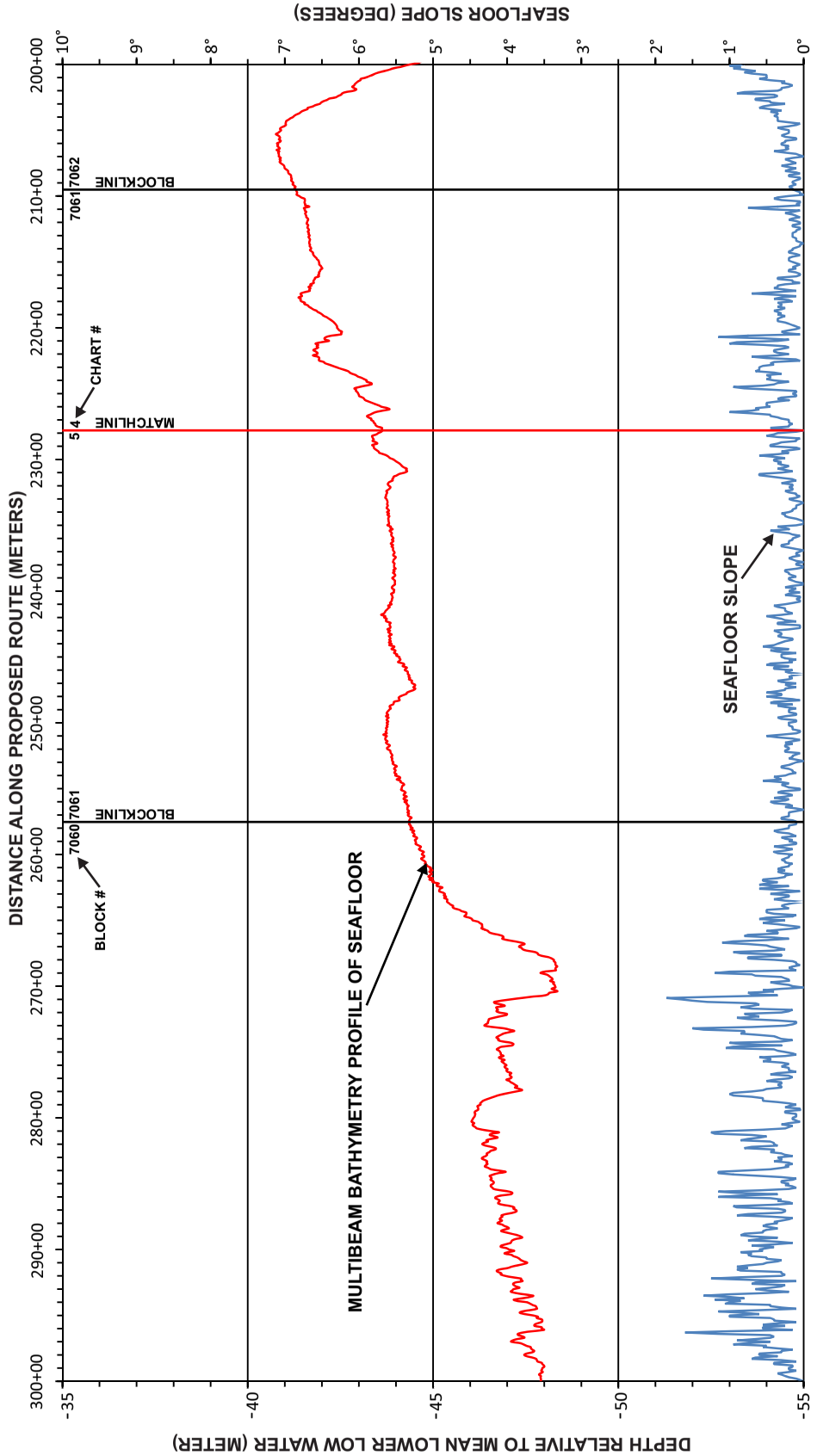
SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



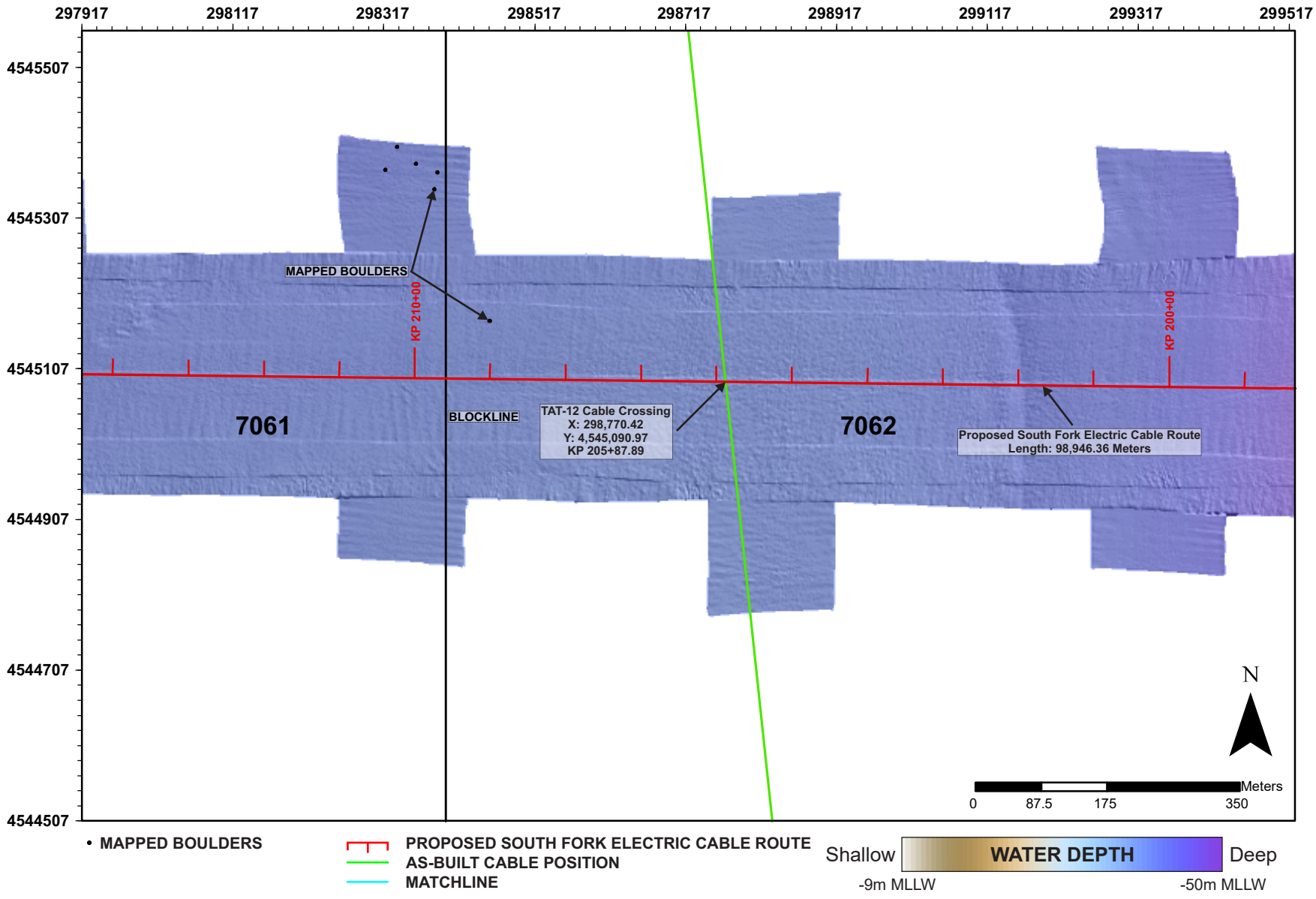
SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



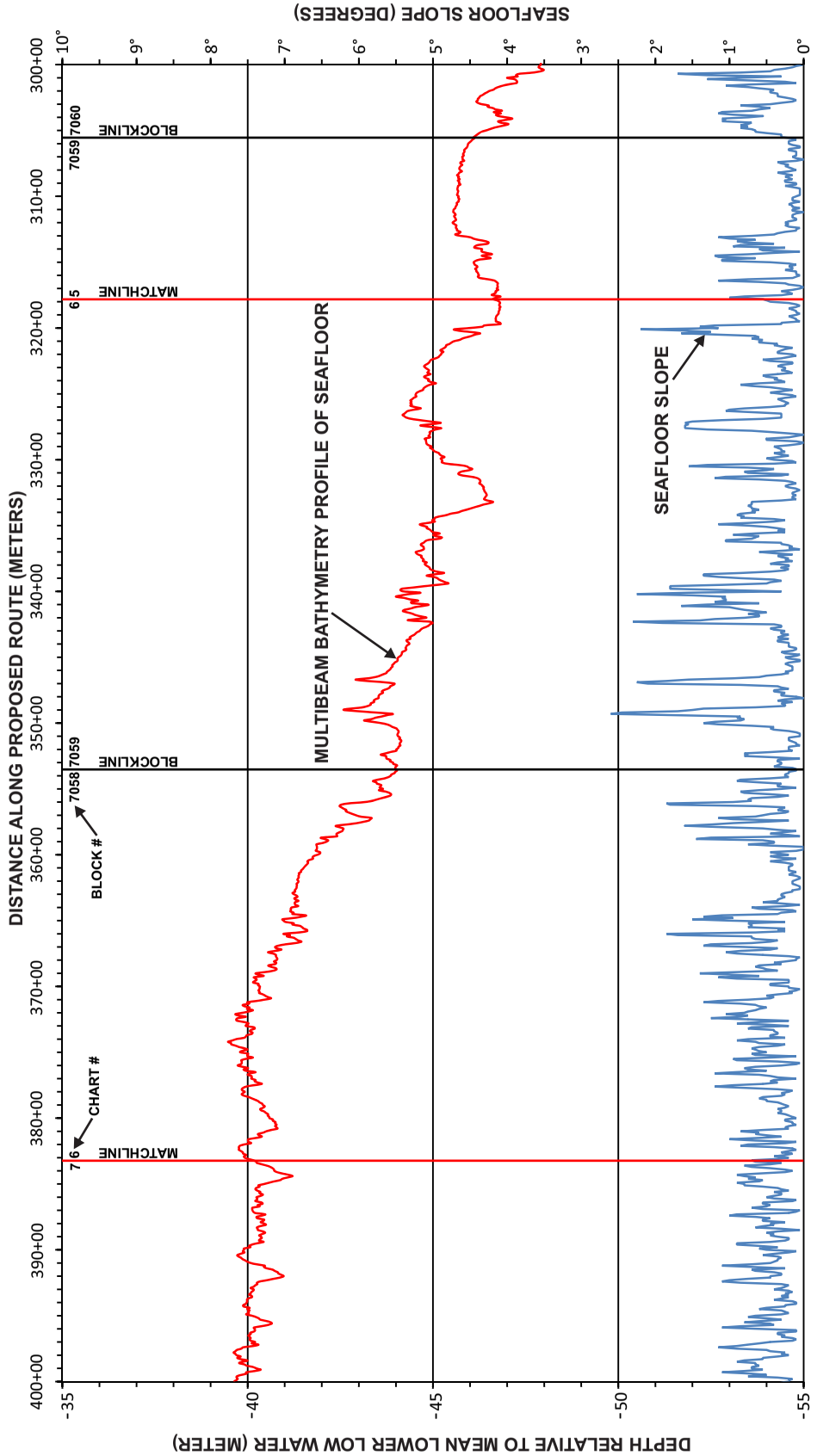
MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING PROJECTED CABLE CROSSINGS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



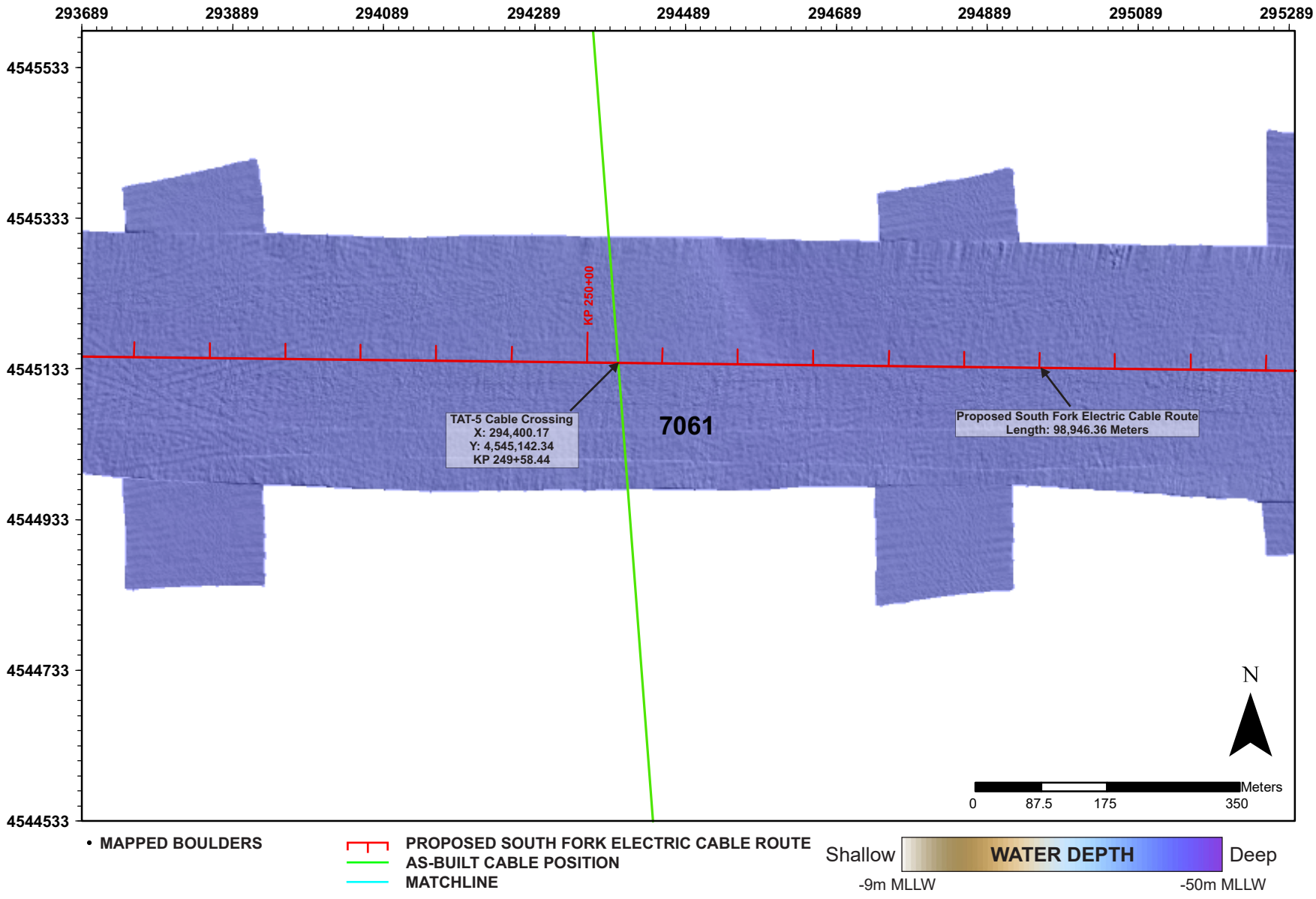
SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



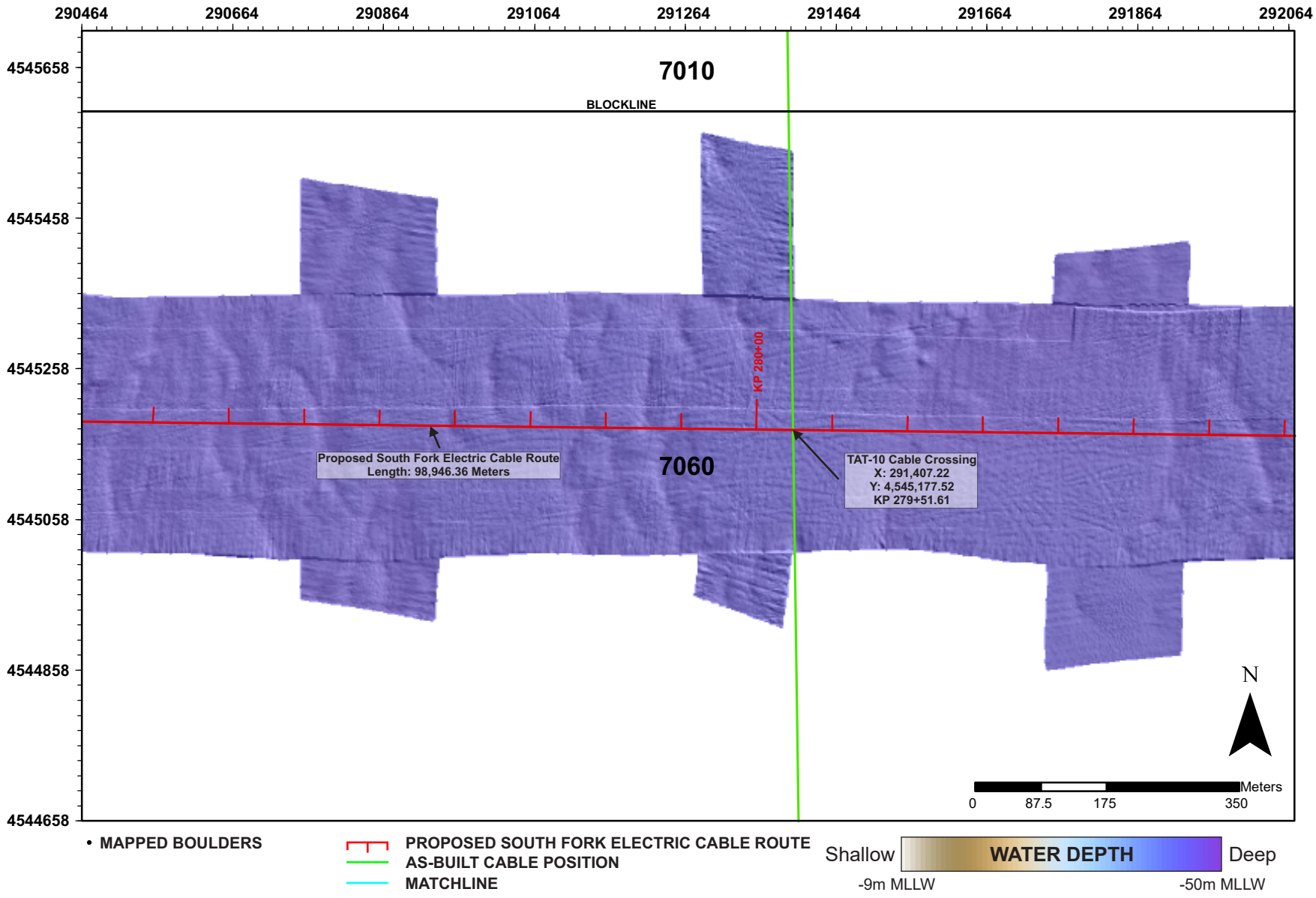
MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING PROJECTED CABLE CROSSINGS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



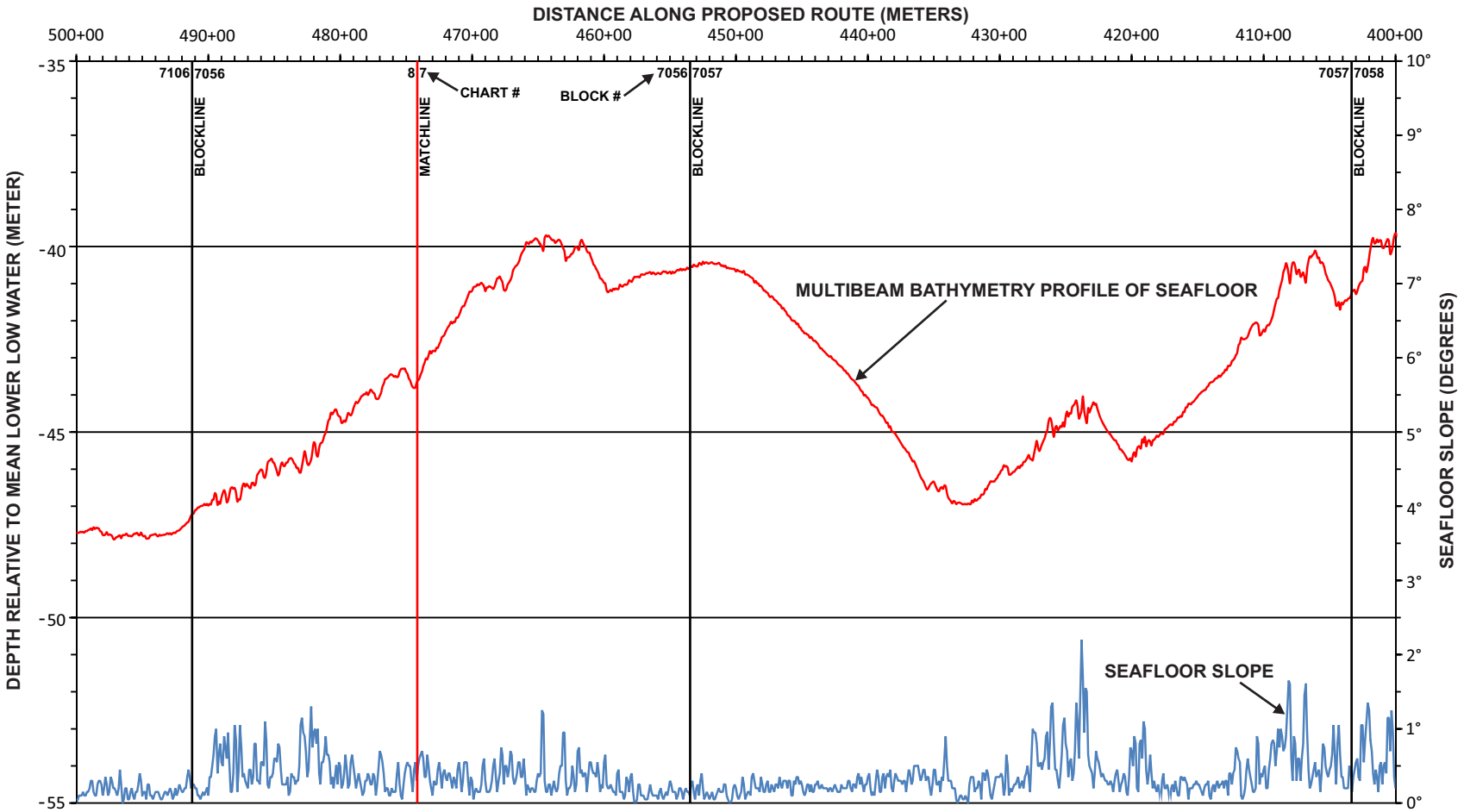
SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



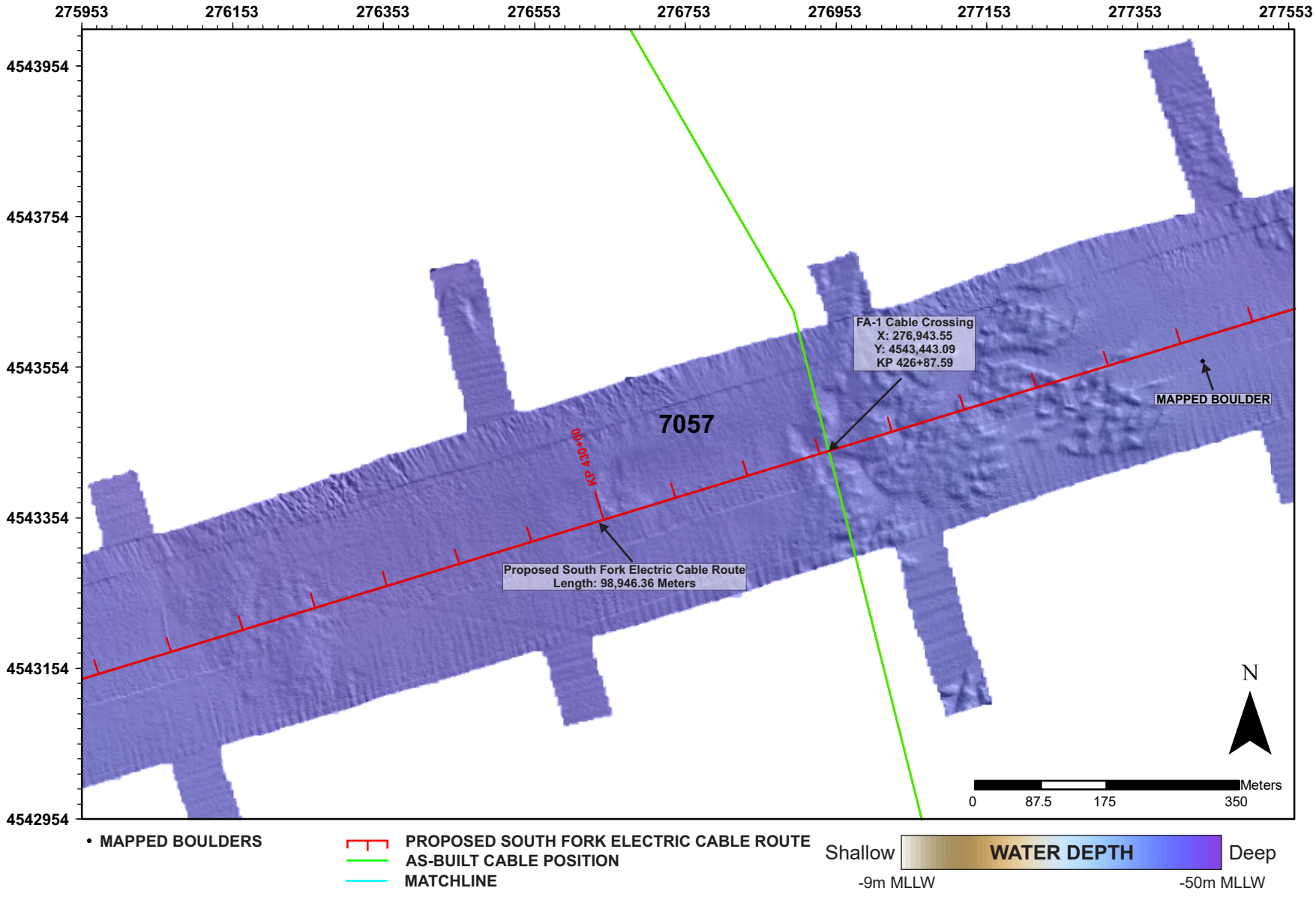
MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING PROJECTED CABLE CROSSINGS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING PROJECTED CABLE CROSSINGS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



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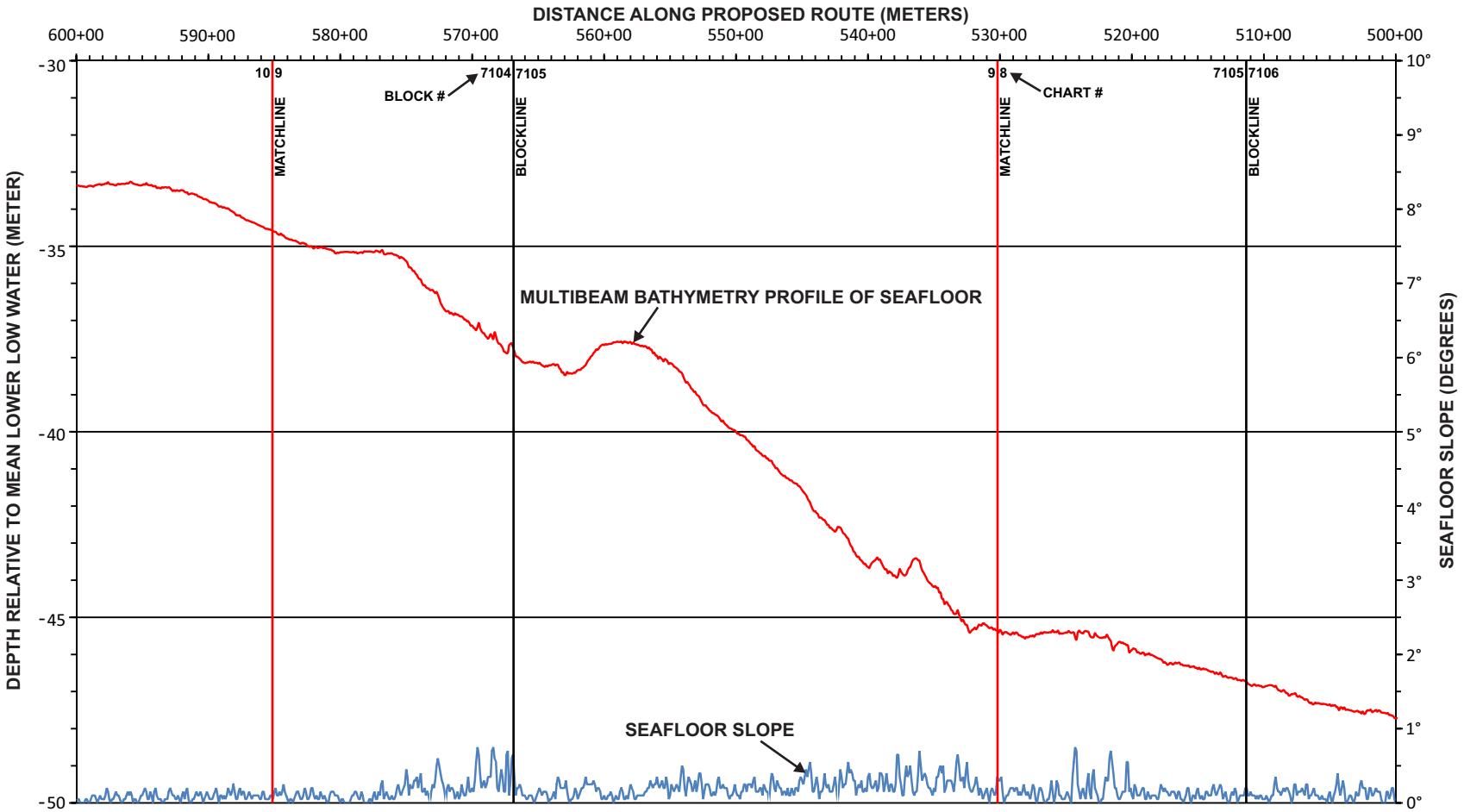
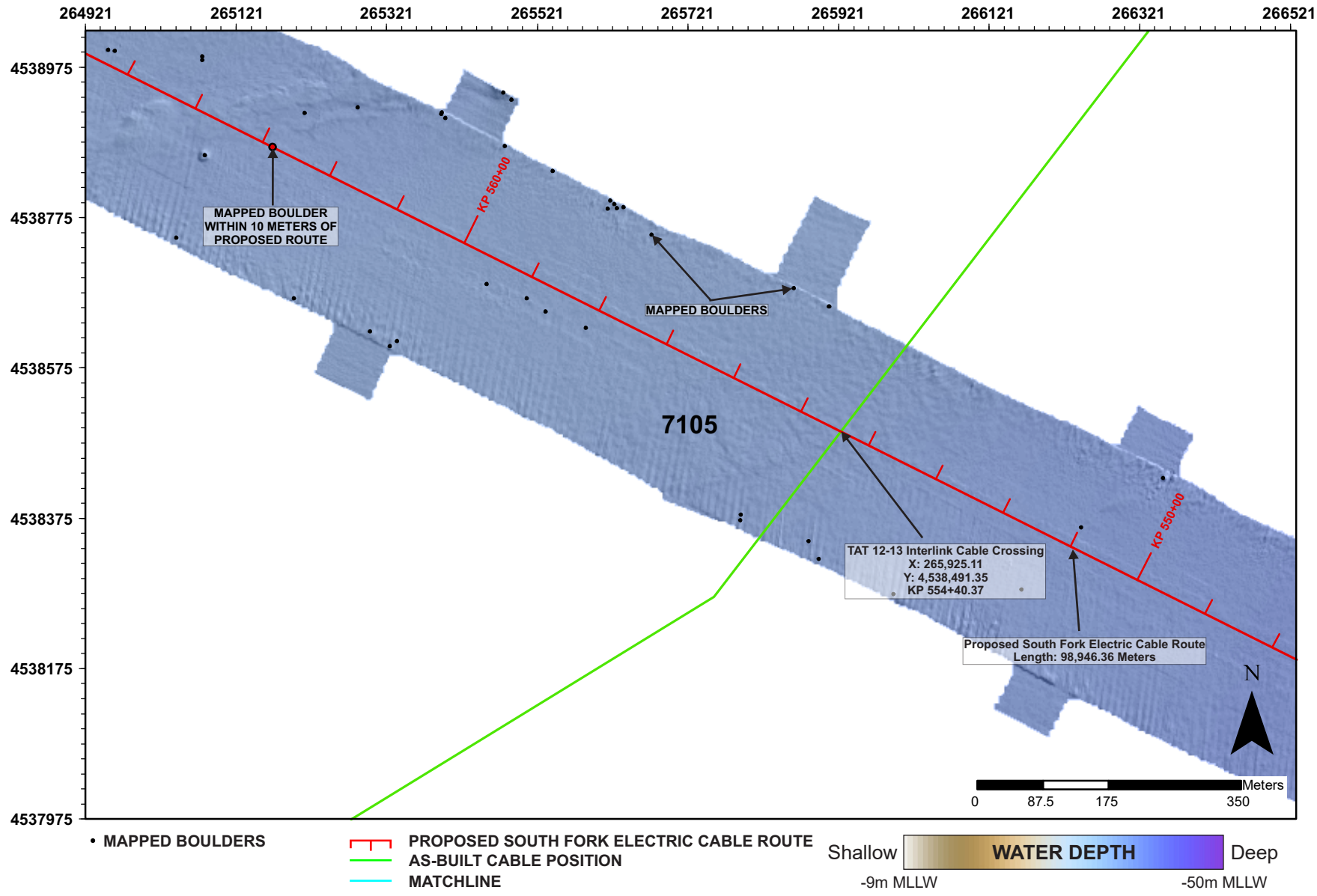
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



