
PRELIMINARY CHARACTERIZATION OF OFFSHORE SAND RESOURCES IN SELECTED STUDY AREAS

FINAL REPORT OF FINDINGS

Project No. 631226219

March 28, 2018
(Final, Revision 2)

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1.0 Executive Summary

Aptim Environmental & Infrastructure, Inc. (APTIM) together with CR Environmental, Inc. (CR) were contracted by the Massachusetts Office of Coastal Zone Management on June 13, 2017, to conduct a preliminary characterization of offshore sand resources in five (5) Study Areas located offshore of Massachusetts. The project consisted of an historic data review, collection of 20, up to 4-meter long vibracores, collection of 25 surface grab samples, collection of towed video footage, and sediment analysis.

The first phase of the project consisted of a desktop study, where APTIM performed an extensive search for previous geophysical and geotechnical investigations conducted within the five (5) Study Areas. After reviewing the available data, APTIM, CR, and the Massachusetts Office of Coastal Zone Management conducted a kick off meeting on May 26, 2017 to discuss the proper allocation of vibracore samples, surface grab samples and video collection efforts. It was decided that the field investigation would consist of the collection of five (5) vibracores in Study Area 1 offshore of the Merrimack River, four (4) vibracores in Study Area 2 offshore of Nantasket Beach, three (3) vibracores in Study Area 3 offshore of Duxbury Bay, three (3) vibracores in Study Area 4 offshore of Sandwich, five (5) vibracores in Study Area 5 offshore of Cuttyhunk along with five (5) surface grab samples in each of the Study Areas and enough towed video transects to accurately determine the bottom type and habitat. APTIM and CR submitted a final Data Acquisition Plan on July 14, 2017. APTIM collected the vibracores offshore of Massachusetts between September 15, and October 5, 2017, while CR conducted separate offshore operations to collect the surface grab samples and towed video data between August 2 and November 9, 2017.

Upon the completion of field investigations, vibracores and surface grabs samples were sent to APTIM's geotechnical laboratory in Boca Raton, Florida for description and analysis. Vibracores were processed to determine sedimentary properties by strata in terms of thickness, color, texture (grain size), composition and presence of clay, silt, sand, gravel, or any other identifying features. Samples from individual layers were extracted for grain size distribution analysis. Much like samples taken from the vibracores, surface grab samples were also described and processed for grain size. Results from the vibracore analysis were correlated to the available seismic sub-bottom data (where available) in order to create isopach surfaces of the potential sand resources in each of the Study Areas to determine an estimated sand volume available. Video transects were analyzed in real time for habitat type, sediment composition, observed fauna (epibenthic/nekton), and their relative abundance. Table 1 provides a breakdown of the investigation results per Study Area (also described below). These results include either the range of the average thickness of these isopach, \pm one standard deviation, or the average thickness not shown as a range (for areas without historic seismic sub-bottom data), shown as a discrete value representing the average thickness of that sand



deposit as logged in the newly collected vibracores within that specific Study Area. The volumes shown are the actual calculated estimated volumes in m³ rounded to the nearest 10,000 m³. The rounded m³ volume value was then converted to cubic yards and rounded to the nearest 100 cubic yards.

For Study Area 1, the dominant substrate type was low relief sand waves with some coarse grain sands and pebbles in the troughs. Dominant fauna included juvenile sea scallops, lobster, mysid shrimp, and amphipods. A total of 37 lobsters were observed on 85% of the collected transects. Dominant fish included winter flounder (16) and sculpin (18). APTIM was able to determine an estimated preliminary volume of 99,730,000 m³ (130,442,000 cy) of potential sand resources throughout Study Area 1.

For Study Area 2, the bottom substrates were highly variable, ranging from flat sand, mud to sand waves, pebble-cobble, and partially buried or dispersed boulders. Dominant invertebrates included sea scallops, rock crabs, and sand dollars. The dominant fish observed was cunner with 62 observations. The Massachusetts OMP Study Area 2 was broken down into three (3) Study Areas (2A, 2B and 2C). Interpretation of historic seismic sub-bottom data correlated to the vibracore results from this project indicated preliminary estimates of potential sand resource volumes of 3,600,000 m³ (4,708,600 cy) in the Study Area 2A. Recent backscatter and high resolution bathymetric data within Study Area 2B indicate the presence of surficial gravels as well as high-relief ledges, likely rocky in nature, crossing portions of the Study Area. As a result, little or no potential sand resource volume is expected in Study Area 2B. Based on historical surficial backscatter data indicating limited surficial sands, Study Area 2C was narrowed down to a smaller area with an estimated preliminary volume of 3,600,000 m³ (4,708,600 cy) of potential sand resources.

Offshore of Duxbury Bay, the bottom substrate at Study Area 3 was primarily flat sand, mud with limited observations of pebble-cobble bottom, and occasional shell aggregate bottom. Dominant invertebrates were mysid shrimp and sand dollars. Commercial species observed included 17 observations of rock crabs and nine (9) lobsters. The dominant fish species at Study Area 3 off of Duxbury Bay included red hake (33), winter flounder (15) and sculpin (12). The Massachusetts OMP Study Area 3 was broken down into two (2) Study Areas (3A and 3B). Interpretations of the historic sidescan sonar data in Study Area 3A indicate that the surface is likely mostly sand, therefore, in order to determine the potential volume of sand, an average thickness value was calculated from the isopach and used as a general representation of the entire Study Area 3A, yielding an estimated preliminary volume of 46,940,000 m³ (61,395,200 cy) of potential sand resources. The isopach in Study Area 3B was clipped to the Interpreted Sandy Area polygon in order to avoid areas that appear to have a hard bottom/rock outcrop. The total estimated



preliminary volume of Study Area 3B is 46,000,000 m³ (60,165,700 cy) of potential sand resources.

Offshore of Sandwich, the habitat type at Study Area 4 was primarily flat sand and mud with the exception of sand waves with coarser sand east of the Cape Cod Canal. Occasional biogenically-structured bottom (burrows and mounds) was also observed. A limited amount of pebble-cobble bottom was observed and some rock disposal material was observed in the Cape Cod Canal Offshore Dredged Material Disposal Site. Dominant fauna included sand dollars that were abundant at all of nine (9) sandy bottom transects. The dominant fauna on the silty/sand sediment at the Disposal Site were mysid shrimp. Counts of the commercial species included 40 rock crabs, 20 winter flounder, and 10 lobsters. Study Area 4 was divided into two (2) Study Areas, 4A and 4B. Study Area 4B was considered, but not included for additional geotechnical data collection as it is designated as a USACE/EPA Offshore Dredge Material Disposal Site and can likely be initially characterized via historic dredging records. The estimated preliminary volume in Study Area 4A is estimated to be 51,670,000 m³ (67,581,800 cy) of potential sand resources. Given the fact that no seismic sub-bottom data were available for this area, it is impossible to know the exact nature and full extent of the deposit without additional design-level data.

For Study Area 5, offshore of Cuttyhunk, the bottom substrate was primarily flat sand/mud, with occasional exceptions of observed sand waves and partially buried and dispersed boulders. The dominant invertebrate at eight (8) of the 10 transects were two (2) species of hermit crabs. Fish species observed at Study Area 5 included 21 red hake and one (1) winter flounder. The Massachusetts OMP Study Area 5 was broken down into two (2) Study Areas (5A and 5B). Sand deposits in Study Area 5A are associated with a shoaling feature with an estimated preliminary volume of 54,470,000 m³ (71,244,100 cy) of potential sand resources. Study Area 5B contains a thin (approximately 1.4 m (4.27 ft) thick) sand layer overlaying a paleochannel complex likely filled with clays and silts yielding an estimated preliminary volume of approximately 7,460,000 m³ (9,757,300 cy) of potential sand resources.

In total, APTIM was able to identify potential sand resources totaling a preliminary, reconnaissance-level estimate of approximately 313,470,000 m³ (410,003,400 cy) across all five (5) Study Areas. These are preliminary volumes of potential sand resources based on widely-spaced reconnaissance-level geotechnical data and varying levels of geophysical data coverage. Actual borrow area design would require additional, design-level geotechnical and geophysical data collection in order to accurately and fully characterize these sand deposits, account for environmental and cultural resources, determine compatibility of the potential sand resource with the recipient beach, evaluate dredgeability of the sand resource, and design permit plans and specifications (including dredge cuts) for a final borrow area.



Table 1: Project results summary

Region	Study Area	Vibracores	Surface Grabs	Towed Video Transects	Dominant Bottom Habitat/Substrate (Auster, 1998)	Dominant Fauna	Average Grain Size (mm)	Average Silt %	Average Sand Thickness (m)	Area of Isopach (m ²)	Estimated Volume of Isopach (m ³)	Estimated Volume of Isopach (cy)		
Merrimack River	1	5	5	10 at 750 m long 1 at 250 m ¹ long	Low relief sand waves with coarse grains and pebbles in troughs.	Juvenile sea scallops, lobsters, mysid shrimp, amphipods. Lobsters in 85% of transects (37 total), winter flounder and sculpin.	0.30	2.50	1.76 to 3.84	35,665,334	99,730,000	130,442,000		
Nantasket Beach	2A	1	2	2 at 750 m long	Variable. Flat sand and mud, sand waves, pebble-cobble, partially buried and dispersed boulders.	Sea scallops, rock crabs, lobsters. Cunner, sculpin, red hake and winter flounder.	0.11	11.75	2.54 to 4.18	1,070,310	3,600,000	4,708,600		
	2B	0	0	1 at 750 m long									N/A; There were no cores or grabs in this sub-area	
	2C	3	3	7 at 750 m long									0.11	12.28
Duxbury Beach	3A	1	2	4 at 500 m long	Primarily flat sand and mud; also limited pebble-cobble, shell aggregates.	Mysid shrimp, sand dollars, rock crabs, lobsters. Red hake, winter flounder, sculpin.	0.17	1.69	0.84 to 5.68	14,398,272	46,940,000	61,395,200		
	3B	2	3	6 at 500 m long									0.16	10.59
Sandwich	4A	3	5	9 at 1000 m long	Primarily flat sand and mud; also sand waves, biogenic structures (burrows and mounds).	Sand dollars, mysid shrimp, rock crabs, lobster. Winter flounder and skate.	0.23	2.68	3.38	15,286,265	51,670,000	67,581,800		
	4B	0	0	1 at 1000 m long									N/A; There were no cores or grabs in this sub-area	
Cuttyhunk	5A	3	2	5 at 500 m long	Primarily flat sand and mud; also sand waves, partially buried or dispersed boulders.	Hermit crabs, slipper limpets, bread crumb sponges, lobster, channeled whelk. Red hake, winter flounder	0.19	4.66	1.61 to 7.33	12,180,335	54,470,000	71,244,100		
	5B	2	3	5 at 500 m long									0.17	6.49

¹ Transect ended at 250 meters because the video sled was at the edge of the shape file (defined boundary of the sand resources area) drifting in the wrong direction. A new transect was started 1000 m to the east and 750 meters completed

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3.0 Abbreviations

AGC	Automatic Gain Control
APTIM	Aptim Environmental & Infrastructure, Inc.
ASTM	American Society for Testing and Materials
Avg	Average
cm	centimeters
CMEC	Construction Materials Engineering Council, Inc.
Comp	Composite
CR	CR Environmental, Inc.
cy	cubic yards
CZM	Massachusetts Office of Coastal Zone Management
DBE	Disadvantages Business Enterprise
DGPS	Differential Global Positioning System
EPA	Environmental Protection Agency
ft	feet
GPS	Global Positioning System
HD	High Definition
in	inch
kHz	kilohertz
km	kilometer
m	meter
m ²	square meters
m ³	cubic meters
mp	megapixel
NAVD88	North American Vertical Datum, 1988
ODMDS	Offshore Dredge Material Disposal Site
OMP	Ocean Management Plan
OTI	Outland Technologies'
SBA	Small Business Administration
Thk	Thickness
USACE	United States Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
Vac	volts, alternating current
WBE	Women Business Enterprise
WOSB	Women Owned Small Business



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7.0 Introduction

APTIM Environmental & Infrastructure, Inc. (APTIM) was contracted by the Massachusetts Office of Coastal Zone Management (CZM) on June 13, 2017, to conduct a preliminary characterization of offshore sand resources in five (5) study areas located offshore of Massachusetts. The project consisted of conducting an historic data review of the investigation areas, collection of 20 vibracores up to four-meters long, and 25 surface grab samples along with towed video footage of the seafloor. Additionally, APTIM was tasked with conducting detailed logging and analysis of the collected geotechnical samples and estimating volumes of potential sand resources for future coastal restoration efforts.

APTIM teamed with CR Environmental, Inc. (CR), located in Falmouth, Massachusetts to conduct this investigation. CR is a Massachusetts certified Women Business Enterprise (WBE) and certified Disadvantaged Business Enterprise (DBE); and a Small Business Administration (SBA) self-certified Women Owned Small Business (WOSB). APTIM and CR have a relationship extending back to 2006, working jointly to collect and provide the highest quality data in geophysical, geotechnical and oceanographic surveys in support of shore-protection projects.

Together, APTIM and CR coordinated the desktop study, site selection, data collection, processing and reporting. The field collection phase consisted of two separate operations. APTIM conducted the desktop historical data analysis study and, with the assistance of a CR research vessel, the vibracore collection components of the project. CR conducted the surface grab samples and underwater towed video collection from a separate, smaller local vessel owned and operated by CR. The vibracores, along with the surface grab samples collected by CR, were transported to APTIM's accredited geotechnical laboratory in Boca Raton, Florida and analyzed in accordance with American Society for Testing and Materials (ASTM) standard procedure D 2488-09a (Standard Practice for Description and Identification of Soils). APTIM then reviewed the results of the vibracore analysis, and together with the data from the desktop study, identified potential sand resource characteristics and volumes in all five (5) investigation areas.

8.0 Scope of Work

The purpose of this project was to conduct a preliminary characterization of sand resources off the coast of Massachusetts in five (5) areas identified in the Massachusetts Ocean Management Plan (OMP) as having the potential for use in future shore-protection projects. APTIM and CR conducted a project kickoff meeting with CZM in Boston, Massachusetts on May 26, 2017, to



discuss the project schedule, historic data and operational plans. At the meeting, the overall Scope of Work, proposed equipment, schedule, and project planning activities were discussed. In an effort to complete the most amount of work as possible within the available CZM budget, it was decided that a total of 20 vibracores, 25 surface grab samples, and underwater towed video would be collected within the five (5) Study Areas.

APTIM conducted a thorough review of existing geophysical and geotechnical data and information to gain an understanding of the geologic background and existing geologic conditions of the proposed Study Areas, outlined in Section 9.0 Desktop Study. For the desktop study APTIM utilized historic geophysical (sidescan sonar, bathymetric and seismic sub-bottom) data along with historic geotechnical data (surface grab samples and vibracores) and photographs of the seafloor provided by the United States Geological Survey (USGS) and CZM to narrow down areas of potential sand for this investigation. In areas with limited raw geophysical and geotechnical data, APTIM relied on historic reports prepared for The Division of Mineral Resources State of Massachusetts, The Commonwealth of Massachusetts Department of Natural Resources Division of Mineral Resources, the USGS, and other references provided by CZM.

Upon the completion of the desktop study and the review of the chosen geotechnical sample sites and towed video transects, APTIM submitted a final Data Acquisition Plan to CZM on July 14, 2017. APTIM and CR commenced field operations on August 2, 2017. APTIM collected 20, up to 4-meter long vibracores within the proposed Study Areas, consisting of five (5) vibracores in Study Area 1 offshore of the Merrimack River, four (4) vibracores in Study Area 2 offshore of Nantasket Beach, three (3) vibracores in Study Area 3 offshore of Duxbury Bay, three (3) vibracores in Study Area 4 offshore of Sandwich, and five (5) vibracores in Study Area 5 offshore of Cuttyhunk in Buzzards Bay. Vibracore sample locations were determined based on the previous geophysical data review, targeting deposits with a generally higher potential for thicker and/or larger sand resources.

CR conducted the towed video and surface grab sample operations separately from APTIM's vibracore operations. At each of the five (5) Study Areas, 10 up to 1,000-meter primary transects were selected for underwater video sled survey coverage. Additional secondary underwater video coverage was collected at each site if time and weather permitted. At each of the Study Areas, five (5) surface grab samples were collected for sediment grain size. Final locations of the sediment samples were based on the video observations.

Upon completion of field operations, APTIM and CR analyzed all of the collected data to develop interpretations in support of producing a comprehensive summary of the surficial and subsurface geology of the Study Areas. Geotechnical data (vibracores and surface samples) were analyzed for



sedimentary properties in terms of layer thickness, color, texture (grain size), composition and presence of clay, silt, sand, gravel, or any other identifying features, and grain size distribution. Towed video footage was used to determine a qualitative summary of incidental macrofauna and nekton.

9.0 Desktop Study Results

In order to obtain an understanding of the geologic background and existing geologic conditions of the proposed Study Areas, APTIM conducted a thorough review of existing geophysical and geotechnical data and information. APTIM maintains a comprehensive internal database that is an excellent starting point for conducting preliminary evaluations of the potential for offshore sand resources. In addition to APTIM's extensive internal database, APTIM reviewed geologic data and information from the USGS and The Massachusetts Department of Natural Resources Division of Mineral Resources, provided by CZM. Based on the review of historic bathymetry data, acoustic backscatter data, seismic-reflection profiles, sediment samples, and photography from the five (5) proposed Massachusetts OMP Sand Resource Areas, APTIM was able to determine areas of potential sand resources for future shore protection projects in Massachusetts.

9.1 Study Area 1: Merrimack River

Five (5) vibracore samples were proposed within Study Area 1 offshore of the Merrimack River. APTIM used historic backscatter, bathymetry, surface grab samples, and photography to further delineate the sandy bottom within Study Area 1 (Figures 1 and 2).

While this area did not need to be divided into Study Areas, the historic data all confirmed the presence of rock outcrops in several areas throughout the study area. These areas were clipped out of the Study Area and not considered for further data collection. For Study Area 1, the historic backscatter data are presented in a reverse pattern, with the lighter colors representing low backscatter areas indicative of finer/sandy materials (Barnhardt et al., 2009). The dark colors represent high backscatter indicative of areas of rock, gravel, or other coarse materials. In addition to the extensive seismic sub-bottom data, there are extensive historic surface grab samples confirming the sidescan sonar imagery, allowing for easy delineation of the sandy seafloor (Buczowski and Kelsey, 2006; Barnhardt et al., 2009).

This area has full coverage of historic USGS seismic sub-bottom data, providing APTIM geologists with ample data to review and propose vibracore locations (Barnhardt et al., 2009). Prior to the collection of the vibracores, APTIM utilized the exported imagery of the seismic sub-bottom data for review and site selection together with shapefiles with shot-point information and as-run tracklines.



Historic seismic sub-bottom data indicate the presence of buried rock, sands, and potentially finer materials, likely associated with paleofluvial activities (Figures 3, 4, 5, 6, and 7). APTIM targeted the thickest and potentially sandiest deposits as interpreted from the seismic sub-bottom data, while avoiding areas of rock outcrops or finer materials. In the northwest portion of the Study Area, APTIM attempted to target the thickest portion of the sand feature in an attempt to characterize the maximum sand deposit possible. In the northeast, APTIM collected a vibracore on the lateral extents of the potential sand deposit to assist with the identification of the edges of the deposit, including the potential to sample the material beneath the sandy deposit. The centrally-located proposed vibracore was intended to target the central portion of the deposit, allowing for regional coverage and general characterization of the overall sand feature. The southeast location targeted the edge of the deposit before it drops off to a deeper, rocky seafloor, while the southwest location targeted the thickest deposit on the southern end of the Study Area. All five (5) cores allowed for general coverage and characterization of this potential sand deposit.

All vibracores were collocated along existing seismic sub-bottom lines at or near seismic sub-bottom line crossings, enabling for the easy seismic sub-bottom tie-in of any resulting interpretation from the collected vibracore data.

9.2 Study Area 2: Nantasket Beach

Four (4) vibracores were proposed to be collected within Study Area 2, offshore of Nantasket Beach. Based on APTIM's desktop study, two (2) Study Areas (2A and 2C) were classified as having a higher potential for beach compatible resources within areas of sandy seafloor (Figures 8 and 9). Historic data from the Massachusetts Coastal Mineral Inventory Survey report (Willet, 1972), the United States Army Corps of Engineers (Meisburger, 1976) historic data from the USGS, including Maps and Seismic Profiles Showing Geology of the Inner Continental Shelf, Massachusetts Bay, Massachusetts (Oldale and Bick, 1987), and other historic USGS geophysical and bathymetric data (Ackerman et al., 2006) were used to classify the bottom types within Study Area 2 and to further delineate sandy seafloor in Study Areas 2A, 2B and 2C (Figures 8 and 9) (Barnhardt et al., 2010; Pendleton et al., 2013). APTIM compared historic USGS backscatter and bathymetric data and USGS photographs to confirm seafloor types within the Study Area in an effort to avoid high relief bathymetric data and high (light colored) backscatter data associated with hard bottom/rock outcrops and areas of gravel or cobble seafloor and target areas with the highest potential for beach compatible resources.