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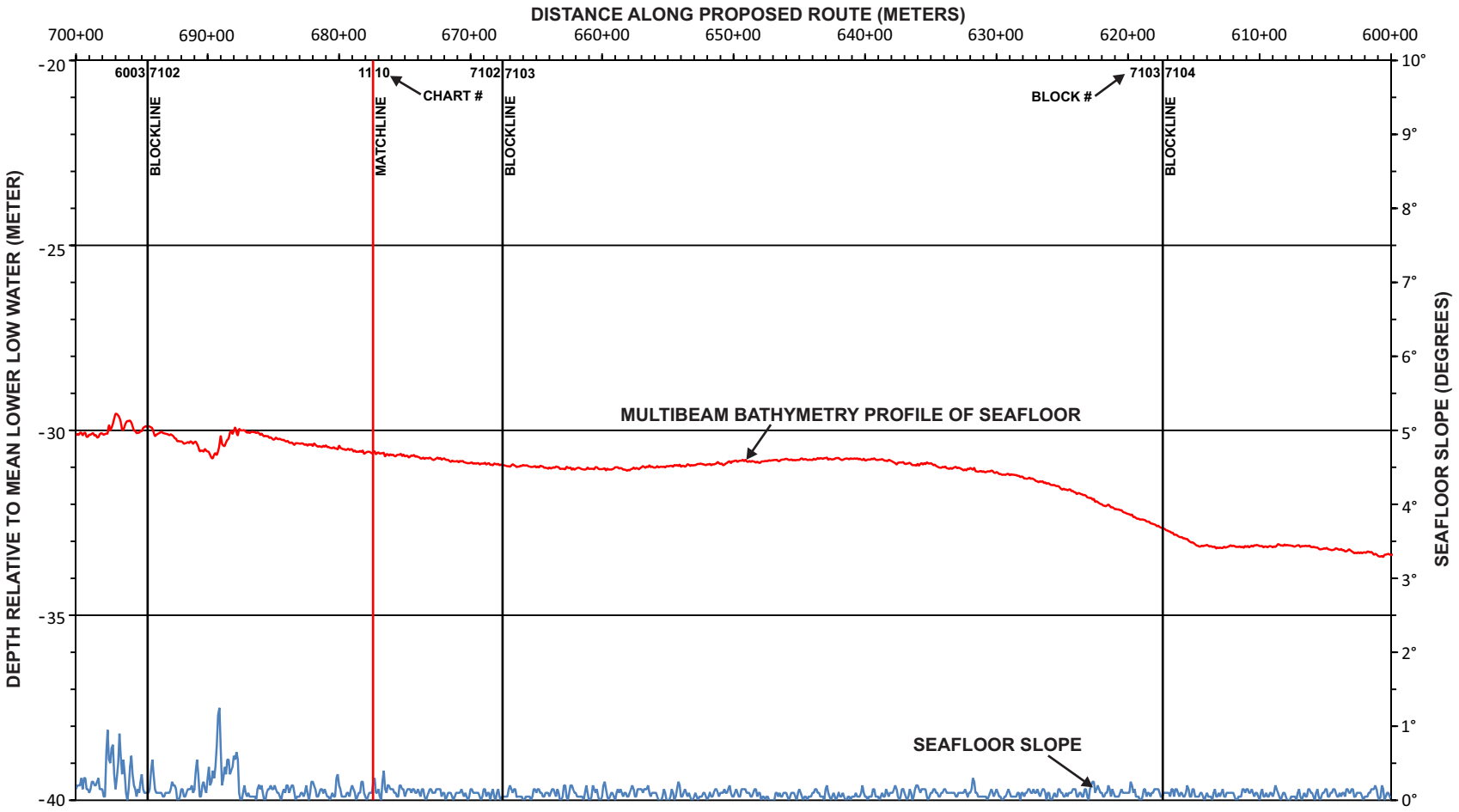
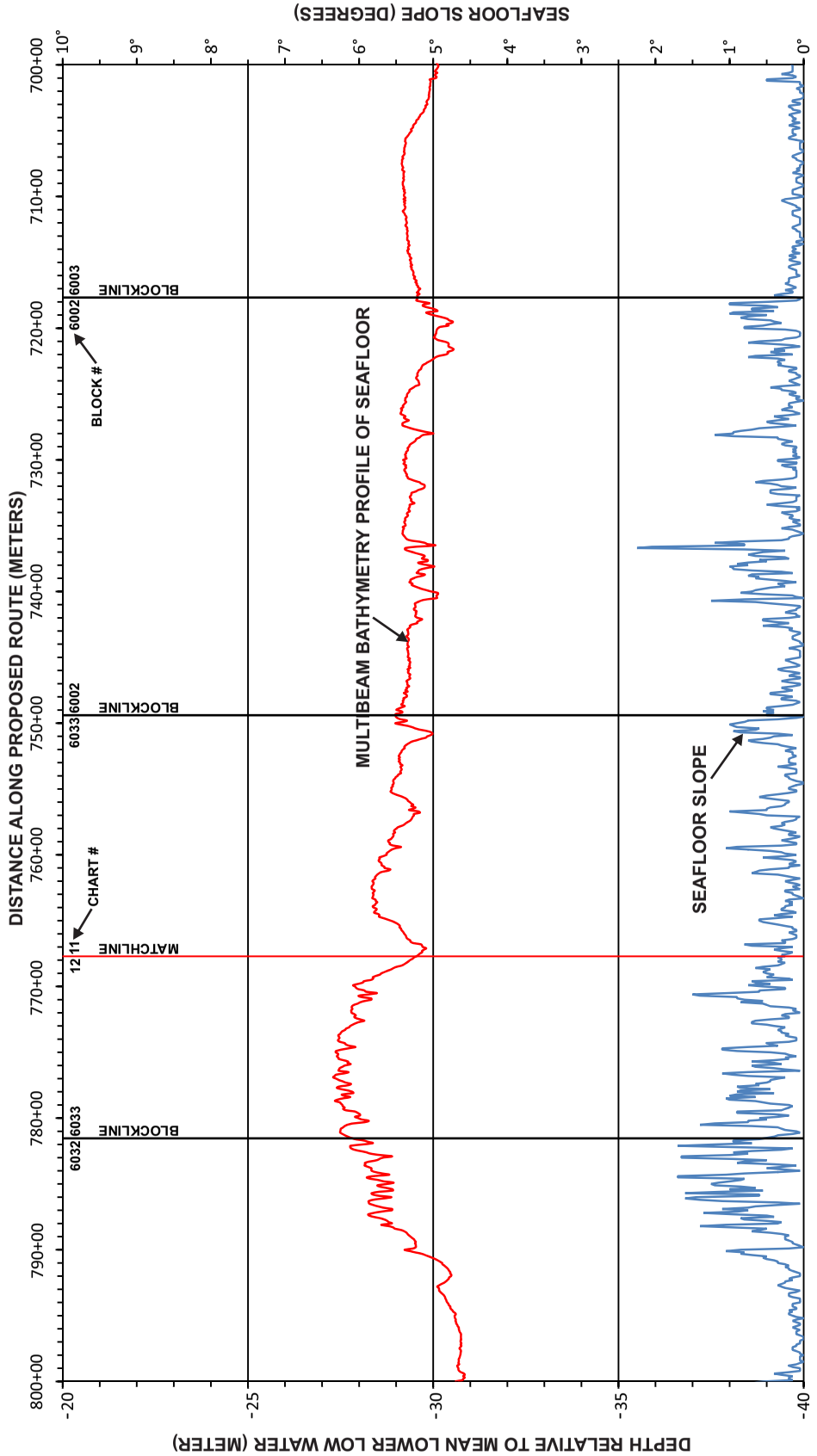
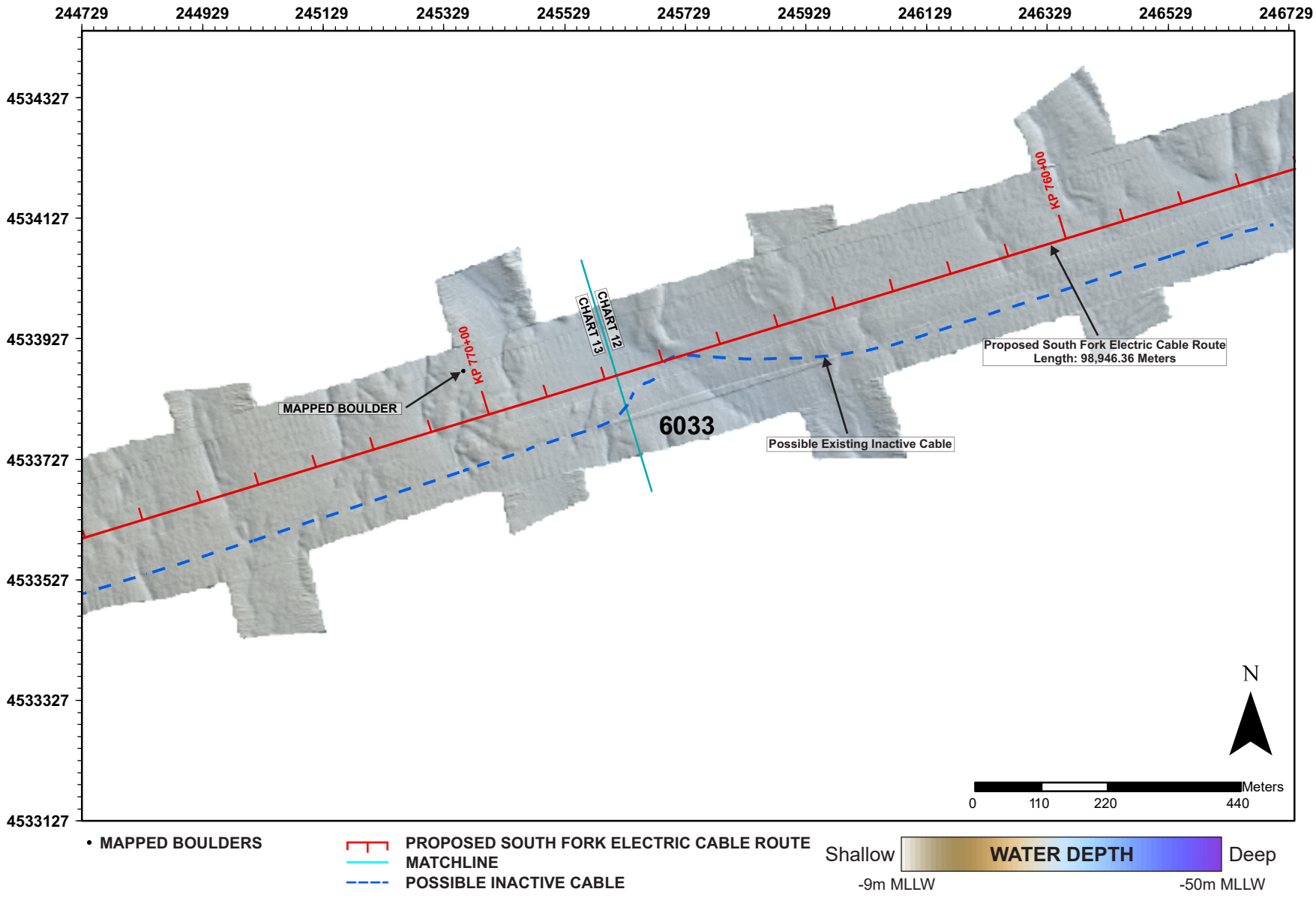
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



SEAFLOOR PROFILE SHOWING TOPOGRAPHIC CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



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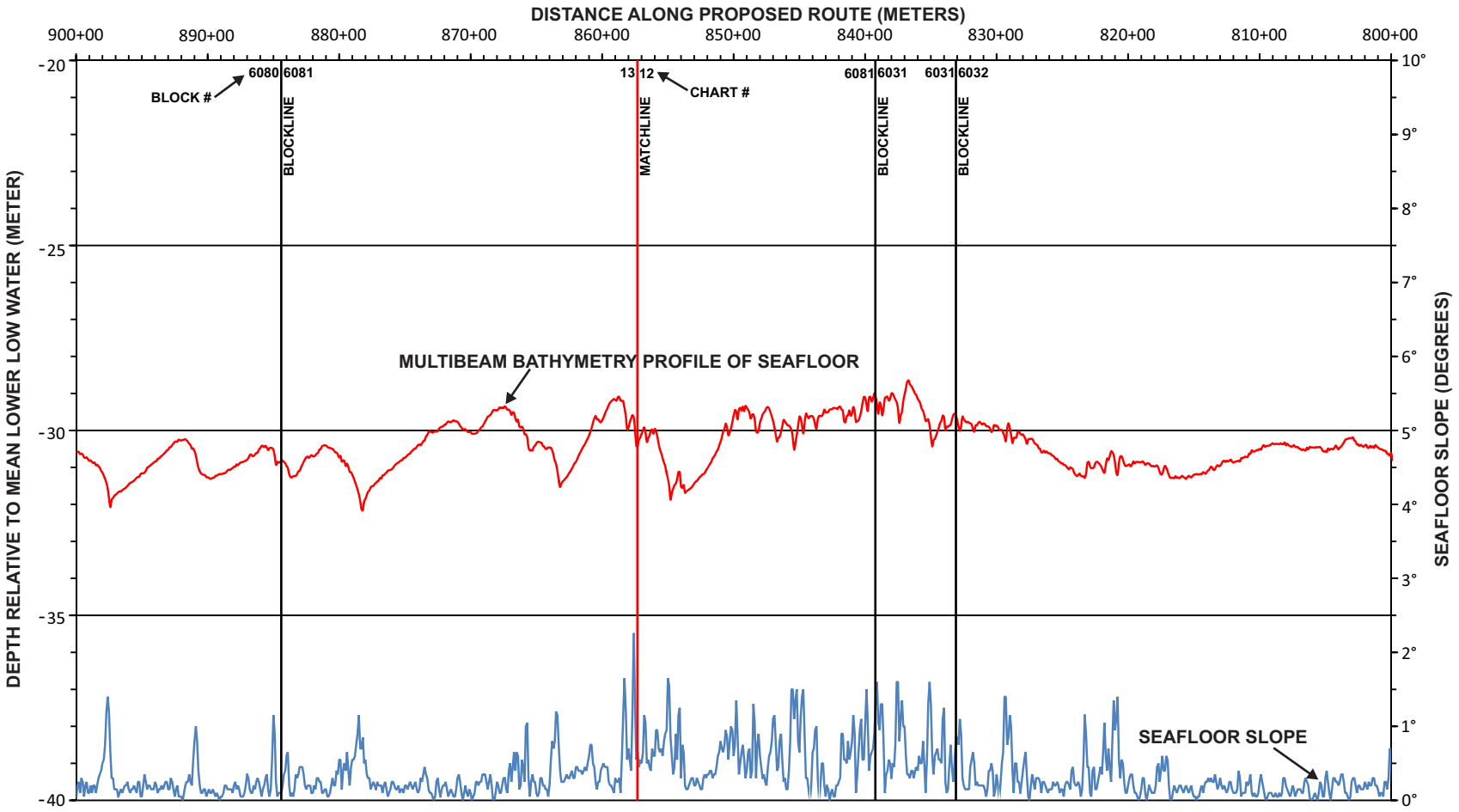
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



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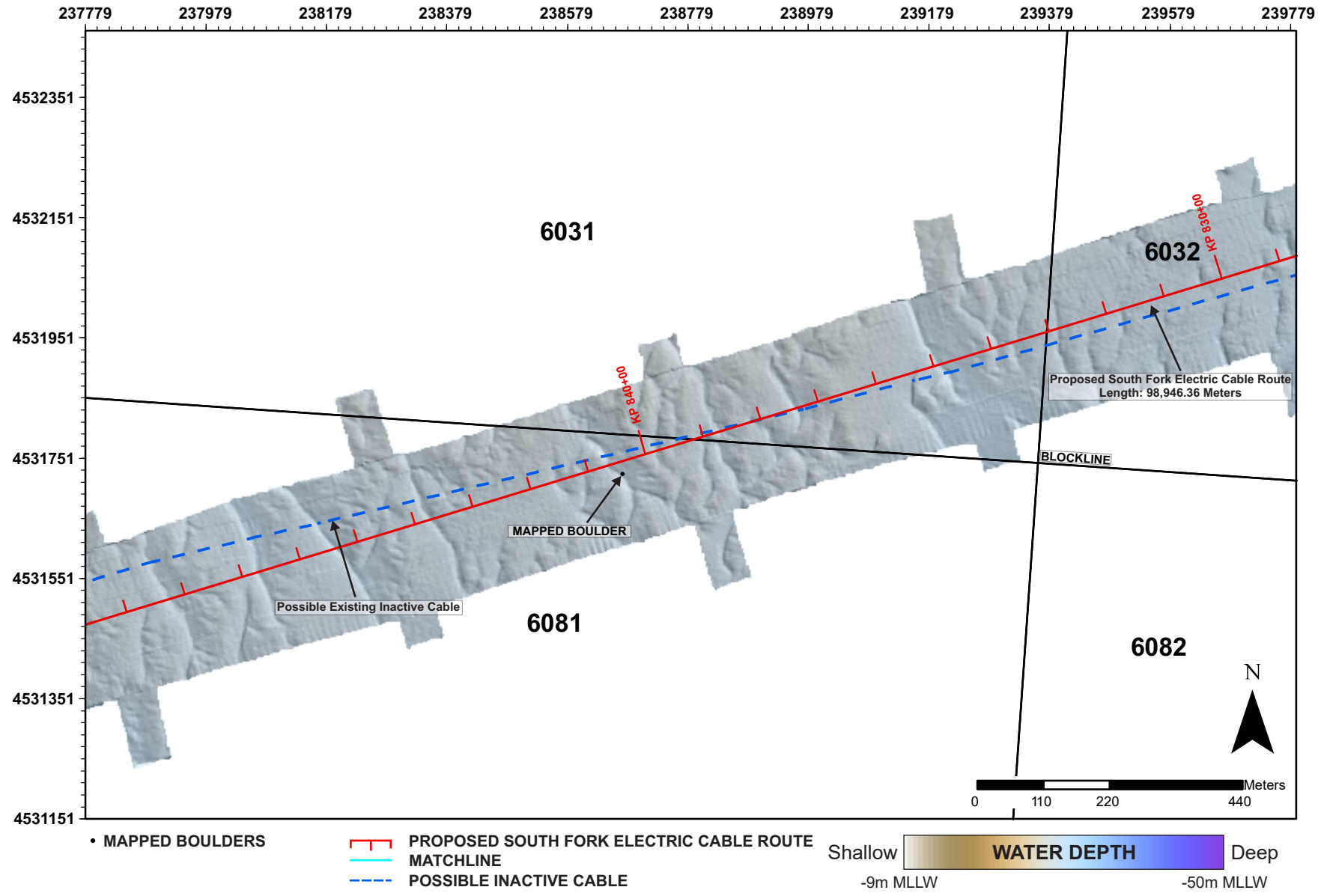
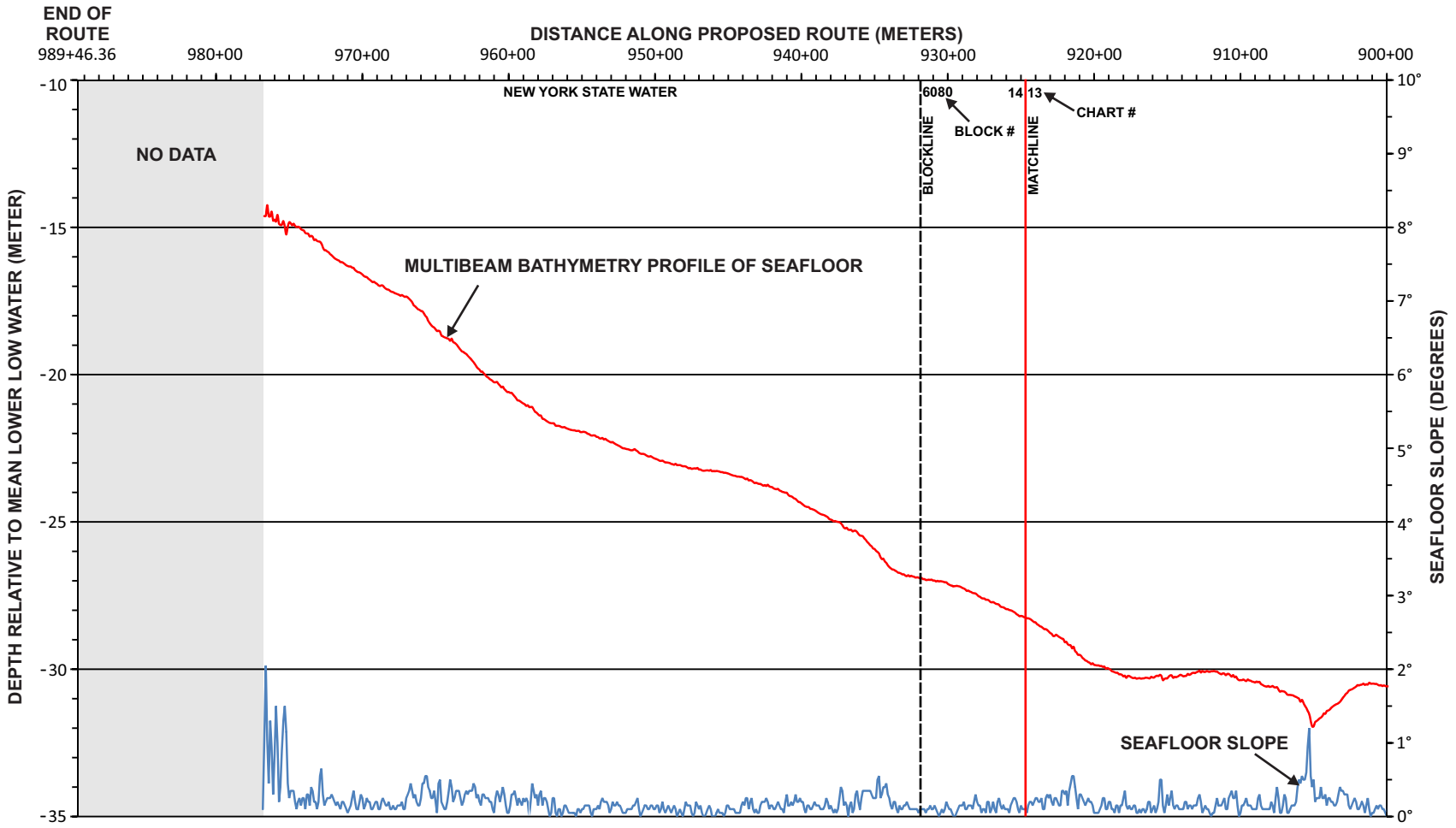
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING SEAFLOOR CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



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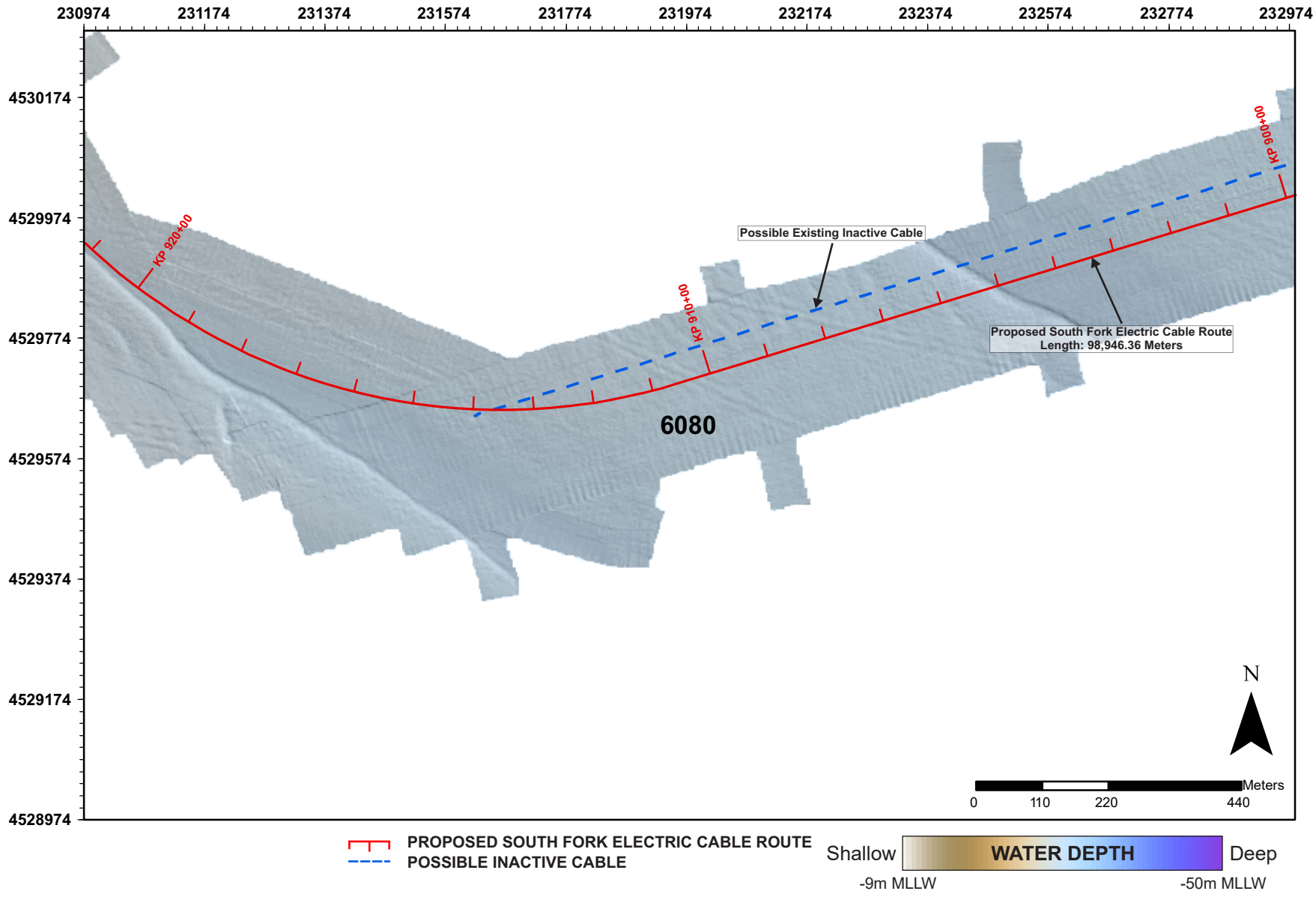
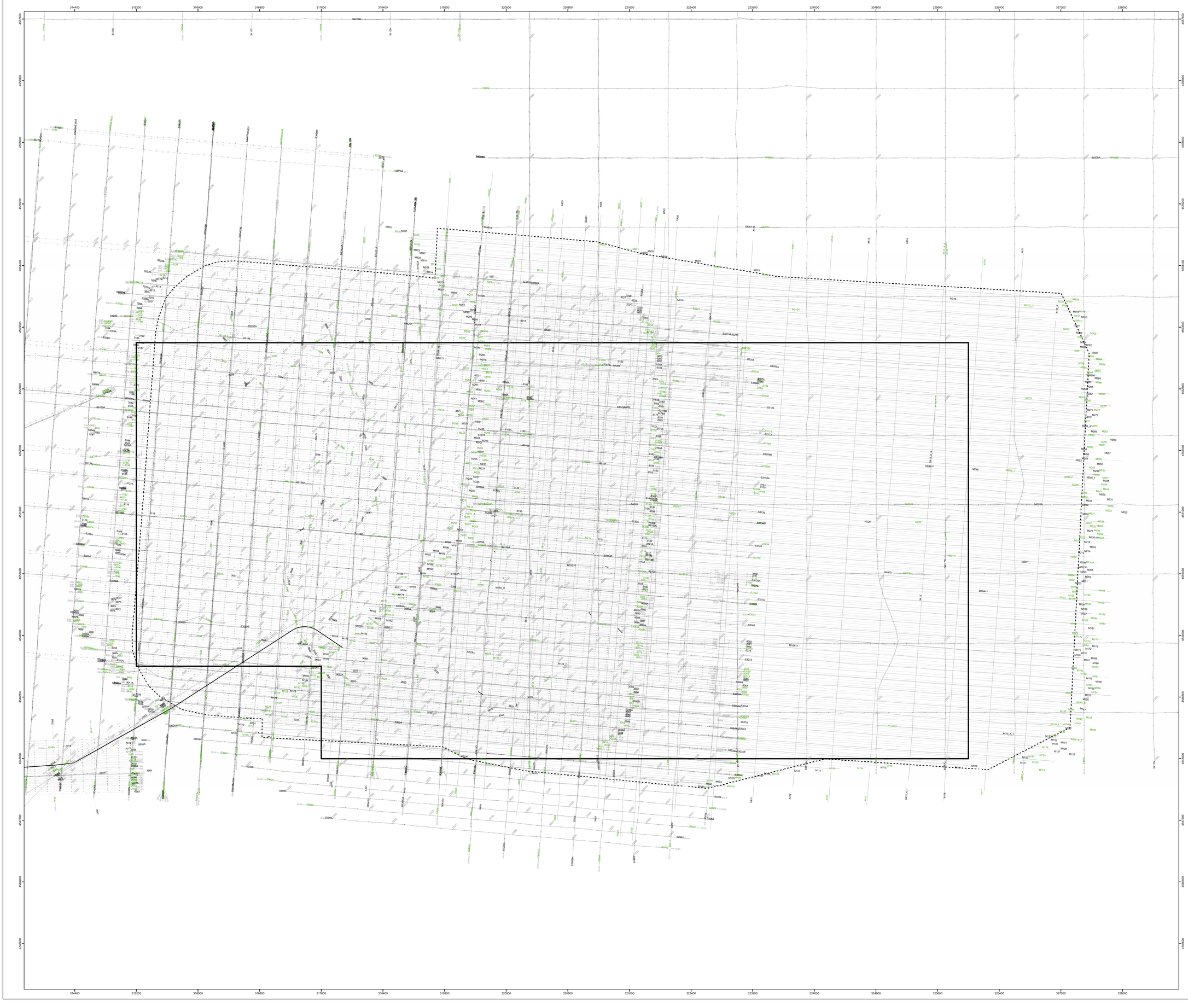
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



MULTIBEAM ECHO SOUNDER RENDERING DISPLAYING SEAFLOOR CONDITIONS ALONG THE PROPOSED SOUTH FORK EXPORT CABLE ROUTE
SFWF COP Survey
Offshore NY/RI/MA, Atlantic OCS



LEGEND

- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- Start of Line M100 — End of Line M100 — MARINE ARCH TRACKLINE (30m SPACING)
- HRG TRACKLINE (150m PRIMARY / 500m TIE LINE SPACING)
- 6917 — OCS BLOCK
- OCS-A 0517 Lease Boundary

CAUTION POINT FEATURE
(SHIPWRECK SOURCES: AWOIS AND NOAA NAUTICAL CHARTS)

- SHIPWRECK
- POTENTIAL SHIPWRECK IDENTIFIED IN 2017/2018 FUGRO SURVEYS

Notes:

1. 2017: Navigation for the 2017 Fugro survey was provided by Fugro Starfix.HP Differential Global Positioning System (DGPS).

   2018: Navigation for the 2018 Fugro survey was provided by Fugro Starpack G2+ GNSS system.

2. 2017: Fugro collected geophysical data for the South Fork Wind Farm (SFWF) between July 19th, and November 9th, 2017, aboard the RN Fugro Enterprise. Within the SFWF survey area coverage consisted of a 150-meter by 500-meter grid. Infill lines were run at a spacing of 30-meters apart.

   2018: Fugro collected geophysical data for the South Fork Wind Farm Extension area between October 30 and December 31, 2018 aboard the Fugro Discovery. Within the SFWF survey area coverage consisted of a 150-meter by 500-meter grid. Infill lines were run at a spacing of 30-meters apart.

3. Data collected included multibeam echo sounder (MBES) bathymetry and backscatter, side scan sonar (SSS), magnetometer (MAG) (Gradiometer in 2018), multichannel and single-channel sparker, and sub-bottom profiler (SBP).

4. 2017: Survey tools operated include: 1) Reson SeaBat 7125 Multibeam Bathymetric Systems with operating frequencies of 200-400 kHz and swath coverage of 128°, 2) EdgeTech 4200 dual frequency Side Scan Sonar system run at frequencies of 110 kHz & 425 kHz and 300 kHz & 600 kHz, with a range of 50 meters per channel and G-882 Marine Magnetometer recording data at 100-gamma and 1,000-gamma scales at a sample rate of 2 Hz, 3) EdgeTech 3200 Sub-bottom Profiling system using a frequency range of 1 to 10 kHz, and 4) Applied Acoustics Dura-Spark sub-bottom profiling system with a single 32-channel streamer with a hydrophone group spacing of 1.56 meters and a dual 32-channel streamer with a hydrophonegroup spacing of 1.56 meters

   2018: Survey tools include; 1) Kongsberg EM712 Multibeam with operating frequencies of 40-100 kHz, and a swath coverage of 140 degrees. 2) EdgeTech 4200 dual frequency Side Scan Sonar System run at frequencies of 300 and 900 kHz. 3) Geometrics G-882 magnetometers run in a transverse gradiometer configuration (TVG), 4) Hull-mounted Massa 4x4 array sub-bottom profiling system, and 5) GSO-360 Tip Sparker run at 1000 joules at a 1.56m shot point interval utilizing a 48-channel streamer for multichannel data and an 8 element single-channel streamer for single-channel (secondary) lines.

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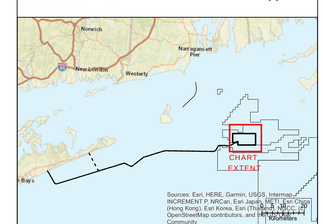
GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N



MAP PREPARED BY:

FUGRO USA MARINE, INC.
World Trade Center, Suite 350
101 West Main Street
Norfolk, Virginia 23510
Tel: (757) 625-3350,
Fax: (757) 625-3352
www.fugro.com

SOUTH FORK WINDFARM

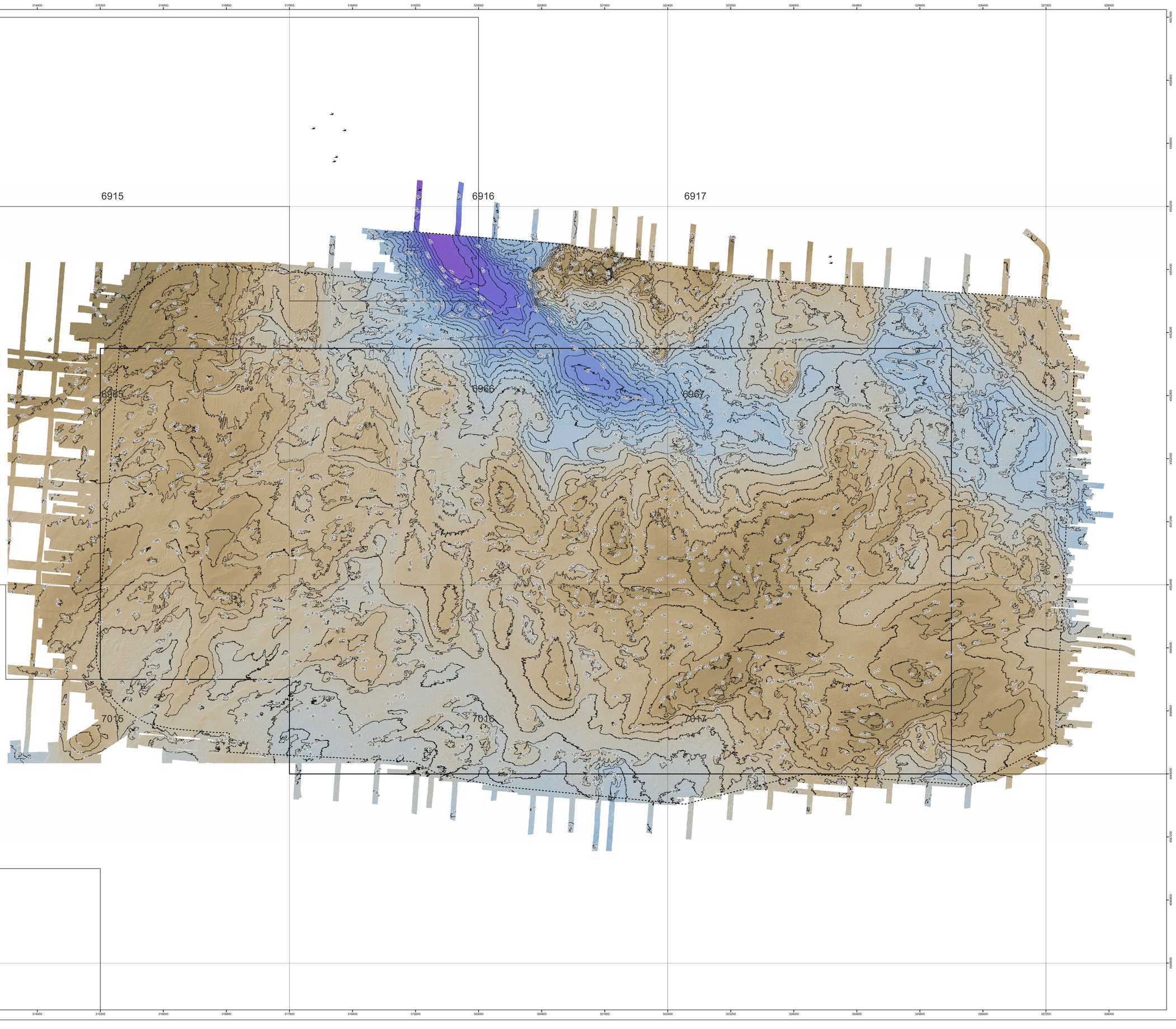
SOUTH FORK WIND FARM
NAVIGATION POST-PLOT
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:15,000

0 150 300 600 900 1,200
Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 1



LEGEND

- MAXIMUM WORK AREA
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA

BATHYMETRY (METER, MLLW) FUGRO 2017 AND 2018

HIGH : -29

LOW : -45

CONTOUR INTERVAL IS 0.5 METER

CAUTION POINT FEATURE
(SHIPWRECK SOURCES: AWOIS AND NOAA NAUTICAL CHARTS)

SHIPWRECK

Notes:

1. Navigation for the 2018 Fugro survey was provided by Fugro Starfix.HP Differential Global Positioning System (DGPS). Geophysical trackline information is presented on Chart 1.
2. 2017: Fugro collected bathymetric data operating a Reson SeaBat 7125 Multibeam Bathymetric Systems with operating frequency of 200-400 kHz and swath coverage of 128°.

   2018: Fugro collected bathymetric data operating a Kongsberg EM712 multibeam echosounder with an operating frequency of 40-100 kHz and a swath coverage of 140 degrees.
3. Water depths and contours were derived from the MBES dataset. Values given in meters and referenced to MLLW.
4. The seafloor rendering displays a semi-transparent, color-shaded depth image overlain on a grayscale scale seafloor hillshade (Azimuth: 315°, Altitude: 45°).
5. Shipwreck locations are based on three sources: 1) the Automated Wreck and Obstruction Information System (AWOIS) database, and 2) NOAA nautical charts for this area, and 3) Fugro locations from the 2017 and 2018 survey data.
   Areas that appear to have multiple shipwrecks, could be due to the location discrepancy between these two sources.

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N

GEODETIC INFORMATION

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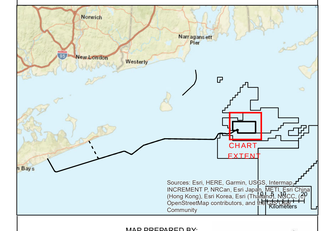
PROJECTION:	UTM
ZONE:	18N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



MAP PREPARED BY:

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SOUTH FORK WINDFARM

SOUTH FORK WIND FARM
SEAFLOOR RENDERING
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

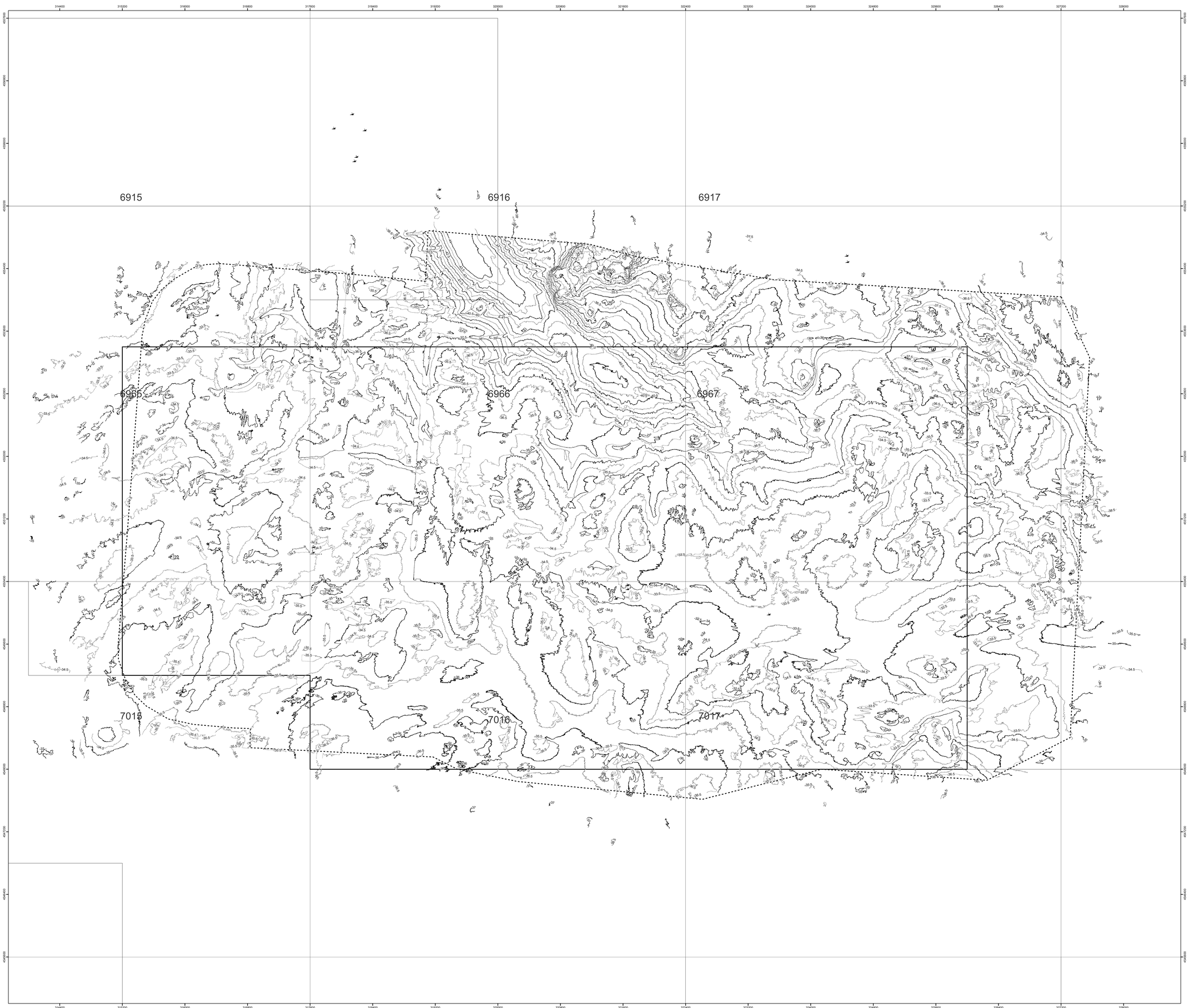
SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 2A



LEGEND

- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA
- CONTOUR INTERVAL IS 1 METER
- CONTOUR INTERVAL IS 0.5 METERS

CAUTION POINT FEATURE
(SHIPWRECK SOURCES: AWOIS AND NOAA NAUTICAL CHARTS)

- SHIPWRECK

Notes:

1. 2017: Fugro collected bathymetric data operating a Reson SeaBat 7125 Multibeam Bathymetric Systems with operating frequency of 200-400 kHz and swath coverage of 128°.

   2018: Fugro collected bathymetric data operating a Kongsberg EM712 multibeam echosounder with an operating frequency of 40-100 kHz and a swath coverage of 140 degrees.

2. Water depths and contours were derived from the MBES dataset. Values given in meters and referenced to MLLW.

3. Shipwreck locations are based on three sources: 1) the Automated Wreck and Obstruction Information System (AWOIS) database, and 2) NOAA nautical charts for this area, and 3) Fugro locations from the 2017 and 2018 survey data. Areas that appear to have multiple shipwrecks could be due to the location discrepancy between these two sources.

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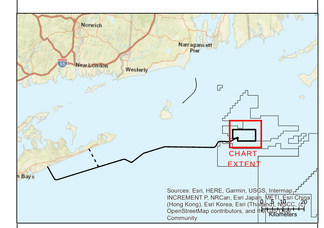
N

GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



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SOUTH FORK WINDFARM

SOUTH FORK WIND FARM BATHYMETRIC CONTOUR MAP

SFWF 2017 AND 2018 COP SURVEY OFFSHORE NY/RI/MA, ATLANTIC OCS

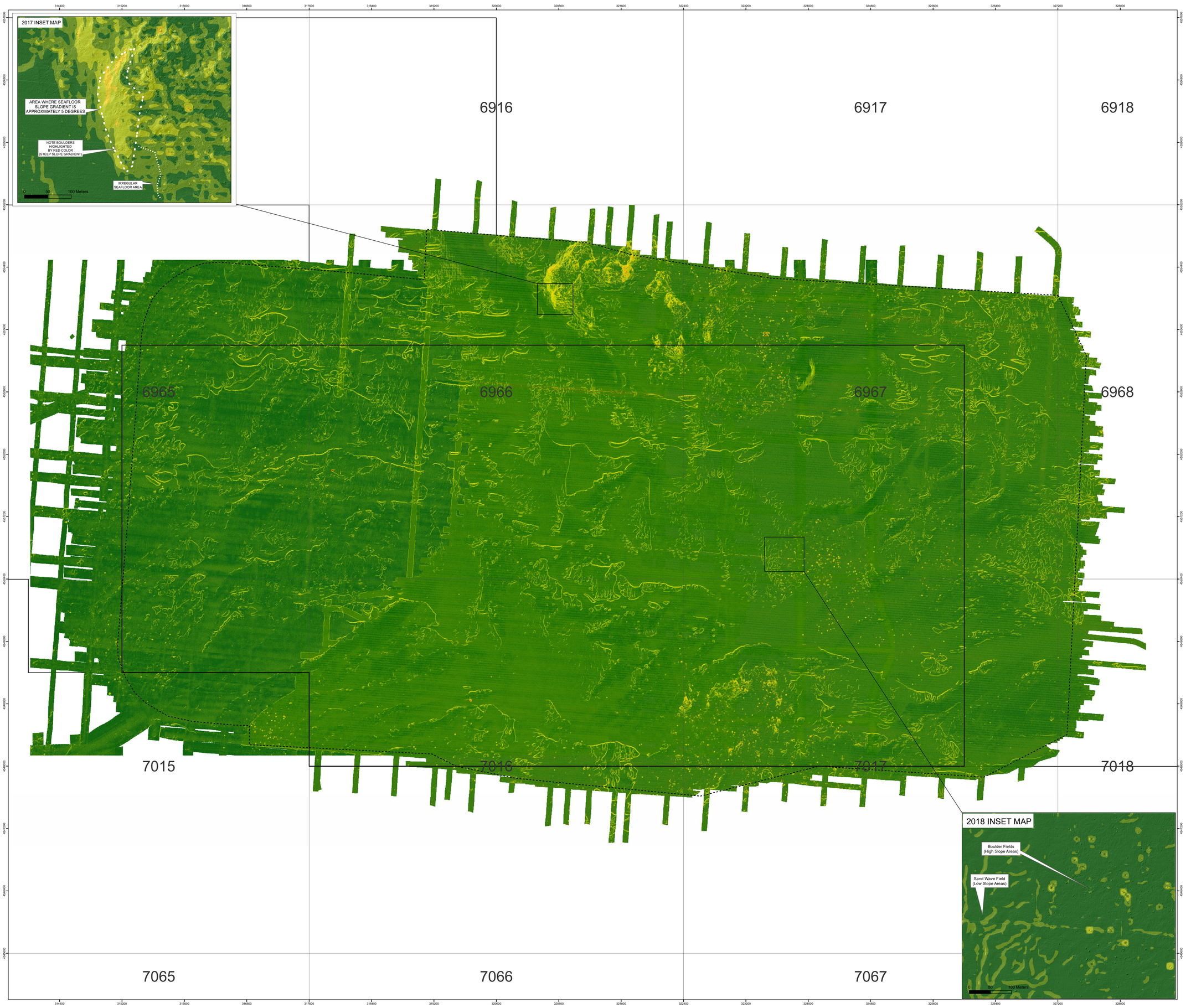
SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 2B



LEGEND

- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA

SLOPE (DEGREES)

- < 1
- 1 to 2
- 2 to 5
- 5 to 10
- 10 to 15
- > 15

Notes:

1. Seafloor slopes were derived from the MBES dataset.
2. Fugro collected bathymetric data operating a Kongsberg EM712 Multibeam Bathymetric System operating frequency of 40-100 kHz and swath coverage of 140°.
4. Water depth contours were derived from the MBES dataset. Values given in meters and referenced to MLLW.

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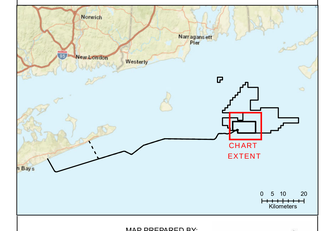
GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N



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SOUTH FORK WIND FARM
BATHYMETRIC SLOPE
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

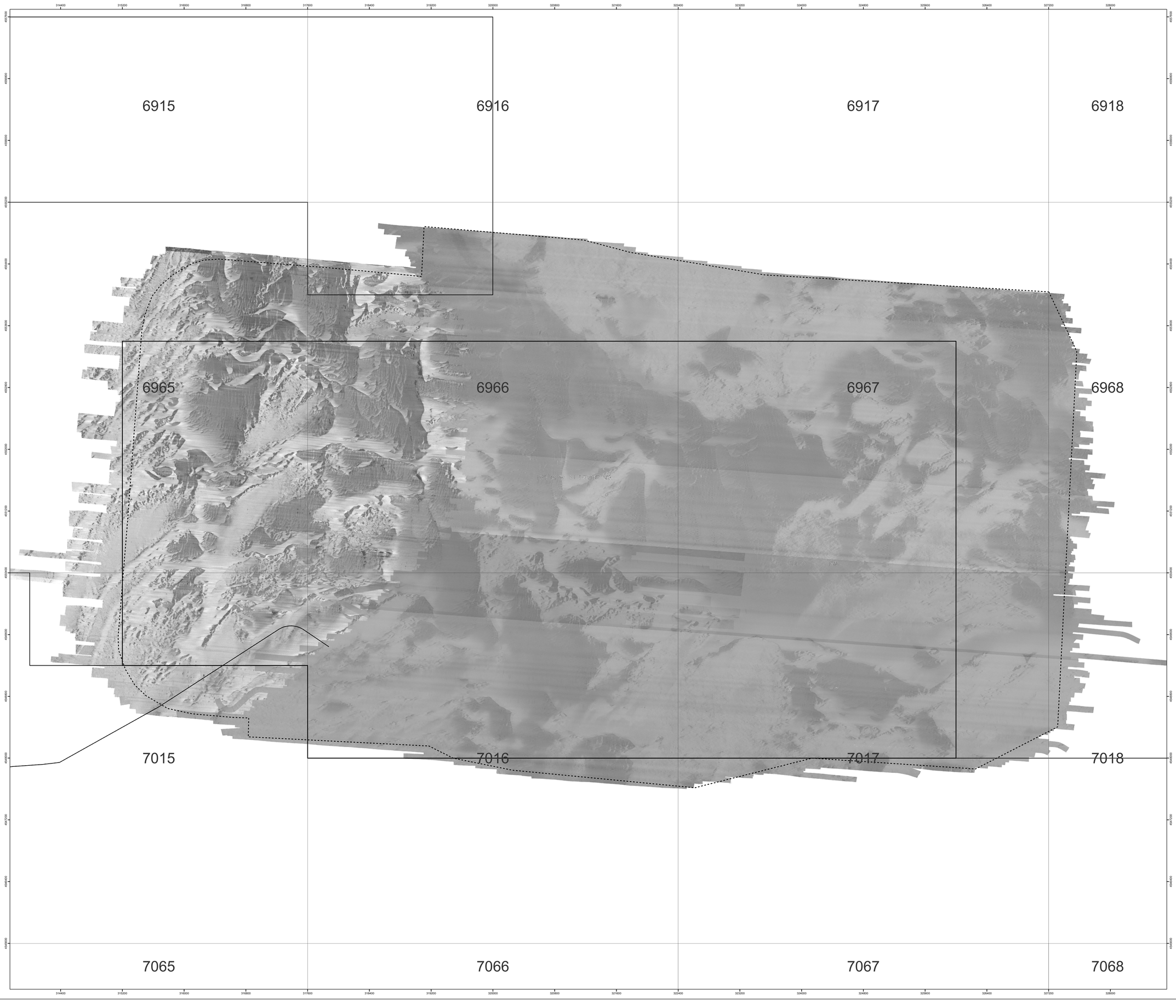
SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 3



LEGEND

- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA

BACKSCATTER INTENSITY

High

Low

Notes:

1. Navigation for the 2018 Fugro survey was provided by Fugro Starfix.HP Differential Global Positioning System (DGPS). Geophysical trackline information is presented on Chart 1.
2. 2017: Fugro collected bathymetric data operating a Reson SeaBat 7125 Multibeam Bathymetric Systems with operating frequency of 200-400 kHz and swath coverage of 128°.

   2018: Fugro collected bathymetric data operating a Kongsberg EM712 multibeam echosounder with an operating frequency of 40-100 kHz and a swath coverage of 140 degrees.
3. Due to the varying frequencies, different systems, and dynamic range of relative backscatter intensity values from combining multiple backscatter surveys, the range of pixel intensity values are presented as-is without normalization.
4. The seafloor rendering displays a semi-transparent, color-shaded depth image overlain on a grayscale scale seafloor hillshade (Azimuth: 315°, Altitude: 45°).
5. Shipwreck locations are based on three sources: 1) the Automated Wreck and Obstruction Information System (AWOIS) database, and 2) NOAA nautical charts for this area, and 3) Fugro locations from the 2017 and 2018 survey data.Areas that appear to have multiple shipwrecks, could be due to the location discrepancy between these two sources.

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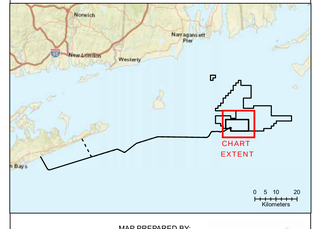
GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	18N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N



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SOUTH FORK WINDFARM

SOUTH FORK WIND FARM
MBES BACKSCATTER
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

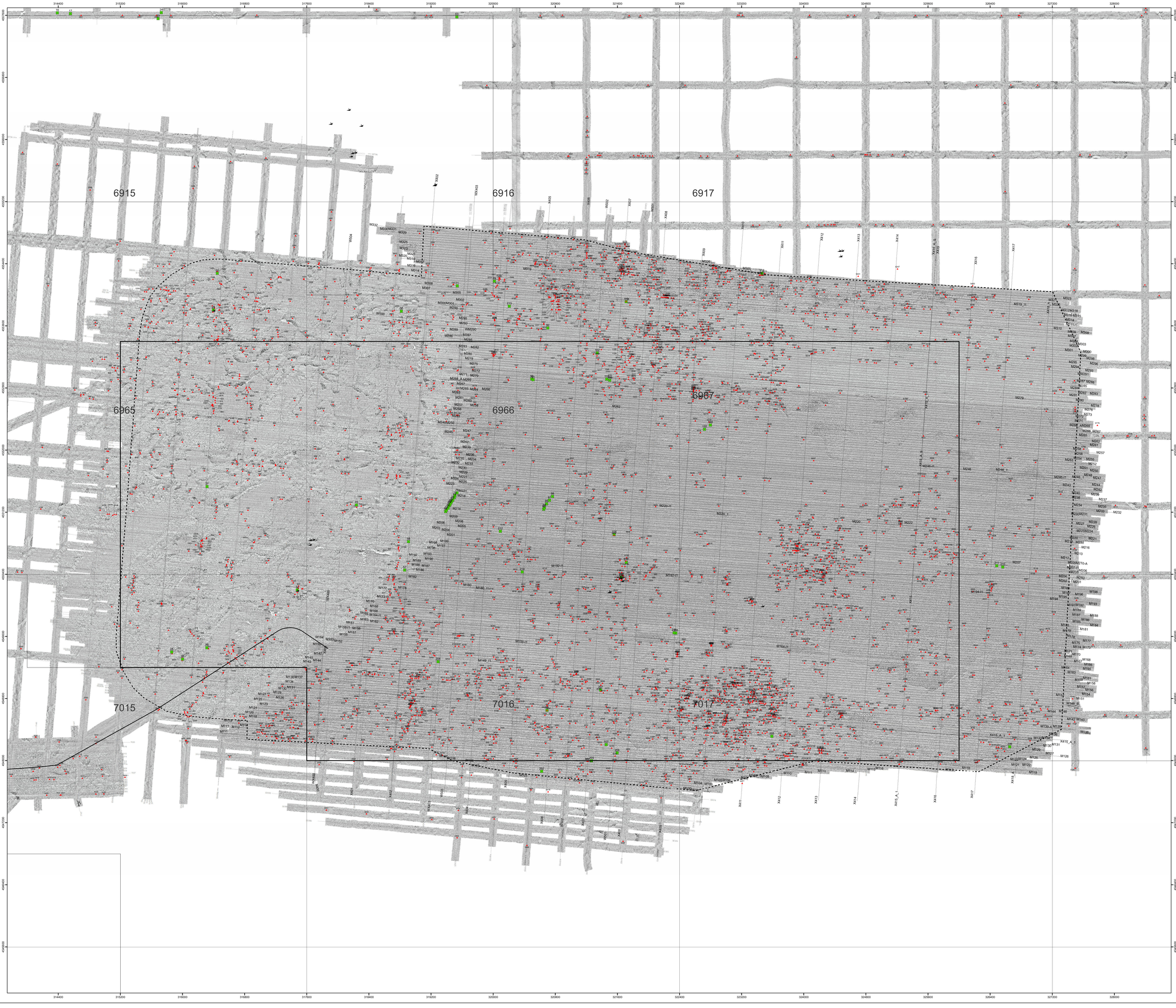
SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 4



LEGEND

- MAGNETIC ANOMALY WITH ID
- SIDE SCAN SONAR CONTACT WITH CONTACT ID
- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- <<< LINE 100 NAVIGATIONAL TRACKLINE WITH NAME AND DIRECTION
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA

SIDE SCAN SONAR REFLECTIVITY

High

Low

CAUTION POINT FEATURE
(SHIPWRECK SOURCES: AWOIS AND NOAA NAUTICAL CHARTS)

- SHIPWRECK

Notes:

1. Navigation for the 2017 Fugro survey was provided by Fugro Starfix.HP Differential Global Positioning System (DGPS).

   Navigation for the 2018 Fugro survey was provided by Fugro Starpack G2+ GNSS System.

2. 2017: Fugro collected side scan sonar and magnetic data using EdgeTech 4200 Side Scan Sonar System run at frequencies of 110 kHz & 425 kHz and 300 kHz & 600 kHz, with a range of 50 meters per channel and a Geometrics G-882 Marine Magnetometer recording data at 100-gamma scales at a sample rate of 2 Hz.

   2018: Fugro collected side scan sonar and magnetic data using an EdgeTech 4200 run at frequencies of 300 and 900 kHz, with a range of 50m per channel and a two Geometrics G-882 marine magnetometers in a transverse gradiometer configuration (TVG) recording at 100-gamma scales at a sample rate of 10 Hz.

3. Side scan sonar mosaic was generated at 25 centimeters per pixel resolution from individual and overlapping side scan sonar line data.

4. Shipwreck locations are based on three sources: 1) the Automated Wreck and Obstruction Information System (AWOIS) database, and, 2) NOAA nautical charts for this area, and 3) Fugro confirmed locations of shipwrecks identified in the 2017 and 2018 surveys. Areas that appear to have multiple shipwrecks, could be due to the location discrepancy between these two sources.

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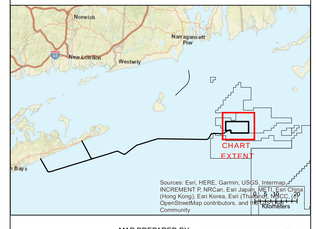
N

GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	18N
LONGITUDE OF ORIGIN:	-75
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



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SOUTH FORK WIND FARM
SIDE SCAN SONAR MOSAIC
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 5

LEGEND

- PROPOSED WTG LOCATION
- PROPOSED ALTERNATE WTG/OSS LOCATION
- PROPOSED OSS LOCATION
- MAXIMUM WORK AREA
- PROPOSED EXPORT CABLE ROUTE
- 6917 OCS BLOCK
- OCS-A 0517 LEASE AREA
- NOAA/AWOIS SHIPWRECK LOCATIONS
- POTENTIAL SHIPWRECK LOCATIONS FROM FUGRO 2017/2018 SURVEY

SURFICIAL BOULDER DISTURBUTION BASED ON SIZE (METERS)

- < 1
- 1 - 2
- 2 - 5
- > 5

- Boulder Field
- Ripples
- Megaripples

Notes:

1. Navigation for the 2017 Fugro survey was provided by Fugro Starfix.HP Differential Global Positioning System (DGPS). Geophysical trackline information is presented on Chart 1.

2. All features shown on this map were interpreted from the MBES bathymetry, MBES backscatter, seafloor slope, SSS mosaic, and all available subsurface geophysical data.

3. Mapped seafloor features are only presented within the Survey Area Boundary.

4. Background image is a grayscale seafloor hillshade (Azimuth: 315°, Altitude: 45°).

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GEODETIC INFORMATION

SPHEROID:	NAD83
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SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICTY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N

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SOUTH FORK WINDFARM

SOUTH FORK WIND FARM SEAFLOOR FEATURES

SFWF COP SURVEY

OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:15,000

0 150 300 600 900 1,200

Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 6

N:\Projects\02_2018\02_1803_1431_DWW_SFEX_Revolution_Wind\GIS\Data\Outputs\2019_02_04_DWW_SFEX_ShallowHaz_Geophysical_Rpt\mxd\Charts\Chart-6_SFWF_Surficial_Hazards_ArchE.mxd, 3/30/2021, t.rasmussen

LEGEND

MAXIMUM WORK AREA

PROPOSED EXPORT CABLE ROUTE

6917 OCS BLOCK

OCS-A 0517 LEASE AREA

MAPPED SUBSURFACE FEATURES

SECOND GENERATION (HOLOCENE): GENERALLY BURIED LESS THAN 1 METER TO APPROXIMATELY 13 METERS BELOW THE SEAFLOOR.

FIRST GENERATION (PLEISTOCENE): GENERALLY BURIED LESS THAN 1 METER TO APPROXIMATELY 31 METERS BELOW THE SEAFLOOR.

NORTHWEST-SOUTHEAST TRENDING DEFORMATION ATTRIBUTED TO GLACIATION CAUSED SHORTENING AND THICKENING OF BOULDER ZONE IN THIS AREA.

STRUCTURAL DEFORMATION TREND (APPROXIMATE AXIS OF SUBSURFACE FOLD) (ARROW INDICATES DIP DIRECTION OF LIMBS)

POTENTIAL SHALLOW GAS

Notes:

1. All subsurface features shown on this map were interpreted from available subsurface geophysical data.

2. Time-depth conversions are based on a constant two-way acoustic velocity of 1,500 meters per second.

3. Background image is a grayscale seafloor hillshade (Azimuth: 315°, Altitude: 45°).

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GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICTY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N

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SOUTH FORK WINDFARM

SOUTH FORK WIND FARM
SUBSURFACE FEATURES
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:15,000

0 150 300 600 900 1,200
Meters

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2					
3					

CHART SFWF 7

N:\Projects\02_2018\02_1803_1431_DWW_SFEX_Revolution_Wind\GIS\Data\Outputs\2019_02_04_DWW_SFEX_ShallowHaz_Geophysical_Rpt\mxd\Charts\Chart-7_SFWF_Subsurface_Hazards_ArchE.mxd, 3/30/2021, t.rasmussen

Vibracore Exploration Number[1]	Completion Date	Seafloor Elevation (Re. MMLW, Meters)	NAD83, UTM19N, Meters		NAD83, Geographic		Penetration (Meters)	Recovery (Meters)	Test Type[2]	Reason for Termination
			Northing	Easting	Latitude	Longitude				
17-V-100	12/3/2017	-33	4,553,465	316,449	41.111746	-71.186118	5.6	4.5	G	Reached Target Penetration
17-V-101	12/3/2017	-34.8	4,553,255	317,793	41.111054	-71.170090	5.9	3.6	G	Reached Target Penetration
17-V-102	12/3/2017	-36	4,553,060	318,901	41.108645	-71.156813	5.2	2.5	G	Reached Target Penetration
17-V-103	12/4/2017	-37.8	4,553,109	320,668	41.109480	-71.135794	1.7	0.8	G	Refusal
17-V-104	12/12/2017	-33.7	4,552,116	316,349	41.099582	-71.186900	1.3	1.2	G	Refusal
17-V-105	12/12/2017	-34.2	4,551,931	317,634	41.098201	-71.171558	2.2	1.0	G	Refusal
17-V-106	12/12/2017	-34.6	4,551,921	318,935	41.098407	-71.156076	2.1	1.4	G	Refusal
17-V-107	12/8/2017	-34.9	4,551,803	320,603	41.097711	-71.136184	2.1	1.3	G	Refusal
17-V-108	12/12/2017	-34.4	4,550,918	316,259	41.088773	-71.187612	1.2	0.6	G	Refusal
17-V-109	12/30/2017	-34.4	4,550,854	317,436	41.088469	-71.173598	1.5	0.7	G	Refusal
17-V-110	12/8/2017	-35	4,550,652	318,930	41.086979	-71.155757	3.4	2.7	G	Refusal
17-V-111	12/8/2017	-34.5	4,550,610	320,539	41.086961	-71.136599	2.9	1.4	G	Refusal
17-V-112	12/29/2017	-35.4	4,549,573	316,144	41.076640	-71.188584	1.1	0.6	G	Refusal
17-V-113	12/30/2017	-35.4	4,549,447	317,489	41.075806	-71.172550	3.8	0.7	G	Refusal
17-V-114	12/30/2017	-35	4,549,305	318,830	41.074830	-71.156551	1.2	1.0	G	Refusal
17-V-115	12/30/2017	-35.1	4,549,143	320,440	41.073727	-71.137350	1.1	0.4	G	Refusal
17-V-116	12/3/2017	-35	4,553,414	316,970	41.111405	-71.179907	2.7	1.9	C	Refusal
17-V-117	12/3/2017	-34.6	4,553,401	317,118	41.111316	-71.178131	5.9	3.4	C	Reached Target Penetration
17-V-118	12/3/2017	-34.6	4,553,351	317,669	41.110989	-71.171559	4.3	4.2	C	Refusal
17-V-119	12/3/2017	-36.1	4,553,213	319,213	41.110092	-71.153143	5.4	1.6	C	Reached Target Penetration
17-V-120	12/2/2017	-34.4	4,552,153	316,033	41.099842	-71.190674	5.3	5.8	C	Reached Target Penetration
17-V-121	12/2/2017	-35	4,551,941	318,420	41.098472	-71.162206	5.2	2.7	C	Reached Target Penetration
17-V-122	12/2/2017	-34.4	4,550,931	316,009	41.088837	-71.190598	5.9	5.4	C	Reached Target Penetration
17-V-123	12/2/2017	-34.7	4,550,662	319,048	41.087094	-71.154359	5.7	5.4	C	Reached Target Penetration
17-V-124	12/2/2017	-35.5	4,549,478	317,316	41.076050	-71.174615	3.8	2.0	C	Refusal
17-V-125	12/1/2017	-34.8	4,549,441	317,812	41.075829	-71.168699	3.2	0.9	C	Refusal
17-V-200	10/28/2017	-30.2	4,529,647	231,764	40.873981	-72.183137	2.2	1.6	G	Refusal
17-V-201	10/28/2017	-31.3	4,530,483	234,571	40.882421	-72.150235	3	2.6	G	Reached Target Penetration
17-V-202	10/30/2017	-30.1	4,531,960	239,394	40.897256	-72.093685	3	1.5	G	Reached Target Penetration
17-V-203	11/1/2017	-31.3	4,532,427	240,923	40.901938	-72.075754	3	2.2	G	Reached Target Penetration
17-V-204	11/1/2017	-30.3	4,533,176	243,374	40.909447	-72.047012	3	2.2	G	Reached Target Penetration
17-V-205	11/1/2017	-28.5	4,533,785	245,355	40.915547	-72.023765	3	2.4	G	Reached Target Penetration
17-V-206	11/1/2017	-29.1	4,534,295	247,035	40.920651	-72.004050	3	3.0	G	Reached Target Penetration
17-V-207	11/1/2017	-30	4,535,027	249,424	40.927972	-71.976021	3	2.8	G	Reached Target Penetration
17-V-208	11/1/2017	-29.3	4,535,466	250,852	40.932363	-71.959257	3	2.9	G	Reached Target Penetration
17-V-209	11/1/2017	-26.1	4,538,432	250,238	40.958857	-71.967738	3	2.9	G	Reached Target Penetration
17-V-210	11/2/2017	-27.3	4,537,209	250,883	40.948052	-71.959586	3	3.4	G	Reached Target Penetration
17-V-211	11/2/2017	-30	4,536,197	253,244	40.939661	-71.931165	3	2.7	G	Reached Target Penetration
17-V-212	11/3/2017	-30.9	4,537,212	256,577	40.949794	-71.892024	2.4	2.1	G	Reached Target Penetration
17-V-213	11/3/2017	-30.9	4,537,669	258,054	40.954344	-71.874681	2.4	2.1	G	Reached Target Penetration
17-V-214	11/3/2017	-32.8	4,538,290	260,099	40.960534	-71.850652	2.7	3.0	C	Reached Target Penetration
17-V-215	11/3/2017	-33.3	4,538,710	261,483	40.964718	-71.834389	3	1.9	C	Reached Target Penetration
17-V-216	11/3/2017	-34.9	4,539,264	263,294	40.970234	-71.813107	1.9	1.6	G	Refusal
17-V-217	11/3/2017	-38.2	4,538,935	265,037	40.967772	-71.792289	2.4	1.7	G	Reached Target Penetration
17-V-218	11/4/2017	-43.2	4,537,968	267,134	40.959673	-71.767029	2.5	1.4	G	Reached Target Penetration
17-V-219	12/15/2017	-47	4,539,740	269,826	40.976383	-71.735732	3.7	2.8	G	Reached Target Penetration
17-V-220	12/15/2017	-41.2	4,542,201	272,986	40.999410	-71.699123	2	0.8	G	Refusal
17-V-221	12/15/2017	-40.7	4,542,624	274,254	41.003570	-71.684211	1.2	0.6	G	Refusal
17-V-222	12/22/2017	-46.8	4,543,298	276,471	41.010248	-71.658121	3	1.6	C	Reached Target Penetration
17-V-223	12/22/2017	-44	4,543,791	278,075	41.015123	-71.639245	3	1.2	G	Reached Target Penetration
17-V-224	12/18/2017	-39.9	4,544,399	280,070	41.021131	-71.615756	1.5	1.3	G	Refusal
17-V-225	12/18/2017	-40.8	4,545,169	282,591	41.028740	-71.586075	1.9	0.8	G	Refusal
17-V-226	12/27/2017	-44.1	4,545,273	284,273	41.029998	-71.566126	2.2	0.9	G	Reached Target Penetration
17-V-227	12/18/2017	-44.8	4,545,248	285,698	41.030273	-71.549182	4.1	3.7	G	Reached Target Penetration
17-V-228	12/18/2017	-46.8	4,545,171	291,867	41.031175	-71.475839	2.2	1.5	G	Refusal
17-V-229	12/22/2017	-44.2	4,545,147	293,818	41.031457	-71.452646	2.7	1.8	G	Reached Target Penetration
17-V-230	12/18/2017	-43.9	4,545,126	295,582	41.031713	-71.431678	3	2.4	G	Reached Target Penetration
17-V-231	12/18/2017	-45.9	4,545,075	300,044	41.032358	-71.378623	2.3	1.5	C	Refusal
17-V-232	12/17/2017	-44.1	4,545,070	300,422	41.032406	-71.374129	3.3	3.2	GC	Reached Target Penetration
17-V-233	12/17/2017	-44.9	4,545,065	300,759	41.032448	-71.370123	2	1.8	C	Refusal
17-V-234	12/22/2017	-46	4,545,046	302,434	41.032686	-71.350210	2.7	1.8	G	Reached Target Penetration
17-V-235	12/21/2017	-42.6	4,545,006	305,932	41.033163	-71.308618	2.6	2.7	G	Reached Target Penetration
17-V-236	12/24/2017	-42.5	4,546,267	307,603	41.044906	-71.289150	3.4	3.2	G	Reached Target Penetration
17-V-237	10/21/2017	-40.1	4,547,744	309,543	41.058663	-71.266534	2.5	1.3	G	Reached Target Penetration
17-V-238	12/29/2017	-38.6	4,547,789	310,867	41.059372	-71.250803	0.9	0.5	G	Refusal
17-V-239	10/21/2017	-38.1	4,547,889	313,790	41.060940	-71.216347	1.7	0.6	G	Refusal
17-V-240	10/21/2017	-34.2	4,548,320	314,969	41.065099	-71.202187	0.8	0.5	G	Refusal
17-V-241	12/29/2017	-34.4	4,549,254	316,398	41.073827	-71.185470	0.6	0.2	G	Refusal
17-V-300	10/23/2017	-10	4,535,221	227,901	40.922848	-72.231352	3	2.7	GE	Reached Target Penetration
17-V-301	10/23/2017	-9.9	4,535,248	227,943	40.923100	-72.230866	3	2.8	E	Reached Target Penetration
17-V-302	10/23/2017	-17	4,534,040	228,577	40.912444	-72.222817	3	3.0	GE	Reached Target Penetration
17-V-303	10/23/2017	-22.1	4,532,741	229,321	40.901011	-72.213436	3	2.9	GE	Reached Target Penetration
17-V-304	10/23/2017	-23.3	4,531,983	229,754	40.894333	-72.207971	3	2.9	E	Reached Target Penetration
17-V-305	10/23/2017	-25.5	4,531,179	230,215	40.887252	-72.202157	3	3.0	GE	Reached Target Penetration
17-V-306	10/21/2017	-10	4,543,606	247,506	41.004562	-72.002262	3	2.8	GE	Reached Target Penetration
17-V-307	10/21/2017	-9.9	4,543,633	247,549	41.004816	-72.001771	3	2.9	E	Reached Target Penetration
17-V-308	10/21/2017	-14.5	4,542,932	247,864	40.998607	-71.997745	3	3.0	E	Reached Target Penetration
17-V-309	10/22/2017	-17.2	4,542,347	248,173	40.993438	-71.993837	3	2.2	GE	Reached Target Penetration
17-V-310	10/22/2017	-21.4	4,540,745	249,017	40.979287	-71.983158	3	3.0	E	Reached Target Penetration
17-V-311	10/22/2017	-23.2	4,539,900	249,463	40.971829	-71.977524	3	2.4	GE	Reached Target Penetration

Vibracore Exploration Number[1]	Completion Date	Seafloor Elevation (Re. MMLW, Meters)	NAD83, UTM19N, Meters		NAD83, Geographic		Penetration (Meters)	Recovery (Meters)	Test Type[2]	Reason for Termination
			Northing	Easting	Latitude	Longitude				
19-V-C-5	1/11/2019	-35.6	4,553,184	319,305	41.109856	-71.152042	4.53	5.2	C	Refusal
19-V-C-4	1/11/2019	-36.9	4,553,255	319,117	41.110454	-71.154301	4.03	3.8	C	Refusal
19-V-C-3	1/12/2019	-36.7	4,553,563	318,501	41.113084	-71.161721	5.8	5.2	C	Refusal
19-V-C-2	1/12/2019	-36.4	4,553,573	318,406	41.113153	-71.162859	5.17	4.0	C	Refusal
19-V-C-1	1/12/2019	-36.0	4,553,577	318,304	41.113169	-71.164071	5.23	5.8	C	Refusal
19-V-C-7	1/12/2019	-35.5	4,553,378	317,454	41.111188	-71.174131	4.92	6.2	C	Reached Target Penetration
19-V-C-6	1/12/2019	-34.9	4,553,390	317,288	41.111260	-71.176114	5.25	6.2	C	Reached Target Penetration
19-V-CF3-3	1/12/2019	-44.9	4,545,004	304,690	41.032845	-71.323377	5.82	6.3	C	Reached Target Penetration
19-V-CF3-2	1/12/2019	-46.1	4,545,008	304,167	41.032769	-71.329598	5.66	5.8	C	Refusal
19-V-CF3-1	1/12/2019	-46.5	4,545,014	303,994	41.032769	-71.331657	2.3	5.6	C	Refusal
19-V-CF5-3	1/13/2019	-44.7	4,545,052	300,625	41.032299	-71.371715	5.77	6.3	C	Reached Target Penetration
19-V-CF5-2	1/13/2019	-45.3	4,545,065	299,957	41.032251	-71.379655	3.72	3.3	C	Refusal
19-V-CF5-1	1/13/2019	-42.9	4,545,071	299,172	41.032106	-71.388986	5.29	5.6	C	Refusal
19-V-CF7-2	1/13/2019	-47.6	4,545,287	290,052	41.031754	-71.497452	5.3	5.6	C	Refusal
19-V-CF7-1	1/13/2019	-47.5	4,545,293	289,687	41.031712	-71.501794	5.32	5.7	C	Refusal
19-V-CF9-2	1/13/2019	-33.5	4,538,847	261,784	40.966036	-71.830867	4.85	5.8	C	Refusal
19-V-CF9-1	1/13/2019	-33.5	4,538,787	261,557	40.965436	-71.833532	4.77	4.9	C	Refusal
19-V-CF11-2	1/13/2019	-31.0	4,537,180	256,337	40.949439	-71.894857	5.19	5.2	C	Refusal
19-V-CF11-1	1/15/2019	-31.0	4,537,142	256,210	40.949053	-71.896356	5.2	6.0	C	Reached Target Penetration
19-V-CF13-2	1/15/2019	-29.3	4,535,528	251,127	40.933003	-71.956013	3.48	3.0	C	Refusal
19-V-CF13-1	1/15/2019	-29.5	4,535,382	250,656	40.931547	-71.961547	5.03	4.6	C	Refusal
19-V-WTG-10	1/15/2019	-34.0	4,550,681	321,956	41.087910	-71.119767	5.7	6.2	G	Reached Target Penetration
19-V-WTG-11	1/15/2019	-32.9	4,550,665	323,053	41.088002	-71.106707	4.72	4.9	G	Refusal
19-V-WTG-12	1/16/2019	-36.0	4,552,548	324,302	41.105225	-71.092384	4.73	6.2	G	Reached Target Penetration
19-V-WTG-14	1/16/2019	-36.1	4,552,496	325,625	41.105041	-71.076629	4.22	3.7	G	Refusal
19-V-WTG-16	1/17/2019	-37.3	4,552,528	326,917	41.105606	-71.061251	5.9	5.1	G	Refusal
19-V-WTG-17	1/17/2019	-34.6	4,550,665	326,905	41.088833	-71.060876	3.7	3.0	G	Refusal
19-V-WTG-18	1/17/2019	-33.5	4,548,833	326,916	41.072341	-71.060225	4.15	3.3	G	Refusal
19-V-WTG-15	1/17/2019	-33.4	4,548,853	325,656	41.072261	-71.075221	4.16	4.6	G	Refusal
19-V-WTG-13	1/17/2019	-34.4	4,548,833	324,333	41.071792	-71.090950	4.26	4.5	G	Refusal
19-V-EX8	1/26/2019	-35.1	4,553,036	327,076	41.110211	-71.059504	6.15	5.2	C	Refusal
19-V-EX9	1/26/2019	-36.2	4,552,758	327,062	41.107712	-71.059595	6.15	4.4	C	Refusal
19-V-EX10	1/26/2019	-37.6	4,552,177	327,021	41.102469	-71.059922	5.86	6.1	C	Reached Target Penetration
19-V-EX11	1/26/2019	-37.1	4,551,705	326,993	41.098215	-71.060120	5.12	5.6	C	Refusal
19-V-EX12	1/26/2019	-36.2	4,551,239	326,957	41.094011	-71.060421	4.53	5.2	C	Refusal
19-V-EX13	1/26/2019	-35.2	4,551,005	326,942	41.091899	-71.060529	3.86	4.0	C	Refusal
19-V-EX4	1/26/2019	-33.4	4,550,623	323,388	41.087695	-71.102713	5.18	6.2	C	Reached Target Penetration
19-V-EX3	1/26/2019	-33.6	4,550,700	322,310	41.088159	-71.115554	3.67	4.5	C	Refusal
19-V-EX2	1/26/2019	-33.8	4,550,708	322,189	41.088206	-71.117003	5.9	5.6	C	Refusal
19-V-EX1	1/27/2019	-34.2	4,550,721	322,013	41.088280	-71.119096	5.35	3.8	C	Refusal
19-V-EX7	1/27/2019	-34.4	4,551,049	320,579	41.090850	-71.136259	6.11	5.4	C	Refusal
19-V-EX6	1/27/2019	-34.4	4,551,049	320,475	41.090893	-71.137487	6.15	4.6	C	Refusal
19-V-EX5	1/27/2019	-34.3	4,551,055	320,410	41.090937	-71.138272	5.49	5.0	C	Refusal

Notes:

[1] For 2017 data, vibracore exploration number represents location in project area. 100-series (e.g. V-101), 200-series, and 300-series represent vibracores conducted in the SFWF area, federal waters on the OCS along the SFEC corridor, and New York state waters along the SFEC corridor, respectively.