Study Area 2A was selected based on historic sidescan sonar data and USGS bottom photographs. A review of these data, along with limited early analog seismic data images, supported the interpretation of a surficial sand deposit within this Massachusetts OMP Sand Resource Area. One vibracore sample was proposed within Study Area 2A on an existing seismic sub-bottom line to further characterize the deposit for beach compatibility.



For Study Area 2B, early analog seismic sub-bottom data images from The Massachusetts Coastal Mineral Inventory Survey report (Willet, 1972) were reviewed to delineate Study Area 2B within a historic sand mineral resource area (BA II). The historic data classifies the area as sand with occasional silt and clay. Unfortunately, more recent backscatter and high resolution bathymetric data indicate the presence of surficial gravels as well as high-relief ledges, likely rocky in nature, crossing portions of Study Area 2B. As a result, and with limited portions of sandy seafloor remaining in Study Area 2B, no vibracore samples were proposed in Study Area 2B.

Study Area 2C was delineated using early analog seismic sub-bottom data images from The Massachusetts Coastal Mineral Inventory Survey report within a historic sand mineral resource area (BA I) (Willet, 1972). The historic data classifies the area as sand with occasional silt and clay. More recent bathymetric and backscatter data, however, indicate some areas of gravel seafloor (high, light-colored, backscatter) and areas of mixed sand/gravel seafloor (central Study Areas 2C). Due to the increased amount of surficial gravel, APTIM proposed only two (2) vibracore samples within Study Area 2C at locations where the Massachusetts OMP Sand Resource Area overlaps low (darker-colored) backscatter sandy areas, while avoiding high relief areas and high (light-colored) backscatter areas interpreted to be gravel, hard bottom, and/or rock outcrops.

Upon reviewing all of the data, APTIM was able to identify an area of low (dark-colored) backscatter, indicating a sandy and/or silty seafloor, just outside of the Massachusetts OMP Sand Resource Area shape that correlated to a potential sand source in the Massachusetts Coastal Mineral Inventory Survey report (Willet, 1972). While the same sand source in the Oldale and Bick, 1987, publication did not occur that far west, it is likely that was due to the lack of data coverage, not necessarily data indicating that the deposit had thinned considerably. As such, and based on the extensive gravel area present within Study Areas 2B and 2C, APTIM proposed one (1) vibracore in this area just west of Study Area 2C.

A total of four (4) vibracore sites were proposed within Study Area 2: one (1) in Study Area 2A, two (2) within Study Area 2C, and one (1) immediately west of Study Area 2C in a low (dark-colored) backscatter area interpreted to have a sand deposit in the Massachusetts Coastal Mineral Inventory Survey report.

9.3 Study Area 3: Duxbury Beach

Three (3) vibracore samples were proposed within Study Area 3, offshore of Duxbury Bay. Study Area 3 was evaluated using historic sidescan sonar data, historic bottom photographs, bathymetry data, and some historic USGS seismic sub-bottom data available for a portion of the Study Area (Figures 10 and 11) (Andrews et al., 2010; Buczkowski and Kelsey, 2006; Normandeau Associates, 2010; Pendleton et al., 2013). Bathymetry data were digitized, and compared to



sidescan sonar data and USGS photographs to classify surficial sand areas for vibracore placement. Areas shown as low (dark-colored) backscatter corresponded to sandy areas, as verified by historic surface grab samples and seafloor photography. Areas of high (lighter-colored) backscatter indicated the presence of gravel, cobble or rocks, and were therefore excluded from the Study Area.

The Study Area was divided into two (2) main Study Areas: 3A being the northern Study Area, and 3B the southern Study Area. A total of three (3) vibracores were proposed within Study Area 3: one (1) in Study Area 3A and two (2) in Study Area 3B. For Study Area 3A, there were no historic seismic sub-bottom data available to confirm the presence of subsurface sand deposits across the entire area. That said, there were high resolution sidescan sonar backscatter, bathymetry, and photographic data indicating the presence of surficial fine-grained sands and some sand with shell material. Based on this information, and the desire to further characterize the subsurface geology of Study Area 3A, APTIM placed one (1) proposed vibracore location within the fine-grained sand area.

For Study Area 3B, there were some seismic sub-bottom data available (Barnhardt et al., 2010; Pendleton et al., 2013). APTIM reviewed and utilized the exported imagery of the seismic sub-bottom data for review and site selection. The seismic sub-bottom data, together with the historic surficial backscatter, grab samples, and photographic data, confirmed the presence of a sand feature. This feature is visible on multiple sub-bottom lines, and can be tied using the sub-bottom lines across Study Area 3B (Figures 12, 13, and 14). APTIM selected two (2) areas within this subsurface sand feature, traceable on multiple seismic sub-bottom lines, for vibracore collection.

9.4 Study Area 4: Sandwich

Three (3) vibracores were collected within Study Area 4, offshore of Sandwich. Based on APTIM's desktop study, one (1) Study Area (4A) is classified as having a higher potential for beach compatible resources. A second Study Area (4B) was considered but avoided as it is designated as a USACE/EPA Offshore Dredge Material Disposal Site and can likely be initially characterized via historic dredging records (Figures 15 and 16). The Coastal Engineering Research Centers Seismic and Coring Investigation of Cape Cod Bay (Samson, 1974), together with historic NOAA bathymetric and backscatter data (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Ocean Survey, 2007) and USGS surface grab samples (Buczowski and Kelsey, 2006; Doner, 2012), were used to classify the bottom type within Study Area 4 and further delineate the sandy seafloor areas within Study Area 4A. APTIM reviewed the historic data to target the areas with the highest volume of potential resources.

Study Area 4A lies partly within a historic sand mineral resource identified in the early 1970's (Samson, 1974). Historic data were plotted in ArcGIS then used to select the proposed vibracore



samples. For the most part, where historic data exist, the vast majority of Study Area 4A appears to have a sandy seafloor. While recent seismic sub-bottom data do not exist, the Samson, 1974, report indicates the presence of subsurface sands. APTIM proposed vibracore samples within the thickest apparent deposits shown in the Samson, 1974, isopach map in the north, central-north, and southwest portions of the Massachusetts OMP Sand Resource Area.

9.5 *Study Area 5: Cuttyhunk*

Five (5) vibracores were collected within Study Area 5, offshore of Cuttyhunk. Study Area 5 is divided into two (2) Study Areas: 5A to the south and 5B to the north. APTIM used historic backscatter, bathymetry, surface grab samples, and photography to further delineate the sandy bottom within both Study Areas (Figures 17 and 18) (Ackerman et al., 2012; Ackerman et al., 2015; Buczkowski and Kelsey, 2006; Doner, 2012; Foster et al., 2016). This area had full coverage of historic USGS seismic sub-bottom data, providing APTIM geologists with ample data to review and propose vibracore locations (Foster et al., 2016). APTIM reviewed and utilized the exported imagery of the seismic sub-bottom data for review and site selection.

Based on the acoustic representation of the seismic sub-bottom data, it appears that each Study Area has a discreet, subsurface sand deposit (Figures 19, 20, 21, 22, and 23). For Study Area 5A in the south, APTIM selected three (3) proposed vibracore locations to characterize the southern sand deposit. The northern 5A vibracore was located to target the thinner, lateral extents of the sand deposit, providing regional coverage of the deposit allowing for characterization of the lateral extents of the deposit. The southeast and southwest locations in Study Area 5A were meant to target the sand deposit at its thickest and prior to the end of the deposit when it drops off significantly to a deeper, rocky seafloor.

For Study Area 5B, APTIM selected two (2) vibracore locations to characterize the northern sand deposit. The northwest location targeted the thickest portion of the sand feature, while the northeast location targeted the lateral extent of the feature in an effort to characterize both the sand deposit and some of the material below the sand deposit, allowing for characterization of the bottom of the sand deposit and the underlying stratigraphy.

All vibracores were collocated with existing seismic sub-bottom lines at or near seismic sub-bottom line crossings, enabling for the easy tie-in of any resulting interpretation from the collected vibracore data.



10.0 Vibracore Survey Systems and Equipment

10.1 Vibracore Sampling Vessel

The *R/V Jamie Hanna*, a USCG inspected and certified vessel, based out of Hull, Massachusetts, was used for vibracore operations. The *R/V Jamie Hanna* is a 55 ft. (16.7 m) Wesmac hulled vessel, acquired with the sole purpose of geophysical, geotechnical and biological surveys. It comes equipped with two low emission diesel engines, two Pullmaster H8 5,000 lb. capacity winches, two 1000 lb. capacity oceanographic winches, a 1,000 lb. capacity stainless davit, and a 5,000 lb. capacity 15 ft. hydraulic a-frame. The *R/V Jamie Hanna* is also equipped with a full head and full galley for offshore operations.

A hydraulically operated a-frame, located on the vessel's stern, offered sufficient height to raise, lower, and retrieve the vibracore system. Furthermore, the hydraulic a-frame added a level of safety for crewmembers in the retrieval and deployment stages of the vibracore, preventing any unnecessary overhang. The ample deck space allowed the vibracore to be laid on the back deck, permitting the safe and secure retrieval of vibracore samples for stowing on the vessel during operations.

10.2 Navigation and Positioning

10.2.1 Hypack

Hypack 2017 is a state-of-the-art navigation and hydrographic surveying software system. The navigation system was interfaced with a differential global positioning system (DGPS) and an onboard navigation computer. The location of the DGPS antennae, the over-the-side mounted fathometer, and the A-frame sheave point were entered into the system to account for offsets, and all data were integrated in real time using the Hypack 2017 software. Online screen graphic displays included the pre-plotted vibracore locations, the updated boat track across the Study Area, adjustable left/right indicator, as well as other positioning information such as boat speed and bearing.

10.2.2 Trimble DGPS

The navigation and positioning system deployed for the vibracore survey consisted of a Trimble DGPS interfaced to Hypack, Inc.'s Hypack 2017. A Pro Beacon receiver provided the DGPS with corrections from the nearest USCG navigational beacon. The DGPS initially receives the civilian signal from the GPS NAVSTAR satellites. The locator automatically acquires and simultaneously tracks the NAVSTAR satellites, while receiving precisely measured code phase and Doppler phase shifts, which enables the receiver to compute the position and velocity of the vessel. The receiver then determines the time, latitude, longitude, height, and velocity once per second. GPS accuracy with differential correction provides for a position accuracy of 30 to 122 cm (1 to 4 ft).



10.3 Single Beam Fathometer

APTIM collected single-beam bathymetry data over each vibracore site. The Odom Hydrographic Systems, Inc.'s Hydrotrac, is a single frequency portable hydrographic echo sounder that was used to determine the top of core depth. The Hydrotrac operates at frequencies of 24, 33, 40, 200, 210, or 340 kilohertz (kHz) and is a digital, survey-grade sounder. A 210 kHz transducer was used for the bathymetric survey.

Upon completion of the fieldwork, data were edited and reduced with Hypack 2017. Tidal data from local predictions and regional tide gauges were reviewed and used to correct the raw water depths to vertical elevations. The offshore bathymetry data were finalized and reported as the top of vibracore elevation for each vibracore site on each vibracore log.

10.4 Vibracore System

APTIM utilized the SEAS VC-700 Vibracoring System, configured to collect undisturbed sediment vibracores up to 4 m (13.12 ft) in length. The VC-700 is a single vibracore electric vibracoring system operational to depths of 200 m (656 ft). This electric vibracore system allows for the successful collection of vibracores in relatively deep-water depths, in the case of this project approaching 35 m (114.83 ft).

The self-contained, free-standing electrically operated vibracore unit contains a VC-700 vibrator head (4.4 kilowatt) configured to 415 Vac or 220 Vac 3-phase power, allowing for a user to operate the vibracorer at fluctuating vibration frequencies to penetrate through otherwise unyielding strata. A 210 m long 4-core Hydrofirm sea cable provided power to the drive unit of the vibracore from the surface control system, located on vessel.

The vessel was anchored at all geologic sample locations to further the vessel's stability for vibracore operations.

11.0 Vibracore Operations

11.1 Vibracore Sampling Protocol

APTIM collected 20 vibracores within the Study Areas between September 17, 2017 and October 3, 2017. Vibracore sample locations were determined based on APTIM's desktop study targeting deposits with a generally thicker and higher potential for increased sand resources. Figures 24 to 28 provide as-built locations for the vibracores and surface grab samples collected in each of the Study Areas.



Vibracore operations were based out of Hull, Massachusetts, at the home dock of the *R/V Jamie Hanna*. The dock had facilities for secure equipment and vibracore storage, supporting equipment for vessel mobilization and demobilization, and was centrally located for Study Areas 2 (Nantasket Beach), 3 (Duxbury Bay), and 4 (Sandwich). For Study Area 1 (Merrimack River), APTIM transited to the site from Hull and conducted operations on site, returning at the end of the day. For Study Area 5 (Cuttyhunk), CR and Goodwin Marine Services had prepositioned the *R/V Jamie Hanna* in Sandwich, allowing APTIM to transit to the site from Sandwich, conduct operations on site, and return to Sandwich at the end of the day.

During vibracore operations, the vibracore recovered a minimum of 80% of the expected penetration through the unconsolidated strata through which it penetrated, except for two cores in Study Area 5 where only 59% and 68% recovery was achieved after three attempts at each site. To calculate the percent recovery, the total recovery length was divided by the measured depth of penetration (by use of markings and a slide ring on the vibracore barrel exterior).

The desired depth of penetration was four (4) meters (13.12 ft). However, that maximum penetration was not necessarily achieved at all sample locations. When located over a boring site, APTIM made every reasonable effort to reach the required depth or to reach penetration refusal. Penetration refusal was completed when less than 0.30 m (1 ft) of advance was accomplished after five (5) minutes of vibration (as measured by winch cable payout through the A-frame sheave). When refusal was met at less than 80% of the desired depth of penetration, APTIM removed the sampled portion and a new vibracore pipe was set up for a second attempt. Retries were accomplished until the desired penetration and recovery was accomplished, or until two (2) retries were attempted (for a total of three (3) attempts), whichever occurred first.

11.1.1 Vibracore Sampling Field Operations Timeline

Vibracore operations began on September 15, 2017 when APTIM staff arrived in Hull, Massachusetts and began to mobilize the *R/V Jaime Hanna* at Goodwin Marine Services. Mobilization was completed on September 16, 2017. Vibracore data collection began on September 17, 2017 at Study Area 2 Nantasket Beach where vibracores MA-CZM-2017-VC01 to MA-CZM-2017-VC04 were collected. Vibracores MA-CZM-2017-VC05 to MA-CZM-2017-VC09 were collected at Study Area 1 Merrimack River on September 18, 2017. Hurricane Jose made its way offshore of the Study Area and survey operations were put on hold waiting for weather conditions to stabilize from September 19, 2017 to September 22, 2017. Survey operations did not begin again until September 25, 2017 when vibracores MA-CZM-2017-VC10 and MA-CZM-2017-VC11 were collected at Study Area 5 Cuttyhunk. Mechanical issues (weldment failure) caused the SEAS VC-700 Vibracoring System to be out of service until repairs could be made, during this time near-future regularly scheduled maintenance on the *R/V Jamie Hanna* was



pushed up to take place during the same time the SEAS VC-700 Vibracoring System was down for repairs. Vibracoring operations were shut down from September 26, 2017 to October 1, 2017 allowing for the SEAS VC-700 Vibracoring System and *R/V Jamie Hanna* maintenance. Vibracores MA-CZM-2017-VC15 to MA-CZM-2017-VC17 were collected at Study Area 3 Duxbury Beach on October 2, 2017. Vibracores MA-CZM-2017-VC18 to MA-CZM-2017-VC20 were collected at Study Area 4 Sandwich on October 2, 2017. Vibracores MA-CZM-2017-VC12 to MA-CZM-2017-VC14 were collected at Study Area 5 Cuttyhunk on October 3, 2017. Demobilization of the *R/V Jamie Hanna* occurred from October 4th to October 5th, at which time all field personnel returned to their respective home offices and the vibracores were transported to APTIM's geotechnical lab in Boca Raton, Florida.

12.0 Data Processing and Interpretation Methods

In order to more accurately estimate potential volumes of sand within the Study Areas, APTIM processed the available historic seismic sub-bottom data and calculated composite geotechnical statistics (where able) and estimated sand resource volumes based by correlating the results of the geotechnical data analysis performed on the vibracores with historic seismic sub-bottom data. The following subsection describes in more detail the methods used by APTIM to process and interpret the geotechnical and historic seismic sub-bottom data.

12.1 Vibracore Sample Processing

Upon collection of the vibracores and removal of the vibracore tube, APTIM geologists sealed, measured, and marked each vibracore to prepare the vibracores for transport. The vibracores, along with the surface grab samples collected by CR, were transported to APTIM's accredited geotechnical laboratory in Boca Raton, Florida. Vibracores were split lengthwise and logged in detail by APTIM geologists, describing sedimentary properties by layer in terms of layer thickness, color, texture (grain size), composition and presence of clay, silt, gravel, or any other identifying features in accordance with ASTM standard procedure D 2488-09a. A flow chart of vibracore logging and sample analysis steps is included as Figure 29.

The vibracores were photographed in 2 ft (0.6 m) intervals using an Olympus Stylus TG-3 16 megapixel camera with a 4.5 mm to 18.0 mm, f2.0 to f4.9 lens (Equivalent to 25 mm to 100 mm on a 35 mm film) that was mounted on a frame directly above the vibracores. The photographs were taken using full spectrum overhead lighting and an 18% gray background, which provided a known reference color and is the standard reference value against which all camera light meters are calibrated.



Sediment samples were extracted from the vibracores at irregular intervals based on distinct stratigraphic layers and sediment quality (strata with apparent high silt/clay content were typically avoided) in the sediment sequence. For stratigraphic layers within each vibracore that occurred at different depths, but that were significantly similar, a sample was not collected or analyzed for the deeper unit(s). Instead, APTIM reported the results of the first sample for the first unit as the virtual results of the similar deeper unit(s). The vibracores were wrapped and boxed for proper storage within APTIM's temporary storage facility.

The vibracores will be stored by APTIM for one (1) year after the completion of the contract, after which time the vibracores will be discarded. If CZM would like to retain the vibracores, the vibracores will be made available to CZM for pickup, or APTIM will transport the vibracores to CZM for additional cost.

Sedimentary properties of the surface grab samples were also described. Each grab sample was split into two (2) representative sub-samples: one (1) sub-sample to conduct the laboratory analysis and the other sub-sample for archiving within APTIM's storage facility with the vibracore samples.

Much like with the vibracore sediment samples, for surface grab samples from the same Study Area that are significantly similar, a sample was not analyzed for all multiple similar samples. Instead, APTIM reported the grain size analysis results of one of the similar samples as a virtual sample for the other similar samples. This was only done in the case of specific samples being significantly similar to others within the same Study Area. If significant similarity is in doubt, the surface grab sample was analyzed in full to determine its own specific geotechnical qualities. This was done for surface grab sample MER7-G3B, which was noted as a virtual sample of surface grab sample MER10-G. It should also be noted that surface grab samples CANAL6-G5 and DUX6-G5 were not analyzed for grain size as they were predominantly clay.

The sediment samples extracted from the vibracores and the surface grab samples were prepared for processing in APTIM's geotechnical laboratory. This laboratory is accredited by the Construction Materials Engineering Council, Inc. (CMEC) for ASTM D422/T88 Sieve Analysis, D1140, D4648, and CPE-HAT-09 and is validated by USACE's Materials Testing Center for ASTM D422/T88, D1140, D3740, D4648, CPE-HAT-09, and E329. Geologic samples were analyzed to determine texture (grain size and sorting) and color. The testing methods are summarized below.

The sediment samples were analyzed to determine color and grain size distribution. During sieve analysis, the wet, dry, and washed Munsell colors were noted. Grain size was determined through sieve analysis in accordance with ASTM Standard Materials Designation D422-63 for particle size analysis of soils. This method covers the quantitative determination of the distribution of sand



particles. Sediment finer than the No. 230 sieve (4.0 phi) was analyzed following ASTM Standard Test Method, Designation D1140-00. Mechanical sieving was accomplished using calibrated sieves with a gradation of half phi intervals. Additional sieves representing key ASTM sediment classification boundaries were included to meet appropriate beach-compatible mineral characterization. Weights retained on each sieve were then recorded cumulatively. The sieve stack, together with its Wentworth equivalence, used for mechanical analysis is provided in Table 2. Grain size results were entered into the gINT® software program, which computes the mean and median grain size, sorting, and silt/clay percentages for each sample using the moment method.