[2] Test type code is as follows:
C = Cultural vibracore for archaeological study
E = Environmental vibracore
G = Geotechnical vibracore

Grab Samples Exploration Number	Completion Date	Seafloor Elevation (Re. MMLW, Meters)	NAD83, UTM19N, Meters		NAD83, Geographic		Location
			Northing	Easting	Latitude	Longitude	
17-GS-2	11/16/2017	-35.2	4,553,285	317,310	41.110322	-71.175817	SFWF
17-GS-10	11/15/2017	-35.0	4,550,033	318,845	41.081392	-71.156590	SFWF
17-GS-11	11/15/2017	-35.5	4,549,496	319,642	41.076732	-71.146945	SFWF
17-GS-13	11/16/2017	-35.2	4,548,896	315,854	41.070482	-71.191829	SFWF
17-GS-19	11/15/2017	-34.8	4,552,297	318,101	41.101604	-71.166110	SFWF
17-GS-20	11/16/2017	-34.3	4,551,500	316,233	41.094005	-71.188102	SFWF
17-GS-21	11/16/2017	-33.7	4,552,714	316,366	41.104967	-71.186883	SFWF
17-GS-25	11/16/2017	-40.6	4,547,749	310,039	41.058819	-71.260637	Cable
17-GS-26	11/15/2017	-43.0	4,545,182	306,731	41.034938	-71.299174	Cable
17-GS-27	11/16/2017	-40.5	4,544,064	278,987	41.017823	-71.628508	Cable
17-GS-28	11/15/2017	-43.7	4,545,272	283,947	41.030024	-71.569998	Cable
17-GS-29	11/16/2017	-45.4	4,538,473	268,193	40.964514	-71.754652	Cable
17-GS-30	11/15/2017	-24.9	4,539,528	249,656	40.968539	-71.975080	Cable
17-GS-32	11/16/2017	-29.9	4,534,364	247,220	40.921336	-72.001890	Cable
17-GS-33	11/14/2017	-29.4	4,530,950	236,122	40.887117	-72.132047	Cable
17-GS-34	11/16/2017	-44.2	4,545,130	296,250	41.031915	-71.423740	Cable
17-GS-35	11/14/2017	-29.3	4,531,743	238,700	40.895075	-72.101830	Cable
17-GS-37	11/16/2017	-44.0	4,541,599	272,214	40.993775	-71.708063	Cable
17-GS-40	11/16/2017	-46.7	4,545,191	290,752	41.031067	-71.489097	Cable

CPT Exploration Identification Number[1]	Completion Date	Seafloor Elevation (Re. MML, Meters)	NAD83, UTM19N, Meters		NAD83, Geographic		Penetration (Meters)	Reason for Termination
			Northing	Easting	Latitude	Longitude		
17-C-100	11/12/2017	-33	4,553,462	316,447	41.111721	-71.186134	0.5	Differential Pressure
17-C-100A	11/12/2017	-33.1	4,553,462	316,443	41.111719	-71.186186	0.6	Slope Threshold
17-C-100B	11/28/2017	-33	4,553,466	316,452	41.111757	-71.186081	1.4	Slope Threshold
17-C-101	11/12/2017	-34.8	4,553,354	317,792	41.111050	-71.170099	2.4	Differential Pressure
17-C-101A	11/12/2017	-34.9	4,553,355	317,798	41.111055	-71.170024	2.3	Differential Pressure
17-C-101B	11/28/2017	-34.9	4,553,356	317,796	41.111070	-71.170047	2.4	Slope Threshold
17-C-102	11/11/2017	-36	4,553,059	318,900	41.108643	-71.156824	3.1	Differential Pressure
17-C-102A	11/11/2017	-35.9	4,553,059	318,892	41.108638	-71.156916	3.2	Tip Threshold
17-C-102B	11/11/2017	-35.9	4,553,060	318,894	41.108648	-71.156900	3.3	Differential Pressure
17-C-103	11/11/2017	-37.8	4,553,108	320,669	41.109476	-71.135787	2.1	Differential Pressure
17-C-103A	11/11/2017	-37.8	4,553,103	320,669	41.109429	-71.135783	2.3	Differential Pressure
17-C-103B	11/11/2017	-37.7	4,553,107	320,664	41.109461	-71.135839	2.1	Differential Pressure
17-C-103C	11/28/2017	-37.8	4,553,110	320,673	41.109494	-71.135742	2.1	Differential Pressure
17-C-104	11/12/2017	-33.7	4,552,115	316,348	41.099568	-71.186912	7.1	Differential Pressure
17-C-105	11/12/2017	-34.2	4,551,932	317,636	41.098212	-71.171534	1	Slope Threshold
17-C-105A	11/12/2017	-34.2	4,551,925	317,635	41.098150	-71.171541	0.4	Tip Threshold
17-C-106	11/12/2017	-34.7	4,551,923	318,932	41.098425	-71.156107	2	Differential Pressure
17-C-106A	11/12/2017	-34.8	4,551,927	318,929	41.098455	-71.156147	0.9	Slope Threshold
17-C-106B	11/28/2017	-34.6	4,551,920	318,936	41.098397	-71.156063	4.2	Differential Pressure
17-C-107	11/12/2017	-34.9	4,551,802	320,601	41.097705	-71.136216	1.8	Slope Threshold
17-C-107A	11/12/2017	-34.9	4,551,801	320,596	41.097690	-71.136271	4.4	Differential Pressure
17-C-108	11/12/2017	-34.4	4,550,918	316,256	41.088773	-71.187649	0.5	Slope Threshold
17-C-108A	11/12/2017	-34.4	4,550,915	316,249	41.088749	-71.187734	5.6	Differential Pressure
17-C-109	11/13/2017	-34.4	4,550,852	317,428	41.088447	-71.173692	1	Slope Threshold
17-C-109A	11/13/2017	-34.4	4,550,852	317,428	41.088448	-71.173686	0.5	Slope Threshold
17-C-110	11/13/2017	-35	4,550,653	318,928	41.086989	-71.155782	0.8	Slope Threshold
17-C-110A	11/13/2017	-35	4,550,651	318,922	41.086967	-71.155853	0.8	Slope Threshold
17-C-110B	11/28/2017	-35	4,550,654	318,931	41.087002	-71.155743	0.9	Tip threshold
17-C-111	11/13/2017	-34.5	4,550,612	320,538	41.086977	-71.136611	0.5	Slope Threshold
17-C-111A	11/13/2017	-34.5	4,550,614	320,539	41.086995	-71.136602	3.2	Differential Pressure
17-C-112	11/13/2017	-35.4	4,549,572	316,144	41.076635	-71.188578	0.6	Slope Threshold
17-C-112A	11/13/2017	-35.4	4,549,569	316,146	41.076607	-71.188559	1.5	Differential Pressure
17-C-113B	11/28/2017	-35.4	4,549,447	317,489	41.075809	-71.172542	4.6	Slope Threshold
17-C-114	11/28/2017	-35	4,549,308	318,832	41.074861	-71.156533	2.6	Differential Pressure
17-C-115	11/28/2017	-35.2	4,549,146	320,437	41.073754	-71.137395	6	Differential Pressure
17-C-200	11/15/2017	-29.1	4,529,983	230,928	40.876735	-72.193194	7.3	Tip Threshold
17-C-201	11/15/2017	-31.4	4,531,376	237,477	40.891388	-72.116169	9.1	Tip Threshold
17-C-202	11/15/2017	-30.3	4,532,841	242,270	40.906087	-72.059963	1.5	Differential Pressure
17-C-202A	11/15/2017	-30.3	4,532,838	242,272	40.906063	-72.059935	1.6	Tip Threshold
17-C-203	11/9/2017	-29.1	4,536,067	251,646	40.938005	-71.950081	0	Tip Threshold
17-C-203A	11/9/2017	-29.2	4,536,063	251,640	40.937973	-71.950148	5.4	Differential Pressure
17-C-204	11/9/2017	-30.9	4,536,790	255,178	40.945578	-71.908463	0.4	Tip Threshold
17-C-204A	11/9/2017	-30.9	4,536,788	255,182	40.945564	-71.908407	6.3	Tip Threshold
17-C-205	11/9/2017	-33.1	4,538,371	260,358	40.961340	-71.847605	9.6	Differential Pressure
17-C-206	11/9/2017	-46.4	4,541,043	271,492	40.988578	-71.716436	5	Differential Pressure
17-C-207	11/24/2017	-44.3	4,543,074	275,742	41.008031	-71.666707	4.1	Slope Threshold
17-C-208	11/24/2017	-46.8	4,545,224	287,713	41.030582	-71.525227	10.1	Reached Target Depth
17-C-209	11/24/2017	-47.8	4,545,196	289,927	41.030899	-71.498906	10.1	Reached Target Depth
17-C-210	11/24/2017	-41.4	4,545,104	297,606	41.032022	-71.407615	6.8	Differential Pressure
17-C-211	11/24/2017	-50	4,545,078	299,635	41.032290	-71.383484	3	Slope Threshold
17-C-212	11/24/2017	-45.7	4,545,024	304,379	41.032956	-71.327085	1.4	Slope Threshold
17-C-212A	11/24/2017	-45.8	4,545,028	304,383	41.032990	-71.327033	1.4	Slope Threshold
17-C-213	11/25/2017	-43.1	4,545,575	307,156	41.038578	-71.294244	0.7	Differential Pressure
17-C-213A	11/25/2017	-43	4,545,580	307,160	41.038621	-71.294191	0.3	Differential Pressure
17-C-214	11/25/2017	-39.2	4,547,692	312,220	41.058813	-71.234688	2.8	Slope Threshold
17-C-215B	11/28/2017	-34.8	4,548,252	314,859	41.064456	-71.203476	0.8	Tip Threshold
17-C-216	11/13/2017	-35.6	4,549,426	316,913	41.075490	-71.179397	0.2	Tip Threshold
17-C-216A	11/13/2017	-35.5	4,549,429	316,916	41.075520	-71.179362	0	Tip Threshold
17-C-300	11/15/2017	-9.9	4,535,224	227,902	40.922874	-72.231347	10.8	Tip Threshold
17-C-301	11/16/2017	-10	4,543,612	247,506	41.004619	-72.002269	0.4	Tip Threshold
17-C-301A	11/16/2017	-9.9	4,543,616	247,507	41.004655	-72.002257	0.7	Tip Threshold
19-C-WTG-18	2/22/2019	-33.5	4,548,834	326,916	41.072352	-71.060228	6.51	Slope Threshold
19-C-WTG-15	2/22/2019	-33.4	4,548,854	325,659	41.072261	-71.075193	11.93	Tip Threshold
19-C-WTG-13	2/22/2019	-34.4	4,548,835	324,334	41.071808	-71.090948	13.57	Slope Threshold
19-C-WTG-10	2/22/2019	-34	4,550,682	321,956	41.087922	-71.119760	7.09	Slope Threshold
19-C-WTG-11	2/22/2019	-32.9	4,550,665	323,052	41.088007	-71.106716	9.37	Slope Threshold
19-C-WTG-17	2/23/2019	-34.6	4,550,663	326,908	41.088821	-71.060838	19.24	Differential Pressure
19-C-WTG-16	2/23/2019	-37.3	4,552,525	326,916	41.105584	-71.061270	19.75	Slope Threshold
19-C-WTG-14	2/23/2019	-36.1	4,552,497	325,624	41.105052	-71.076633	13.9	Slope Threshold
19-C-WTG-12	2/23/2019	-36	4,552,549	324,302	41.105239	-71.092390	4.27	Tip Threshold
19-C-WTG-12a	2/23/2019	-36	4,552,548	324,301	41.105227	-71.092396	4.19	Tip Threshold

Notes:

1 For 2017 data, cone penetration test (CPT) sounding exploration number represents location in project area. 100-series (e.g. C-101), 200-series, and 300-series represents CPTs conducted in the SFWF area, federal waters on the OCS along the SFEC corridor, and New York state waters along the SFEC corridor, respectively.

Notes:

1. Charted shipwrecks from AWOIS database and NOAA Charts are displayed on chart. If more then one shipwreck symbol is displayed at a location, this may represent the same wreck but charted at different locations in their respective data source.

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GEODETIC INFORMATION

SPHEROID:	NAD 1983
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICTY[2]:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:

FUGRO USA MARINE, INC.
World Trade Center, Suite 350
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www.fugro.com

AS-BUILT GEOTECHNICAL EXPLORATION LOCATIONS
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:110,000 (0 1 2 4 6 8 Kilometers)

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	MLG	KRS	KRS
2	Apr. 2019	Integrated G&G Site Characterization Report	WBC	KRS	KRS
3	Mar. 2021	Integrated G&G Site Characterization Report	WBC	DMC	KRS

SFWF CHART 8

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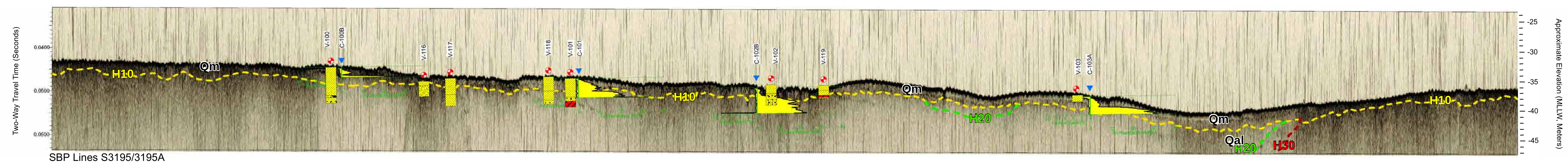
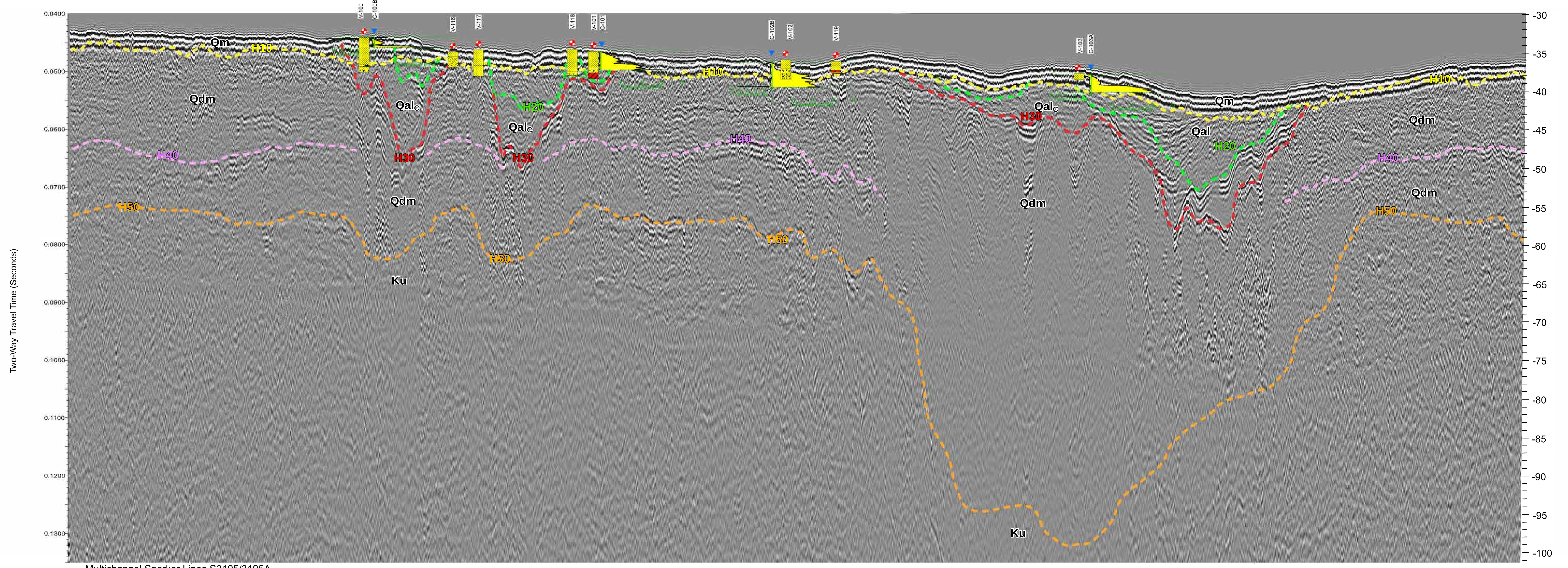
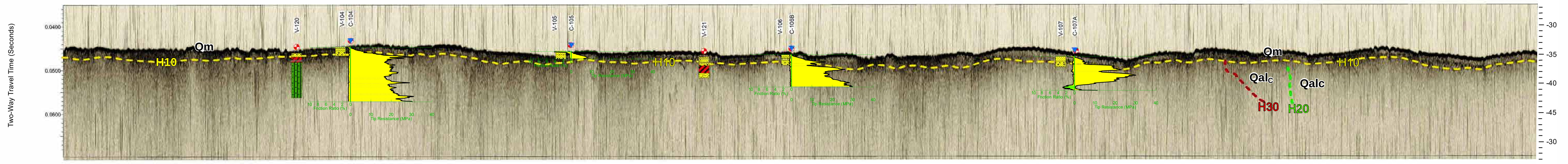


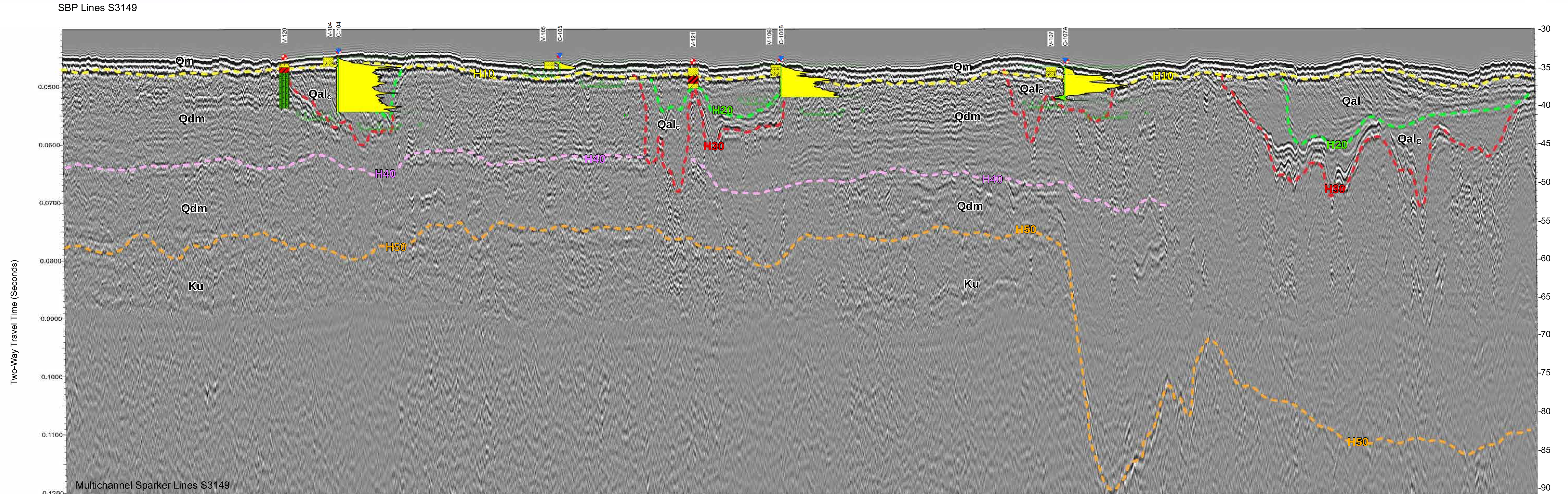
SBP Lines S3195/3195A



Multichannel Sparker Lines S3195/3195A



SBP Lines S3149



Multichannel Sparker Lines S3149

LEGEND

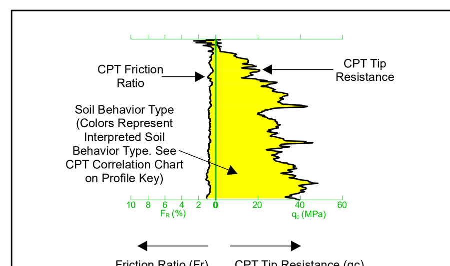
V-201 Vibracore Location

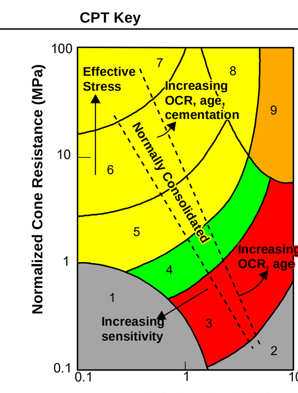
C-201 CPT Location

Soil Types

- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Silty CLAY with Sand (CL-ML)
- Lean CLAY with Sand (CL)
- Sandy Lean Clay (CL)
- Fat CLAY (CH)
- Fat CLAY with SAND (CH)
- Sandy Fat CLAY (CH)
- Gravelly Fat CLAY (CH)
- Silt (ML)
- Clayey SILT (ML)
- SILT with Sand (ML)
- Sandy SILT (ML)
- Poorly-Graded SAND (SP)
- Poorly-Graded SAND with Clay (SP-SC)
- Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND (SP)
- Well-Graded SAND (SW)
- Well-Graded SAND with Silt (SW-SM)
- Gravelly Well-Graded SAND (SW)
- Clayey SAND (SC)
- Clayey SAND to Lean CLAY (SC-CL)
- Silty SAND (SM)
- Silty SAND to Sandy SILT (SM-ML)
- Gravelly Silty SAND (SM)
- Poorly-Graded GRAVEL (GP)
- Sandy GRAVEL (GP)
- Well-Graded GRAVEL (GW)
- Low-Plasticity Organic (OL)
- High-Plasticity Organic (OH)

CPT Key



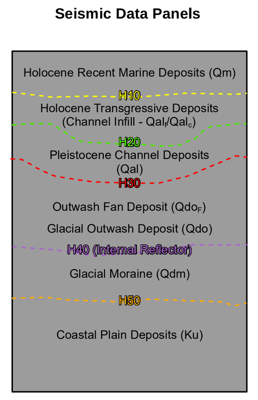


Correlation Chart (Roberston, 1990)

Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

Seismic Data Panels



Holocene	**Qm** - Recent marine deposits consisting of predominantly fine to medium-grained sand with shell fragments	
	Qal - Fluvial coarse-grained (Qal$_C$) and fine-grained (Qal$_f$) channel infill deposits	
Pleistocene	**Qal** - Channel infill deposits consisting of glacial erratics (boulders), gravels, and sands.	
	Qdo$_F$ - Outwash fan deposits are clean, coarse-grained sands with some gravel lenses. Thickens southward (see Figure 4-1a for location of these deposits)	
	Qdo - Outwash deposits consist of coarse-grained sands with gravel and pebbles intermixed.	
	Qdm - Terminal moraine deposits dominate the SFWF area and consist of wide-spread boulders from 1 to 10 meters in diameter. Estimated to be 20 to 30 meters thick in the wind farm area.	
Pre-Quaternary	**Ku** - Coastal Plain deposits are inferred to be mostly Late Cretaceous in age and consist of unconsolidated to semi-consolidated sand, gravel, silt, and clay. It is seen to be flat-lying or gently dipping seaward and may contain Late Tertiary deposits. Identified in seismic section as an erosioanl unconformity.	

Notes:

1. Navigation for the 2017 Fugro survey were provided by Fugro Starfix.HP Differential Global Positioning System (DGPS) (F/V Fugro Enterprise) and Applanix Pos M/V Inertial Navigation System (R/V Harry Miller).

2. Fugro collected geophysical data in federal waters (SFWF and SFEC) from July 19 to November 9, 2017 aboard the R/V Fugro Enterprise and in New York State waters from July 27 to August 16, 2017, aboard the R/V Harry Miller.

3. Data collected included the multibeam echo sounder (MBES) bathymetry and backscatter, side scan sonar (SSS), magnetometer (MAG), multichannel and single channel sparker, and subbottom profiler (SBP).

4. Survey tools operated aboard the R/V Fugro Enterprise include: 1) Reson SeaBat 7125 Multibeam Bathymetric System operating at 400 kHz and swath coverage of 128 degrees, 2) EdgeTech 4200 dual frequency side scan sonar system operating at 300 kHz and 600 kHz, with a range of 50 meters per channel, 3) G-882 Marine Magnetometer recording data at 100-gamma and 1,000-gamma scales at a sample rate of 2 Hz, 4) sub-bottom profiling system using four Massa TR-1075D sub-bottom transducers in a two-by-two configuration operating at a frequency range of 1 to 10 kHz, heave compensated, and an EdgeTech 3200 topside system, 5) Applied Acoustics Dura-Spark medium penetration seismic profiling system with an eight-element single channel streamer, and 6) Applied Acoustics Dura-Spark medium penetration seismic profiling system with a 32-channel hydrophone streamer and a group spacing of 1.56 meters.

5. Survey tools operated aboard the R/V Harry Miller include: 1) R2Sonic 2024 Multibeam Echo Sounder operating at 300 kHz, 2) EdgeTech 4125 Side Scan Sonar System operating at frequencies of 400 and900 kHz, 3) Marine Magnetics SeaSpy Magnetometer, and 4) EdgeTech 3200 SB-216 Sub-bottom system using a frequency range of 2 to 16 kHz.

6. Elevation values shown on the profiles should be considered as approximate. Time-depth conversions are based on a constant two-way acoustic velocity of 1,500 meters per second.

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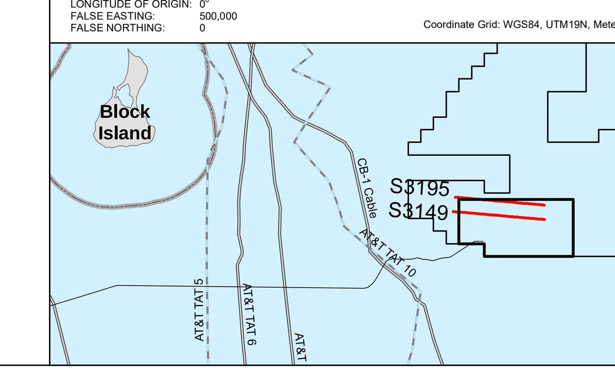
ECCENTRICITY^2:	0.006694380
PROJECTION:	UNIVERSAL TRANSVERSE MERCATOR
ZONE:	ZONE 19 NORTH
LONGITUDE OF ORIGIN:	0°
FALSE EASTING:	500,000
FALSE NORTHING:	0

Coordinate Grid: WGS84, UTM19N, Meters



MAP PREPARED BY:

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SOUTH FORK WINDFARM

GEOPHYSICAL SURVEY AND SITE CHARACTERIZATION SOUTH FORK WIND FARM

DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	April 2018	Site Characterization Report	MLG		
2	April 2021	Site Characterization Report	MLG		
3					

CHART SFWF 9

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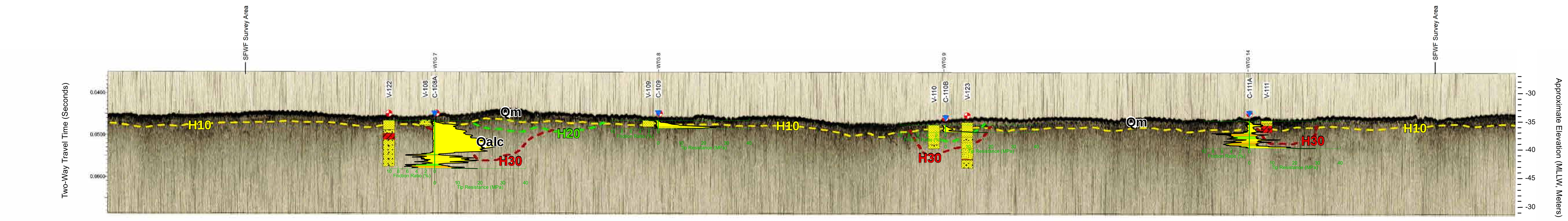

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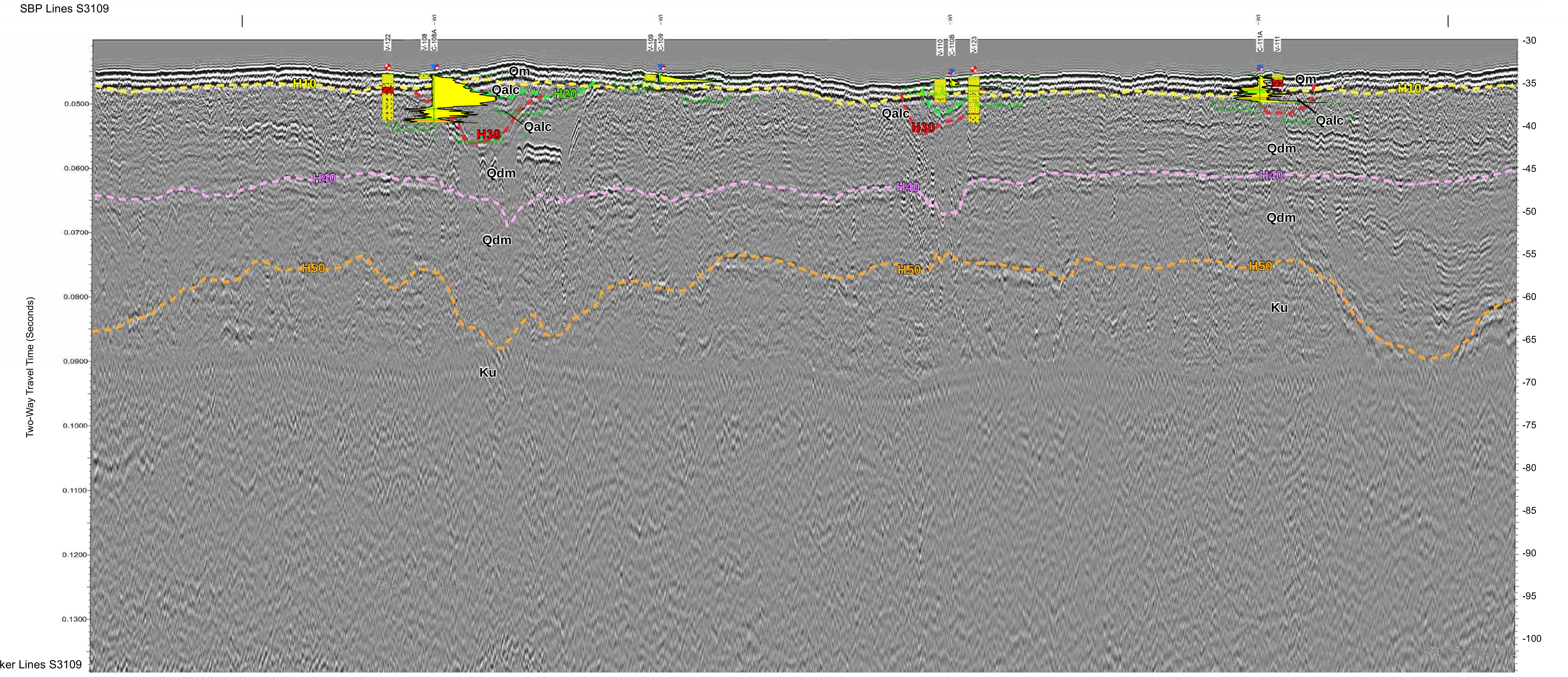
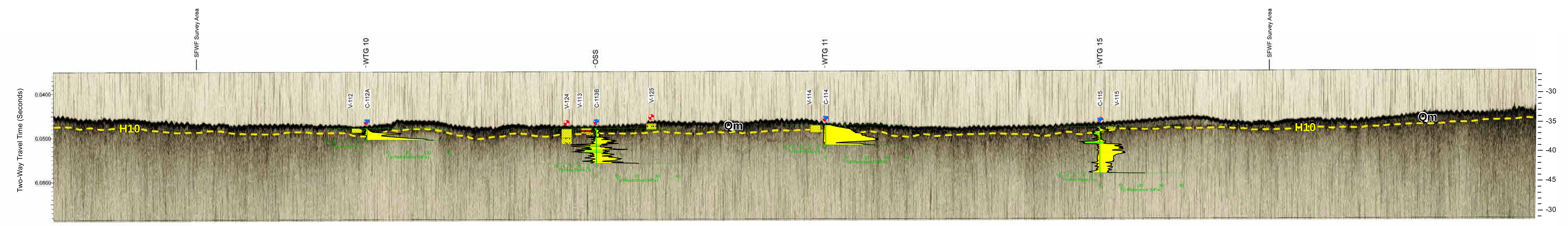


Multichannel Sparker Lines S3109



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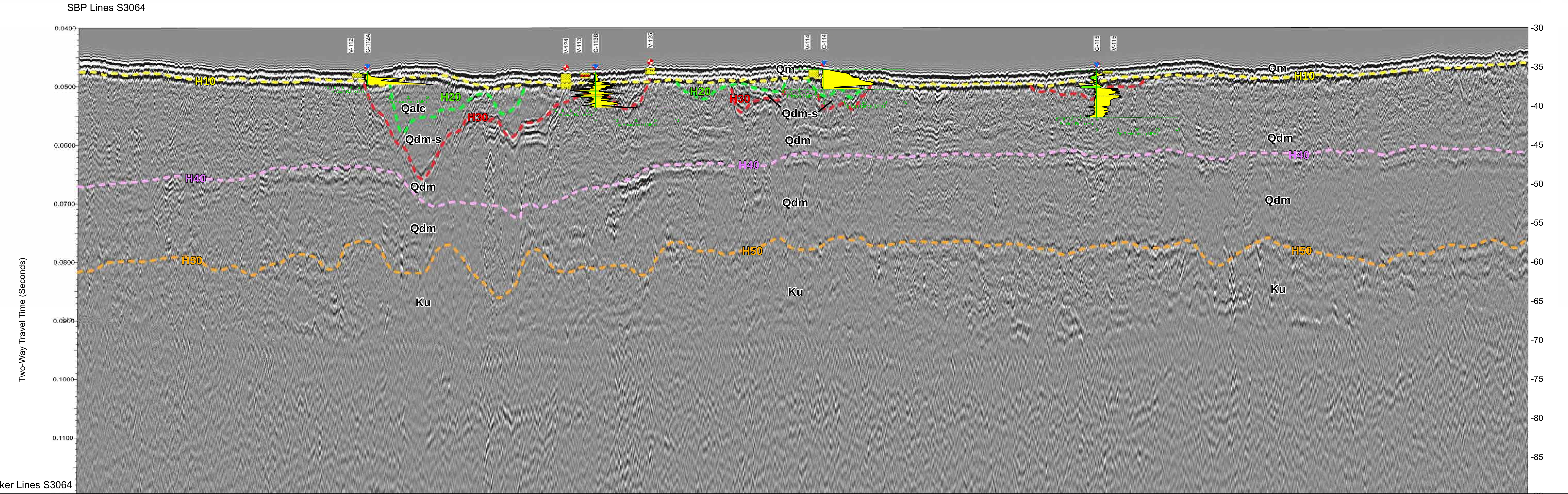

Multichannel Sparker Lines S3064

LEGEND

- V-201 Vibracore Location
- C-201 CPT Location

Soil Types

- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Silty CLAY with Sand (CL-ML)
- Lean CLAY with Sand (CL)
- Sandy Lean Clay (CL)
- Fat CLAY (CH)
- Fat CLAY with SAND (CH)
- Sandy Fat CLAY (CH)
- Gravelly Fat CLAY (CH)
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- Clayey SILT (ML)
- SILT with Sand (ML)
- Sandy SILT (ML)
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- Poorly-Graded SAND with Clay (SP-SC)
- Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND (SP)
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- Well-Graded SAND with Silt (SW-SM)
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- Clayey SAND to Lean CLAY (SC-CL)
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- Silty SAND to Sandy SILT (SM-ML)
- Gravelly Silty SAND (SM)
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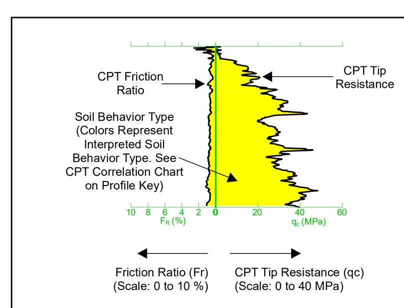
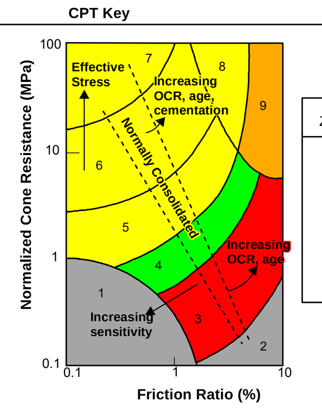
- Sandy GRAVEL (GP)
- Well-Graded GRAVEL (GW)
- Low-Plasticity Organic (OL)
- High-Plasticity Organic (OH)

CPT Key





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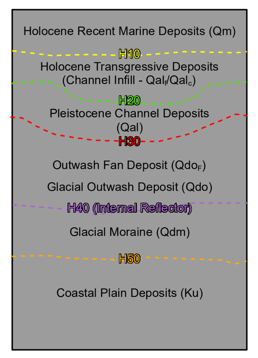
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

Seismic Data Panels



Holocene	**Qm** - Recent marine deposits consisting of predominantly fine to medium-grained sand with shell fragments
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Pleistocene	**Qal** - Channel infill deposits consisting of glacial erratics (boulders), gravels, and sands.
	Qdo_F - Outwash fan deposits are clean, coarse-grained sands with some gravel lenses. Thickens south-ward (see Figure 4-1a for location of these deposits)
	Qdo - Outwash deposits consist of coarse-grained sands with gravel and pebbles intermixed.
	Qdm - Terminal moraine deposits dominate the SFWF area and consist of wide-spread boulders from 1 to 10 meters in diameter. Estimated to be 20 to 30 meters thick in the wind farm area.
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6. Elevation values shown on the profiles should be considered as approximate. Time-depth conversions are based on a constant two-way acoustic velocity of 1,500 meters per second.

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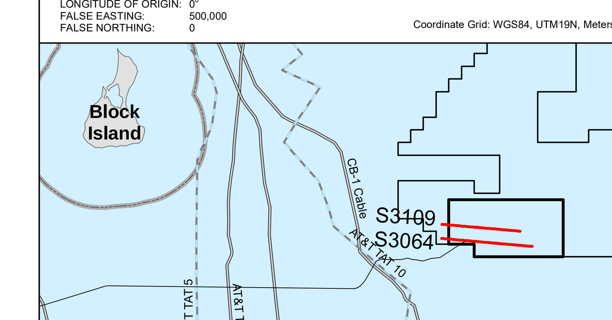
ZONE:	ZONE 19 NORTH
LONGITUDE OF ORIGIN:	0°
FALSE EASTING:	500,000
FALSE NORTHING:	0

Coordinate Grid: WGS84, UTM19N, Meters



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DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Site Characterization Report	MLG		
2	April 2021	Site Characterization Report	MLG		
3					

CHART SFWF 10

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GEOLOGIC UNITS

Horizon H10 - Base of Recent Marine Sand - Recent marine deposits consisting of predominantly fine to medium-grained sand with shell fragments

Horizon H20 - Interpreted Holocene / Pleistocene Boundary - Fluvial coarse-grained and fine-grained channel infill deposits

Horizon H30 - Interpreted Base of Generation 1 Channels (Pleistocene) - Contains channel infill deposits of gravel, sand, and glacial erratics

Horizon H50 - Interpreted Top of Coastal Plain Deposits (CPD) - Coastal Plain deposits are inferred to be mostly Late Cretaceous in age and consist of unconsolidated to semi-consolidated sand, gravel, silt, and clay. It is seen to be flat-lying or gently dipping seaward and may contain Late Tertiary deposits. Identified in seismic section as an erosional unconformity.

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GEODETIC INFORMATION

SPHEROID:	NAD83
SEMI-MAJOR AXIS:	6378137.000
SEMI-MINOR AXIS:	6356752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

FUGRO USA MARINE, INC.
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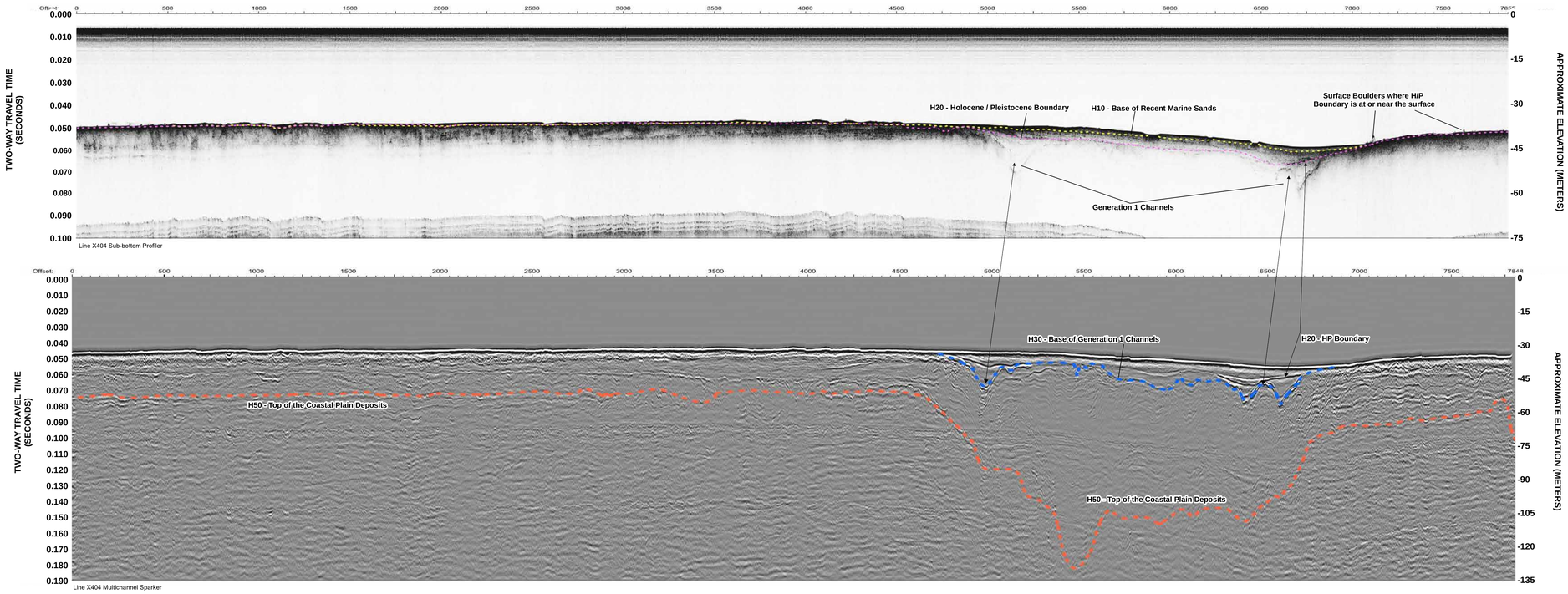
Norfolk, Virginia 23510
Tel: (757) 625-3350
Fax: (757) 625-3352
www.fugro.com

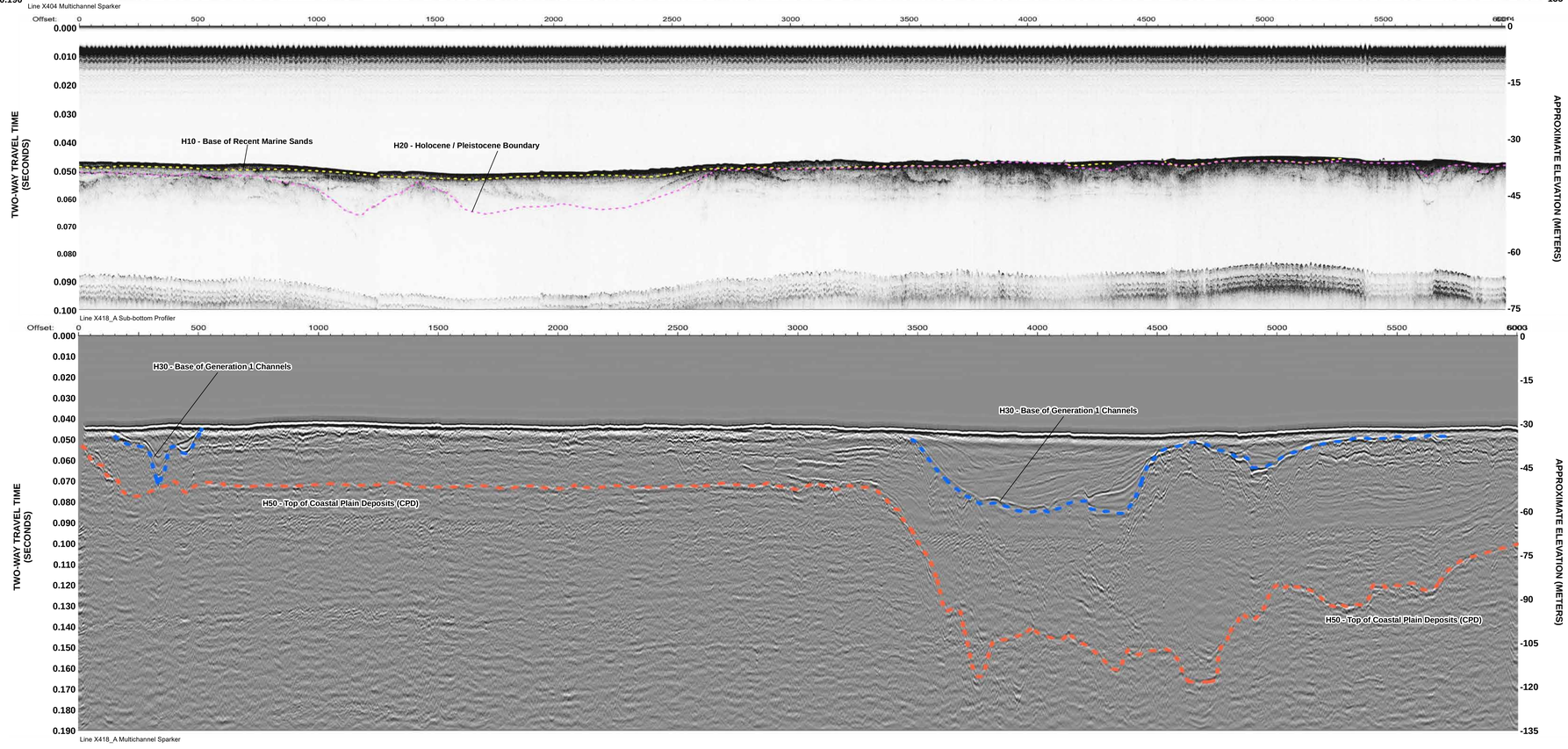
EAST TO WEST SEISMIC
2018 SEISMIC DATA EXAMPLES
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2	April 2021	Geophysical and Shallow Hazards Report	WBC	KRS	
3					

JOB NUMBER: 02.18031431 CHART NO.: SFWF CHART 11

N:\Projects\02_2018\02_1803_1431_DWW_SFEX_Revolution_Wind\GISData\Outputs\2019_02_04_DWW_SFEX_ShallowHaz_Geophysical_Rpt\mxd\Charts\Chart-6_SFWF_E-W_Seismic_Data_Examples.mxd, 4/5/2021, wcupples





GEOLOGIC UNITS

Horizon H10 - Base of Recent Marine Sand - Recent marine deposits consisting of predominantly fine to medium-grained sand with shell fragments

Horizon H20 - Interpreted Holocene / Pleistocene Boundary - Fluvial coarse-grained and fine-grained channel infill deposits

Horizon H30 - Interpreted Base of Generation 1 Channels (Pleistocene) - Contains channel infill deposits of gravel, sand, and glacial erratics

Horizon H50 - Interpreted Top of Coastal Plain Deposits (CPD) - Coastal Plain deposits are inferred to be mostly Late Cretaceous in age and consist of unconsolidated to semi-consolidated sand, gravel, silt, and clay. It is seen to be flat-lying or gently dipping seaward and may contain Late Tertiary deposits. Identified in seismic section as an erosional unconformity.

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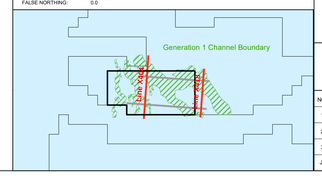
FALSE NORTHING:	0.0



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www.fugro.com

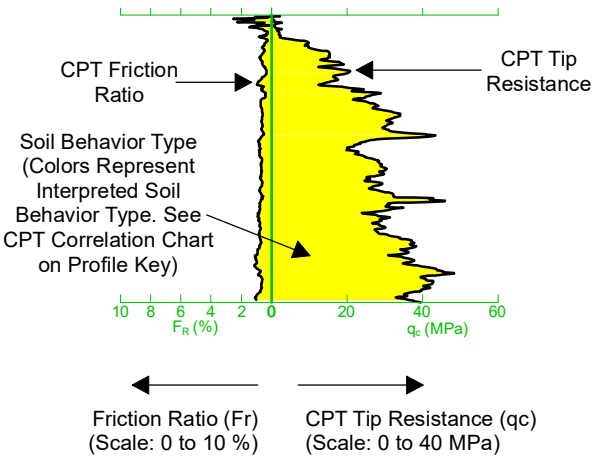
NORTH TO SOUTH SEISMIC 2018 SEISMIC DATA EXAMPLES
SFWF COP SURVEY
OFFSHORE NY/RI/MA, ATLANTIC OCS

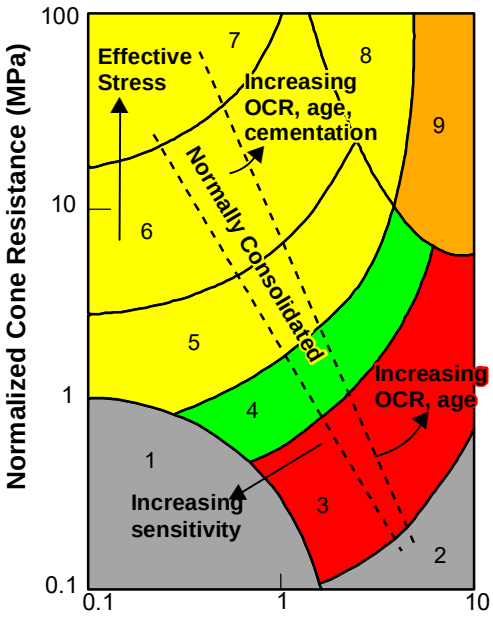
NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Feb. 2018	Geophysical and Shallow Hazards Report	WBC	KRS	
2	April 2021	Geophysical and Shallow Hazards Report	WBC	KRS	
3					

JOB NUMBER: 02.18031431

CHART NO.: SFWF CHART 12

CPT Key





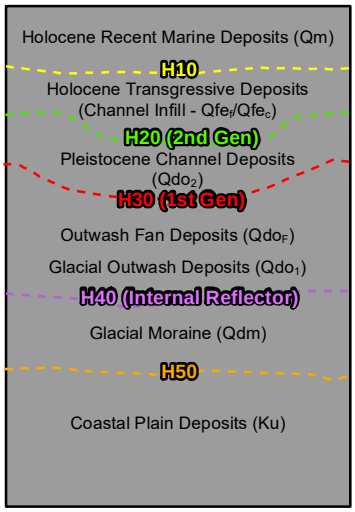
Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

Soil Descriptions

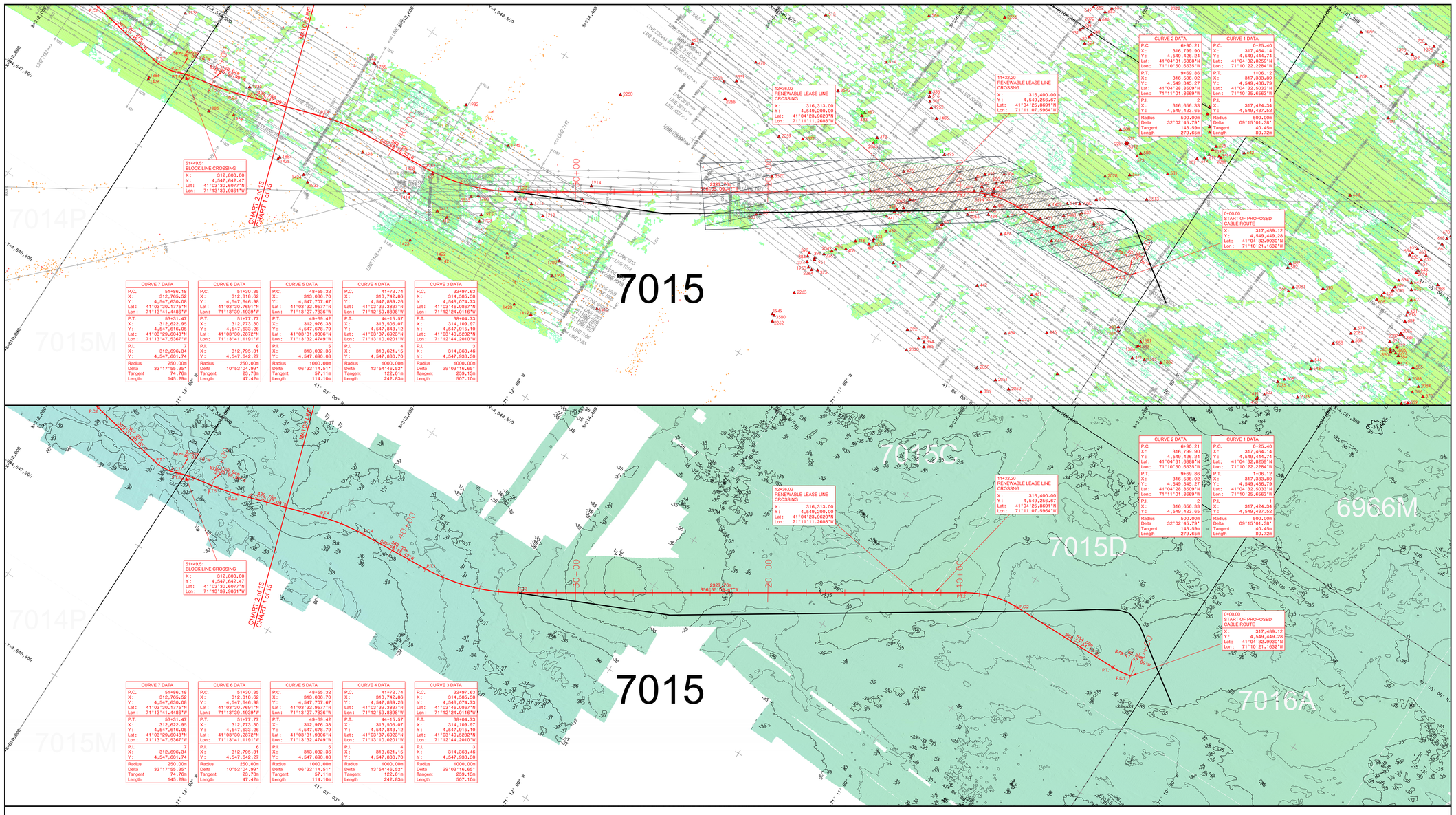
- Lean CLAY (CL)
- Silty CLAY (CL-ML)
- Silty CLAY with Sand (CL-ML)
- Lean CLAY with Sand (CL)
- Sandy Lean Clay (CL)
- Fat CLAY (CH)
- Fat CLAY with SAND (CH)
- Sandy Fat CLAY (CH)
- Gravelly Fat CLAY (CH)
- Silt (ML)
- Clayey SILT (ML)
- SILT with Sand (ML)
- Sandy SILT (ML)
- Poorly-Graded SAND (SP)
- Poorly-Graded SAND with Clay (SP-SC)
- Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND with Silt (SP-SM)
- Gravelly Poorly-Graded SAND (SP)
- Well-Graded SAND (SW)
- Well-Graded SAND with Silt (SW-SM)
- Gravelly Well-Graded SAND (SW)
- Clayey SAND (SC)
- Clayey SAND to Lean CLAY (SC-CL)
- Silty SAND (SM)
- Silty SAND to Sandy SILT (SM-ML)
- Gravelly Silty SAND (SM)
- Poorly-Graded GRAVEL (GP)
- Sandy GRAVEL (GP)
- Well-Graded GRAVEL (GW)
- Low-Plasticity Organic (OL)
- High-Plasticity Organic (OH)

Seismic Data Panels



Holocene	**Qm** - Recent marine deposits consisting of predominantly fine to medium-grained sand with shell fragments
Holocene	**Qfe** - Fluvial coarse-grained (Qfe_c) and fine-grained (Qfe_f) channel infill deposits
Pleistocene	**Qdo_2** - Channel infill deposits consisting of glacial erratics (boulders), gravels, and sands.
Pleistocene	**Qdo_F** - Outwash fan deposits are clean, coarse-grained sands with some gravel lenses. Thickens southward (see Figure 4-1a for location of these deposits)
Pleistocene	**Qdo_1** - Outwash plain deposits consist of coarse-grained sands with gravel and pebbles intermixed.
Pleistocene	**Qdm** - Terminal moraine deposits dominate the SFWF area and consist of wide-spread boulders from 1 to 10 meters in diameter. Estimated to be 20 to 30 meters thick in the wind farm area.
Pre-Quaternary	**Ku** - Coastal Plain deposits are inferred to be mostly Late Cretaceous in age and consist of unconsolidated to semi-consolidated sand, gravel, silt, and clay. It is seen to be flat-lying or gently dipping seaward and may contain Late Tertiary deposits. Identified in seismic section as an erosioanl unconformity.

KEY TO SUBSURFACE PROFILES
SFEC CHARTS



BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

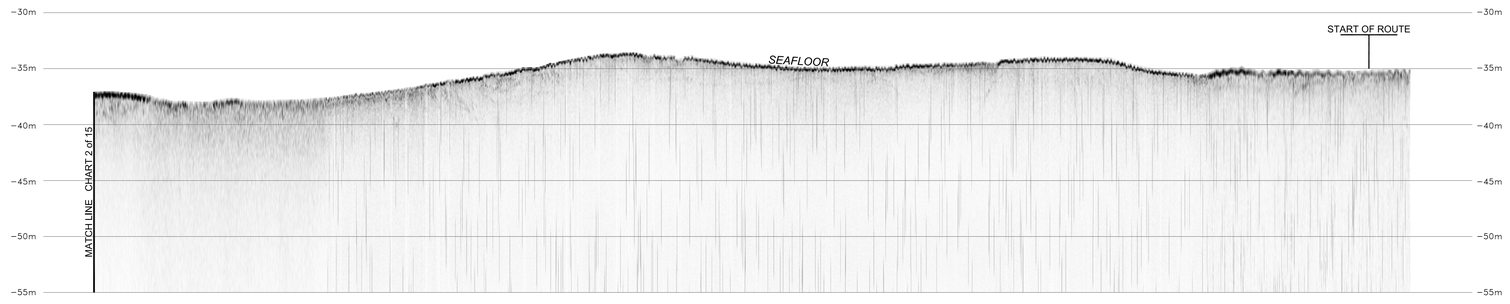
INTERPRETIVE LEGEND

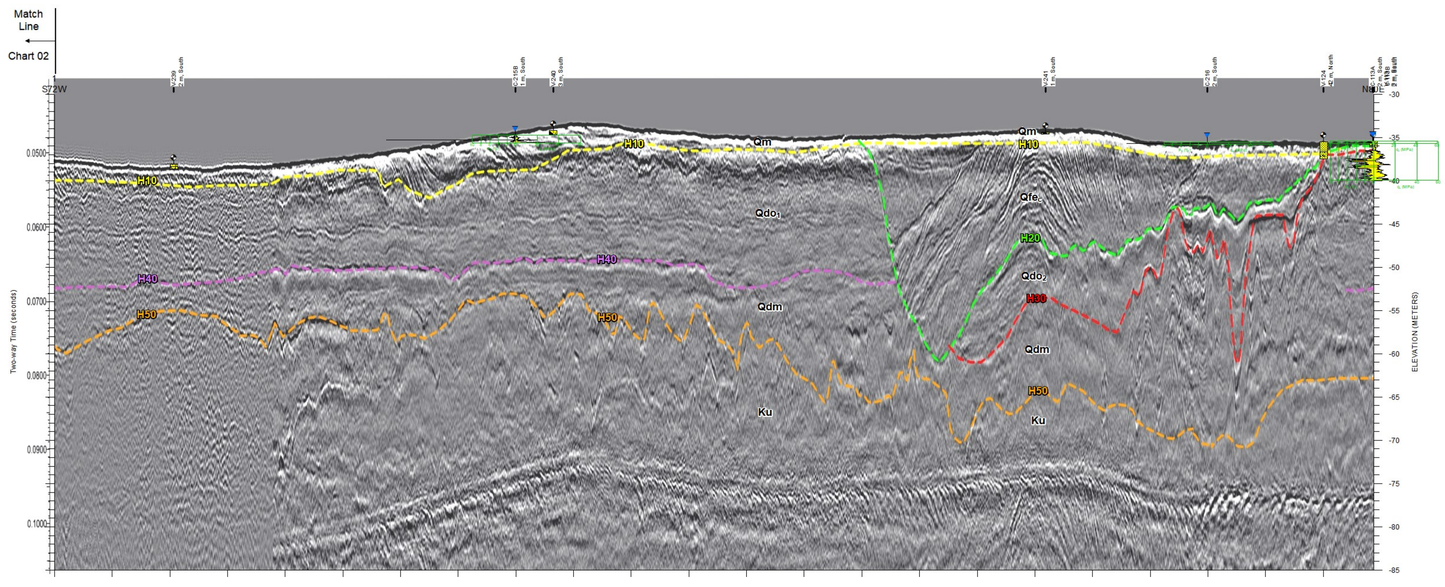
- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS
- **SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)**
  - <1
  - 1 - 2
  - 2 - 5
  - >5
- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)
-2m -15m -20m -25m -30m -35m -40m -45m -50m

LINE S6082A | **LINE S6021** | **LINE S3064**

EVENT:	2000	1800	4600	4400	4200	4000	3800	3600	3400	3200	3000	2800	2600	2600	2800
STATION:	43+71	40+39	37+40	34+59	31+46	28+34	25+21	22+09	18+96	15+84	12+71	9+59	6+64	4+78	1+68
DISTANCE OFF TRACK:	91.5m	124.6m	107.5m	4.4m	10.5m	14.6m	15.2m	11.7m	10.6m	15.6m	20.6m	26.3m	67.1m	89.8m	53.3m





PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
DATABASE POSITIONS OF COMMUNICATION AND/OR POWER CABLES (WHERE APPLICABLE) ARE BASED ON AS-BUILT DATABASE INFORMATION AND COULD NOT BE VERIFIED BY INSTRUMENTS UTILIZED DURING THIS SURVEY.

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INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0,0
FALSE EASTING:	500000,0
FALSE NORTHING:	0,0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-0636
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-1 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE (COP)
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY
- PROPOSED CABLE ROUTE V4

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-9m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT
<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC
RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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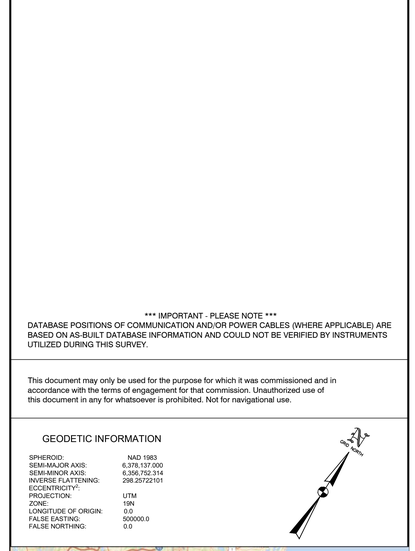
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



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LAFAYETTE, LOUISIANA 70506
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WWW.FUGRO.COM

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SOUTH FORK WINDFARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

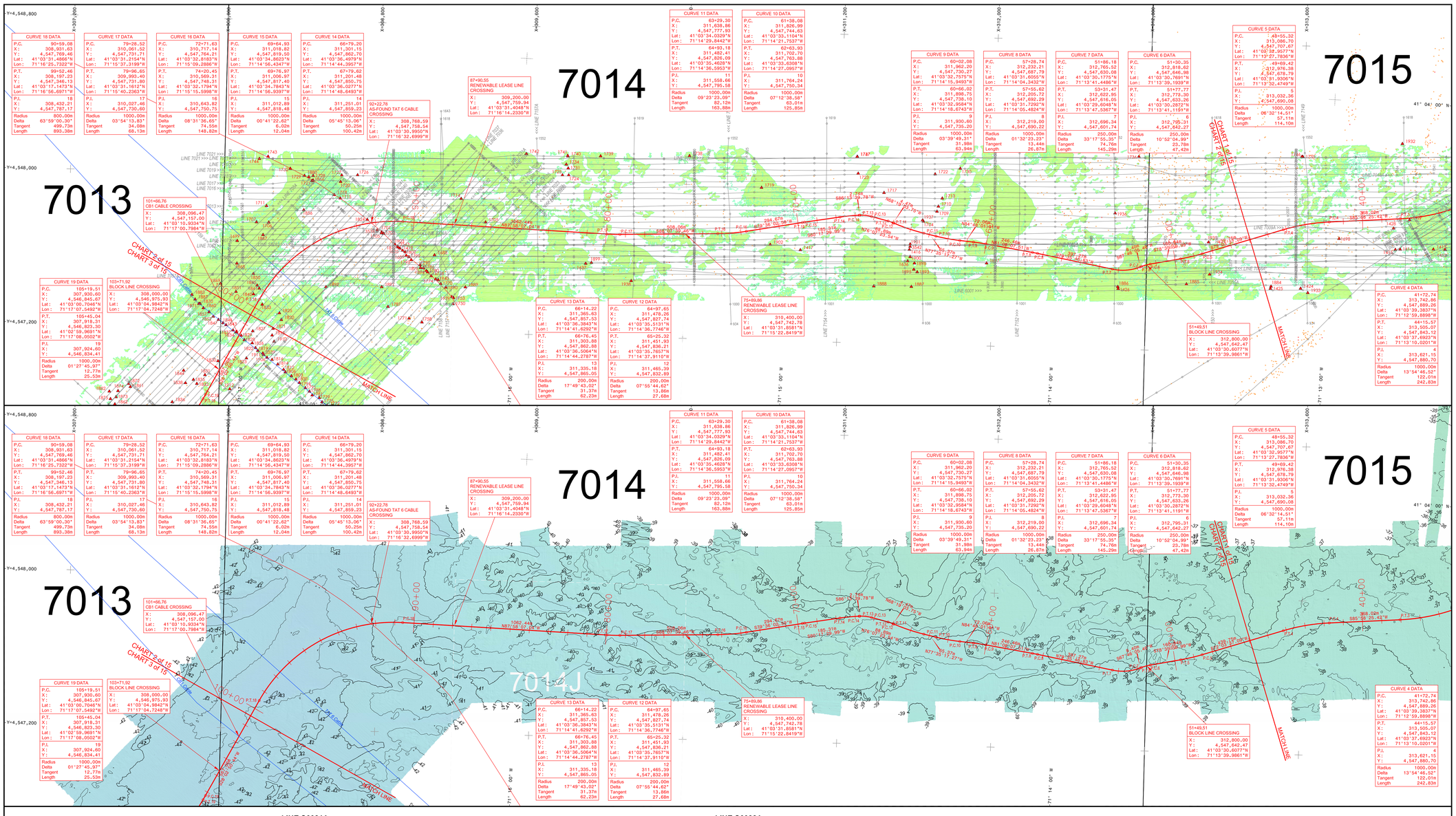
SCALE = 1:8000

0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-1



BASE LEGEND

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- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS
- SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)
  - <1
  - 1 - 2
  - 2 - 5
  - >5
- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

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SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-2 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

- NEGATIVE MAGNETIC CONTOURS (-30) CONTOUR INTERVAL = 5 GAMMAS
- POSITIVE MAGNETIC CONTOURS (30) CONTOUR INTERVAL = 5 GAMMAS

*** IMPORTANT - PLEASE NOTE ***

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MAP PREPARED BY:
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SOUTH FORK WINDFARM

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SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

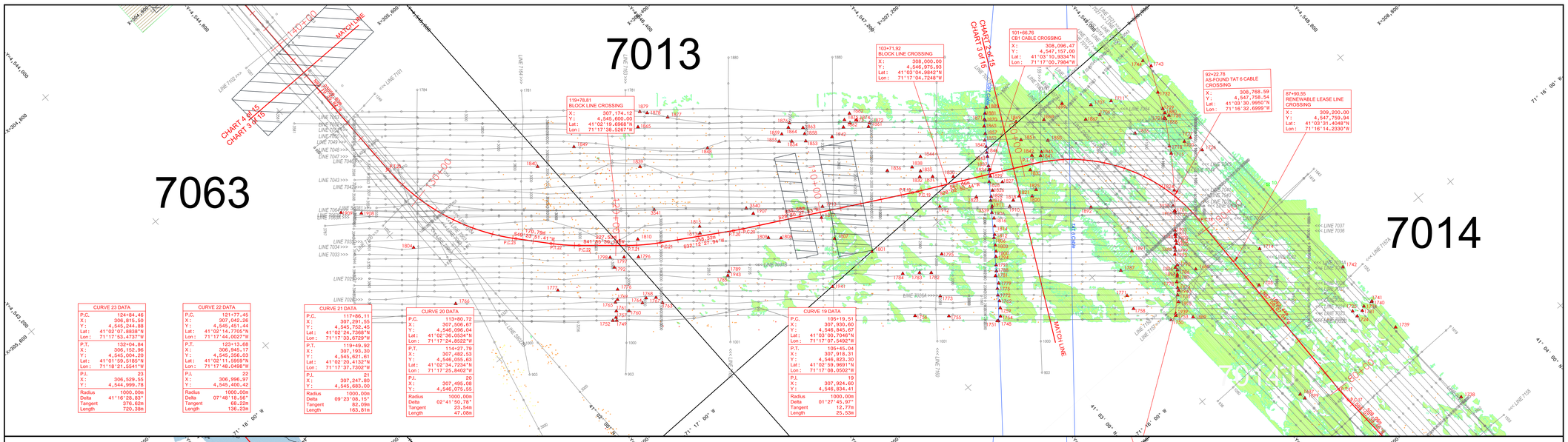
SCALE = 1:8000

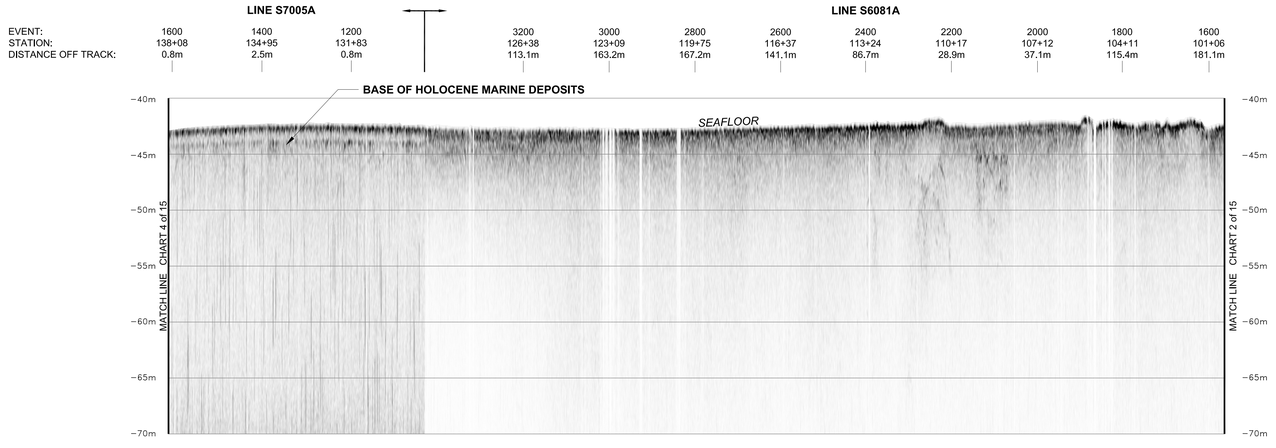
0 160 320 480 640 800

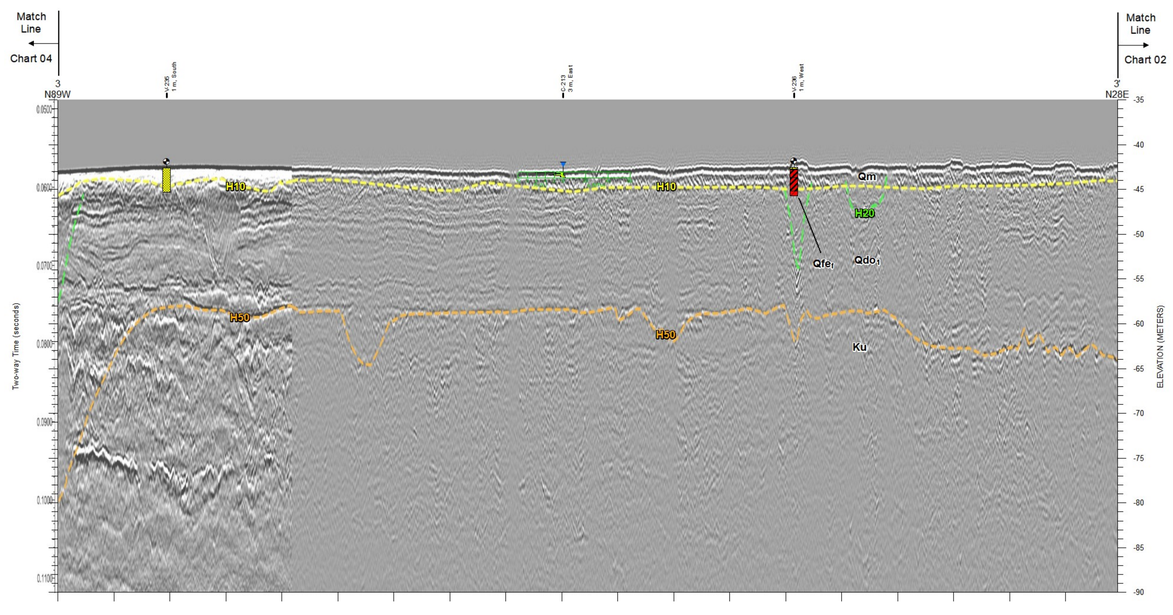
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-2







BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT

WATER DEPTH CONTOURS
CONTOUR INTERVAL = 0.5 METERS
ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)
-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
DATABASE POSITIONS OF COMMUNICATION AND/OR POWER CABLES (WHERE APPLICABLE) ARE BASED ON AS-BUILT DATABASE INFORMATION AND COULD NOT BE VERIFIED BY INSTRUMENTS UTILIZED DURING THIS SURVEY.