Table 2: Granularmetric Analysis Mesh Sizes with associated Wentworth Size Class

Sieve Number	Size (phi)	Size (mm)	Wentworth Scale	
3/4	-4.25	19.00	Pebble	Gravel
5/8	-4.00	16.00		
7/16	-3.50	11.20		
5/16	-3.00	8.00		
3 1/2	-2.50	5.60		
4	-2.25	4.75		
5	-2.00	4.00		
7	-1.50	2.80	Granule	
10	-1.00	2.00		
14	-0.50	1.40	Very Coarse Sand	
18	0.00	1.00		
25	0.50	0.71	Coarse Sand	
35	1.00	0.50		
45	1.50	0.36	Medium Sand	Sand
60	2.00	0.25		
80	2.50	0.18	Fine Sand	
120	3.00	0.13		
170	3.50	0.09	Very Fine Sand	
200	3.75	0.08		
230	4.00	0.06		

Based on the grain size results of the surface grab samples and vibracores, and the results of the initial data review, APTIM conducted an evaluation of potential sand resources. This includes the identification of potential sand resource thickness, aerial extents, and estimated volumes.



12.2 Seismic Sub-Bottom Processing

Processing of the historic USGS seismic sub-bottom data was completed using Chesapeake Technology, Inc.'s SonarWiz 7 software. This software allows the user to apply specific gains and settings in order to produce enhanced seismic sub-bottom imagery that can then be interpreted and digitized for specific stratigraphic facies relevant to project goals. Figures 30 through 33 depict the location of all historic seismic sub-bottom data coverage, as well as the historic seismic sub-bottom data coverage used for the development of the sediment thickness calculations. As can be seen in some instances, not all available historic data were utilized due to the fact that some *.segy* files were corrupted and APTIM was unable to properly import them into SonarWiz, the data was not available, or the quality of the data did not permit a feature to be digitized.

Raw and/or processed *.segy* files were imported into SonarWiz 7 and the data bottom tracked and gained. The process of bottom tracking uses the high-amplitude signal associated with the seafloor to map it as the starting point for gains and swell corrections. Automatic gain control (AGC) was applied and manipulated when necessary to produce a better image (contrasts between low and high return signals). In addition Time-Varying Gain (TVG) was used to adjust the imagery below the seafloor to increase the contrast within the stratigraphy, and increase the amplitude of the stratigraphy with depth, accounting for some of the signal attenuation normally associated with sound penetration over time.

12.3 Geotechnical Data Interpretation

For proper integration into the seismic sub-bottom project in SonarWiz 7, individual layers in each vibracore were color-coded based on the amount (percent) of fine material (percent passing the #230 sieve). Samples with a fine-grain content less than or equal to 5% were color coded as green/good potential for sand while samples that were between 5% and 10% were classified as yellow/moderate potential for sand. Layers described as being clay were classified as red/poor potential for sand. Descriptive vibracore logs (Appendix A), granulometric reports (Appendices B and C), granulometric curves (Appendix D) and photographs of vibracores (Appendix E) were used to compile sediment characteristics and vibracore composite statistics in all of the Study Areas.

Composite mean grain size and percent silt content were computed for each vibracore within the Study Areas by calculating the weighted average (sample weighted by effective lengths of the sampled layer above the base of sand elevation). The final product of this calculation was a composite vibracore sample with weights for each phi interval. This composite vibracore sample was then input into gINT with any other composite vibracores (if available) where a final mean grain size and silt content was calculated for each study area (where able) based on the weighted average. Generally, the maximum base of sand elevation was determined to be the base of the last



layer classified as potentially beach-compatible (green), however, sometimes discrete yellow or red layers containing increased silt contents were also included in the composite statistics as long as the overall resulting deposit would still be classified as sandy and not silt or clay.

12.4 Seismic Sub-bottom Interpretation

After data processing, subsurface data interpretation was performed using SonarWiz 7 software. Bottom tracked seismic sub-bottom lines were opened to digitally display the recorded subsurface stratigraphy. Using the software's Sonar File Manager, color-coded vibrocore descriptions were added directly to the seismic sub-bottom profiles. As described earlier, a project specific color scheme, based on a stoplight (red, yellow, green) color scale, was developed for the CZM vibrocores based on the amount of fine grain content and general layer description.

Using the color-coded vibrocore descriptions as a guide, the seismic sub-bottom stratigraphy was interpreted and the depth of the top of marginal to poor quality material (also known as the base of beach-compatible “good” sand) was determined. The stratigraphic reflector that best correlated with this layer was digitized by clicking on the reflector within SonarWiz to create a digital color-coded boundary. This boundary appears on the subsequent seismic sub-bottom imagery to allow for an easy, visual reference for the boundary between potentially beach-compatible material and marginal to poor quality material.

At this point, the thickness of each potential sand resource was calculated and exported from SonarWiz to serve as the basis for the initial isopach (sediment thickness) maps for each of the four (4) Study Areas that had historic seismic sub-bottom data (note, Study Area 4 did not have any historic seismic sub-bottom data, and as a result, an isopach could not be created for Study Area 4). This was accomplished by using the “Thickness” tool within SonarWiz, which subtracts the elevation below the towfish of the digitized reflector representing the non-beach-compatible material (i.e., high silt, clay, or bedrock/hard bottom content) boundary (as interpreted from the historic seismic sub-bottom data) from the elevation below the towfish of the digitized seafloor reflector. This then creates a visual, digital feature of the thickness of the deposit (between the seafloor and the boundary of non-compatible material) on each individual seismic sub-bottom line. From here, a file is exported from SonarWiz for all lines containing the thickness file, creating one single X/Y/Thickness ASCII file for the geologic deposit. This X/Y/Thickness ASCII file is then gridded into a surface to develop the isopach map (see section 12.5 below for more information on isopach creation).

12.5 Isopach Creation

The ASCII X/Y/Thickness file from SonarWiz was imported into Golden Software Inc.'s Surfer software program (software version 13), gridded, and reviewed for quality and accuracy (i.e.,



obvious visual inconsistencies, inaccuracies, and/or anomalies in the resulting gridded surface, like isolated holes, valleys, or obvious interpretation mismatches between survey lines). Output cell sizes (X, Y) ranged from 9.75 m to 39.96 m (Table 3) and were auto calculated by the software program depending on the size of the study area, seismic sub-bottom coverage of the study areas, and the resulting interpreted-data density of the available seismic sub-bottom data points in each study area. Upon review, if the resulting gridded thickness surface displayed discrepancies or clear artifacts (such as mismatched interpreted thicknesses at line crossings due to interpreting and digitizing different features on adjacent lines), the historic seismic sub-bottom data was reviewed and adjustments to the interpreted boundary location were made to the seismic sub-bottom digitization to fix these inconsistencies, ensuring that all interpreted and digitized features tied together in each study area. Once adjusted in SonarWiz, the X/Y/Thickness file was re-exported (as detailed in section 12.4) and re-gridded in Surfer to review the resulting isopach surface. This process was repeated until all visual inconsistencies and tie issues in the seismic sub-bottom data were corrected. After this quality assurance/quality control step, a final ASCII X/Y/Thickness file was exported for each area and gridded into a raster isopach surface within ArcGIS.

Table 3: Topo to Raster Grid Information

Field	Value
Feature Layer	Point file
Field	Thickness field
Type	Point Elevation
Cell Output Size (Auto-populates)	SA1: 34.45 X, 34.47 Y SA2: 9.75 X, 9.75 Y SA3: 32.74 X, 32.74 Y SA5: 39.85 X, 39.96 Y
Output extent	Default
Margin in cells	20 (default)
Smallest Z value to be used in interpolation	Blank
Largest Z value to be used in interpolation	Blank
Drainage enforcement	Enforce
Primary type of input data	Spot
Maximum number of iterations	20 (default)
Roughness penalty	Blank
Profile curvature roughness penalty	Blank
Discretization error factor	1 (default)
Vertical standard error	0 (default)
Tolerance 1	0 (default)
Tolerance 2	200 (default)

To accomplish this, the X/Y/Thickness file was imported into ArcGIS and a topographic surface was created using the Spatial Analyst Topo to Raster tool. APTIM chose to use this tool due to the widely spaced, limited nature of the data coverage, together with the relative straightforwardness and limited input and processing variables of this tool. In addition, as described in ArcGIS, this tool has the ability to follow abrupt changes in terrain likely due to stream channels, ridges, and other geomorphic features, which are likely the most prevalent geomorphologic controls related to



the interpretation of the boundaries/features digitized in these datasets. This Topo to Raster tool uses an iterative finite difference interpolation technique. As described by ArcGIS, this grid development tool is “optimized to have the computational efficiency of local interpolation methods, such as inverse distance weighted (IDW) interpolation, without losing the surface continuity of global interpolation methods, such as Kriging and Spline. It is essentially a discretized thin plate spline technique (Wahba, 1990) for which the roughness penalty has been modified to allow the fitted DEM [Digital Elevation Model] to follow abrupt changes in terrain, such as streams, ridges and cliffs” (ArcGIS, 2012). Surfaces were generated by selecting the parameters outlined in Table 3.

The generated surface provided a visual and digital representation of the thickness (in meters) of the potential sand resource. The isopach surface was then clipped to the digitized Interpreted Sandy Seafloor delineation in order to avoid areas of exposed hard bottom and focus on the sandy seafloor areas evident as part of the historic data review described in Section 9.0. A volume of the resulting clipped isopach surface was then calculated by using the Surface Volume tool in ArcGIS. This tool utilizes the difference between two (2) surfaces to determine a potential volume in cubic meters (m³) of the sand deposit. For this particular project, the volume was determined by comparing the clipped, computed isopach surface to a zero thickness plane, generating a total potential volume of the sandy seafloor area.

It is important to note that the accuracy of the isopach and volume results is a function of the overall data density in each study area. While none of the study areas had data coverage consistent with borrow area design-level densities, all had sufficient coverage to make reconnaissance-level calculations on rough magnitude of potential volumes and locations of sand resources. In some cases, some areas (Study Areas 1 and 5, for instance) had more data coverage and data density than others (Study Area 2), and as a result have a higher accuracy of reconnaissance-level results. That said, all isopach and volume data are based on reconnaissance-level coverage and would require additional, design-level information to confirm and refine specific sand resource statistics.

13.0 Vibracore Results

The following sections describe the vibracore results, geotechnical composite statistics (where able), and resulting Study Area volumetric estimates.

Where historic seismic sub-bottom data existed (Study Areas 1, 2A, 3A, 3B, 5A, and 5B), the newly-collected vibracore data were correlated to the historic seismic sub-bottom data to develop an isopach as described earlier. The results below show the range of the average thickness of these isopach, ± one standard deviation. The volumes shown are the actual calculated estimated volumes



of the isopach in m³ rounded to the nearest 10,000 m³. The rounded m³ volume value was then converted to cy and rounded to the nearest 100 cy.

Where historic seismic sub-bottom data did not exist (Study Areas 2C and 4A), the average thickness of the sandy deposit (as logged from the newly collected vibracores) was multiplied by the area of the Interpreted Sandy Seafloor area to develop the potential volume of the sand deposit. In this case, the average thickness is not shown as a range, but shown as a discrete value representing the average thickness of that sand deposit as logged in the newly collected vibracores within that specific Study Area. The volumes shown are the actual calculated estimated volumes in m³ rounded to the nearest 10,000 m³. The rounded m³ volume value was then converted to cy and rounded to the nearest 100 cy.

In areas where historic seismic sub-bottom data did not exist, where there was insufficient sandy seafloor to develop a potential borrow area, and/or there was a sediment disposal area with dredge records available to support additional characterization (Study Areas 2B and 4B), no new data was collected for this investigation, and as a result, no Interpreted Sandy Seafloor area or estimated volumes were calculated. The following Table 4 summarizes the as collected information of the vibracore field operations.

Table 4: Results of vibracore field operations

Vibracore	Number of Attempts	Penetration (ft)	Recovery (ft)	Recovery %	Study Area
MA-CZM-2017-VC01	1	12.0	12.0	100	2
MA-CZM-2017-VC02	1	12.0	9.8	82	2
MA-CZM-2017-VC03	1	12.3	12.3	100	2
MA-CZM-2017-VC04	2	12.3	11.8	96	2
MA-CZM-2017-VC05	3	8.7	8.7	100	1
MA-CZM-2017-VC06	3	12.3	12.2	99	1
MA-CZM-2017-VC07	3	11.5	10.8	94	1
MA-CZM-2017-VC08	1	12.3	12.3	100	1
MA-CZM-2017-VC09	1	12.3	12.0	98	1
MA-CZM-2017-VC10	3	11.5	6.8	59	5
MA-CZM-2017-VC11	2	9.9	9.9	100	5
MA-CZM-2017-VC12	3	12.3	8.4	68	5
MA-CZM-2017-VC13	1	12.3	11.5	93	5
MA-CZM-2017-VC14	2	10.5	10.5	100	5
MA-CZM-2017-VC15	3	11.0	10.7	97	3
MA-CZM-2017-VC16	1	12.2	11.2	92	3
MA-CZM-2017-VC17	1	11.0	11.0	100	3
MA-CZM-2017-VC18	1	11.0	10.0	91	4
MA-CZM-2017-VC19	1	12.3	11.5	93	4
MA-CZM-2017-VC20	1	12.3	10.8	88	4



Additionally, the description and geotechnical information for the top layer of each vibracore was analyzed and described according to CZM’s modified Barnhardt sediment classification scheme (Table 5).

Table 5: Top of vibracore Barnhardt sediment classification

Vibracore	Study Area	Easting	Northing	CZM Barnhardt sediment classification
MA-CZM-2017-VC01	2A	257169.10	895589.73	Fine with Gravel
MA-CZM-2017-VC02	2C	257831.68	899232.26	Fine
MA-CZM-2017-VC03	2C	259735.01	897546.71	Fine
MA-CZM-2017-VC04	2C	262857.57	897529.60	Fine with Gravel
MA-CZM-2017-VC05	1	262481.69	948256.51	Fine with Rock
MA-CZM-2017-VC06	1	259678.20	948189.85	Fine with Rock
MA-CZM-2017-VC07	1	259788.11	951977.41	Fine with Rock
MA-CZM-2017-VC08	1	261676.60	953809.18	Fine with Rock
MA-CZM-2017-VC09	1	259585.07	955109.78	Fine with Rock
MA-CZM-2017-VC10	5A	239899.46	793490.73	Fine with Rock
MA-CZM-2017-VC11	5A	241178.01	796123.47	Fine with Rock
MA-CZM-2017-VC12	5A	237838.67	798152.26	Fine with Rock
MA-CZM-2017-VC13	5B	234032.12	802507.65	Fine with Rock
MA-CZM-2017-VC14	5B	232757.46	801103.10	Fine with Gravel
MA-CZM-2017-VC15	3A	277516.22	870903.09	Fine with Rock
MA-CZM-2017-VC16	3B	276445.66	866962.22	Fine with Rock
MA-CZM-2017-VC17	3B	275720.97	865047.61	Fine with Rock
MA-CZM-2017-VC18	4A	283241.53	843846.94	Fine with Rock
MA-CZM-2017-VC19	4A	285623.80	840878.07	Fine with Rock
MA-CZM-2017-VC20	4A	284592.15	838399.08	Fine with Rock

Table 6 below provides sand thicknesses and resulting vibracore composite statistics. It should be noted that the identified final composite values are only an estimate based on a few, widely-spaced geologic samples, and that additional vibracores and design-level geophysical data should be collected during an offshore design-level investigation in order to more confidently determine the beach-compatibility, volumes, hazards, protected resources, and dredgeability of potential preliminary borrow areas.

13.1 Study Area 1 Merrimack River

Seismic sub-bottom interpretation of Study Area 1 offshore of Merrimack River yielded one of the largest potential sand volumes (Figure 34). The area was covered by 570 line kilometers (km) of historic seismic sub-bottom data and five (5) vibracores. MA-CZM-2017-VC05 and MA-CZM-2017-VC06 characterized the subsurface as sand, with a silt content not exceeding 3%. MA-CZM-2017-VC07 characterized the topmost 2.3 m (7.5 ft) of the subsurface as sand, with a thin layer of sand with a high silt/clay content (almost 30%) which was excluded from the composite statistics



for the vibrocore and the Study Area and represents the base of the sand resource. MA-CZM-2017-VC08 indicated that the topmost 3.2 m (10.5 ft) of the vibrocore were sands, with the lower 0.5 m (1.7 ft) of the vibrocore as clay with silty sands. This lower layer was excluded from the composite statistics. MA-CZM-2017-VC-09 characterized the upper part of the subsurface stratigraphy as sand, with the lower 1.0 m (3.2 ft) of the vibrocore as sand with a silt content of 7.41%. Even though this deeper layer contained slightly increased silt content, it was included in the composite statistics of the vibrocore and of the Study Area as the overall composite (including this increased silt layer) still resulted in general geotechnical statistics considered to be beach-compatible. Table 7 below provides a breakdown of the composite statistics for the Merrimack River Study Area.

Table 6: Vibrocore sand thicknesses and composite statistics

Vibrocore	Study Area	Top of Core (ft)	Bottom of Sand (ft)	Sand Thickness (ft)	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC01	2A	-76.1	-86.0	9.9	0.1	0.62	11.8
MA-CZM-2017-VC02	2C	-122.0	n/a	n/a	n/a	n/a	n/a
MA-CZM-2017-VC03	2C	-120.4	n/a	n/a	n/a	n/a	n/a
MA-CZM-2017-VC04	2C	-123.7	-132.4	8.7	0.1	0.66	12.3
MA-CZM-2017-VC05	1	-104	-112.7	8.7	0.4	0.41	1.3
MA-CZM-2017-VC06	1	-79.7	-91.9	12.2	0.1	0.55	3.3
MA-CZM-2017-VC07	1	-86	-93.6	7.6	0.3	0.54	1.9
MA-CZM-2017-VC08	1	-107.6	-118.2	10.6	0.5	0.47	1.0
MA-CZM-2017-VC09	1	-92.5	-104.5	12.0	0.3	0.34	4.3
MA-CZM-2017-VC10	5A	-71.9	-78.7	6.8	0.2	0.65	2.1
MA-CZM-2017-VC11	5A	-66.6	-76.5	9.9	0.3	0.50	7.0
MA-CZM-2017-VC12	5A	-58.4	-66.8	8.4	0.1	0.66	3.9
MA-CZM-2017-VC13	5B	-56.8	-62.6	5.8	0.2	0.46	6.8
MA-CZM-2017-VC14	5B	-62.3	-65.6	3.3	0.17	0.53	6.0
MA-CZM-2017-VC15	3A	-80.1	-90.8	10.7	0.2	0.60	1.7
MA-CZM-2017-VC16	3B	-78.4	-89.6	11.2	0.2	0.49	10.6
MA-CZM-2017-VC17	3B	-71.5	-82.5	11.0	0.1	0.46	16.4
MA-CZM-2017-VC18	4A	-43.3	-53.3	10.0	0.3	0.61	1.1
MA-CZM-2017-VC19	4A	-56.8	-67.3	10.5	0.2	0.58	4.6
MA-CZM-2017-VC20	4A	-55.1	-65.9	10.8	0.2	0.46	2.3

The area appears to have a generally thick sand deposit to the north and south of the area, with some rock outcrops and/or thin sand layers in the central and western areas. The hard bottom outcrops can be seen both on the interpreted seismic sub-bottom data (Figure 35 shown in brown) as well as the historic sidescan sonar and seafloor photographs. Due to the drastic change in bottom type in the area, the isopach surface was clipped to the interpreted sandy area shapefile to isolate the portions of the Study Area that have hard bottom/rock outcrops (Figure 34). The final potential



volume of 99,730,000 m³ (130,442,000 cy) is estimated based off the interpreted seismic sub-bottom data with the plotted vibracores (Table 8).

As can be seen by comparing the Massachusetts OMP Sand Resource Area and the Interpreted Sandy Area derived from the sidescan sonar and seafloor photographs, only approximately 68% of the area could potentially be developed into a future borrow area. Additional geophysical and geotechnical data will be necessary to fully characterize and further delineate the sand resource offshore of the Merrimack River, however, from the available data it does appear to be a significant sand source with likely beach-compatible sand resources in substantial project quantities.