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GEODETIC INFORMATION

SPHEROID:	NAD 1983
SEMI-MAJOR AXIS:	6,378,137,000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-0636
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-3

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

*** IMPORTANT - PLEASE NOTE ***
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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

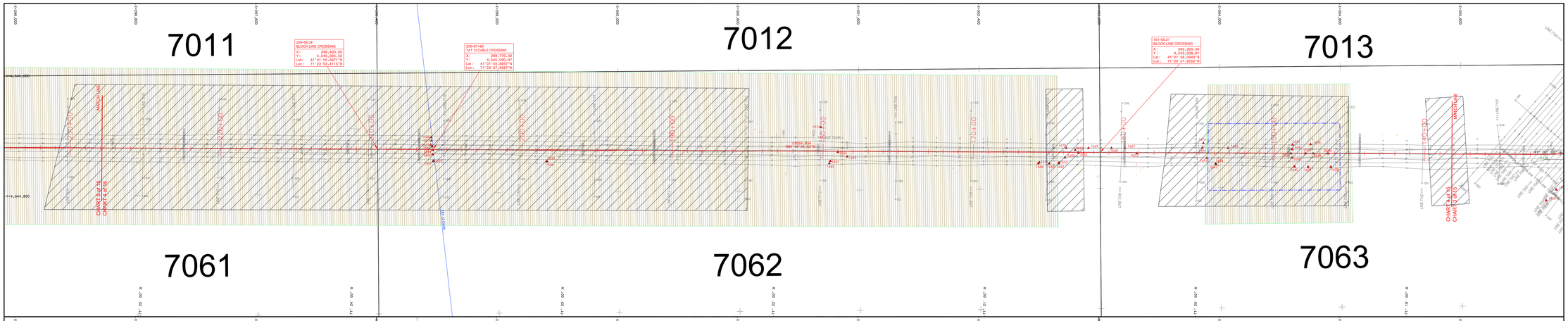
SCALE = 1:8000

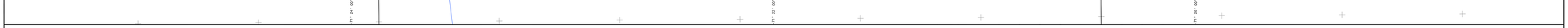
0 160 320 480 640 800

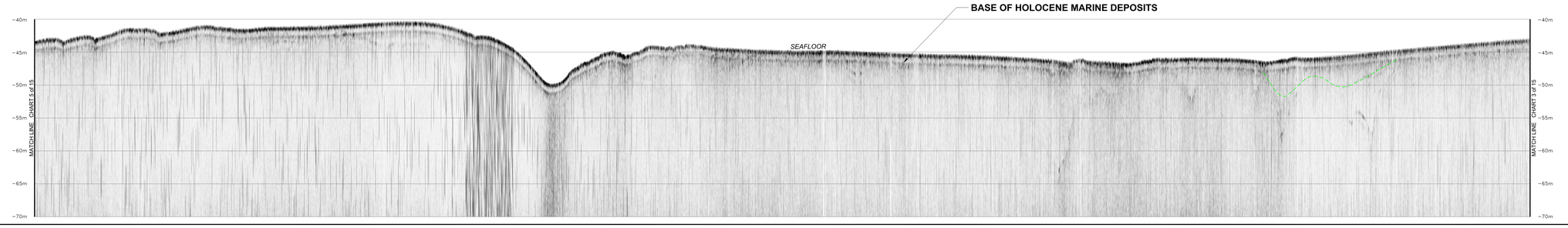
METERS

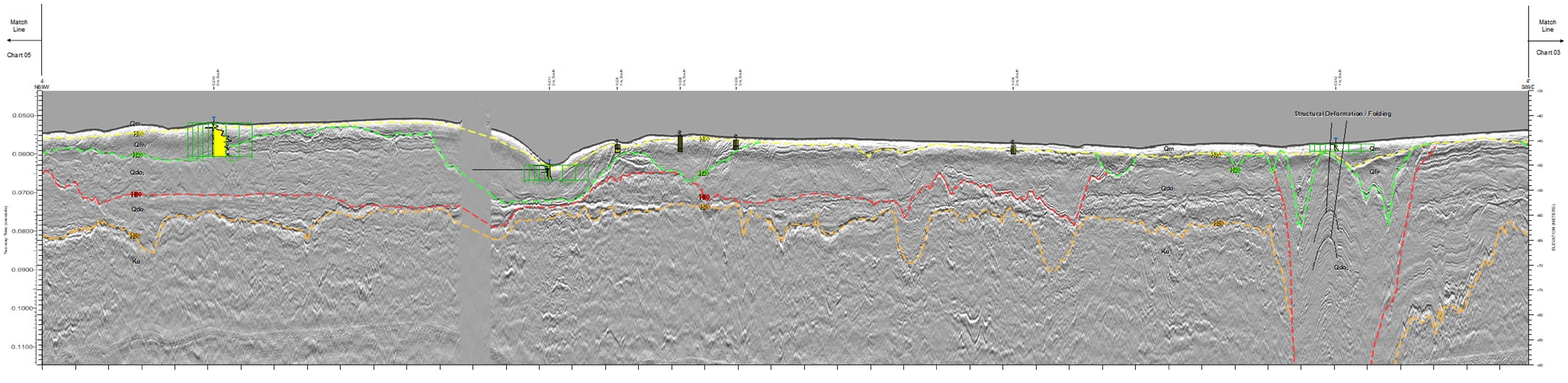
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-3









BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- AREA OF SUBSURFACE DEFORMATION
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 5.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:

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115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

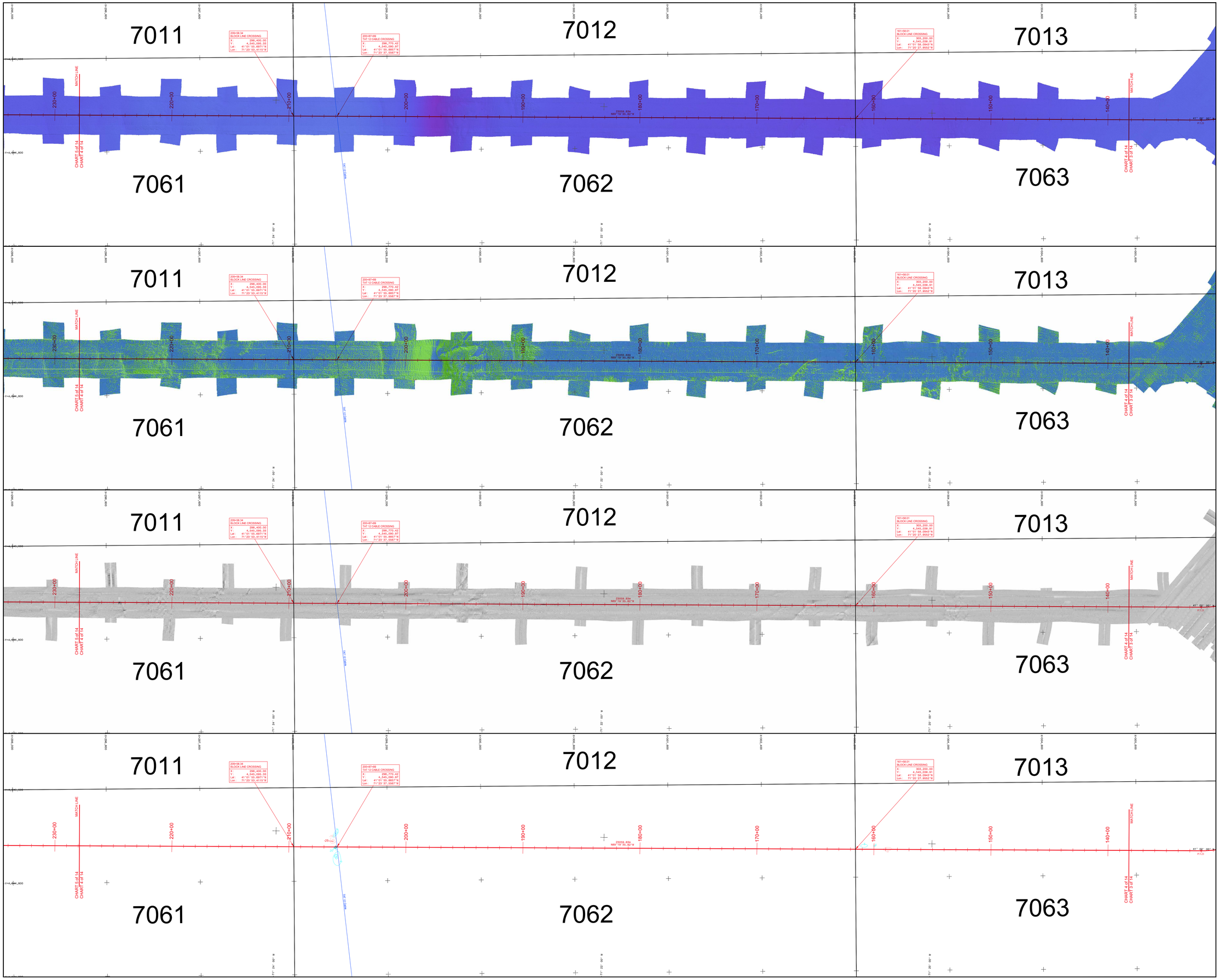
SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-4 SHEET NO. 1 OF 2



BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

-30 NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

30 POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE | SEAFLOOR GRADIENT | SIDESCAN MOSAIC

WATER DEPTH (METERS, MEAN LOWER LOW WATER): 0m, -15m, -20m, -25m, -30m, -35m, -40m, -45m, -50m

SEAFLOOR GRADIENT: <1, 1 to 4.9, 5 to 9.9, 10 to 14.9, >15

SIDESCAN MOSAIC: RELATIVE SEAFLOOR REFLECTIVITY — HIGH / LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZMUTH: 45°

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ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

N
NOT TO SCALE

MAP PREPARED BY:
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LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2836
WWW.FUGRO.COM

FUGRO

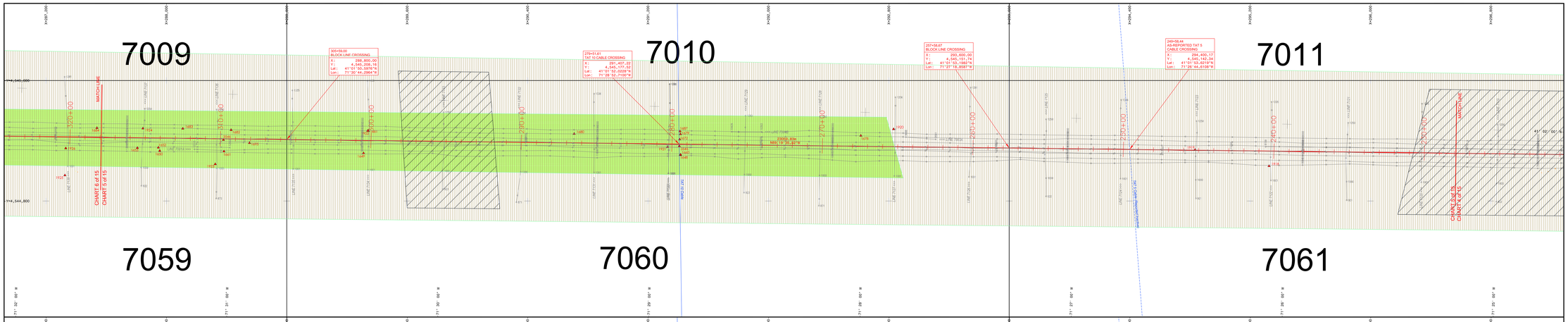
SOUTH FORK WIND FARM

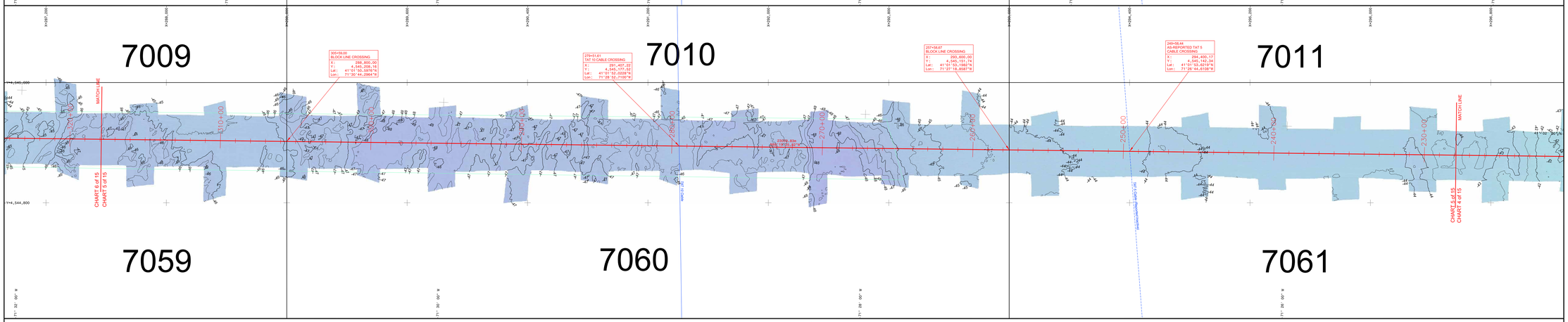
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

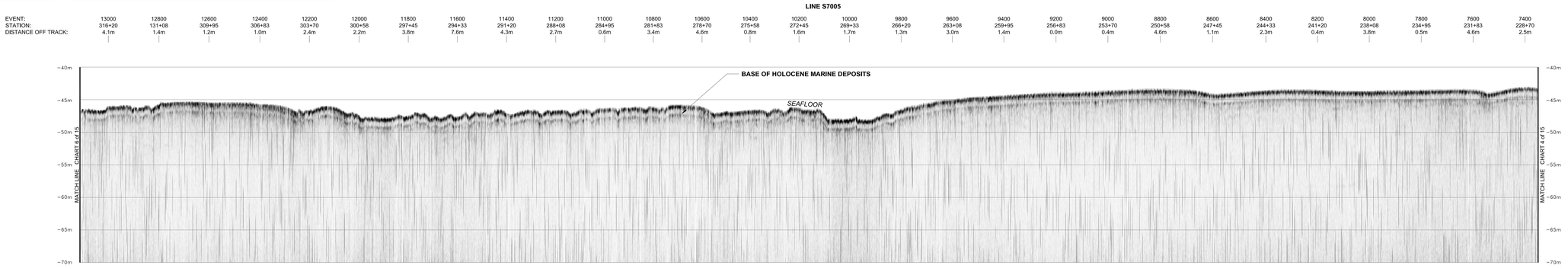
SCALE = 1:8000
0 160 320 480 640 800
METERS

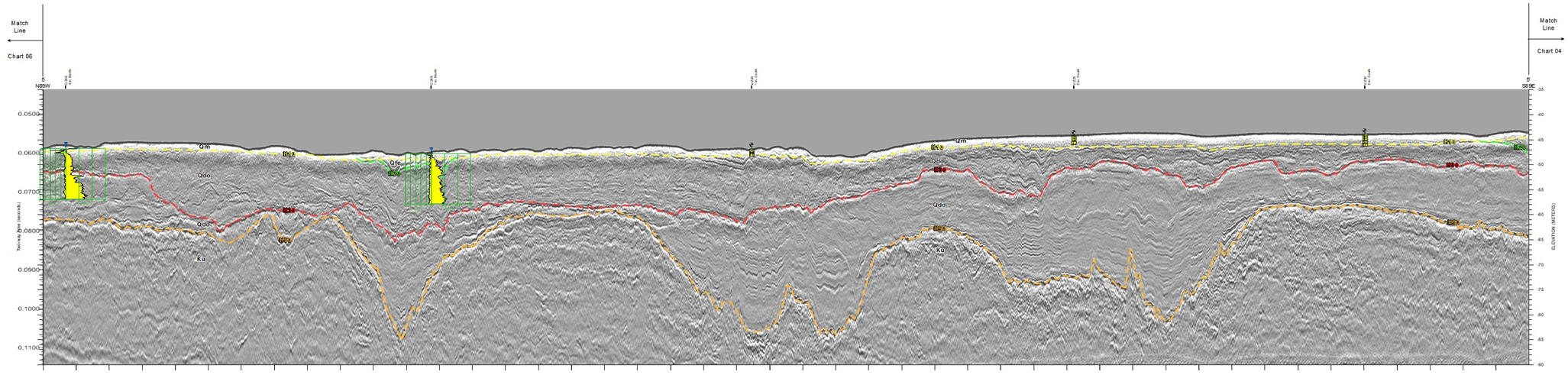
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-4









BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -30 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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GEODETIC INFORMATION

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SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-5 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-0m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT
<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC
RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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INVERSE FLATTENING:	298.257222101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	18
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

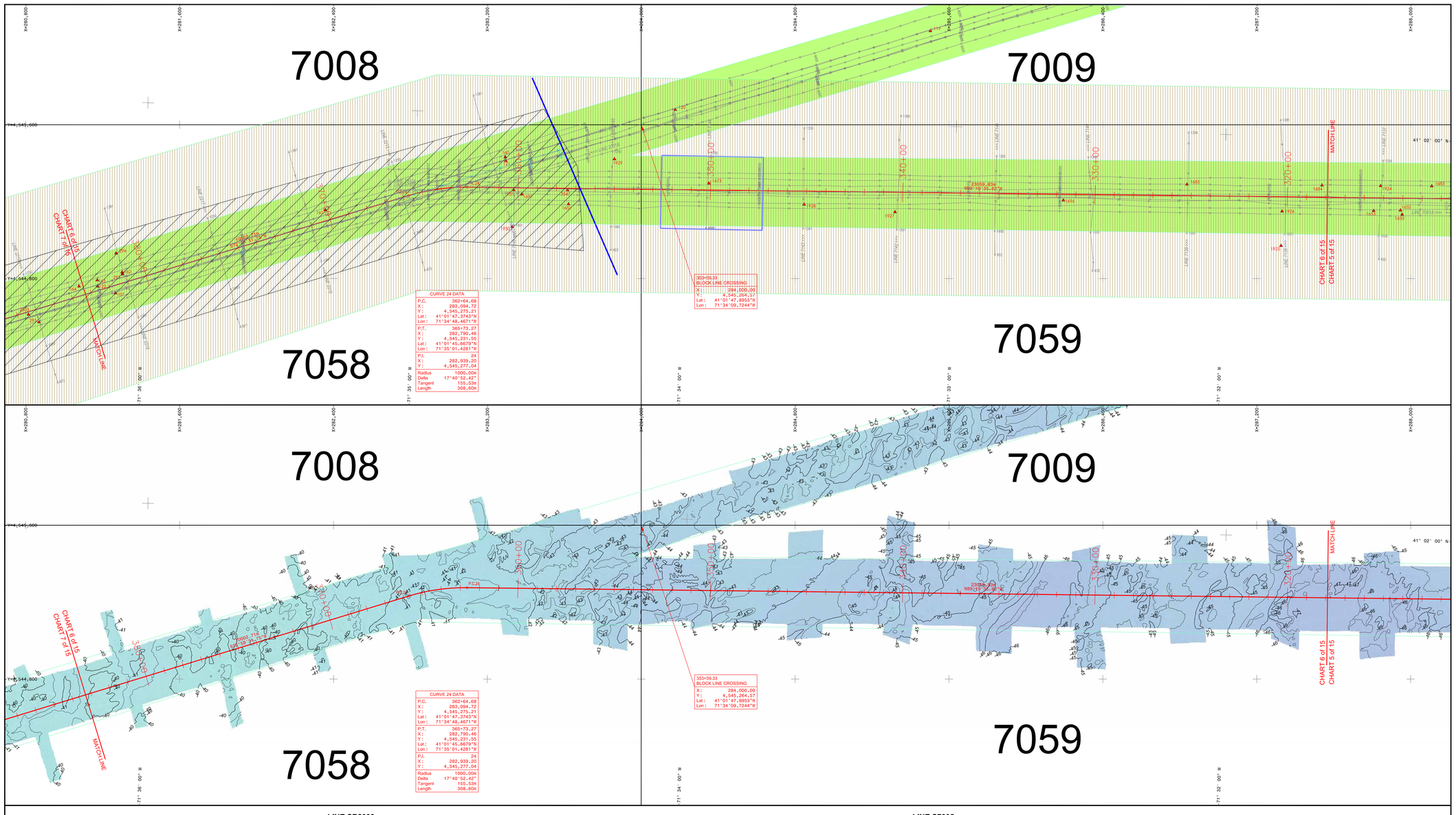
SOUTH FORK WINDFARM

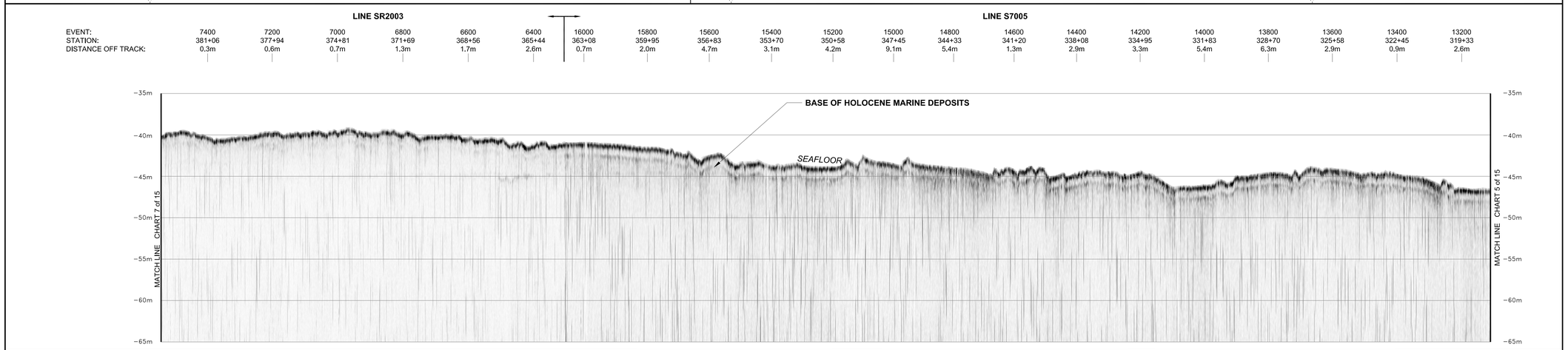
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-5 SHEET NO. 2 OF 2





BASE LEGEND

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- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS
- BURIED FAULT (UNCLASSIFIED)

NOTE: UNCLASSIFIED FAULT MAPPED BY REED ET AL, 2005. SEE SECTIONS 3.3 AND 5.2.2 AND FIGURES 3.3-1 AND 5.2-1 FOR FURTHER DISCUSSION ON REGIONAL SEISMICITY AND FAULTING.

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- AREA OF SUBSURFACE DEFORMATION
- WATER DEPTH CONTOURS (-30)

CONTOUR INTERVAL = 0.5 METERS
ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)
-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

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FUGRO

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SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-6 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-9m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

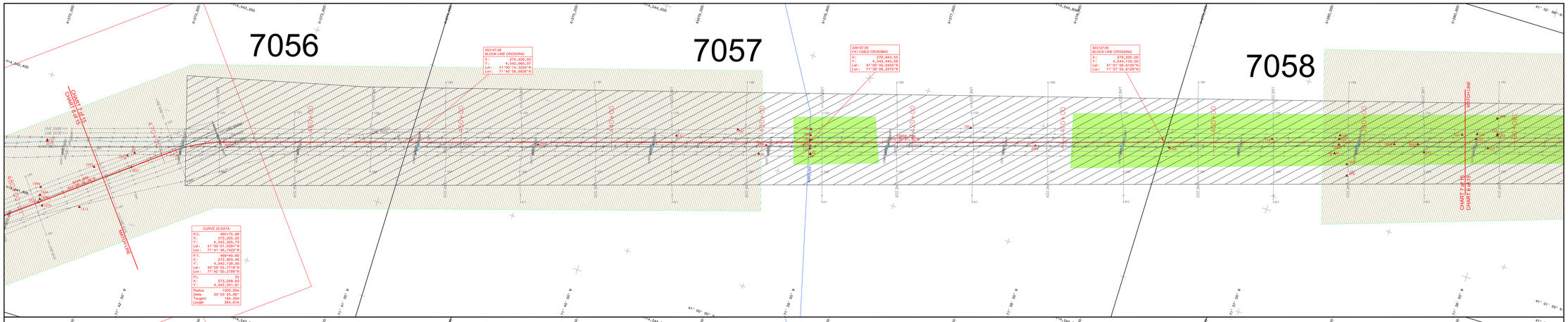
SCALE = 1:8000

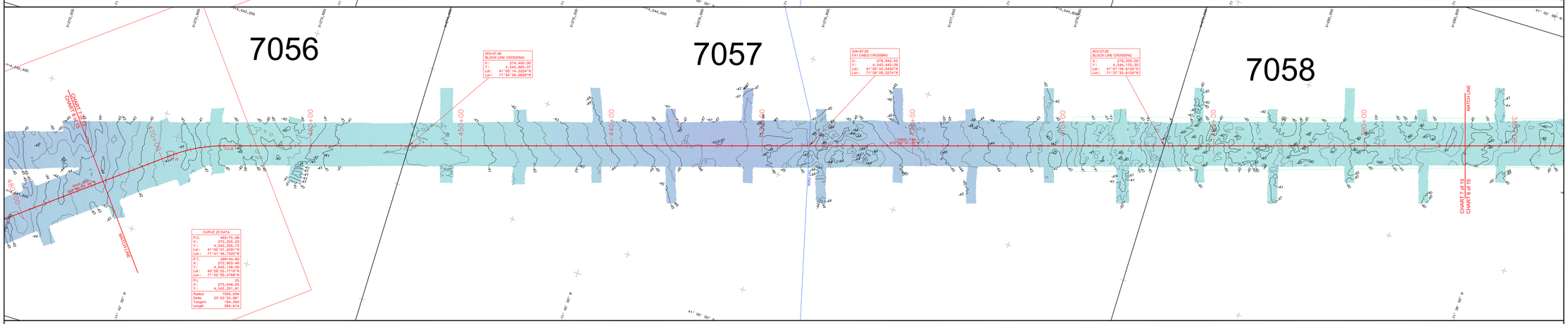
0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-6

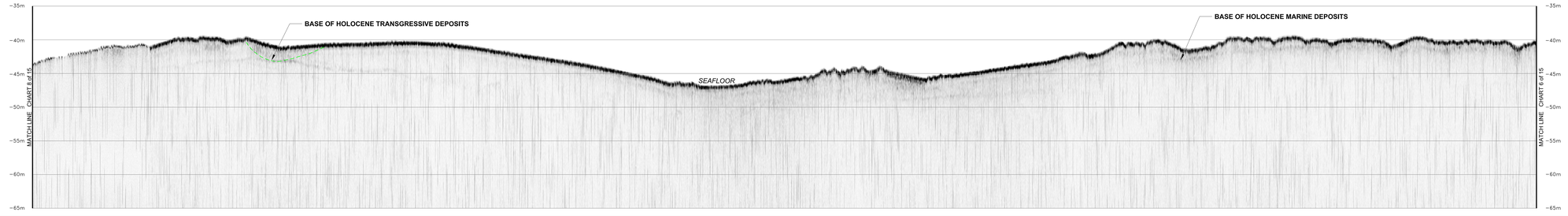


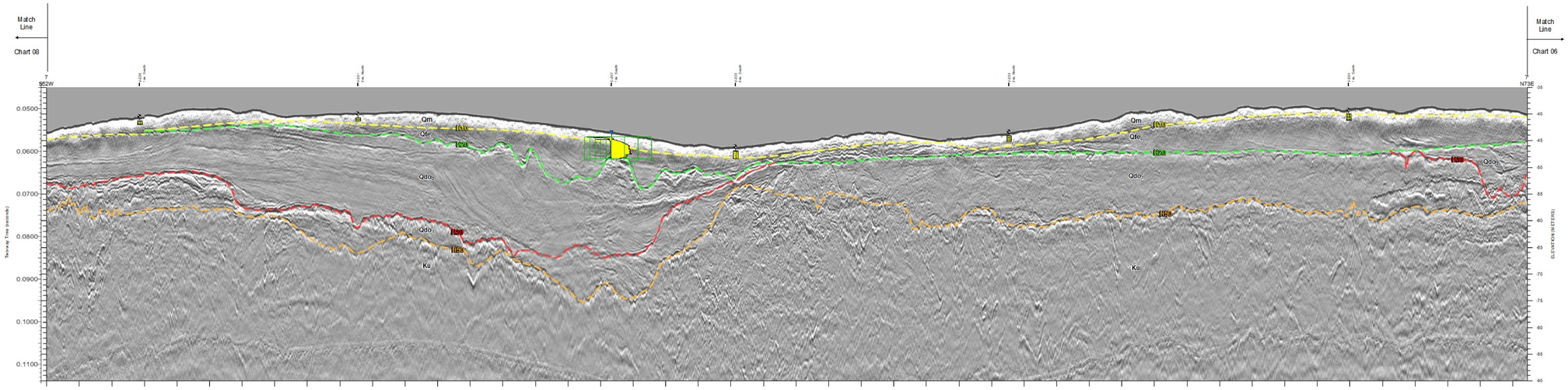


LINE S6054B

EVENT:	1400	1200	12800	12600	12400	12200	12000	11800	11600	11400	11200	11000	10800	10600	10400	10200	10000	9800	9600	9400	9200	9000	8800	8600	8400	8200	8000	7800	7600
STATION:	472+33	469+21	465+44	462+31	459+19	456+06	452+94	449+81	446+69	443+56	440+44	437+31	434+19	431+06	427+94	424+81	421+69	418+56	415+44	412+30	409+19	406+06	402+94	399+81	396+69	393+56	390+44	387+31	384+19
DISTANCE OFF TRACK:	11.2m	11.1m	3.9m	2.0m	3.3m	5.5m	2.9m	0.7m	2.1m	1.1m	2.0m	3.9m	3.7m	1.4m	5.9m	4.7m	1.6m	2.2m	0.2m	0.6m	1.2m	2.5m	3.8m	1.2m	0.2m	2.6m	4.3	0.9m	0.4m

LINE SR2003





BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -32 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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GEODETIC INFORMATION

SPHEROID:	NAD 1983
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
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LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

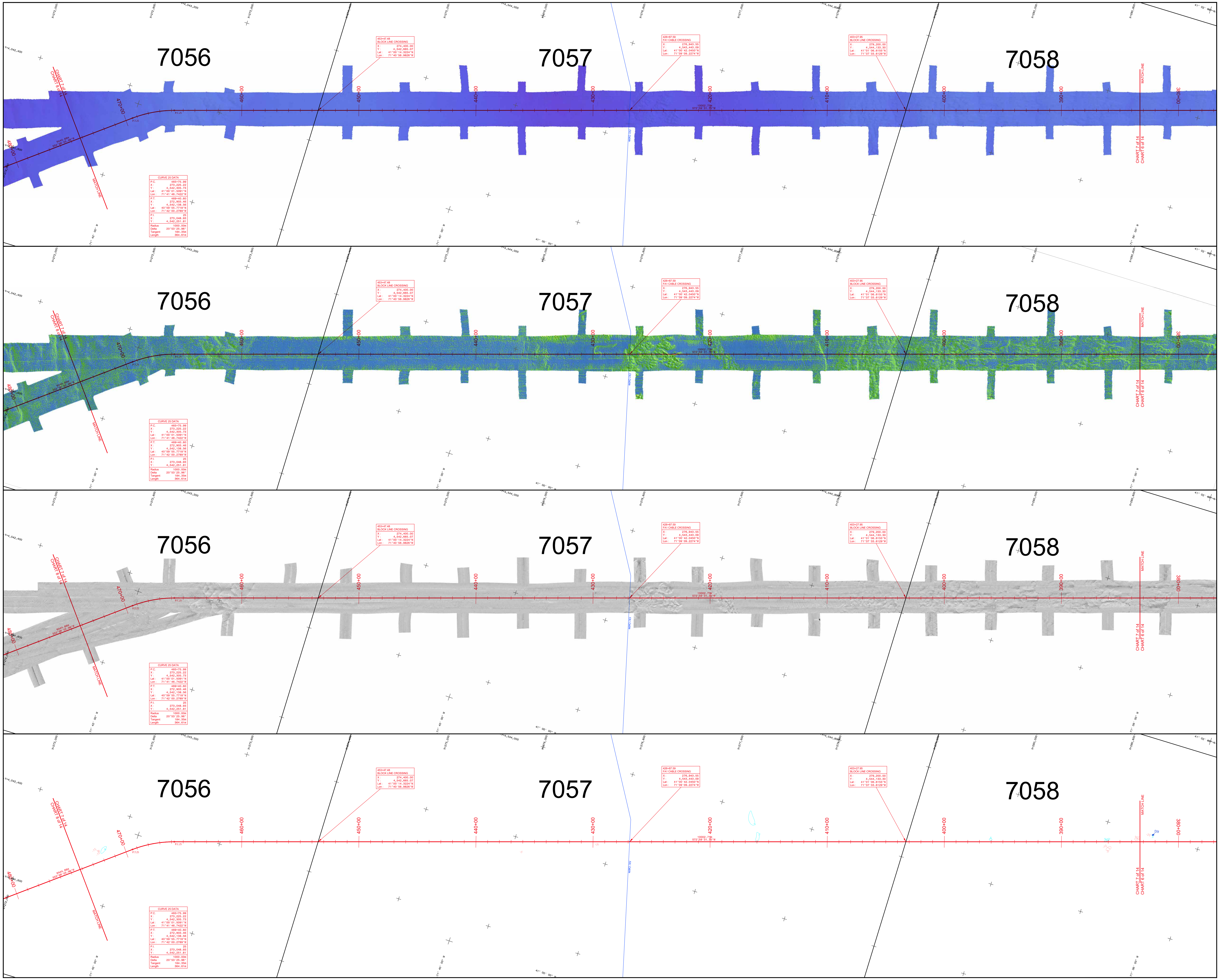
SCALE = 1:8000

0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-7



BASE LEGEND

- <<< LINE 100 — NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

-30 NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

30 POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE — WATER DEPTH (METERS, MEAN LOWER LOW WATER): -9m, -15m, -20m, -25m, -30m, -35m, -40m, -45m, -50m

SEAFLOOR GRADIENT: <1; 1 to 4.9; 5 to 9.9; 10 to 14.9; >15

SIDESCAN MOSAIC — RELATIVE SEAFLOOR REFLECTIVITY: HIGH … LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

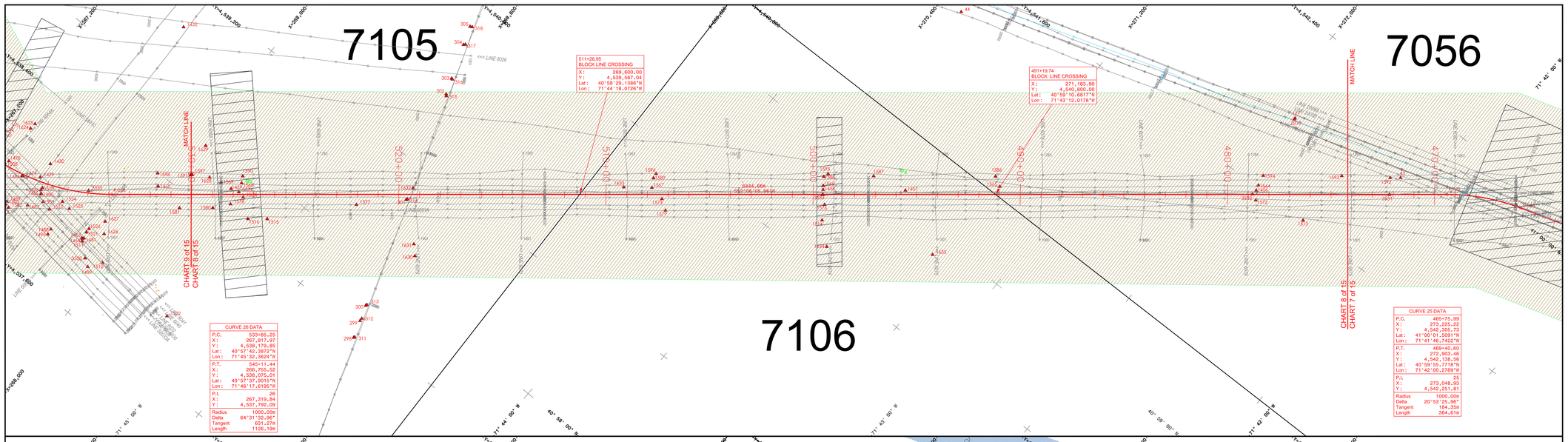
SOUTH FORK WINDFARM

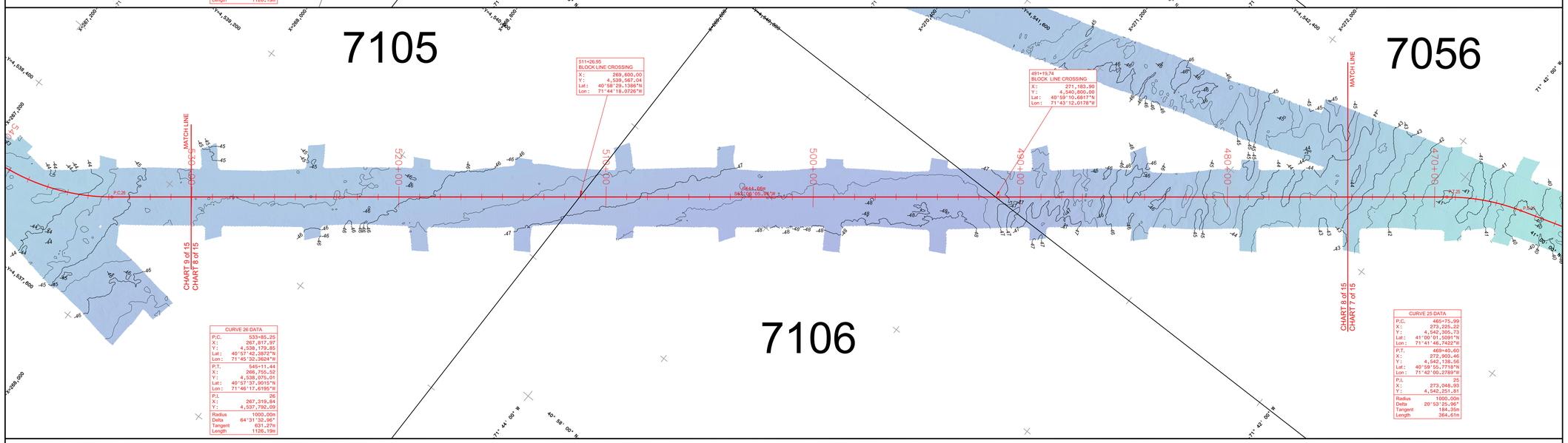
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

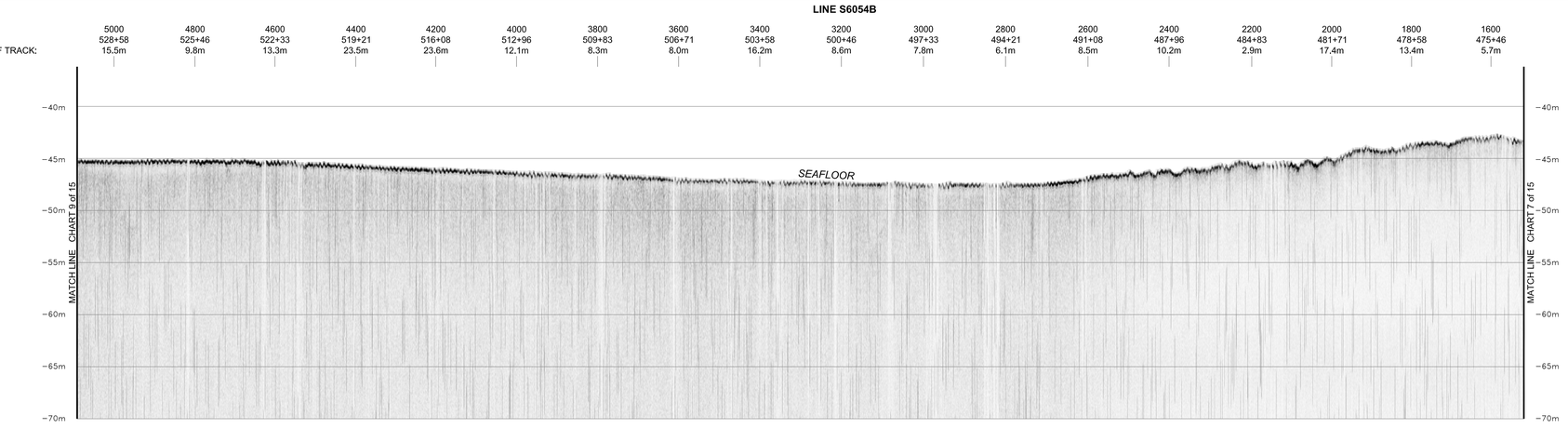
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

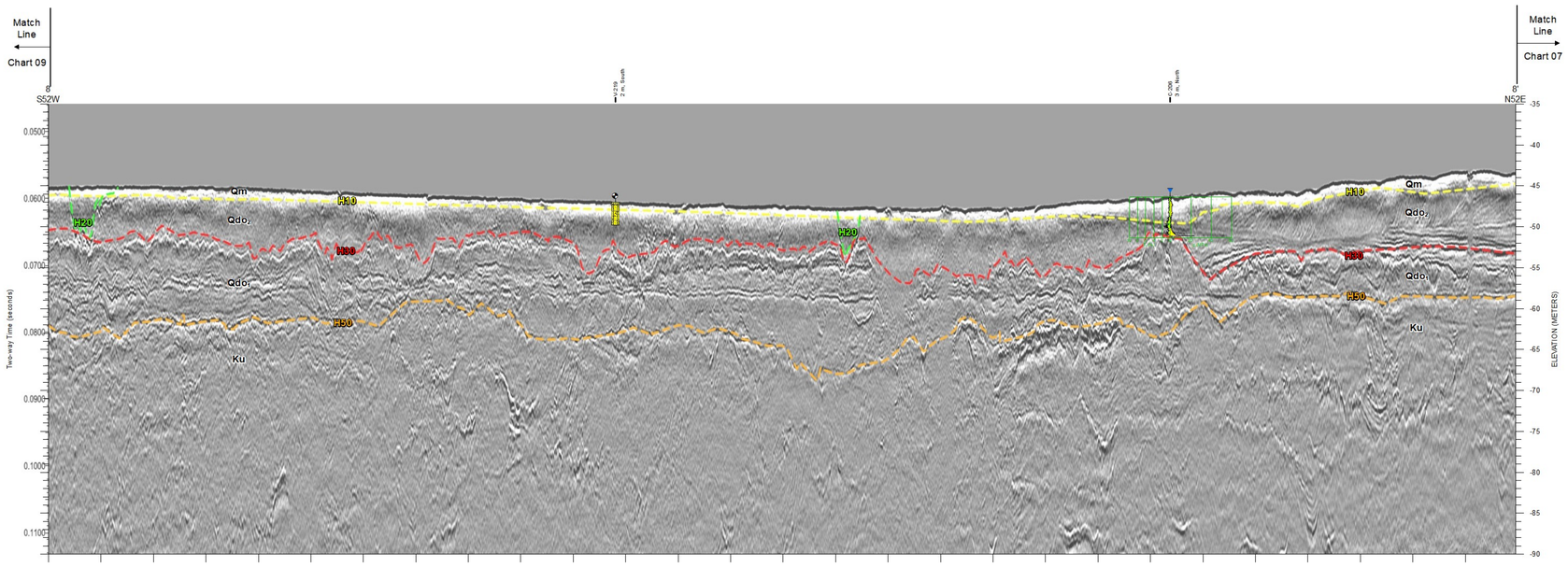
CHART SFEC-7 — SHEET NO. 2 OF 2





LINE S6054B





BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

−2m −15m −20m −25m −30m −35m −40m −45m −50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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GEODETIC INFORMATION

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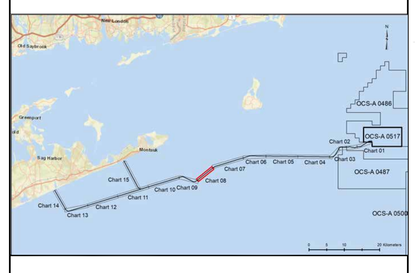
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-0636
WWW.FUGRO.COM

SOUTH FORK WINDFARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-8 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-9m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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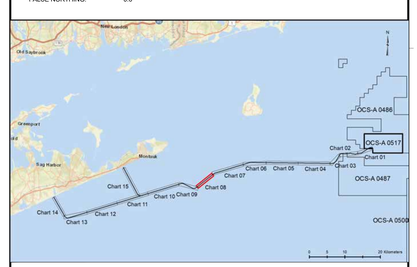
INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



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PHONE: 337-237-2636
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GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

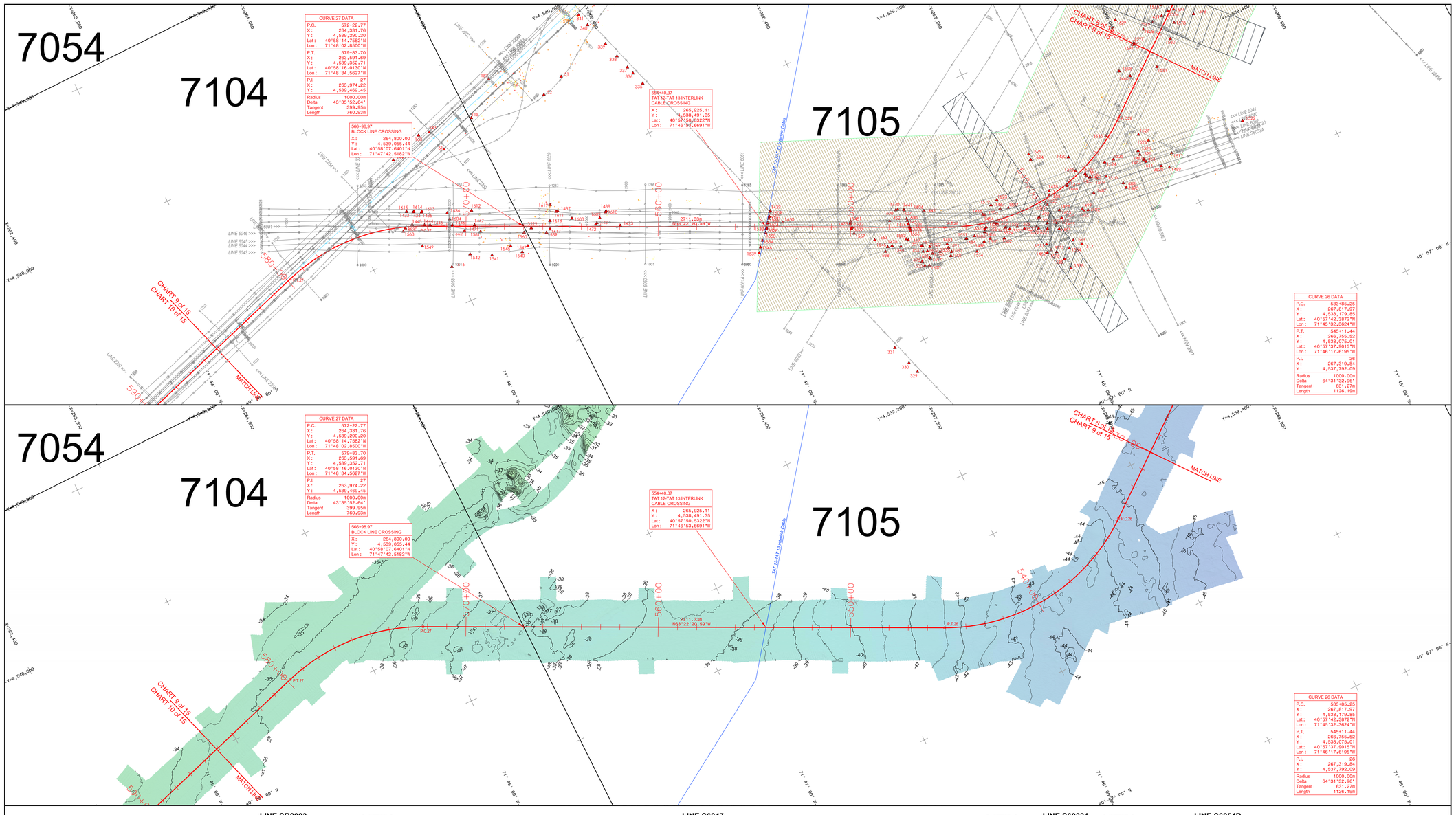
SCALE = 1:8000

0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-8 SHEET NO. 2 OF 2



BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
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- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

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LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

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SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-9 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

- NEGATIVE MAGNETIC CONTOURS (-30) CONTOUR INTERVAL = 5 GAMMAS
- POSITIVE MAGNETIC CONTOURS (30) CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)

-9m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT

- <1
- 1 to 4.9
- 5 to 9.9
- 10 to 14.9
- >15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY: HIGH – LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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INVERSE FLATTENING:	298.25722101
ECCENTRICITY^2:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

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FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

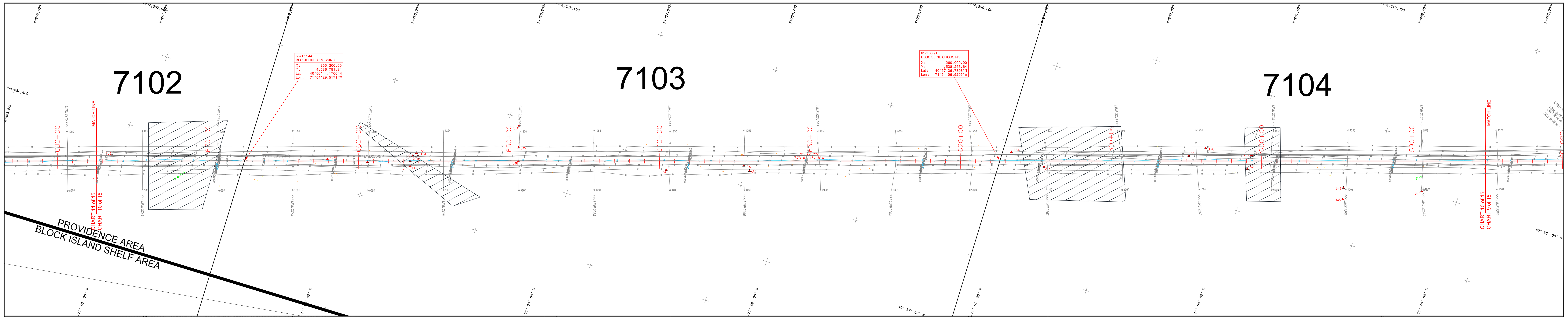
SCALE = 1:8000

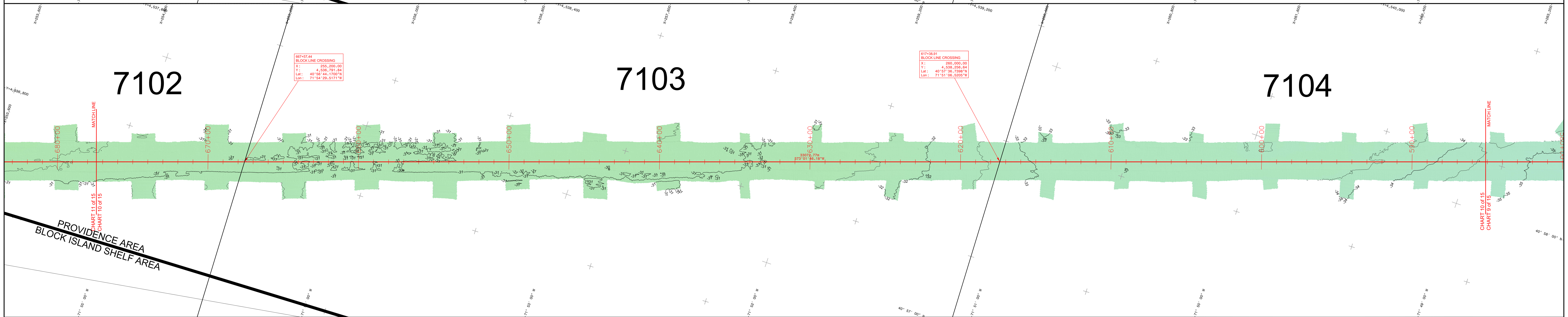
0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

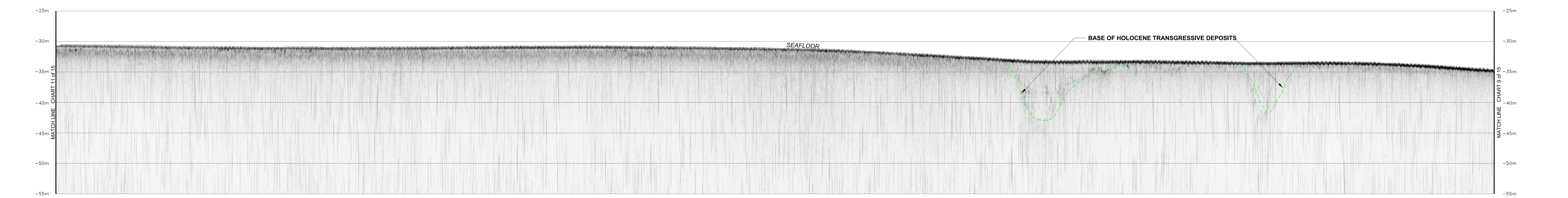
CHART SFEC-9

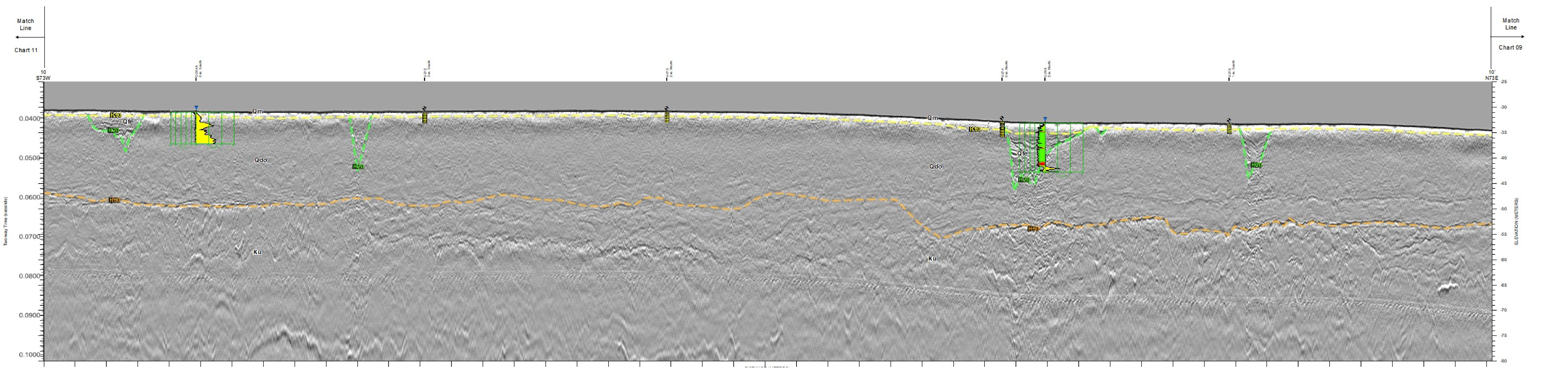




LINE SR2003

EVENT:	25400	25200	25000	24800	24600	24400	24200	24000	23800	23600	23400	23200	23000	22800	22600	22400	22200	22000	21800	21600	21400	21200	21000	20800	20600	20400	20200	20000	19800		
STATION:	675+63	672+51	669+38	666+26	663+13	660+01	656+88	653+76	650+63	647+51	644+38	641+26	638+13	635+01	631+88	628+76	625+63	622+51	619+38	616+26	613+13	610+01	606+88	603+76	600+63	597+51	594+38	591+26	588+81		
DISTANCE OFF TRACK:	0.9m	11.8m	0.8m	8.0m	1.8m	8.9m	2.4m	8.1m	3.5m	6.5m	2.0m	9.1m	2.2m	1.7m	3.9m	11.0m	1.0m	6.6m	5.6m	3.6m	9.7m	2.8m	6.6m	13.1m	1.2m	0.4m	5.1m	6.4m	5.3m		





BASE LEGEND

NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
EXISTING CABLE AS-BUILT LOCATION
EXISTING CABLE AS-FOUND LOCATION
EXISTING CABLE REPORTED INACTIVE
PROPOSED CABLE ROUTE
OCS BLOCK BOUNDARY
BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

UNIDENTIFIED MAGNETIC ANOMALY
SONAR CONTACT
DEVIATED CABLE
LINEAR DEBRIS

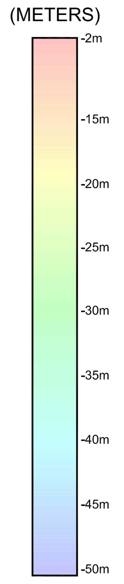
SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

<1
1 - 2
2 - 5
>5

SECOND GENERATION CHANNELS (HOLOCENE)
FIRST GENERATION CHANNELS (PLEISTOCENE)
MEGARIPPLE EXTENT

WATER DEPTH CONTOURS
CONTOUR INTERVAL = 0.5 METERS
ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)



PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:

WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:

HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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GEODETIC INFORMATION

SPHEROID:	NAD 1983
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-10 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-0m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZMUTH: 45°

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

PROFILE VIEW

ZERO DATUM = SEA LEVEL

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 5,000/sec.

SCALE:
HORIZONTAL: 0' 1000' 2000'
VERTICAL: 0 -20 -40

VERTICAL EXAGGERATION =

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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
VERTICAL DATUM:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:

FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2606
WWW.FUGRO.COM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

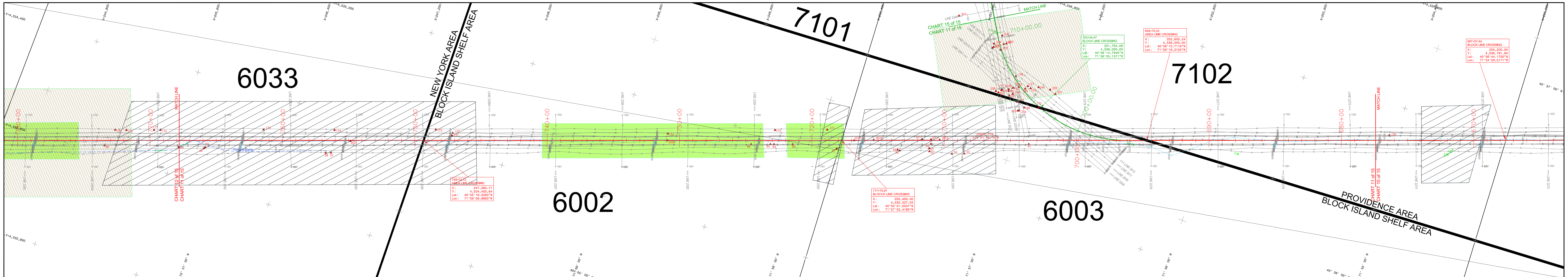
SCALE = 1:8000

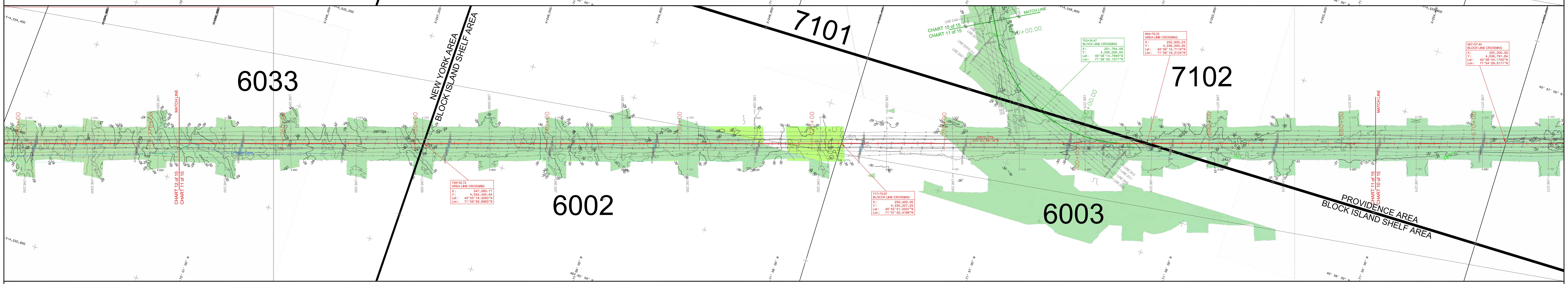
0 160 320 480 640 800

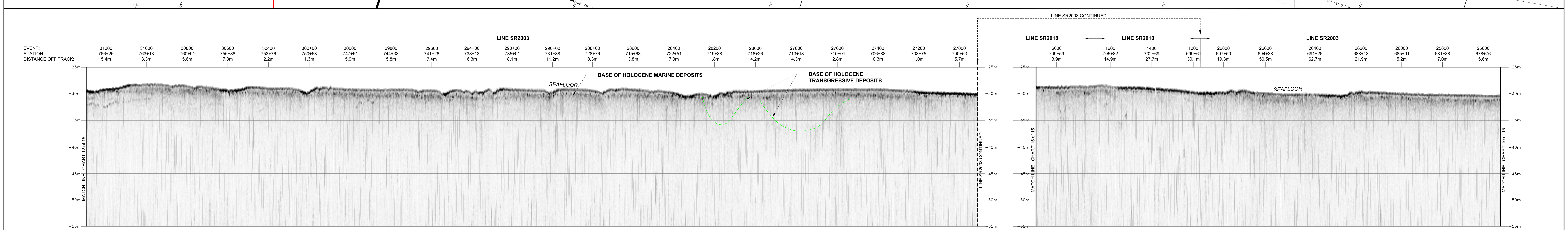
METERS

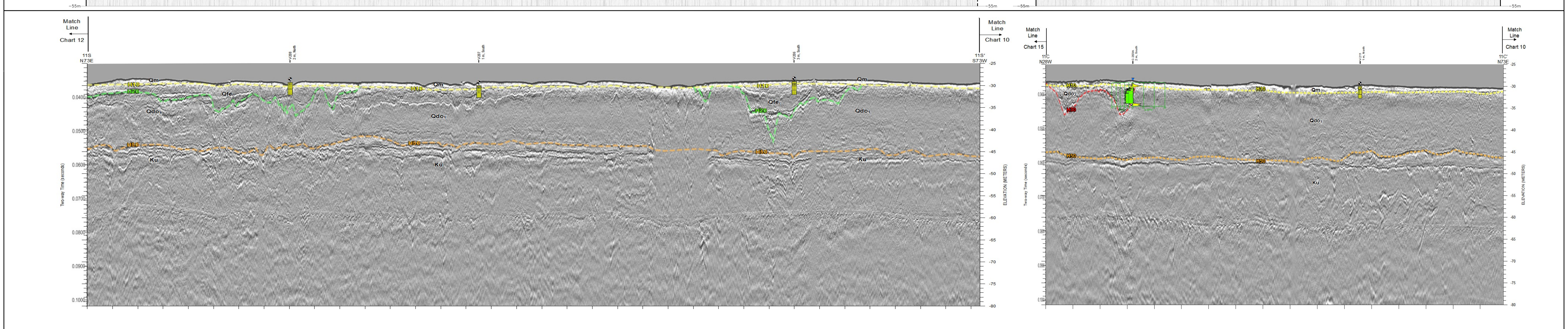
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-10









BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m, -15m, -20m, -25m, -30m, -35m, -40m, -45m, -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:

WATER COLUMN = HARMONIC MEAN

SEDIMENT = 1,550m/sec.

SCALE:

HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m

VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***

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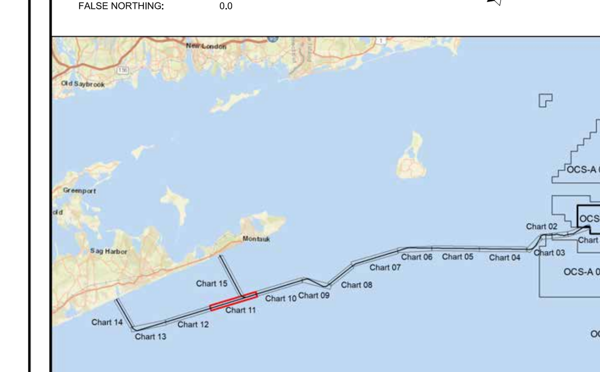
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



MAP PREPARED BY:

FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

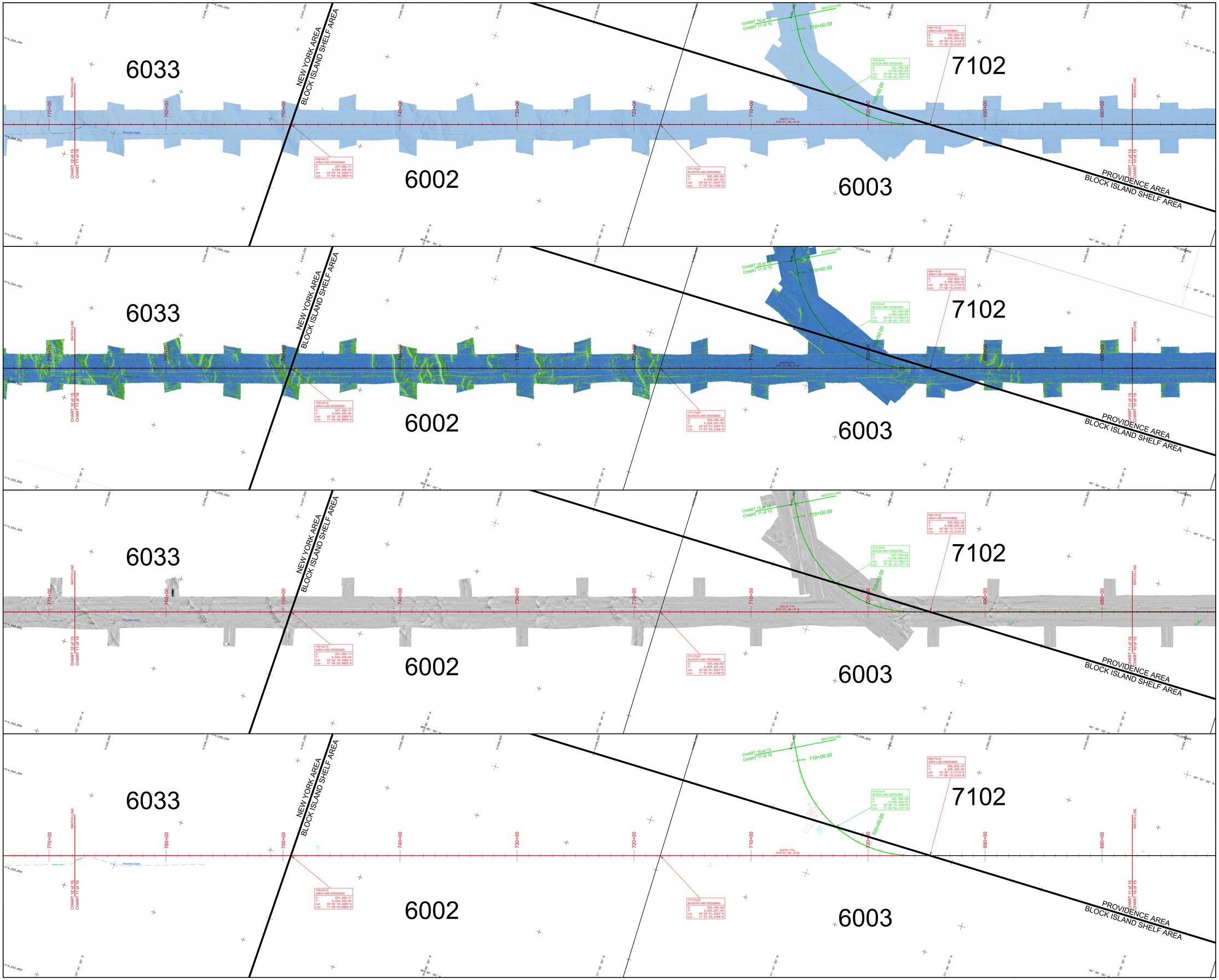
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000

0 160 320 480 640 800 METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-11



BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-2m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

*** IMPORTANT - PLEASE NOTE ***
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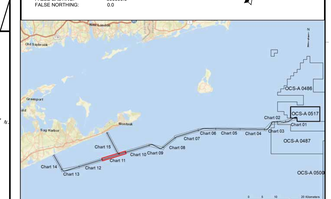
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	19N
CENTRAL MERIDIAN OF ORIGIN:	-69°
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0



MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
119 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