Table 7: Composite statistics for Study Area 1

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt %	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC05	1	0.36	0.41	1.3			
MA-CZM-2017-VC06	1	0.15	0.55	3.3			
MA-CZM-2017-VC07	1	0.33	0.54	1.9	0.30	0.40	2.5
MA-CZM-2017-VC08	1	0.52	0.47	1.0			
MA-CZM-2017-VC09	1	0.31	0.34	4.3			

Table 8: Estimated volumes for Study Area 1

Study Area	Vibracores	MA OMP Sand Res. Area (m ²)	Interp. Sandy Area (m ²)	Approximate Sand Thickness Range (m)	Volume (m ³)	Volume (cy)
1	MA-CZM-2017-VC05					
	MA-CZM-2017-VC06					
	MA-CZM-2017-VC07	52,282,963	35,665,334	1.76 to 3.84	99,730,000	130,442,000
	MA-CZM-2017-VC08					
	MA-CZM-2017-VC09					

13.2 Study Area 2 Nantasket Beach

Study Area 2 offshore of Nantasket Beach yielded the smallest potential sand volumes. The area was sub-divided into Study Area 2A to the west, Study Area 2C as the largest centralized portion, and Study Area 2B to the south (Figure 36). Only Study Area 2A had any historic seismic sub-bottom data (a total of 61 line km of data). Study Area 2 was sampled by four (4) cores, of which only two (2) characterized the subsurface as having potential sand. Based on vibracore MA-CZM-2017-VC01, the subsurface is best characterized as sand with higher silt content (9%), with an increase in the silt content at an elevation of -86.0 ft below the seafloor. This layer, with almost 20% sand was not included as part of the vibracore composite. Upon review of the available seismic sub-bottom data, this sand layer is associated with a buried channel complex. MA-CZM-2017-VC02 and MA-CZM-2017-VC03 indicate that the subsurface geology is generally clay, with some sand around MA-CZM-VC03. Since the visual inspections of MA-CZM-2017-VC02 and



MA-CZM-2017-VC03 indicate that they are predominantly clay, and therefore not beach-compatible, no sediment samples were analyzed for grain size content, therefore there are no composite statistics for these two (2) cores. MA-CZM-2017-VC04 characterizes the subsurface as mostly sand with up to 14% silt content, with the lower 0.9 m (3.0 ft) of the vibracore consisting of mostly sandy clays. Table 9 below provides the composite information for the collected vibracores.

As previously mentioned, interpretation of the seismic sub-bottom data in Study Area 2A indicated that the estimated 3,600,000 m³ (4,708,600 cy) of potential sand is associated with the infill of a channel (Figure 37). This sand infill is present across the entire 2A area (Figure 37) and could be a potential source of sand for future shore protection projects, however, sediment deposits are normally not well organized within channels, complicating the development of a borrow area. Study Area 2C was narrowed down to a small 1,348,929 m² area around MA-CZM-2007-VC04 (approximately 12% of the central portion of Study Area 2) based off the historical sidescan sonar data. This area could have a potential sand volume of 3,600,000 m³ (4,708,600 cy) based on the sand thickness (Table 6) and the Interpreted Sandy Area (Table 10). Since no seismic sub-bottom data were available to corroborate the information provided by the vibracores, fence diagrams were made correlating vibracores MA-CZM-2017-VC02, MA-CZM-2017-VC03 and MA-CZM-2017-VC04 (Figure 38). The fence diagrams indicate that the majority of Study Area 2C is clay, with some mixed fine sands and clayey sands being introduced toward the southwest within Study Area 2C. While there is some indication of mixed sands in MA-CZM-2017-VC04, these sands contain high percentages of fine material (between 7% and 14% of material passing through the 230 sieve) and would need to be evaluated in the context of a potential recipient beach to fully determine beach compatibility and environmental impacts.

Table 9: Composite statistics for Study Area 2

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt %	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC01	2A	0.11	0.62	11.75	n/a	n/a	n/a
MA-CZM-2017-VC02	2C	n/a	n/a	n/a	n/a	n/a	n/a
MA-CZM-2017-VC03	2C	n/a	n/a	n/a	n/a	n/a	n/a
MA-CZM-2017-VC04	2C	0.11	0.66	12.28	n/a	n/a	n/a

Table 10: Estimated volumes for Study Area 2

Study Area	Vibracores	MA OMP Sand Res. Area (m ²)	Interp. Sandy Area (m ²)	Approximate Sand Thickness Range (m)	Volume (m ³)	Volume (cy)
2A	MA-CZM-2017-VC01	1,739,373	1,070,310	2.54 to 4.18	3,600,000	4,708,600
2B	n/a	1,039,425	n/a	n/a	n/a	n/a
2C	MA-CZM-2017-VC04	11,056,961	1,348,929	2.67	3,600,000	4,708,600



Additional data are required for the entire Study Area 2, more specifically within Study Area 2C in order to properly determine the nature of the sand deposit around MA-CZM-2017-VC04. Moreover, due to the lack of available vibrocores, and a poor indication of potential sand resources, no samples were taken in Study Area 2B, limiting the potential borrow area to a small portion of areas 2C and 2A. While data coverage, and actual sand resources, appear to be limited, there is sufficient likely beach-compatible sand resources present in shore protection project quantities for small to moderate sized shore protection projects within Study Area 2. Additional seismic sub-bottom and vibrocore data coverage, however, could potentially identify larger quantities within the Study Area.

13.3 Study Area 3 Duxbury Beach

Study Area 3 offshore of Duxbury Beach was sampled by three (3) vibrocores and approximately 560 line km of historic seismic sub-bottom data covering mostly Study Area 3B and the small southern portion of Study Area 3A. MA-CZM-2017-VC15, located in Study Area 3A, characterizes the subsurface geology as sand, likely associated with a shoal feature with less than 2% of silt content. MA-CZM-2017-VC16 and MA-CZM-2017-VC17 are located in Study Area 3B. MA-CZM-2017-VC16 characterizes the subsurface geology as a 1.3 m (4.3 ft) thick sand layer with little silt content, followed by a 2.1 m (6.1 ft) layer of sand with 15% silt content. This silty layer was included in the composite statistics for the vibrocore and the 3B area. MA-CZM-2017-VC17, much like MA-CZM-2017-VC16, indicates that the subsurface geology consists of a 1 m (3.3 ft) layer of sand followed by a thicker layer of sand with higher silt content, which was also included as part of the composite statistics for the area (Table 11). Including these marginal units allowed for the maximum understanding of the potential sand resource deposit pending additional geophysical and geotechnical data collection and further characterization of the potential resource.

Table 11: Composite statistics for Study Area 3

Vibrocore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt %	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC15	3A	0.17	0.60	1.69	n/a	n/a	n/a
MA-CZM-2017-VC16	3B	0.16	0.49	10.59	0.15	0.47	13.46
MA-CZM-2017-VC17	3B	0.14	0.46	16.43			

Interpretation of the available historic seismic sub-bottom data indicated that the sand available in both areas 3A and 3B is likely associated with a shoal deposit that crosses the entire Study Area 3 (Figure 39). The isopach in Study Area 3B was clipped to the Interpreted Sandy Area polygon in order to avoid areas that appear to have a hard bottom/rock outcrop (Figure 40). The total volume within Study Area 3B of 46,000,000 m³ (60,165,700 cy) of sand is generally located in the central portion of the Study Area, where the shoal feature appears to be more prominent (Table 12). Interpretations of the historic sidescan sonar data in Study Area 3A indicate that the surface is likely mostly sand, therefore, in order to determine the potential volume of sand, the sand thickness



(Table 6) was used as a general representation of the entire Massachusetts OMP Sand Resource Area 3A, yielding a potential volume of 46,940,000 m³ (61,395,200 cy) of sand. It is important to note however, that this is an estimated volume, assuming the subsurface stratigraphy of Study Area 3A is mostly uniform in nature (i.e. assuming that the three shoal features visible in Figure 40 are consistent throughout the area to the north where geophysical data is lacking).

From the available historic data and collected vibracores, Study Area 3 appears to be a viable source of likely beach compatible sand, with some silt content, in shore protection project quantities. However, additional geotechnical and geophysical data are necessary to further delineate the potential sand resource and better understand the subsurface geology in both areas, especially in Study Area 3A.

Table 12: Estimated volumes for Study Area 3

Study Area	Vibracores	MA OMP Sand Res. Area (m ²)	Interp. Sandy Area (m ²)	Approximate Sand Thickness Range (m)	Volume (m ³)	Volume (cy)
3A	MA-CZM-2017-VC15	14,398,272	n/a	0.84 to 5.68	46,940,000	61,395,200
3B	MA-CZM-2017-VC16	25,371,615	17,497,037	0.71 to 4.55	46,000,000	60,165,700
	MA-CZM-2017-VC17					

13.4 Study Area 4 Sandwich

Study Area 4 offshore of Sandwich was divided into 2 sub-areas: Study Area 4A being the larger nearshore area and 4B being the delineation of the Offshore Dredge Material Disposal Site (ODMDS). Study Area 4A was sampled by three (3) vibracores and did not have any historic seismic sub-bottom data. The three (3) collected vibracores (MA-CZM-2017-VC18, MA-CZM-2017-VC19 and MA-CZM-2017-VC20) characterize the subsurface as a thick (up to 3.2 m (10.5 ft)) layer of sand, with MA-CZM-2017-VC19 indicating that the sand layer is overlaying a clayey sand unit. Due to the lack of historic data in Study Area 4, all collected vibracores were used to estimate the potential sand composite (Table 13).

Table 13: Composite statistics for Study Area 4

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt %	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC18	4A	0.31	0.61	1.10	0.23	0.52	2.68
MA-CZM-2017-VC19	4A	0.21	0.58	4.57			
MA-CZM-2017-VC20	4A	0.18	0.46	2.31			

Since Study Area 4A was lacking historic seismic sub-bottom data, preventing the development of a detailed isopach map, the volume estimates for Study Area 4A were calculated by determining the average sand thickness of the deposit from the base of sand elevation between the three (3) vibracores and multiplying it by the area of the entire Massachusetts OMP Sand Resource Area for Study Area 4A. The potential volume in Study Area 4A is estimated to be 51,670,000 m³



(67,581,800 cy) of sand (Table 14). Given the fact that no seismic sub-bottom data were available for this area, it is impossible to know the exact nature and full extent of the deposit, and impossible to develop a detailed isopach for this area. As such, there is no isopach figure for Study Area 4 presented in this report. Since no seismic sub-bottom data were available to corroborate the information provided by the vibracores, fence diagrams were made correlating vibracores MA-CZM-2017-VC18, MA-CZM-2017-VC19 and MA-CZM-2017-VC20 (Figure 41). The fence diagram illustrates the general uniform nature of the surficial sand deposit across all of Study Area 4A, with the sand averaging approximately 3.38 m (11.09 ft) thick. In addition, based on MA-CZM-2017-VC19, the diagram shows the potential for clay deposits at deeper elevations immediately beneath the surficial sand deposit.

Table 14: Estimated volumes for Study Area 4

Study Area	Vibracores	MA OMP Sand Res. Area (m ²)	Interp. Sandy Area (m ²)	Approx. Average Sand Thickness (m)	Volume (m ³)	Volume (cy)
4A	MA-CZM-2017-VC18	15,286,265	n/a	3.38	51,670,000	67,581,800
	MA-CZM-2017-VC19					
	MA-CZM-2017-VC20					
4B	n/a	2,026,170	n/a	n/a	n/a	n/a

Additional information is needed in Study Area 4 in order to better delineate and understand the nature of the sand deposit, however based on the collected vibracores it is likely that Study Area 4 could be a potential sand source with beach compatible sand in project quantities.

13.5 Study Area 5 Cuttyhunk

Study Area 5, located offshore of Cuttyhunk in Buzzards Bay, was divided into two (2) sub-areas, with area Study Area 5A located further offshore and Study Area 5B located nearshore. There were five (5) vibracores collected in Study Area 5 and approximately 350 line km of historic seismic sub-bottom data. Vibracore MA-CZM-2017-VC10, MA-CZM-2017-VC11 and MA-CZM-2017-VC12 were collected in Study Area 5A (further from shore). MA-CZM-2017-VC10 had a short recovery (6.8 ft), however, it characterizes the top 2 m (6.6 ft) as sand deposits. MA-CZM-2017-VC11 and MA-CZM-2017-VC12 penetrated approximately 3 m (9.8 ft) and also characterizes the subsurface geology as sand. MA-CZM-2017-VC13 and MA-CZM-2017-VC14 located in Study Area 5B (closer to shore) had deeper penetration, however, they indicate that only the topmost layers are thin sand. According to MA-CZM-2017-VC13, the layers below 1.7 m (5.6 ft) are predominantly clay, while MA-CZM-2017-VC14 is mostly clay below 1 m (3.3 ft) from the surface (Table 15). In both areas, the composite statistics only utilized the layers which were describes as being mostly sand, which yielded a thicker sand layer in Study Area 5A and a thin sand deposit in Study Area 5B (Table 16).



Analysis of the available historic seismic sub-bottom data indicate that the sand in Study Area 5 is likely associated with a seven (7) to 10 m thick shoal deposit that thins out closer to shore (Figure 42). The isopach in Study Areas 5A and 5B was clipped to the Interpreted Sandy Area polygon in order to avoid areas that appear to have a hard bottom/rock outcrop. A total of 61,930,000 m³ (81,001,400 cy) of potential sand are located across Study Area 5, with 54,470,000 m³ (71,244,100 cy) in Study Area 5A and 7,460,000 m³ (9,757,300 cy) in Study Area 5B (Table 16, Figure 43).

Table 15: Composite statistics for Study Area 5

Vibracore	Study Area	Mean Grain Size (mm)	Sorting (mm)	Silt %	Composite Grain Size (mm)	Composite Sorting (mm)	Composite Silt %
MA-CZM-2017-VC10	5A	0.15	0.65	2.14	0.19	0.52	4.66
MA-CZM-2017-VC11		0.29	0.50	7.04			
MA-CZM-2017-VC12		0.14	0.66	3.91			
MA-CZM-2017-VC13	5B	0.18	0.46	6.78	0.17	0.49	6.49
MA-CZM-2017-VC14		0.17	0.53	6.00			

Table 16: Estimated volumes for Study Area 5

Study Area	Vibracores	MA OMP Sand Res. Area (m ²)	Interp. Sandy Area (m ²)	Approximate Sand Thickness Range (m)	Volume (m ³)	Volume (cy)
5A	MA-CZM-2017-VC10	18,201,875	12,180,335	1.61 to 7.33	54,470,000	71,244,100
	MA-CZM-2017-VC11					
	MA-CZM-2017-VC12					
5B	MA-CZM-2017-VC13	12,462,666	5,338,989	0.76 to 2.04	7,460,000	9,757,300
	MA-CZM-2017-VC14					

From the available historic data and newly collected vibracores, Study Area 5 appears to be a viable source of potential sand, with significant volumes of likely beach-compatible sand, however, additional information is needed in order to better delineate the shoal feature and characterize the sediment.

14.0 Surface Grab and Towed Video Systems and Equipment

14.1 Vessels

Vessel support for the underwater video operations and sediment grab sampling was provided by CR's 26-foot *R/V Lophius*, and the 25-foot *R/V Charlotte Anne* based in Falmouth, MA, and the 40-foot lobster boat, *Cynthia Lee* based in New Bedford. These vessels were all equipped with lifting davits and lobster pot haulers to deploy the underwater video sled and Ted Young modified Van Veen grab sampler. They also have 12 volt and 110 power supplies, benches for sample logging, and precision navigation and depth sounding equipment. For these sediment grab



sampling efforts, CR provided a three man crew: a USCG licensed boat captain, a field biologist, and an oceanographic technician.

14.2 Navigation

Navigation for the survey and sampling events was accomplished using a Hemisphere sub-meter GPS and digital compass system capable of receiving the USCG Beacon corrections and providing vessel heading. A shipboard computer running HYPACK® hydrographic surveying software was used to provide a steering display for the vessel's captain. The use of georeferenced imagery (e.g., orthophotos) as background files ensured that the correct sampling stations and video transects were occupied. The GPS antenna was mounted at the stern of the vessel, and cable out was carefully monitored during survey operations to apply an accurate layback or offset to the video sled position.

14.3 Underwater Video Sled

At the Study Areas, 10 500 to 1,000 meter long video transects were selected for underwater video sled survey coverage.

Underwater video data were collected with CR's portable towed video sled consisting of a lightweight aluminum frame, Outland Technologies' (OTI) high-resolution low light color camera, and two UWL-401 LED lights with variable output control. The video camera was cabled to the surface to an OTI-960 DVR recorder and topside monitor. The video sled is also equipped with a High Definition GoPro Hero 4+ Black video camera in a Nimar deep water housing mounted below the OTI camera and programmed to record HD video at 1080P (resolution), 30 frames per second, and take 12 megapixel still frames every 5-10 seconds. The GoPro camera was time synced to the OTI camera and the navigation computer at regular intervals during battery changes. Prior to launching the video sled, both cameras were set in record mode and the time, date, and video transect ID was recorded from a labelled board. When the video sled came in contact with bottom, the HYPACK navigation file was started.

14.4 Surface Grab Sampler

At each of the Study Areas, five (5) surface grab samples were collected for sediment grain size. The surface grab samples were collected at five (5) of the 10 video transects and located away from the planned APTIM vibrocore locations. Sediment grain size samples were collected with a Ted Young modified Van Veen sediment sampler. Samples were inspected through the upper doors of the grab sampler, and samples with good recovery collected in buckets, transferred to one gallon zip lock bags, labeled, and stored on ice. Grain size samples were temporarily stored at CR's Falmouth, MA headquarters and then transported for analysis to APTIM's geotechnical laboratory in Boca Raton, Florida.



15.0 Surface Grab and Towed Video Operations

The video sled surveys and grab sampling operations at the Study Areas along the Massachusetts coast were performed from August-November 2017 (Table 17).

Table 17: Dates of CR's survey operations per Study Area

Study Area	Survey Dates
4	August 2 to 3, 2017
2	August 16 to 17, 2017
1	September 12 to 13, 2017
3	November 3 and 6, 2017
5	November 8 to 9, 2017

At the completion of each survey, navigation and underwater video data were backed up on a portable hard drive. The navigation data were edited for outlying positions and adjusted for the amount of cable out to provide underwater video sled positions at five (5) second intervals.

The 10 video transect tracklines at each of the five (5) Study Areas are shown on Figures 44 to 48. The start of each color-coded trackline is labeled (e.g., S2). In a few cases, the tracklines were broken into two (2) segments if the sled became entangled in lobster gear or if the vessel was near the edge of the shapefile boundary. These second segments were identified with an "A".

The first site to be surveyed was Study Area 4, offshore of Sandwich, in early August. The proposed survey plan was to run ten (10) 1,000 meter transects at each of the Study Areas. After snagging multiple lobster pots, and having to tow the sled at 1.5-2 knots to obtain the required survey coverage, CR made the decision that the video transect lengths would have to be shortened on future surveys to obtain high quality underwater video footage. CR discussed this situation with CZM (Todd Callaghan), and he concurred that the video transects should be shortened to improve the quality, especially in areas of homogeneous bottoms. Therefore, on subsequent surveys, CR performed video drifts at 0.5 -1 knot and data quality was greatly improved. Transect lengths were shortened to 750 meters at Study Areas 1 and 2 and 500 meters at Study Areas 3 and 5. Although video data at Study Area 4 was adequate to identify major substrate types and biota, it was of average quality for screen captures and video analysis. CR is willing to return to Study Area 4 during the fixed gear closure (February-April) to obtain better quality video data in slow drift mode.

15.1 Towed Video Survey Operations

During field operations the video sled was raised and lowered with the ship's pot hauler and the height of the system off the bottom was continually adjusted to achieve the best bottom coverage



and video quality. The video system operated in “drift and tow mode” and the vessel speed varied between 0.5 and 2 knots based on sea conditions and bottom currents. Mounted lasers set at 25 cm (9.8 in) apart on the video sled frame were used for scaling purposes. Occasionally, due to impacts with the side of the vessel or the bottom, the lasers would be knocked out of alignment, but this was corrected when the sled returned to surface. Batteries were changed if lasers went out or were intermittent.

The onboard field biologist performed real-time visual observations of the video at all times. Codes were used when recording substrate type based on CZM’s modified Barnhardt et al. (1998) classification (Table 1 in Appendix L), and habitat/substrate classifications following Auster (1998) (Table 2 in Appendix L). The CZM modified Barnhardt et al. (1998) bottom sediment classes were: Fine, Fine with Gravel, Fine with Rock, Gravel with Fine, Gravel, Gravel with Rock, Rock with Fine, Rock with Gravel and Rock. Auster et al. (1998) developed a hierarchical approach for classifying marine bottom habitats in the outer continental shelf of the northwest Atlantic. Sediments were classified along a gradient of grain sizes from mud to boulders. The various forms these take and the associations of the infauna and epifauna with sediments produce a wide diversity of habitat types for fish and associated fauna. Eight general habitat categories increase from simple (Category 1) to highly complex (Category 8) (Table 2 in Appendix L).

Observations of algae and the dominant fauna (epibenthic/nekton) and the relative abundance (rare, occasional, common, or abundant) of the dominant invertebrate or fish species observed were recorded using species codes (Table 3 in Appendix L) approximately every 250 meters on formatted Excel spreadsheets. Data were checked for accuracy during the surface interval between transects. These data provide rough counts or numbers of times assemblages of a species were observed while the survey was underway.

15.1.1 Underwater Video Sled Viewing Area

When the video sled system was operated in a drift mode, the average vessel speed was 0.5 to 1 knot. In drift mode the video sled undulates in the water column and is either suspended a few inches above the bottom or comes to rest flat on the bottom. The viewing area of the video sled when it is off the bottom is approximately one square meter. When the video sled is on the bottom, the viewing area of the camera is approximately 50 cm x 50 cm and the video quality is optimal for substrate and biota identifications and video screen captures. The lasers are set 25 cm (9.8 in) apart and are useful for scaling bottom features and biota.

15.1.2 GoPro HD Camera Still Photographs and Video Review

The GoPro HD camera on the video sled was programmed to automatically record a photograph every 10 seconds at Study Area 4 offshore of the canal. This was changed to 5 second intervals for the remainder of the sites to collect more useable sharp photographs. There were up to 500 still



images taken per transect. The photograph quality is best when the video sled comes to a complete stop when used in a drifting mode. Each of the still photos are time stamped, the GoPro still photographs can be used as a guide to navigate to segments of GoPro HD video. In addition, one can scroll through all the still photos to examine changes in bottom type or biota over the entire transect at a rapid pace.

The GoPro camera provided detailed 1080P HD video footage detecting bottom features and biota that were not observed on the analog real time OTI camera. Thus, the GoPro data should be used to perform future video analyses. CR post-processed the GoPro camera video files using Adobe Media Encoder CC software. The resulting video files have embedded time stamps (local time) and file names on each frame enabling identification of video frame coordinates by comparing time on the video to time in the navigation files using tables or ESRI ArcGIS software. In cases where transects included more than one raw video file, the multiple files were “stitched” together to generate a single high-resolution file for each transect.

An efficient semi-automated method for review of the post-processed GoPro video files and extraction of full-resolution frame captures could include use of free open-license software packages. Playback could be conducted using Media Player Classic, available at <https://mpc-hc.org/>. Media Player Classic is a simple program that allows the tracks to be replayed in slow motion or you can step through the video frame by frame to select the appropriate video segments for screen captures.

A video de-coding software program, ffdshow, can be configured to automatically extract frame capture images at a specified frame interval (e.g., 1 capture per 30 frames = 1 capture per second) while simultaneously applying user-specified color, contrast or saturation levels during playback with Media Player Classic. This software is available at <http://ffdshow-tryout.sourceforge.net/>. Finally review of extracted image files (.jpg, .tif or other specified ffdshow output formats) may be expedited using free Irfanview software, available at <http://www.irfanview.com/>.

16.0 Towed Video and Surface Grab Data Interpretation and Results

A preliminary inspection of the underwater video data was performed to determine data quality and completeness, confirm identifications, and create representative high quality screen captures of substrate types and biota (Plates 1-17 in Appendix K).

At two (2) transects (hull-8 at Study Area 2 off Nantasket Beach, and canal-10 at Study Area 4 off Sandwich), the GoPro camera turned off, possibly due to an impact with the side of the vessel during deployment. There is OTI video data to use for analysis but no GoPro video or still picture data for these two (2) transects.



In a few transects at Study Area 4 off Sandwich, the video light brightness was adjusted too low and the color balance is off, giving the footage a green tint. At these transects, the low light OTI camera footage is well illuminated and can be used instead of the GoPro data.

At the completion of survey operations, the Field Data Spreadsheets for each of the Study Areas, listing both the Auster and CZM codes for habitat-substrate types and the CR biota abbreviations, were edited (Tables 4 to 8 in Appendix L). The information on the Field Data Spreadsheets is ordered by time. Information on the dominant species and substrate type for each study area's transects is summarized in Tables 9 to 13 in Appendix L. Species observed at each study area are provided in Table 14 in Appendix L. A total of 37 invertebrates, 11 fish, one (1) tunicate, and four (4) algal species were observed over the course of the study.

In terms of overall habitat complexity, Study Area 2 off Nantasket Beach, with areas of pebble-cobble bottom and partially buried and dispersed boulders, was the most complex in structure followed by Study Area 5 of Cuttyhunk which also had areas of pebble-cobble and boulders. Study Area 1 of the Merrimack was characterized by sand waves. Study Area 3 off of Duxbury Bay and Study Area 4 off the canal at Sandwich were the least complex, with primarily flat sand/mud bottom substrates.

Geotechnical sediment analysis of the surface grab samples in each of the Study Areas characterize the seafloor as generally sand and some areas with some clay. Table 18 below shows the CZM Modified Barnhardt classification of each of the collected surface samples.

More detail can be teased from the notes on species presence and habitat-substrate on the field data spreadsheets (Tables 4 to 8 in Appendix L) for individual transects within each Study Area. The observed species numbers provide a relative idea of the abundance of a species within a study area during the month the work was conducted. Numbers have not been normalized for length of transect or time. Rock crabs and Jonah crabs could not be differentiated in the field and are reported as rock crabs. Likewise the flat claw hermit crab and long-wrist hermit crabs were recorded as hermit crabs and were not differentiated in the field observations but can be identified in the video footage.

Deliverables for the video survey effort are contained in a portable hard drive accompanying this report. The hard drive includes:

- The OTI camera video files (Appendix M, digital only),
- GoPro HD video files and still photographs (Appendix N, digital only),
- 150 to 200 selected HD towed video screen captures from each of the five main study areas (Appendix O, digital only) and
- A navigation table with times and corrected positions of the video sled every five seconds (Appendix P digital only).



- Post-processed GoPro HD video with time stamps, enabling identification of frame coordinates by comparing the navigation file time with the video time using the navigation tables or ESRI ArcGIS software (Appendix Q, digital only).

Table 18: Surface grab sediment classification

Surface Grab Sample ID	Study Area	Easting	Northing	CZM Barnhardt Sediment Classification
BUZ10-G5	5A	240287.74	792641.10	Sand with Rock
BUZ1-G1	5B	232760.94	802636.98	Sand with Rock
BUZ2-G2	5B	233048.41	801884.71	Sand with Gravel
BUZ6-G3	5A	237499.26	798970.14	Sand with Gravel
BUZ9-G4	5A	240206.44	795415.04	Sand with Rock
CANAL2-G3	4A	283003.85	844583.68	Sand with Rock
CANAL4-G4A	4A	283105.07	842254.59	Sand with Rock
CANAL6-G5	4A	283539.40	839631.30	Fine
CANAL7-G2	4A	285205.95	840521.27	Sand with Rock
CANAL9-G1	4A	285715.54	837977.32	Sand with Rock
DUX3-G1	3A	278991.95	871887.63	Sand with Rock
DUX4-G2	3A	276756.33	871867.76	Sand with Rock
DUX6-G5	3B	277206.28	863108.03	Fine
DUX7-G3A	3B	274737.64	867514.37	Sand with Rock
DUX9-G4	3B	276696.64	865531.22	Sand with Gravel
HULL1-G5A	2A	257134.88	895877.88	Fine
HULL2-G4	2A	257862.30	896014.30	Sand with Rock
HULL4-G1	2C	263323.98	897006.43	Sand with Gravel
HULL5-G2	2C	262608.54	898060.89	Sand with Gravel
HULL7-G3A	2C	261231.15	898099.88	Sand with Rock
MER10-G1	1	261287.16	946846.97	Sand with Rock
MER2-G5	1	261020.50	955438.23	Sand with Rock
MER4-G4	1	260341.34	953193.41	Sand with Rock
MER7-G3B	1	261486.81	949990.06	Sand with Rock
MER8-G2	1	260292.42	948669.34	Sand with Rock

16.1 Study Area 1: Merrimack River

Study Area 1 results are presented in Tables 4, 9, and 14 in Appendix L and Plates 1 to 3 in Appendix K. The Study Area was sampled by a total of 10, 750 m long video transects.

- The dominant substrate type was low relief sand waves with some coarse grain sands and pebbles in the troughs.
- A total of 14 invertebrates and eight (8) fish species were observed.
- Dominant fauna included juvenile sea scallops, lobster, mysid shrimp, and amphipods.
- Lobsters were observed on 85% of the collected transects.



- A total of 200 scallops, mostly juvenile, 37 lobsters, and 29 rock crabs were observed during the video survey.
- Dominant fish included winter flounder (16) and sculpin (18).

16.2 Study Area 2: Nantasket Beach

Study Area 2 results are presented in Tables 5, 10, and 14 in Appendix L and Plates 4 to 7 in Appendix K. The Study Area was sampled by a total of 10, 750 m long video transects.

- Bottom substrates at Study Area 2 were highly variable, ranging from flat sand and mud, mud to sand waves, pebble-cobble, and partially buried or dispersed boulders.
- A total of 21 invertebrates, eight (8) fish, and four (4) algal species were observed.
- Dominant invertebrates included sea scallops, rock crabs, and sand dollars.
- A total of 407 sea scallops were observed, 186 rock crabs, and only nine (9) lobsters
- The dominant fish observed was cunner with 62 observations. Cunner were always associated with pebble-cobble and partially buried or dispersed boulder habitat. A total of 41 sculpin, 31 red hake, and 18 winter flounder were also observed in Massachusetts Bay offshore of Nantasket Beach, Hull.

16.3 Study Area 3 Duxbury Beach

Study Area 3 results are presented in Tables 6, 11, and 14 in Appendix L and Plates 8 to 10 in Appendix K. The Study Area was sampled by a total of 10, 500 m long video transects.

- The bottom substrate at Study Area 3 was primarily flat sand and mud with limited observations of pebble-cobble bottom at Transects dux-5A, 6, and 10 and shell aggregate bottom at Transect dux 8.
- A total of 11 invertebrates, eight (8) fish, and one (1) algal species were observed at Study Area 3.
- Dominant invertebrates were mysid shrimp and sand dollars.
- Commercial invertebrate species observed included 17 rock crabs and nine (9) lobsters. No sea scallops were observed.
- The dominant fish species at Study Area 3 of Duxbury Bay included red hake (33), winter flounder (15), and sculpin (12).

16.4 Study Area 4: Sandwich

Study Area 4 results are presented in Tables 7, 12, and 14 in Appendix L and Plates 11 to 13 in Appendix K. The Study Area was sampled by a total of 10, 1,000 m long video transects.

- The habitat type at Study Area 4 was primarily flat sand and mud with the exception of sand waves with coarser sand at Transect canal-9 east of the Cape Cod Canal and some biogenic structure bottom with burrows and mounds at Transects canal-1, 5, 6, and 10. A



limited amount of pebble-cobble bottom was observed at transect canal-2 and some rock disposal material was observed at transect canal-1 in the Canal Disposal Site.

- A total of 13 invertebrate, six (6) fish, and two (2) algal species were observed at Study Area 4.
- Dominant fauna included sand dollars that were abundant at all of nine (9) sandy bottom transects. Dominant fauna at the silty/sand sediment at the Disposal Site was mysid shrimp.
- Counts of the commercial species included 40 rock crabs, 20 winter flounder, and 10 lobsters. A total of 13 skates were also observed.

16.5 Study Area 5: Cuttyhunk

Study Area 5 results are presented in Tables 8, 13, and 14 in Appendix L and Plates 14 to 17 in Appendix K. The Study Area was sampled by a total of 10, 500 m long video transects.

- Bottom substrate at Study Area 5 was primarily flat sand and mud. The exceptions were observations of sand waves at Transects buz-4 and buz-7 and partially buried or dispersed boulder bottom at Transects buz-5 and 7.
- A total of 22 invertebrate and four (4) fish species were observed.
- The dominant invertebrate at eight (8) of the 10 transects were the two species of hermit crabs. Slipper limpet was the dominant species on one 250 meter segment of Transect buz-5 and bread crumb sponge was the dominant species in areas of partially buried or dispersed boulders at Transect buz-7
- No rock crabs, or sea scallops were observed at Study Area 5, the commercial invertebrate species observed were one (1) lobster and nine (9) channeled whelks.
- Fish species observed at Study Area 5 included 21 red hake and one (1) winter flounder.

16.6 Fishing Activity at the Potential Sand Resources Sites

During survey operations, lobster pots were numerous at all Study Areas excluding Study Area 5 in Buzzards Bay off of Cuttyhunk. The vessel track was often altered to avoid pots, and there were multiple entanglements with lobster gear. In all of the Study Areas in Cape Cod Bay and Massachusetts Bay, lobsters were observed living in the sand bottom during the summer and fall months of the underwater video survey. In Buzzards Bay, the lobsters appeared to target the rocky and muddy bottom substrate.

CR identified local lobstermen that fish in the Massachusetts OMP Sand Resource Areas. They have information concerning the fixed and mobile gear fisheries in their locale and can provide information regarding bottom habitat and biota upon request.



17.0 Summary

APTIM and CR were contracted by CZM on June 13, 2017, to conduct a preliminary characterization of potential offshore sand resources in five (5) study areas located offshore of Massachusetts. The project consisted of conducting an historic data review of the investigation areas, collection of 20, up to four-meter long vibracores, and 25 surface grab samples along with towed video footage of the seafloor. Additionally, APTIM was tasked with conducting detailed logging and analysis of the collected geotechnical samples and estimating volumes of potential sand resources for future coastal restoration efforts.

APTIM and CR held a kickoff meeting for the project with CZM at CZM's offices in Boston on May 26, 2017, and submitted a final Data Acquisition Plan on July 14, 2017. APTIM collected the vibracores offshore of Massachusetts between September 15 and October 5, 2017, while CR conducted separate offshore operations to collect the surface grab samples and towed video data between August 2 and November 9, 2017.

For Study Area 1, offshore of the Merrimack River, APTIM and CR collected five (5) vibracores, five (5) surface grab samples, and 10 towed video transects across the entire potential sand resource area. The dominant substrate type of Study Area 1 was low relief sand waves with some coarse grain sands and pebbles in the troughs. Dominant fauna included juvenile sea scallops, lobster, mysid shrimp, and amphipods. Lobsters were observed on 85% of the collected transects. Dominant fish included winter flounder (16) and sculpin (18).

After adjusting the potential sand resource area by removing areas of rock or other incompatible seafloor, and processing and interpreting the available USGS seismic sub-bottom data, APTIM was able to determine an estimated preliminary volume of 99,730,000 m³ (130,442,000 cy) of potential sand resources throughout Study Area 1. This is a preliminary volume of potential sand resources based on widely-spaced reconnaissance level geotechnical data and some geophysical data coverage.

For Study Area 2, offshore of Nantasket Beach, APTIM and CR collected four (4) vibracores, five (5) surface grab samples, and 10 towed video transects across the entire potential sand resource area. The bottom substrates at Study Area 2 were highly variable, ranging from flat sand, mud to sand waves, pebble-cobble, and partially buried or dispersed boulders. A total of 21 invertebrates, eight (8) fish, and four (4) algal species were observed. Dominant invertebrates included sea scallops, rock crabs, and sand dollars. The dominant fish observed was cunner with 62 observations. Cunner were always associated with pebble-cobble and partially buried or dispersed



boulder habitat. A total of 41 sculpin, 31 red hake, and 18 winter flounder were also observed in Massachusetts Bay offshore of Nantasket Beach in Hull.

Study Area 2 was divided into three (3) Study Areas when evaluating for sand resources: 2A, 2B and 2C. Interpretation of Study Area 2A historic seismic sub-bottom data based on the vibracore results from this project, indicated preliminary estimates of potential sand resource volumes of 3,600,000 m³ (4,708,600 cy). That said, the sand is predominantly associated with the infill of a paleochannel, and deposits are not normally well organized within channels, complicating the development of a potential borrow area. Additional, design-level data would be required to fully characterize the nature and full extents of this sand deposit.

Recent backscatter and high resolution bathymetric data within Study Area 2B indicate the presence of surficial gravels as well as high-relief ledges, likely rocky in nature, crossing portions of the Study Area. As a result, little no potential sand resource volume is expected in Study Area 2B, so no vibracore samples were collected in Study Area 2B.

Based on historical surficial backscatter data indicating limited surficial sands, Study Area 2C was narrowed down to a small 1,348,929 m² area around MA-CZM-2007-VC04 (approximately 12% of the central portion of Study Area 2). When this smaller area is evaluated with the vibracore results, this Study Area has an estimated preliminary volume of 3,600,000 m³ (4,708,600 cy) of potential sand resources.

Offshore of Duxbury Bay, APTIM and CR collected three (3) vibracores, five (5) surface grab samples, and 10 towed video transects across the entire potential sand resource area designated Study Area 3. The bottom substrate at Study Area 3 was primarily flat sand, mud with limited observations of pebble-cobble bottom and occasional shell aggregate bottom. A total of 11 invertebrates, eight (8) fish, and one (1) algal species were observed at Study Area 3. Dominant invertebrates were mysid shrimp and sand dollars. Commercial species observed included 17 observations of rock crabs and nine (9) lobsters. No sea scallops were observed. The dominant fish species at Study Area 3 of Duxbury Bay included red hake (33), winter flounder (15) and sculpin (12).

In terms of potential sand resources, Study Area 3 was subdivided into two (2) Study Areas: 3A and 3B. Interpretations of the historic sidescan sonar data in Study Area 3A indicate that the surface is likely mostly sand, therefore, in order to determine the potential volume of sand, an average thickness value was calculated from the isopach and used as a general representation of the entire Study Area 3A, yielding an estimated preliminary volume of 46,940,000 m³ (61,395,200 cy) of potential sand resources. It is important to note however, that this is an estimated volume,



assuming the subsurface stratigraphy of Study Area 3A is mostly uniform in nature (i.e. assuming that the three shoal features visible in the southern portion of Study Area 3A are consistent throughout the Study Area to the north where geophysical data is lacking).

The isopach in Study Area 3B was clipped to the Interpreted Sandy Area polygon in order to avoid areas that appear to have a hard bottom/rock outcrop. The total estimated preliminary volume of Study Area 3B is 46,000,000 m³ (60,165,700 cy) of potential sand resources in a shoal complex generally located in the central portion of the study area, where the shoal feature appears to be more prominent.

Offshore of Sandwich, APTIM and CR collected three (3) vibracores, five (5) surface grab samples, and 10 towed video transects across the entire potential sand resource area designated Study Area 4. The habitat type at Study Area 4 was primarily flat sand, mud with the exception of sand waves with coarser sand east of the Cape Cod Canal and occasional biogenic structure bottom with burrows and mounds. A limited amount of pebble-cobble bottom was observed and some rock disposal material was observed in the Cape Cod Canal Offshore Dredged Material Disposal Site. A total of 13 invertebrate, six (6) fish, and two (2) algal species were observed at Study Area 4. Dominant fauna included sand dollars that were abundant at all of nine (9) sandy bottom transects. Dominant fauna at the silty/sand sediment at the Disposal Site was mysid shrimp. Counts of the commercial species included 40 rock crabs, 20 winter flounder, and 10 lobsters.

Study Area 4 was divided into two (2) Study Areas, 4A and 4B. Study Area 4B was considered, but not included for additional geotechnical data collection as it is designated as a USACE/EPA Offshore Dredge Material Disposal Site and can likely be initially characterized via historic dredging records.

Volume estimates for Study Area 4A were calculated by determining the average base of sand elevation between the three (3) vibracores and utilizing the area of the entire Massachusetts OMP Sand Resource Area for Study Area 4A. The estimated preliminary volume in Study Area 4A is estimated to be 51,670,000 m³ (67,581,800 cy) of potential sand resources. Given the fact that no seismic sub-bottom data were available for this area, it is impossible to know the exact nature and full extent of the deposit without additional design-level data.

For Study Area 5, offshore of Cuttyhunk, APTIM and CR collected five (5) vibracores, five (5) surface grab samples, and 10 towed video transects across the entire potential sand resource area. The bottom substrate at Study Area 5 was primarily flat sand/mud, with occasional exceptions of observed sand waves and partially buried and dispersed boulders. A total of 22 invertebrate and four (4) fish species were observed. The dominant invertebrate at eight (8) of the 10 transects were



the two species of hermit crabs. No rock crabs, or sea scallops were observed at Study Area 5 and the only commercial invertebrate species observed was one (1) lobster and nine (9) channeled whelks. Fish species observed at Study Area 5 included 21 red hake and one (1) winter flounder.