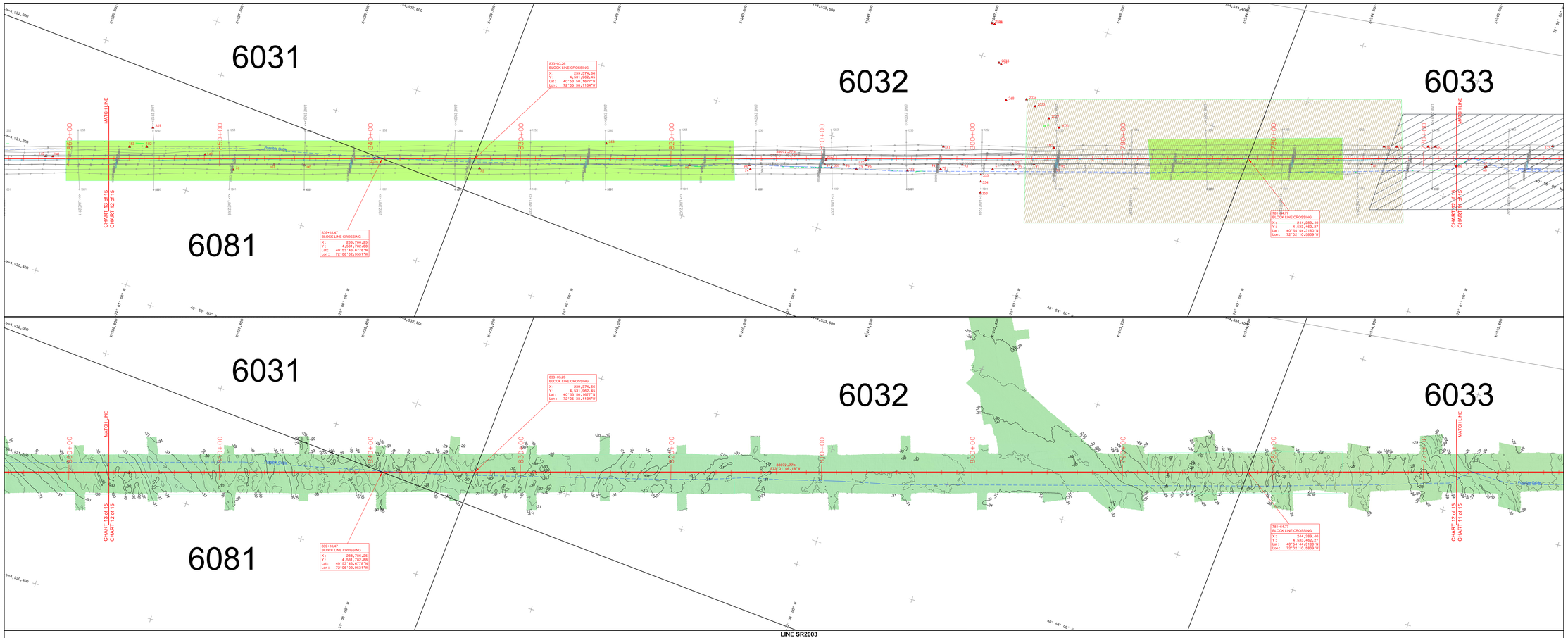
SCALE = 1:8000

0 160 320 480 640 800

METERS

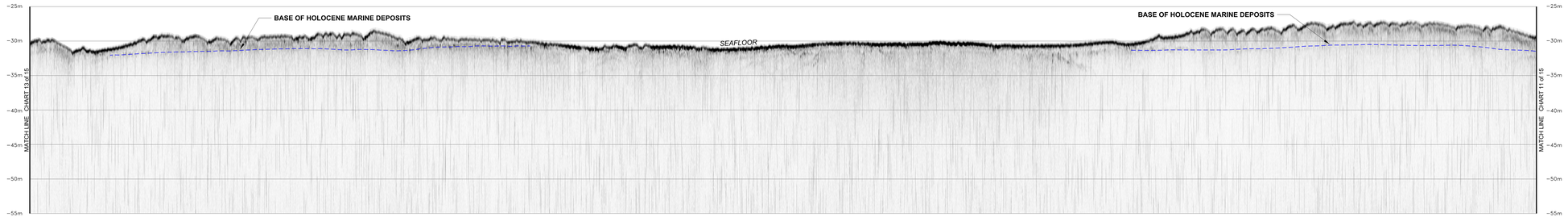
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

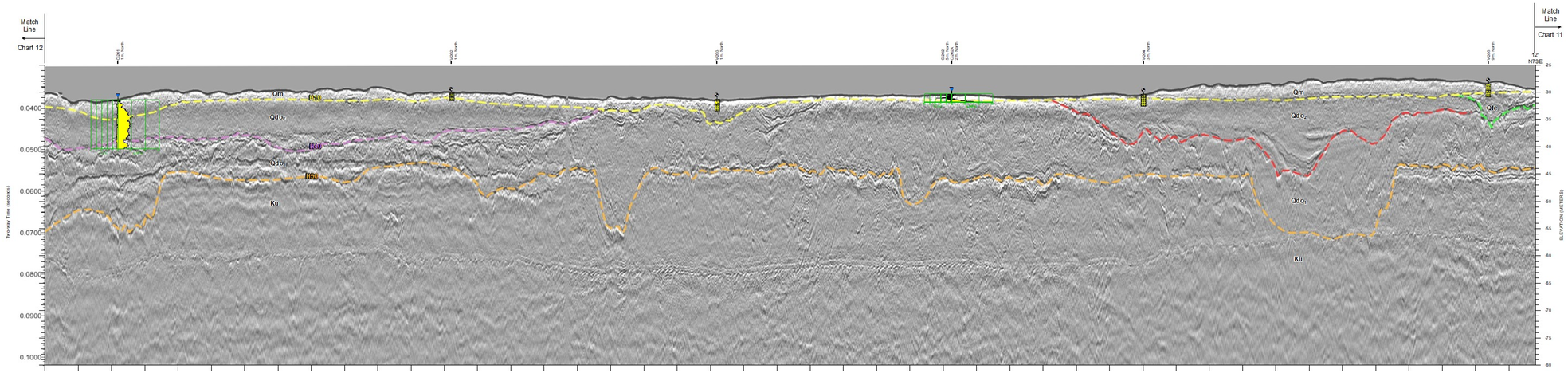
CHART SFEC-11 SHEET NO. 2 OF 2



LINE SR2003

EVENT:	37000	36800	36600	36400	36200	36000	35800	35600	35400	35200	35000	34800	34600	34400	34200	34000	33800	33600	33400	33200	33000	32800	32600	32400	32200	32000	31800	31600	31400
STATION:	856+88	853+76	850+63	847+51	844+38	841+26	838+13	835+01	831+88	828+76	825+63	822+51	819+38	816+26	813+13	810+01	806+88	803+76	800+63	797+51	794+38	791+26	788+13	785+01	781+88	778+76	775+63	772+51	769+38
DISTANCE OFF TRACK:	7.8m	9.7m	8.1m	5.9m	9.6m	8.9m	3.0m	5.0m	9.8m	5.1m	7.0m	6.4m	7.9m	8.2m	5.1m	8.6m	8.1m	6.0m	4.8m	6.0m	7.4m	5.5m	4.9m	6.1m	2.8m	1.7m	7.5m	4.9m	3.3m





BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -30 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, QPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART SOUTH FORK EXPORT CABLE DEEPWATER WIND SOUTH FORK LLC OFFSHORE NY/RI/MA, ATLANTIC OCS

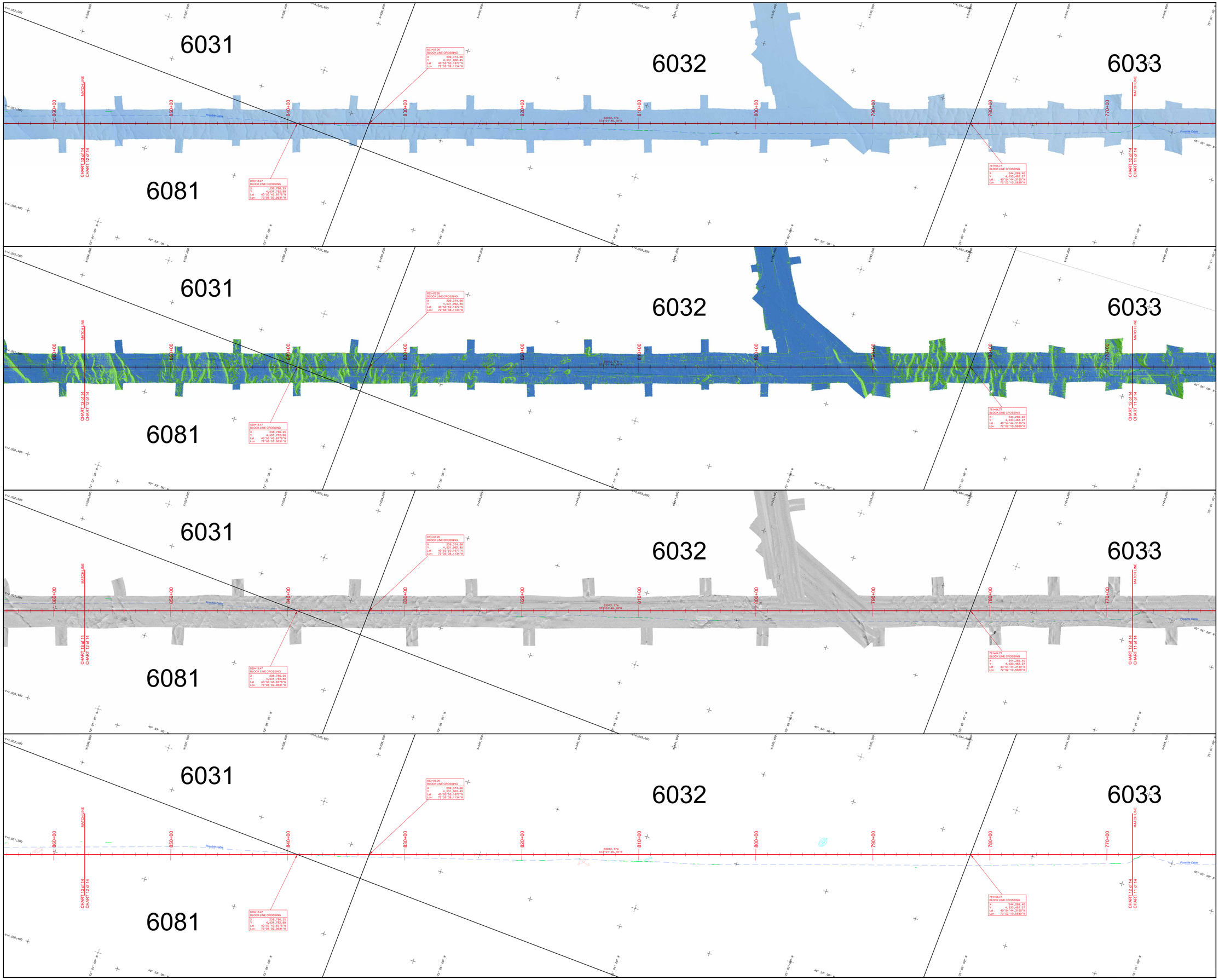
SCALE = 1:8000

0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-12



BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

-30 NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

30 POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-0m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

*** IMPORTANT - PLEASE NOTE ***
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SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.25722101
ECCENTRICITY:	
PROJECTION:	UTM
ZONE:	18
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

FUGRO

SOUTH FORK WINDFARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

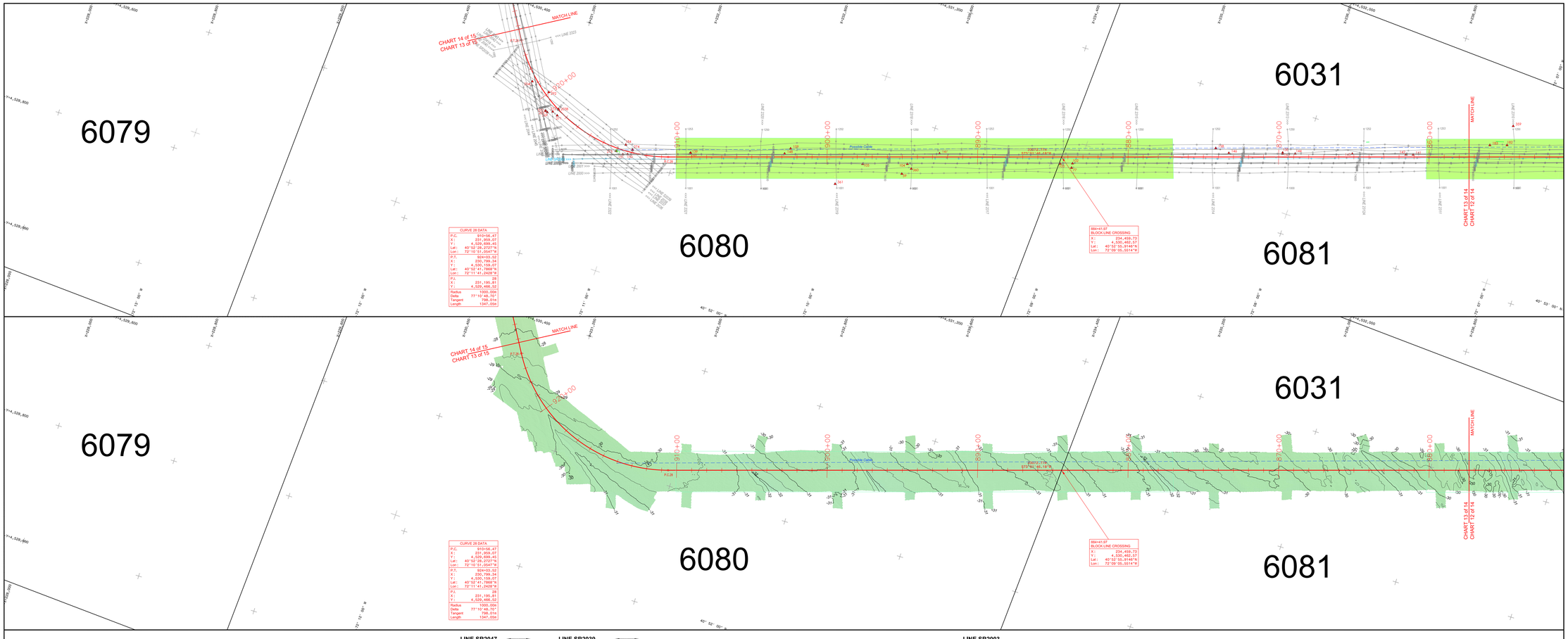
SCALE = 1:8000

0 160 320 480 640 800

METERS

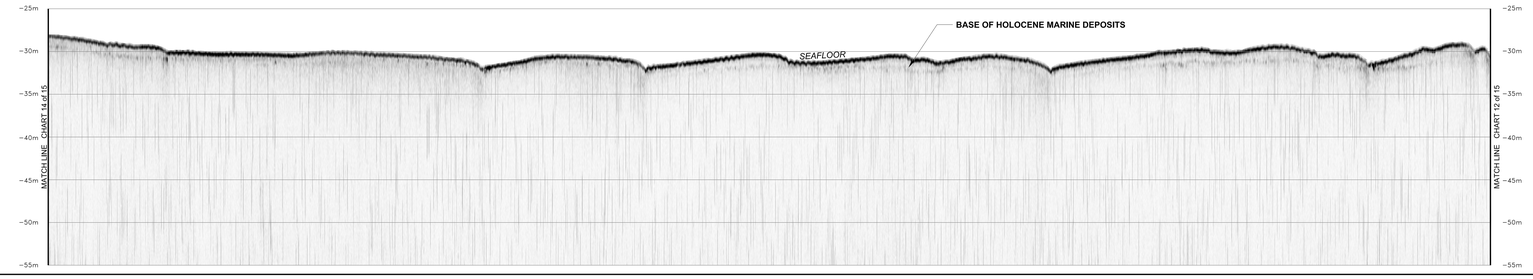
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

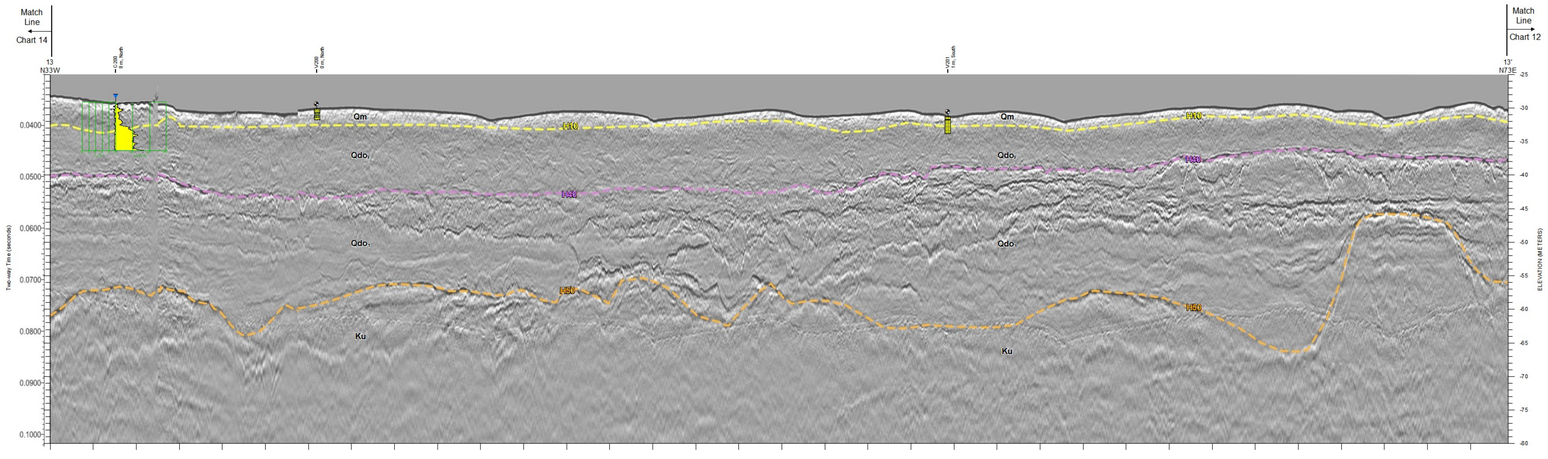
CHART SFEC-12 SHEET NO. 2 OF 2



LINE SR2047 | LINE SR2039 | LINE SR2003

EVENT:	5200	5400	1600	1400	1200	40600	40400	40200	40000	39800	39600	39400	39200	39000	38800	38600	38400	38200	38000	37800	37600	37400	37200
STATION:	924+05	921+04	920+21	917+18	914+15	913+04	910+01	906+88	903+76	900+63	897+51	894+38	891+26	888+13	885+01	881+88	878+76	875+63	872+51	869+38	866+26	863+13	860+01
DISTANCE OFF TRACK:	9.2m	55.1m	47.7m	2.4m	48.5m	45.8m	13.3m	11.5m	12.9m	14.5m	10.8m	12.4m	13.3m	7.4m	7.7m	11.8m	9.8m	11.7m	10.3m	12.6m	8.3m	8.3m	7.0m





BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -30 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m 640m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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GEODETIC INFORMATION

SPHEROID:	NAD 1983
SEMI-MAJOR AXIS:	6,378,137.000
SEMI-MINOR AXIS:	6,356,752.314
INVERSE FLATTENING:	298.257222101
ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:

FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-13 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-0m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT
<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC
RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	18N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2836
WWW.FUGRO.COM

SOUTH FORK WIND FARM

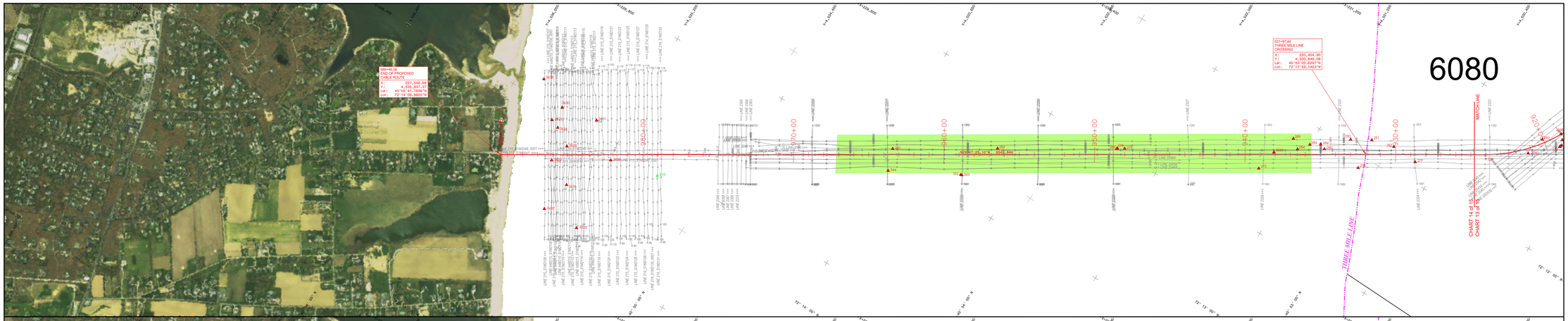
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

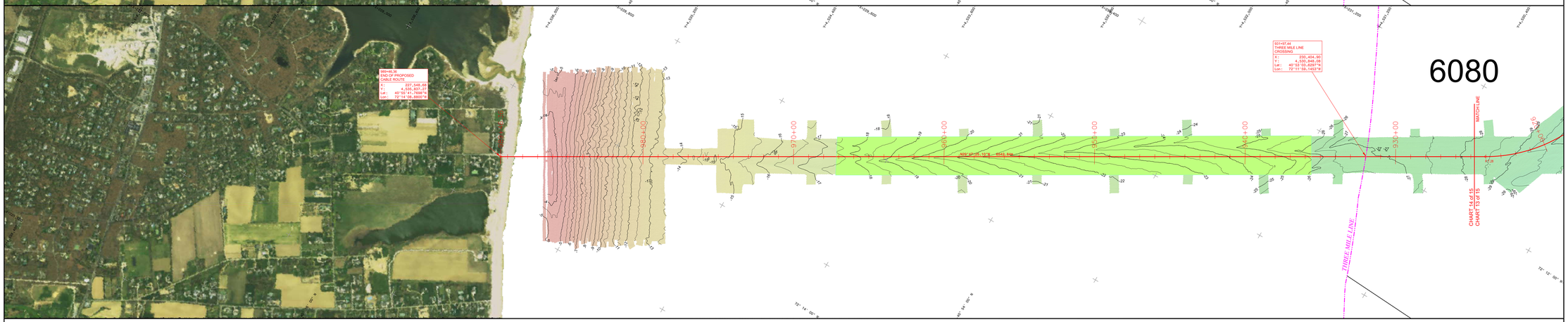
SCALE = 1:8000

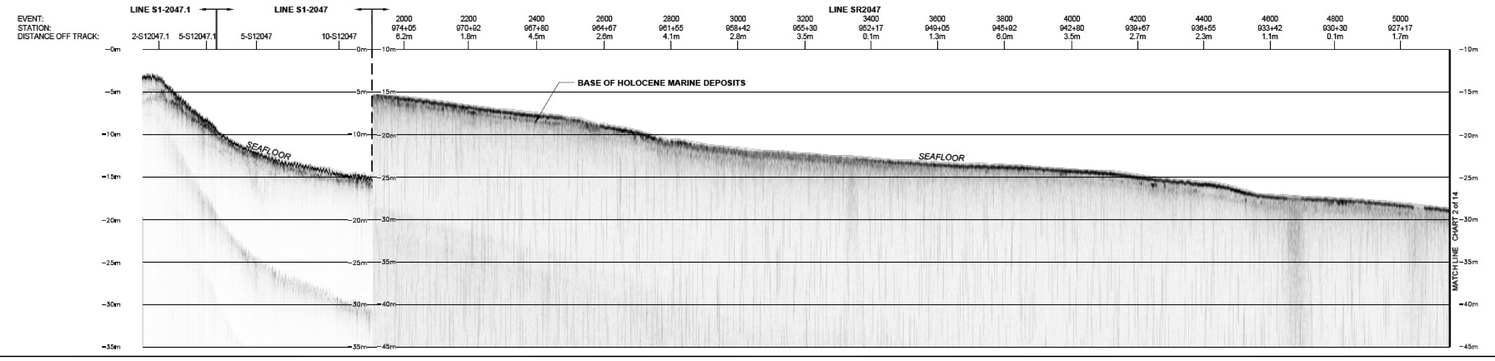
0 160 320 480 640 800
METERS

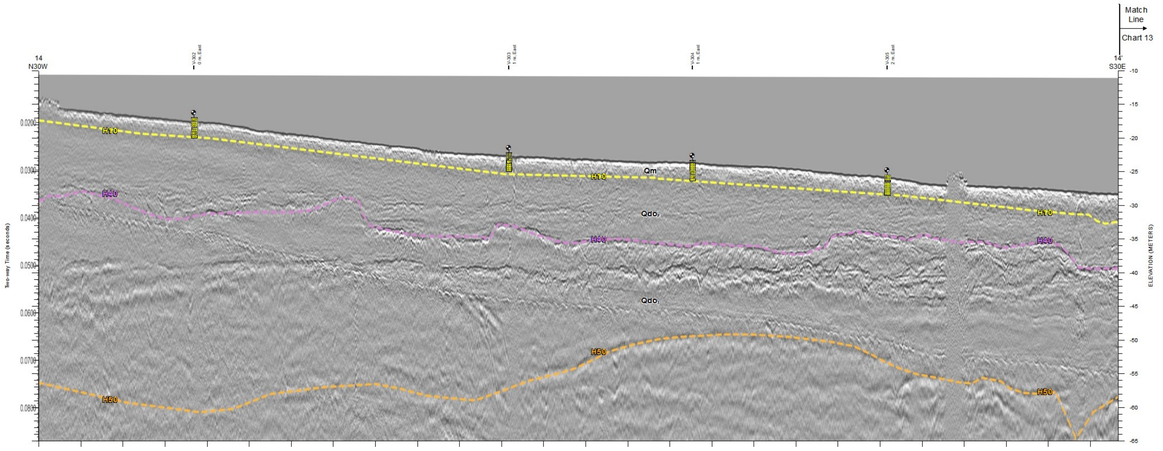
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-13 SHEET NO. 2 OF 2









BASE LEGEND

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- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -30 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m / 0m 2m 4m 6m 8m 10m 12m
VERTICAL:

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2626
WWW.FUGRO.COM

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000

0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-14 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-0m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

SEAFLOOR GRADIENT
<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC
RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:

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LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-2636
WWW.FUGRO.COM

SOUTH FORK WIND FARM

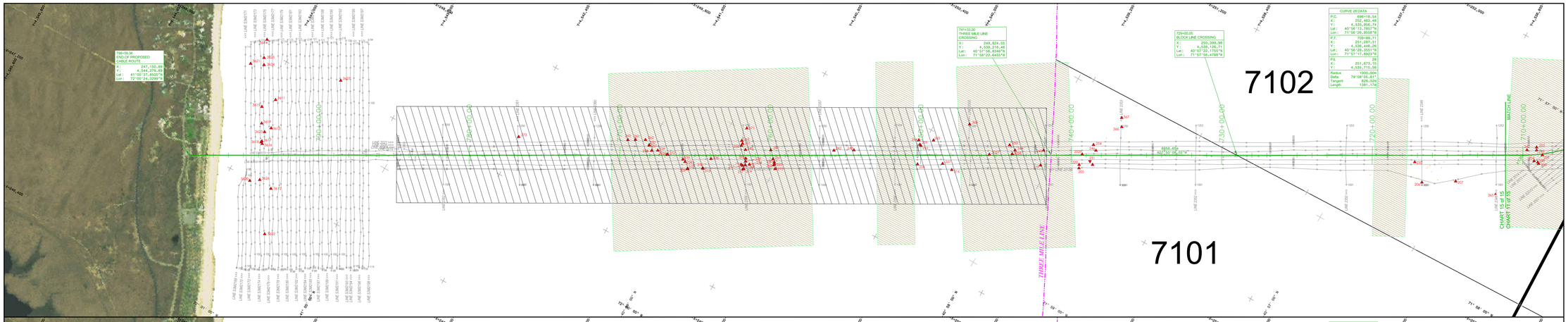
GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

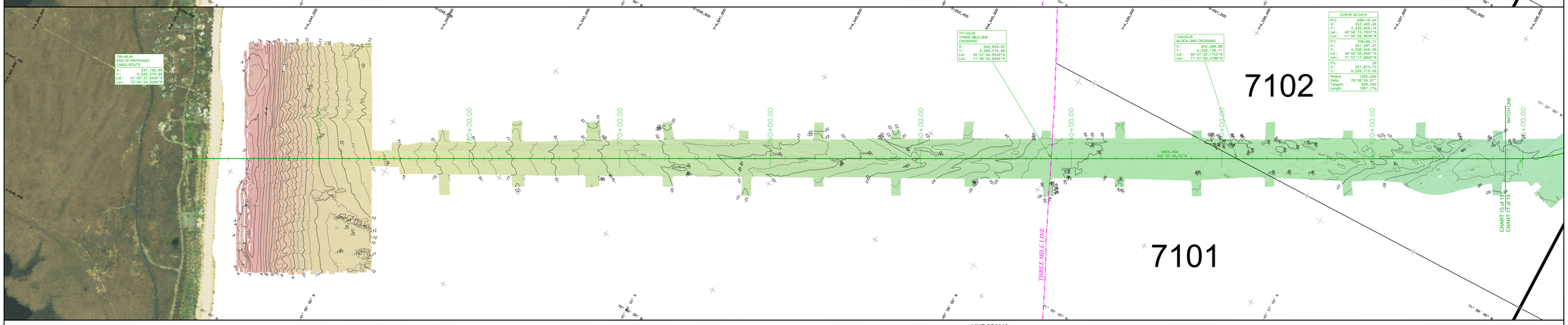
SCALE = 1:8000

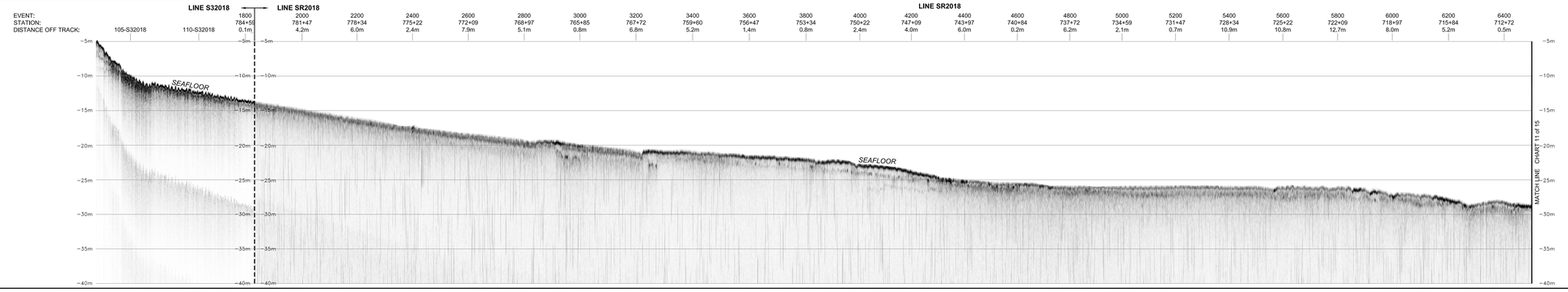
0 160 320 480 640 800
METERS

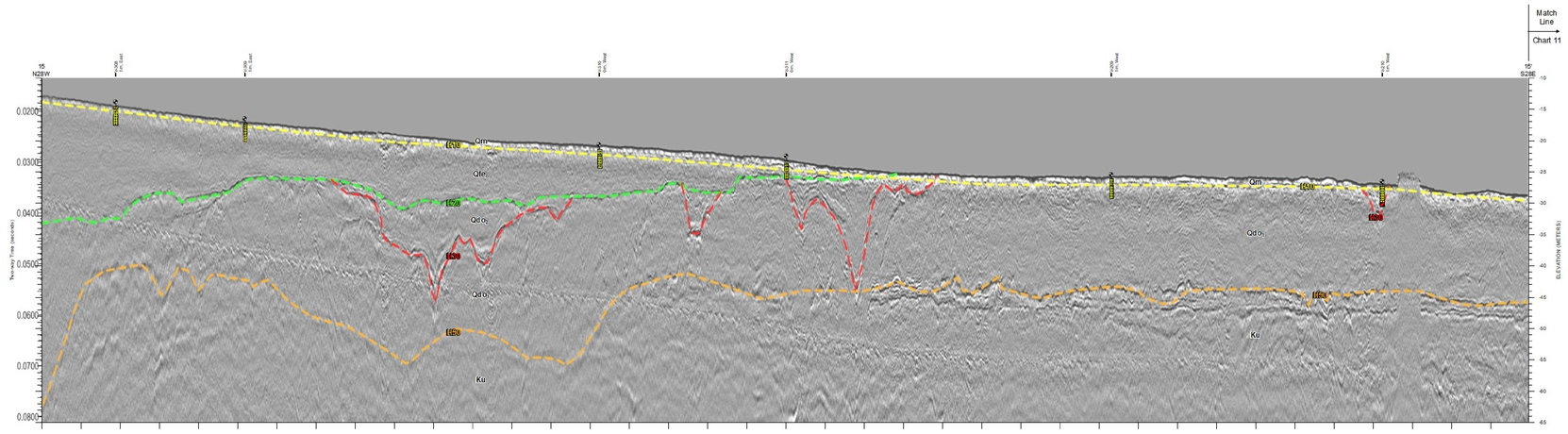
NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	

CHART SFEC-14 SHEET NO. 2 OF 2









BASE LEGEND

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- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

- UNIDENTIFIED MAGNETIC ANOMALY
- SONAR CONTACT
- DEVIATED CABLE
- LINEAR DEBRIS

SURFICIAL BOULDER DISTRIBUTION BASED ON SIZE (METERS)

- <1
- 1 - 2
- 2 - 5
- >5

- SECOND GENERATION CHANNELS (HOLOCENE)
- FIRST GENERATION CHANNELS (PLEISTOCENE)
- MEGARIPPLE EXTENT
- -30 WATER DEPTH CONTOURS
  CONTOUR INTERVAL = 0.5 METERS
  ZERO DATUM = MEAN LOWER LOW WATER, GPS OBSERVED TIDES
  APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

WATER DEPTH (METERS)

-2m -15m -20m -25m -30m -35m -40m -45m -50m

PROFILE VIEW

ZERO DATUM = MEAN LOWER LOW WATER

APPLIED ACOUSTIC VELOCITIES:
WATER COLUMN = HARMONIC MEAN
SEDIMENT = 1,550m/sec.

SCALE:
HORIZONTAL: 0m 80m 160m 240m 320m 400m 480m 640m
VERTICAL: 0m 2m 4m 6m 8m 10m 12m

VERTICAL EXAGGERATION = 40:1

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY²:	
PROJECTION:	UTM
ZONE:	19N
LONGITUDE OF ORIGIN:	0.0
FALSE EASTING:	500000.0
FALSE NORTHING:	0.0

MAP PREPARED BY:
FUGRO MARINE GEOSERVICES, INC.
115 DELTA DRIVE
LAFAYETTE, LOUISIANA 70506
PHONE: 337-237-0626
WWW.FUGRO.COM

FUGRO

SOUTH FORK WIND FARM

GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000

0 160 320 480 640 800

METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	01/12/2018	DRAFT	JRA	DM	
2	09/09/2021	FINAL	CPN	WC	KS

CHART SFEC-15 SHEET NO. 1 OF 2

BASE LEGEND

- NAVIGATION TRACKLINE WITH NAME, DIRECTION, AND SHOT POINT NUMBER (<<< LINE 100)
- EXISTING CABLE AS-BUILT LOCATION
- EXISTING CABLE AS-FOUND LOCATION
- EXISTING CABLE REPORTED INACTIVE
- PROPOSED CABLE ROUTE
- OCS BLOCK BOUNDARY
- BOEM RENEWABLE ENERGY LEASE BOUNDARY

INTERPRETIVE LEGEND

BATHYMETRY
ZERO DATUM = MEAN LOWER LOW WATER,GPS OBSERVED TIDES
APPLIED ACOUSTIC VELOCITY = HARMONIC MEAN

NEGATIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

POSITIVE MAGNETIC CONTOURS
CONTOUR INTERVAL = 5 GAMMAS

SEAFLOOR IMAGE

WATER DEPTH (METERS, MEAN LOWER LOW WATER)
-2m
-15m
-20m
-25m
-30m
-35m
-40m
-45m
-50m

RENDERING PARAMETERS
ILLUMINATION ALTITUDE: 45°
ILLUMINATION AZIMUTH: 45°

SEAFLOOR GRADIENT

<1
1 to 4.9
5 to 9.9
10 to 14.9
>15

SIDESCAN MOSAIC

RELATIVE SEAFLOOR REFLECTIVITY
HIGH
LOW

*** IMPORTANT - PLEASE NOTE ***
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ECCENTRICITY:	
PROJECTION:	UTM
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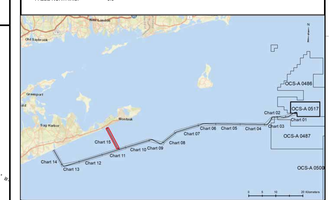
FALSE NORTHING:	0.0



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GEOPHYSICAL SURVEY AND SHALLOW HAZARDS CHART
SOUTH FORK EXPORT CABLE
DEEPWATER WIND SOUTH FORK LLC
OFFSHORE NY/RI/MA, ATLANTIC OCS

SCALE = 1:8000
0 160 320 480 640 800
METERS

NO:	DATE:	DESCRIPTION	DRAWN:	CHKD:	APPR:
1	04/20/2018	DRAFT	JRA	DM	

CHART SFEC-15 SHEET NO. 2 OF 2