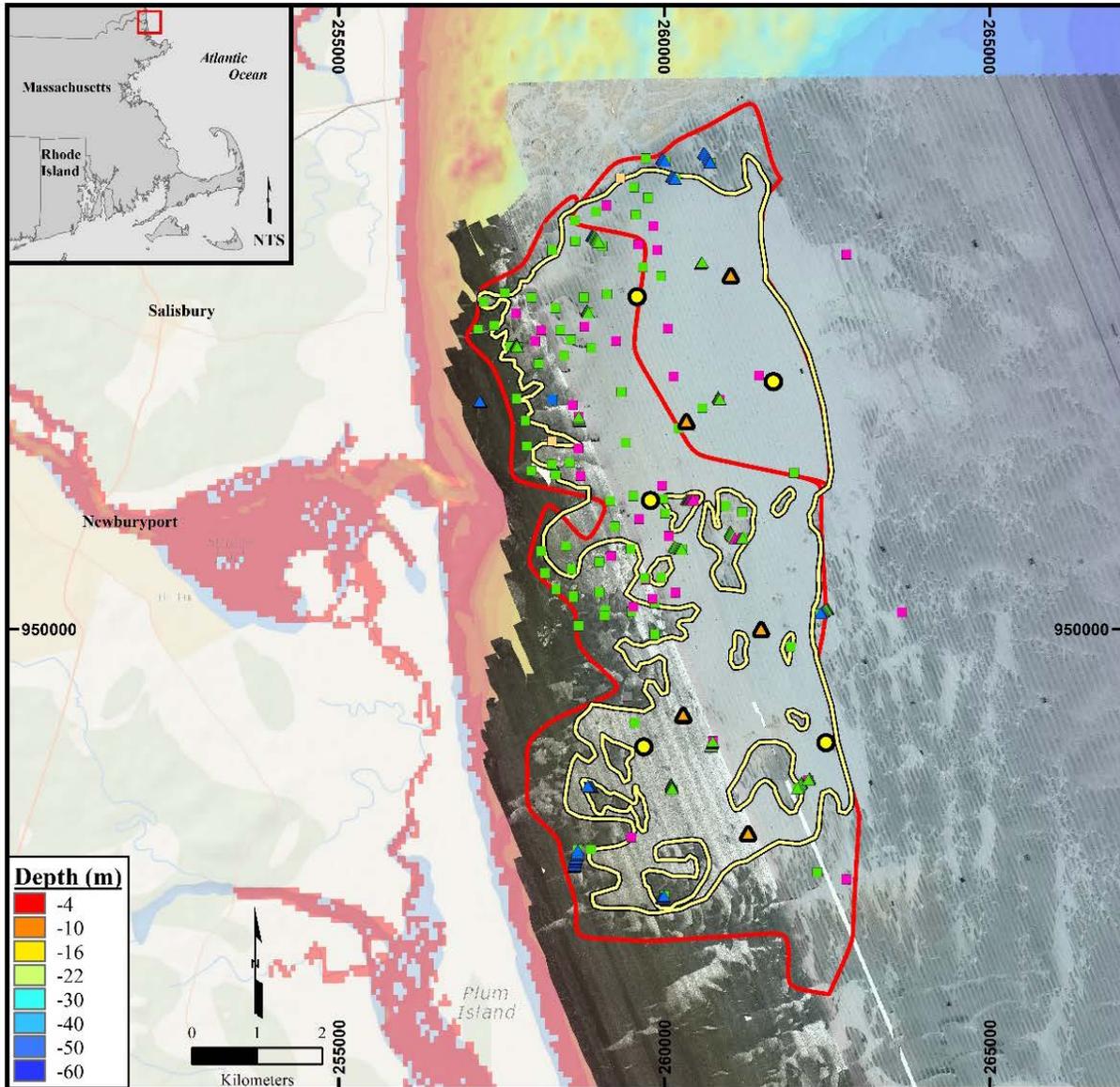
In terms of sand resources, Study Area 5 was divided into two (2) Study Areas: 5A and 5B. Sand deposits in Study Area 5A are associated with a shoaling feature which is predominant in the southern portion of the study area, where a majority of the estimated preliminary 54,470,000 m³ (71,244,100 cy) of potential sand resources within 5A are located.

Study Area 5B contains a thin (approximately 1.4 m (4.27 ft) thick) sand layer overlaying a paleo-channel complex likely filled with clays and silts. This thin sand deposit in Study Area 5B yielded an estimated preliminary volume of approximately 7,460,000 m³ (9,757,300 cy) of potential sand resources. These are preliminary volumes of potential sand resources based on widely-spaced reconnaissance level geotechnical data and some geophysical data coverage.

In total, APTIM was able to identify potential sand resources totaling a preliminary, reconnaissance-level estimate of approximately 313,470,000 m³ (410,003,400 cy) across all Massachusetts OMP Sand Resource Areas. These are preliminary volumes of potential sand resources based on widely-spaced reconnaissance-level geotechnical data and varying levels of geophysical data coverage. Actual borrow area design would require additional, design-level geotechnical and geophysical data collection in order to accurately and fully characterize these sand deposits, account for environmental and cultural resources, determine compatibility of the potential sand resource with the recipient beach, evaluate dredgeability of the sand resource, and design permit plans and specifications (including dredge cuts) for a final borrow area.

18.0 Figures





Study Area 1: Merrimack River, Historic Data

Notes:

1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
4. Surface grab sample data are from the U.S. Geological Survey sample database.
5. Sidescan sonar data and bottom photograph data are from the U.S. Geological Survey Open-File Report 2007-1373.

Legend:

- | | |
|--|---------------|
| ● Planned Vibracores | ■ Clayey Silt |
| ▲ Planned Grab Samples | ■ Gravel |
| ⬭ MA OMP Sand Resource Areas | ■ Sand |
| ⬭ Interpreted Sandy Seafloor | ■ Sandy Silt |
| Seafloor Classification Photographs | |
| ▲ Sand | ■ Silty Sand |
| ▲ FG Sand | |
| ▲ Hardbottom/Rock | |

Figure 1: Study Area 1 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including sidescan sonar (darker imagery representing higher backscatter, indicating harder materials), surface grab samples, and seafloor classification information



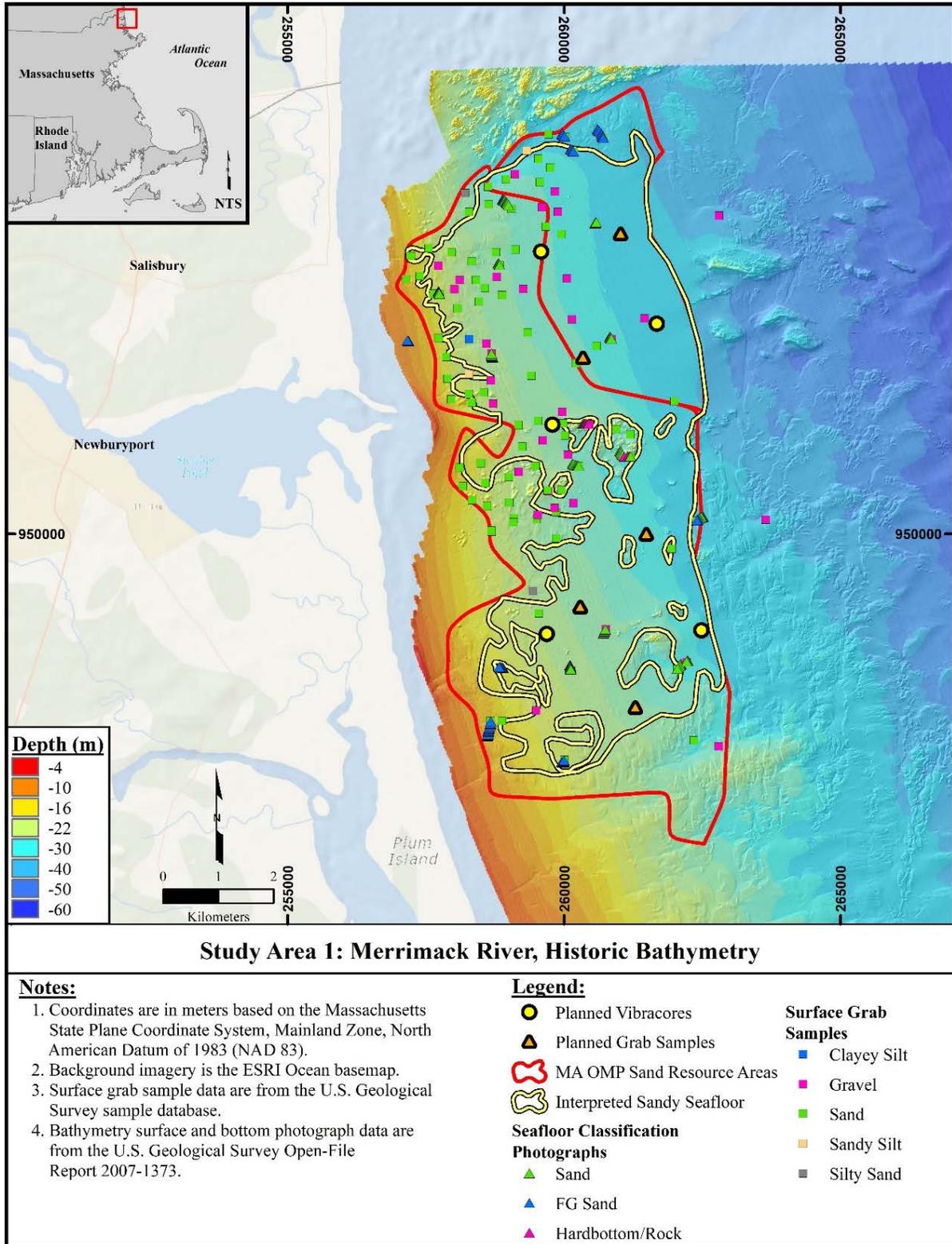


Figure 2: Study Area 1 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including bathymetry, surface grab samples, and seafloor classification information



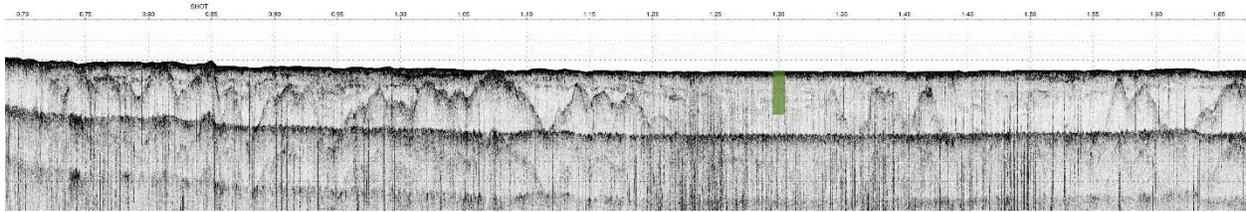


Figure 3 Historic USGS seismic sub-bottom line I12f1 depicting proposed vibracore location (green line) in Study Area 1. Proposed vibracore is targeting unconsolidated sediments away from clear bedrock peaks (dark reflectors)

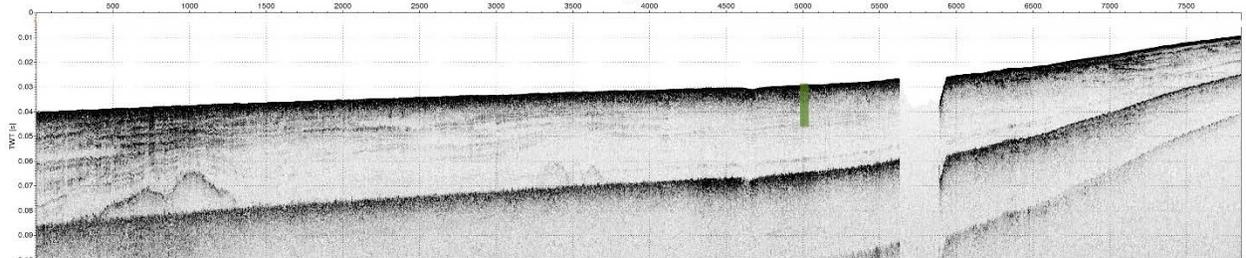


Figure 4: Historic USGS seismic sub-bottom line I40f1 depicting proposed vibracore location (green line) in Study Area 1. Proposed vibracore is targeting a thick, unconsolidated surficial sediment deposit showing flat-lying stratigraphy

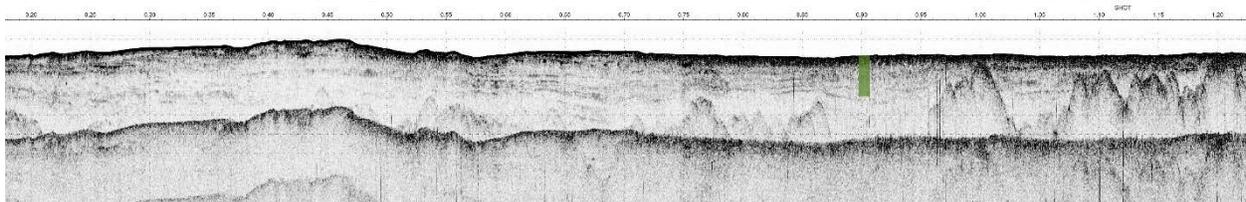


Figure 5: Historic USGS seismic sub-bottom line I53f1 depicting proposed core location (green line) in Study Area 1. Proposed vibracore is targeting a thick, unconsolidated surficial sediment deposit showing flat-lying stratigraphy away from clear bedrock peaks (dark reflectors)

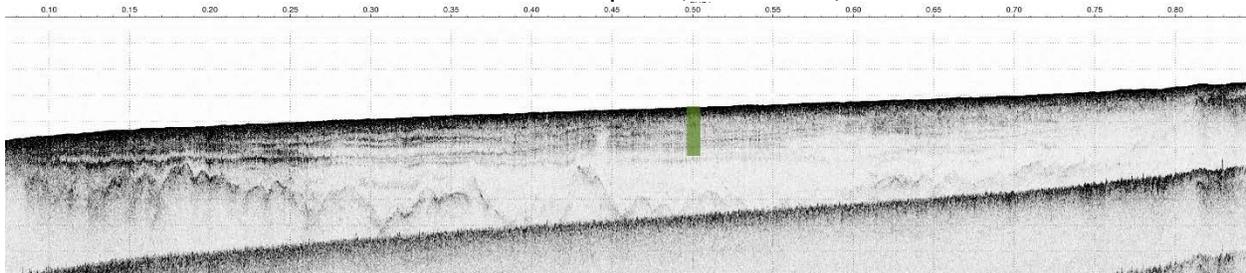


Figure 6: Historic USGS seismic sub-bottom line I117f1 depicting proposed vibracore location (green line) in Study Area 1. Proposed vibracore is targeting a thick, unconsolidated surficial sediment wedge showing flat-lying stratigraphy

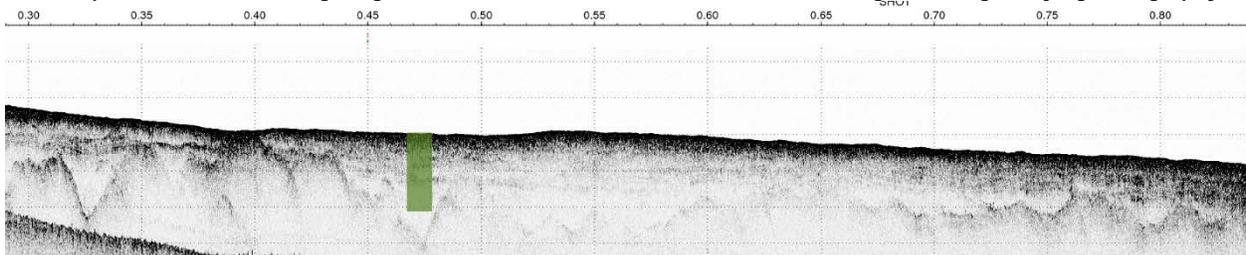
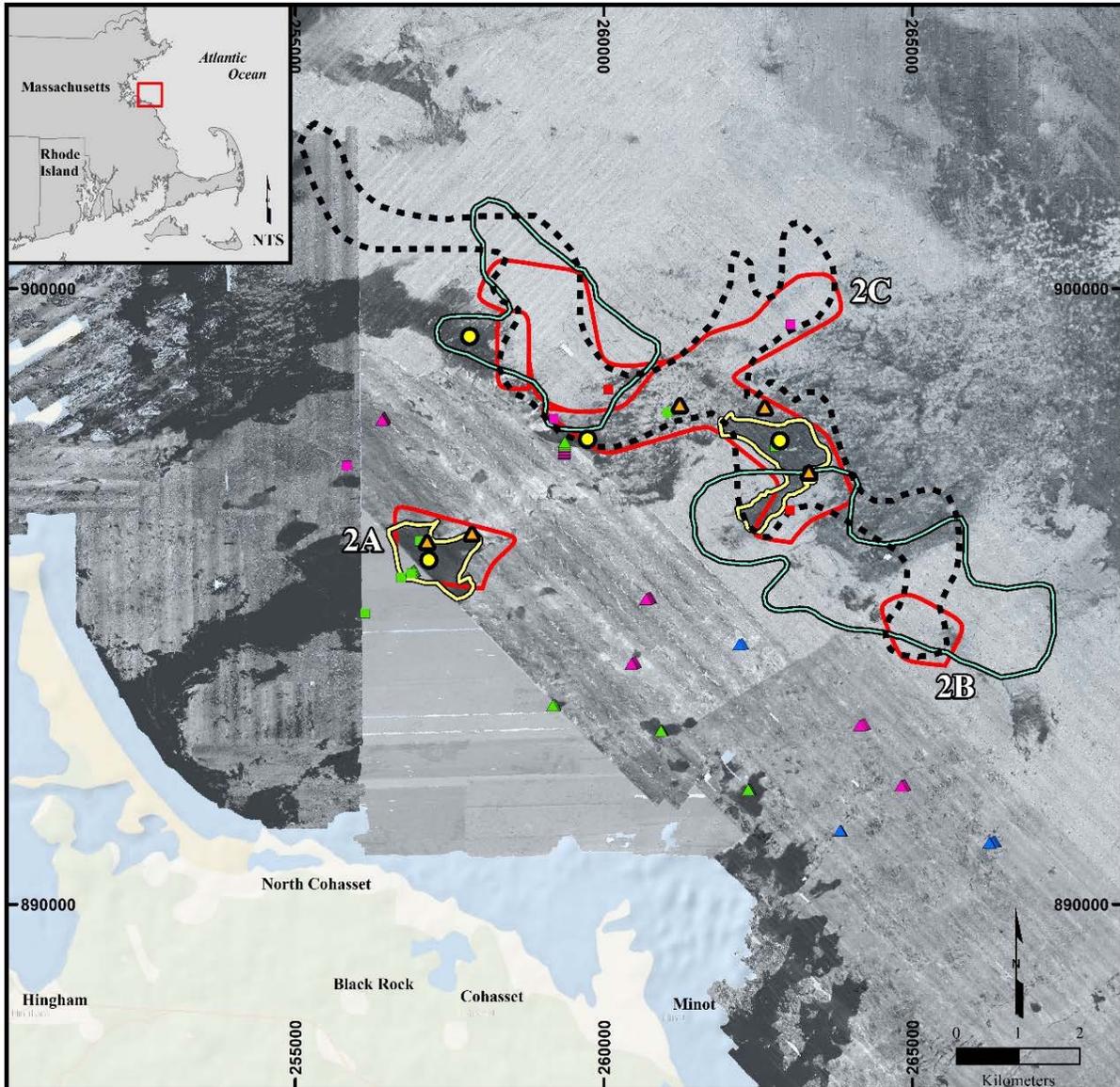


Figure 7: Historic USGS seismic sub-bottom line I116f1 depicting proposed vibracore location (green line) in Study Area 1. Proposed vibracore is targeting a thick, unconsolidated surficial sediment deposit showing flat-lying stratigraphy away from clear bedrock peaks (dark reflectors)



Study Area 2: Nantasket Beach, Historic Data

Notes:

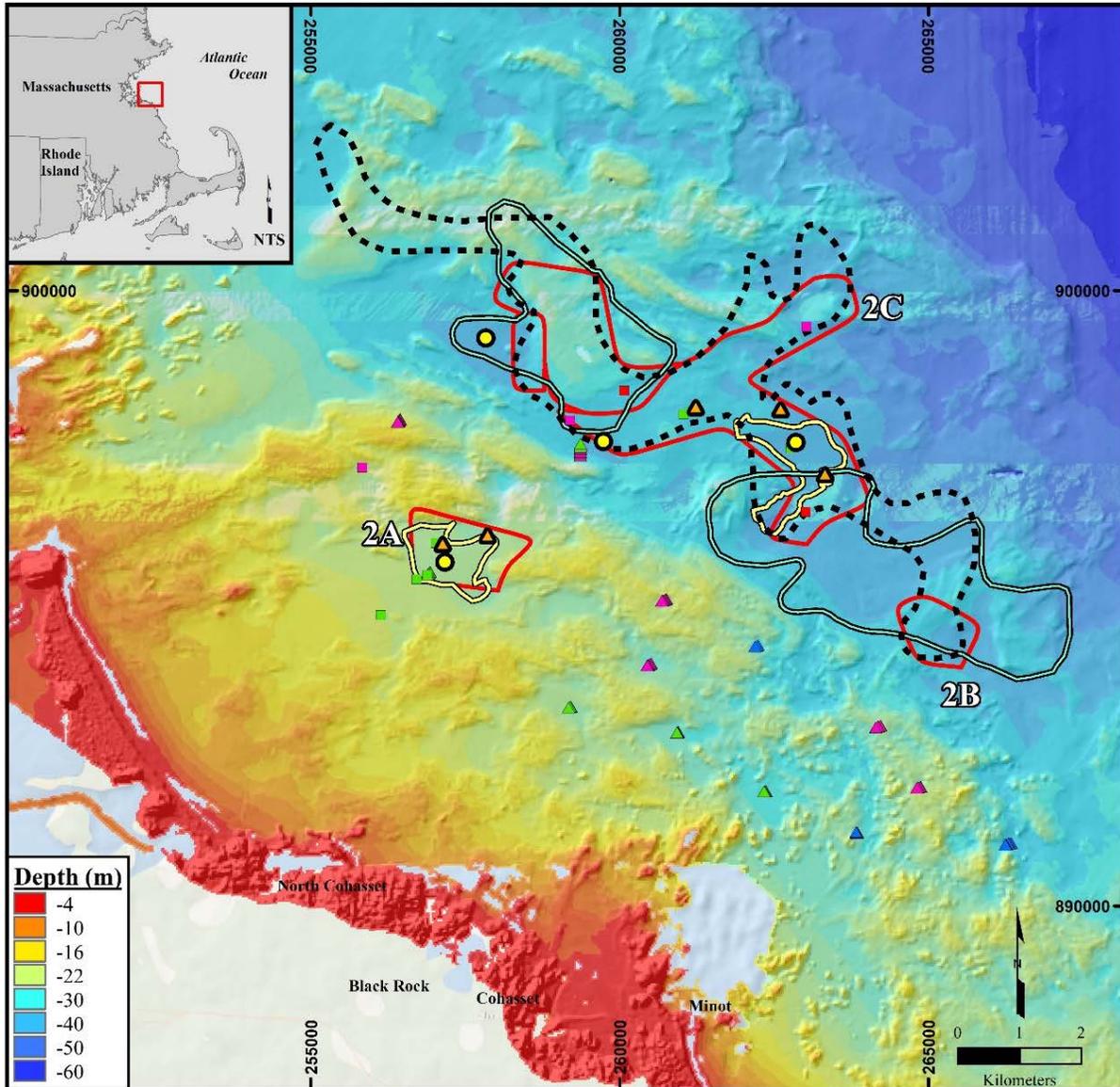
1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Surface grab samples data are from the U.S. Geological Survey sample database.
4. Historic data is from the MA Dept. of Natural Resources (1972), Oldale and Bick, (1923, 1987) and Normandeau Associates, Inc. (2010), full citation available in the references section.
5. Sidescan sonar surface and bottom photographs are from the U.S. Geological Survey Open File Report 2012-1157 and 2009-1072.

Legend:

- | | |
|---|--|
| <ul style="list-style-type: none"> Planned Vibracores Planned Grab Samples MA OMP Sand Resource Areas Historic Sand Mineral Resource Areas (1972) Historic Sand Mineral Resource Area (1987) Interpreted Sandy Seafloor | <p>Seafloor classification Photographs</p> <ul style="list-style-type: none"> FG Sand FG Sand/Gravel Rock/Hardbottom <p>Surface Grab Samples</p> <ul style="list-style-type: none"> Boulders Clayey Silt Gravel Sand |
|---|--|

Figure 8: Study Area 2 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including sidescan sonar (darker imagery representing lower backscatter, indicating softer materials), surface grab samples, and seafloor classification information





Study Area 2: Nantasket Beach, Historic Bathymetry

Notes:

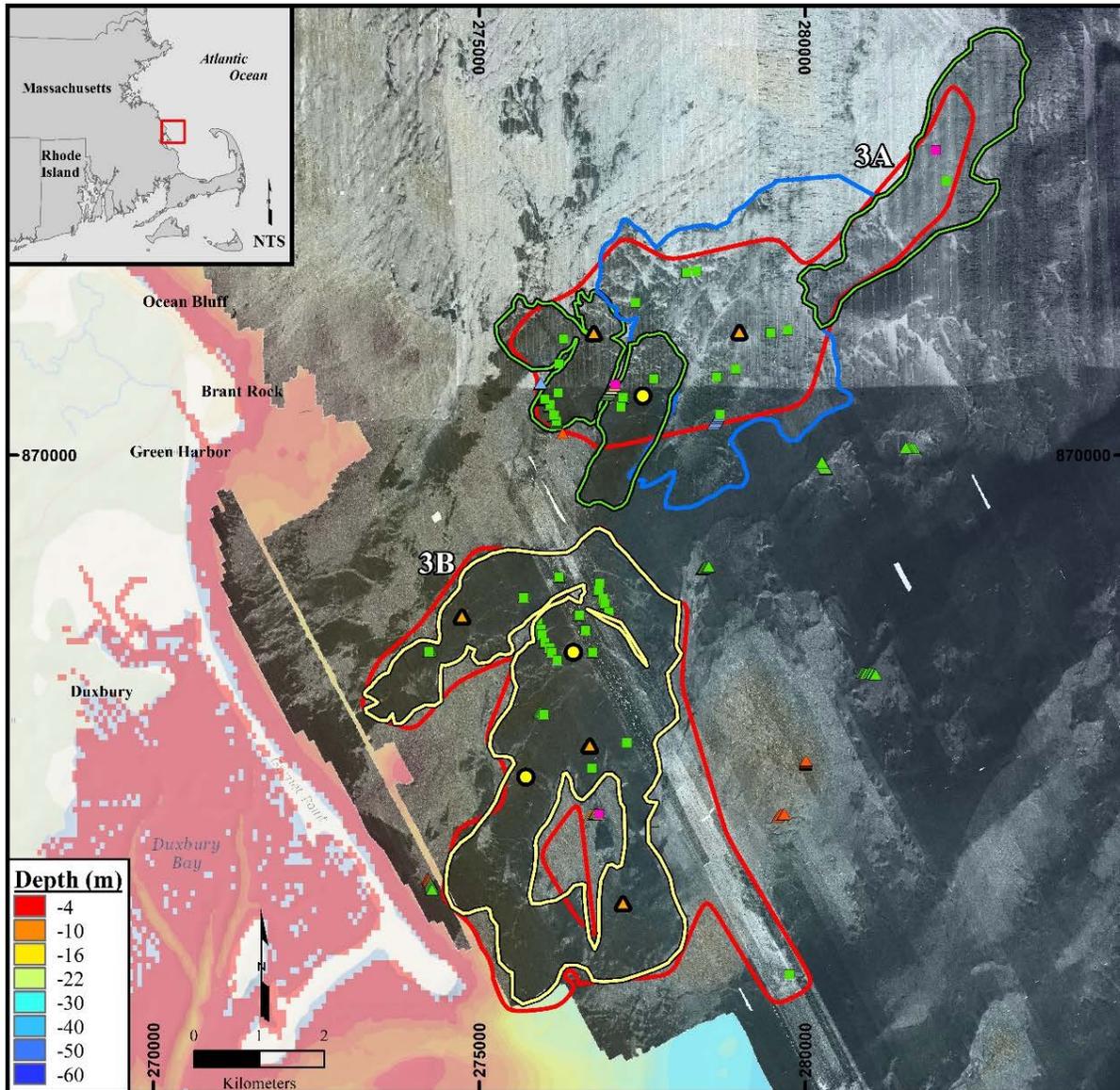
1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Surface grab sample data are from the USGS sample database.
4. Bathymetry surface is from the U.S Geological Survey Open-File Report 2012-1157.
5. Historic data is from the MA Dept. of Natural Resources (1972), Oldale and Bick, (1923, 1987) and Normandeau Associates, Inc. (2010), full citation available in the references section.
6. Bottom photograph data are from the U.S. Geological Survey Open-File Report 2009-1072.

Legend:

- | | |
|---|--|
| <ul style="list-style-type: none"> ● Planned Vibracores ▲ Planned Samples MA OMP Sand Resource Areas Historic Sand Mineral Resource Areas (1972) Historic Sand Mineral Resource Area (1987) Interpreted Sandy Seafloor | <p>Seafloor classification Photographs</p> <ul style="list-style-type: none"> ▲ FG Sand ▲ FG Sand/Gravel ▲ Rock/Hardbottom <p>Surface Grab Samples</p> <ul style="list-style-type: none"> ■ Boulders ■ Clayey Silt ■ Gravel ■ Sand |
|---|--|

Figure 9: Study Area 2 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including bathymetry, surface grab samples, and seafloor classification information





Study Area 3: Duxbury Beach, Historic Data

Notes:

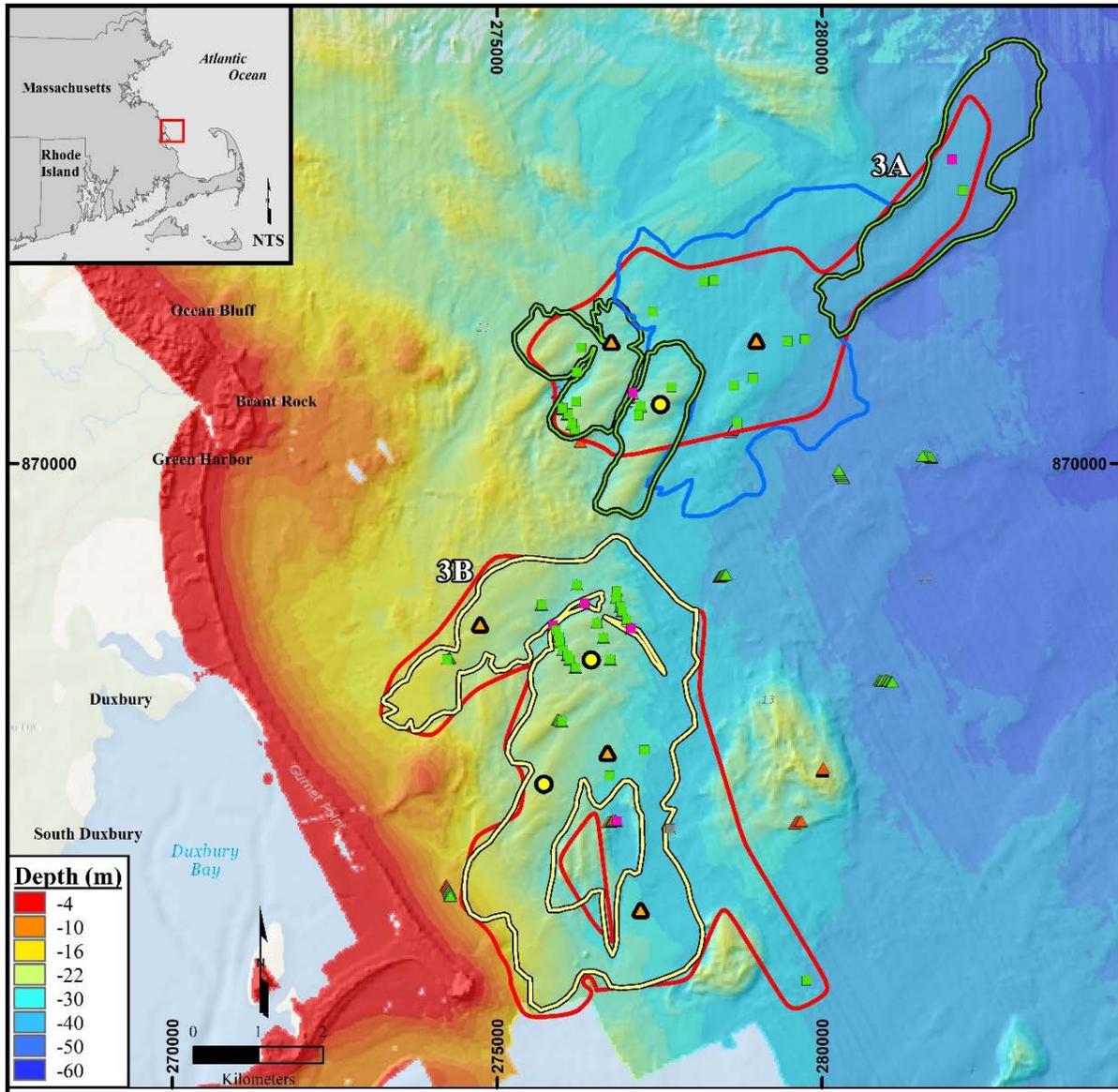
- Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
- Background imagery is the ESRI Ocean basemap.
- Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
- Surface grab sample data are from the U.S. Geological Survey sample database
- Sidescan sonar data surface is from the U.S. Geological Survey Open File Report 2012-1157.
- Bottom photograph data are from the U.S. Geological Survey Open-File Report 2010-1006.

Legend:

● Planned Vibracores	Seafloor Classification	Surface Grab Samples
▲ Planned Grab Samples	▲ FG Sand	■ Gravel
MA OMP Sand Resource Areas	▲ FG Sand/Shell	■ Sand
Interpreted Sandy Seafloor	▲ Shell/Gravel	■ Silty Sand
Seafloor delineation	▲ Gravel	
BottomType	▲ Hardbottom	
FG Sand	▲ Hardbottom/Shell	
FG Sand/Shell		

Figure 10: Study Area 3 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including sidescan sonar (darker imagery representing lower backscatter, indicating softer materials), surface grab samples, and seafloor classification information





Study Area 3: Duxbury Beach, Historic Bathymetry

Notes:

1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Surface grab sample data are from the U.S. Geological Survey sample database.
4. Bathymetry surface is from the U.S Geological Survey Open-File Report 2012-1157.
5. Bottom photograph data are from the U.S.Geological Survey Open-File Report 2010-1006.

Legend:

<ul style="list-style-type: none"> Planned Vibracores Planned Grab Samples MA OMP Sand Resource Areas Interpreted Sandy Seafloor Seafloor delineation Bottom Type FG Sand FG Sand/Shell 	<table border="0"> <tr> <td>Seafloor Classification</td> <td>Surface Grab Samples</td> </tr> <tr> <td> FG Sand</td> <td> Gravel</td> </tr> <tr> <td> FG Sand/Shell</td> <td> Sand</td> </tr> <tr> <td> Shell/Gravel</td> <td> Silty Sand</td> </tr> <tr> <td> Gravel</td> <td></td> </tr> <tr> <td> Hardbottom</td> <td></td> </tr> <tr> <td> Hardbottom/Shell</td> <td></td> </tr> </table>	Seafloor Classification	Surface Grab Samples	FG Sand	Gravel	FG Sand/Shell	Sand	Shell/Gravel	Silty Sand	Gravel		Hardbottom		Hardbottom/Shell	
Seafloor Classification	Surface Grab Samples														
FG Sand	Gravel														
FG Sand/Shell	Sand														
Shell/Gravel	Silty Sand														
Gravel															
Hardbottom															
Hardbottom/Shell															

Figure 11: Study Area 3 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including bathymetry, surface grab samples, and seafloor classification information



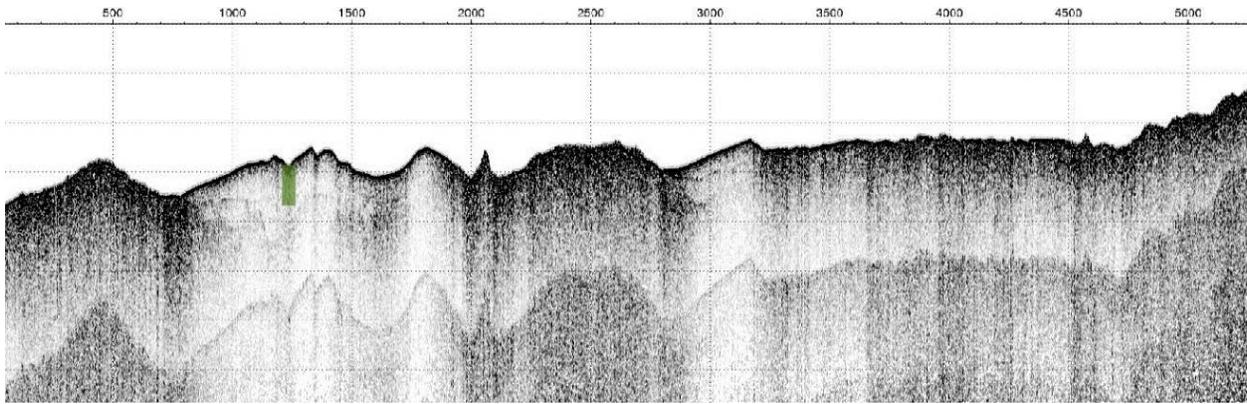


Figure 12: Historic USGS seismic sub-bottom line I13f2 depicting proposed vibracore location (green line) in Study Area 3. Proposed vibracore is targeting a thick, unconsolidated surficial sediment shoal, while avoiding nearby exposed bedrock and clear bedrock peaks (dark reflectors)

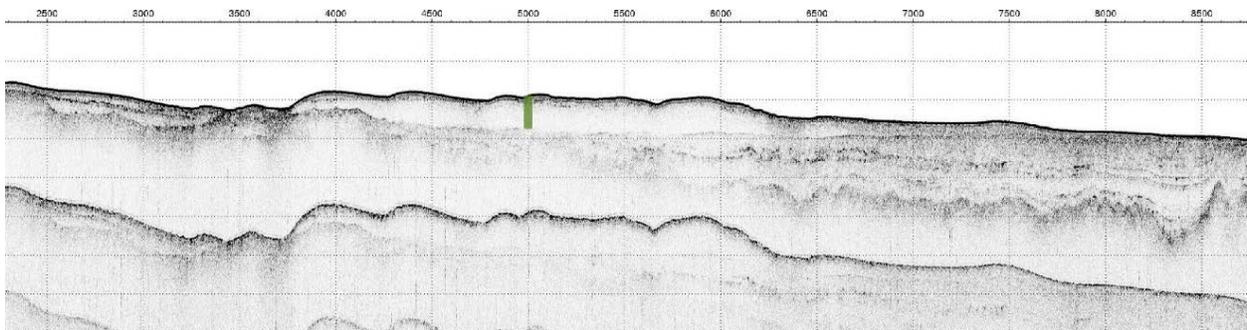


Figure 13: Historic USGS seismic sub-bottom line I74f1 depicting proposed vibracore location (green line) in Study Area 3. Proposed vibracore is targeting a thick, unconsolidated surficial sediment shoal

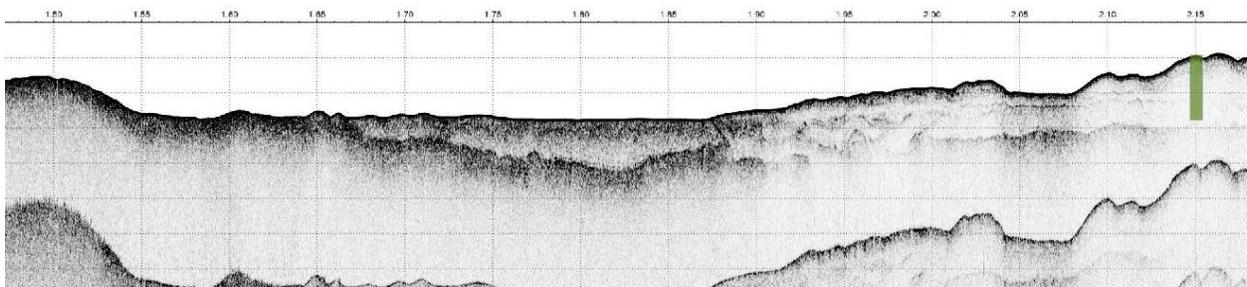
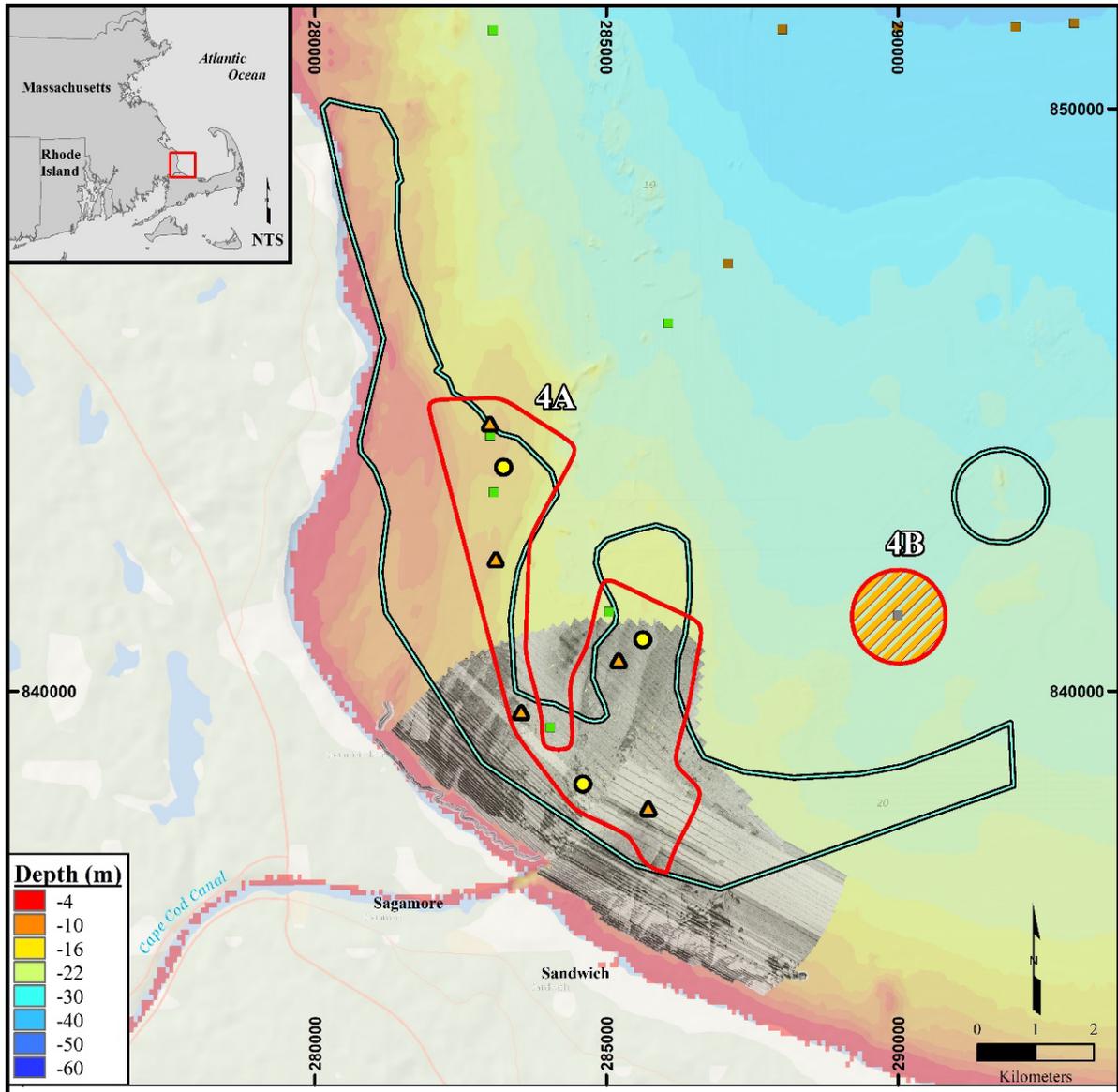


Figure 14: Historic USGS seismic sub-bottom line I108f1 depicting proposed vibracore location (green line) in Study Area 3. Proposed vibracore is targeting a thick, unconsolidated surficial sediment shoal, while avoiding nearby exposed bedrock and clear bedrock peaks (dark reflectors)



Study Area 4: Sandwich, Historic Data

Notes:

- Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
- Background imagery is the ESRI Ocean basemap.
- Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
- Surface grab sample data are from the U.S. Geological Survey sample database.
- Sidescan sonar surface is from the NOAA Hydro. Survey, H11695.
- Historic data are from the MA Dept. of Natural Resources (1974) and AECOM (2012), full citation available in the references section.

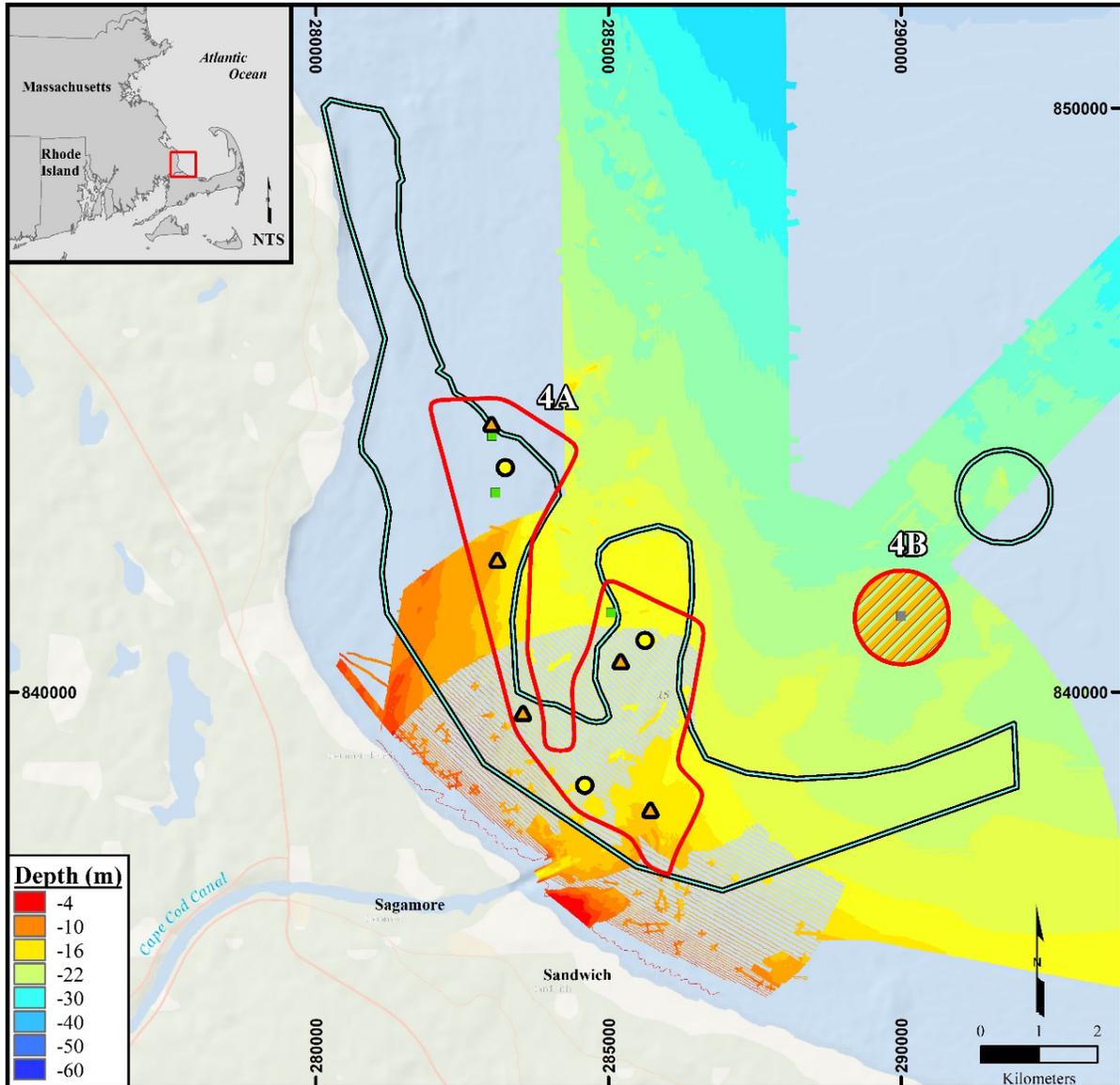
Legend:

- Planned Vibracores (Yellow circle)
- Planned Grab Samples (Yellow triangle)
- MA OMP Sand Resource Areas (Red outline)
- Historic Sand Mineral Resource Areas (Green outline)
- USACE/EPA Offshore Dredge Material Disposal Site (Hatched circle)

Surface Grab Samples

- Sand (Green square)
- Silty Sand (Grey square)
- Mud (Brown square)

Figure 15: Study Area 4 showing the Massachusetts OMP Sand Resource Areas, APTIM’s revised “sandy seafloor” sand resource areas, and APTIM’s planned vibracore locations. Figure also depicts historic data including sidescan sonar (darker imagery representing higher backscatter, indicating harder materials), surface grab samples, and seafloor classification information



Study Area 4: Sandwich, Historic Bathymetry

Notes:

- Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
- Background imagery is the ESRI Ocean basemap.
- Surface grab sample data are from the U.S. Geological Survey sample database.
- Bathymetry surface is from the NOAA Hydro. Survey, H11695.
- Historic data are from the MA Dept. of Natural Resources (1974) and AECOM (2012), full citation available in the references section.

Legend:

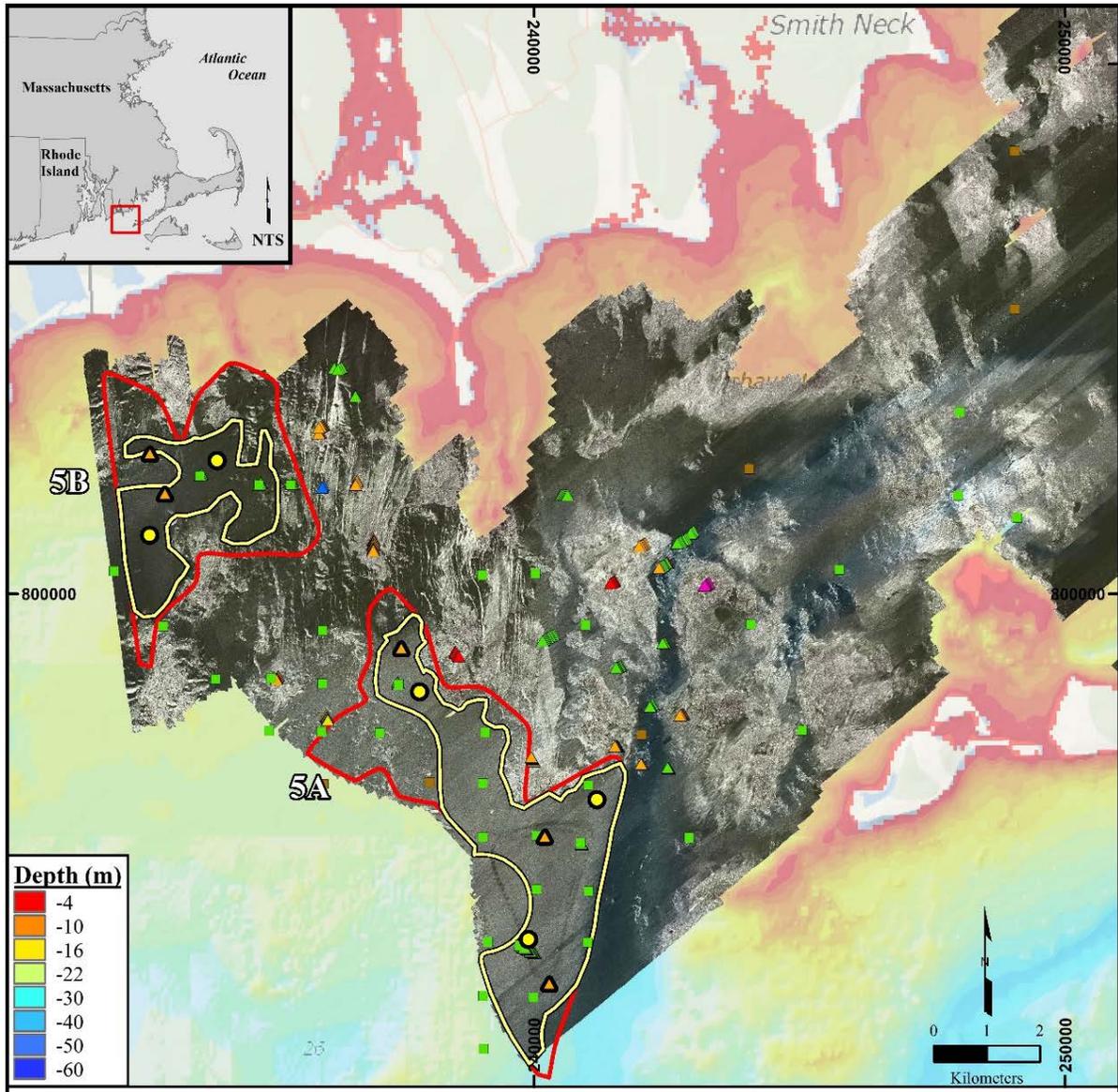
- Planned Vibracores
- ▲ Planned Grab Samples
- ⬮ MA OMP Sand Resource Areas
- ⬮ Historic Sand Mineral Resource Areas
- ▨ USACE/EPA Offshore Dredge Material Disposal Site

Surface Grab Samples

- Sand
- Silty Sand

Figure 16: Study Area 4 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including bathymetry, surface grab samples, and seafloor classification information

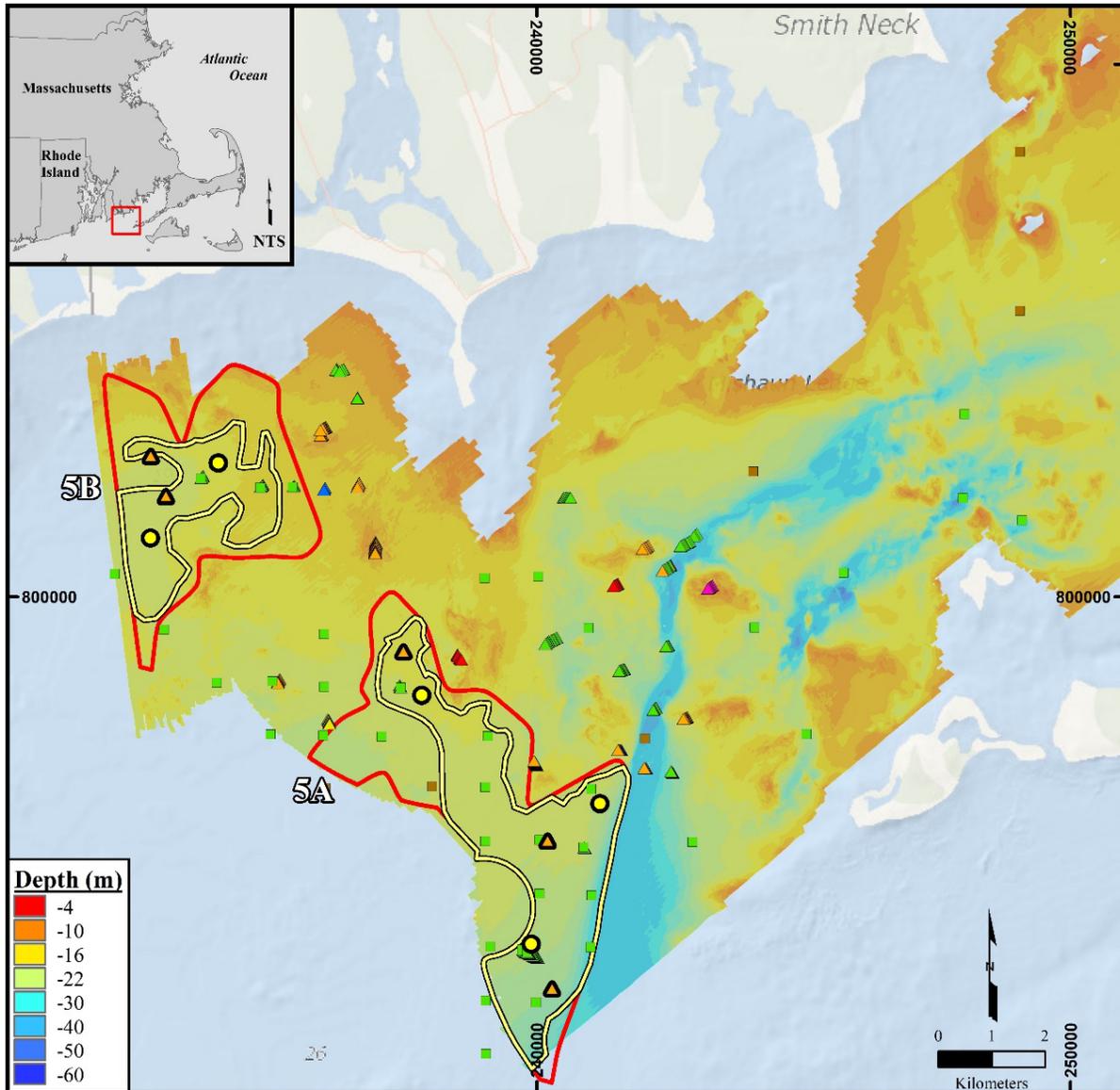




Study Area 5: Cuttyhunk, Historic Data

<p>Notes:</p> <ol style="list-style-type: none"> Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83). Background imagery is the ESRI Ocean basemap. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999. Surface grab sample data are from the U.S. Geological Survey sample database and AECOM (2012), full citation available in the references section. Sidescan sonar and bottom photograph data are from the U.S. Geological Survey Open-File Report 2012-1002 and 2014-1221. 	<p>Legend:</p> <ul style="list-style-type: none"> Planned Vibracores Planned Grab Samples MA OMP Sand Resource Areas Interpreted Sandy Seafloor <p>Surface Grab Samples</p> <ul style="list-style-type: none"> Sand Sandy Silt Mud 	<p>Seafloor Classification Photographs</p> <ul style="list-style-type: none"> FG Sand FG Sand/Gravel Rock Rock/Gravel Rock/Hardbottom Sand/Rocks
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Figure 17: Study Area 5 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including sidescan sonar (darker imagery representing lower backscatter, indicating softer materials), surface grab samples, and seafloor classification information



Study Area 5: Cuttyhunk, Historic Bathymetry

Notes:

1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Bathymetry surface is from the U.S Geological Survey Open File Report 2012-1002.
4. Surface grab sample data are from the U.S. Geological Survey sample database and AECOM (2012), full citation available in the references section.
5. Bottom photograph data are from the U.S. Geological Survey Open-File Report 2014-1221.

Legend:

- | | |
|--|---|
| <ul style="list-style-type: none"> ● Planned Vibracores ▲ Planned Grab Samples MA OMP Sand Resource Areas Interpreted Sandy Seafloor <p>Surface Grab Samples</p> <ul style="list-style-type: none"> ■ Sand ■ Sandy Silt ■ Mud | <p>Seafloor Classification Photographs</p> <ul style="list-style-type: none"> ▲ FG Sand ▲ FG Sand/Gravel ▲ Rock ▲ Rock/Gravel ▲ Rock/Hardbottom ▲ Sand/Rocks |
|--|---|

Figure 18: Study Area 5 showing the Massachusetts OMP Sand Resource Areas, APTIM's revised "sandy seafloor" sand resource areas, and APTIM's planned vibracore locations. Figure also depicts historic data including bathymetry, surface grab samples, and seafloor classification information



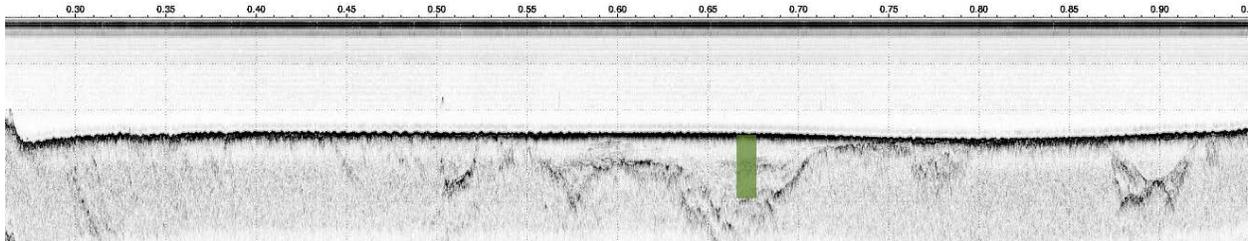


Figure 19: Historic USGS seismic sub-bottom line 170f1 depicting proposed vibracore location (green line) in Study Area 5. Proposed vibracore is targeting a subsurface, channel-like deposit containing flat-lying stratigraphy. The location is away from nearby clear bedrock peaks and exposed bedrock (dark reflectors)

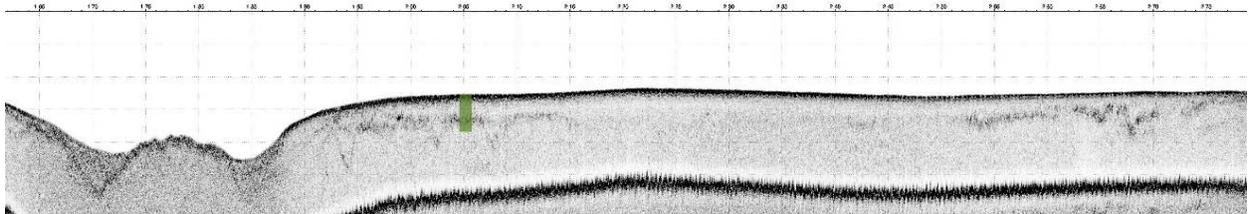


Figure 20: Historic USGS seismic sub-bottom line 175f1 depicting proposed vibracore location (green line) in Study Area 5. Proposed vibracore is targeting a surficial sand deposit, inside of the sand resource area which is bound by a deep, bathymetric low likely controlled by antecedent bedrock topography (dark reflectors)

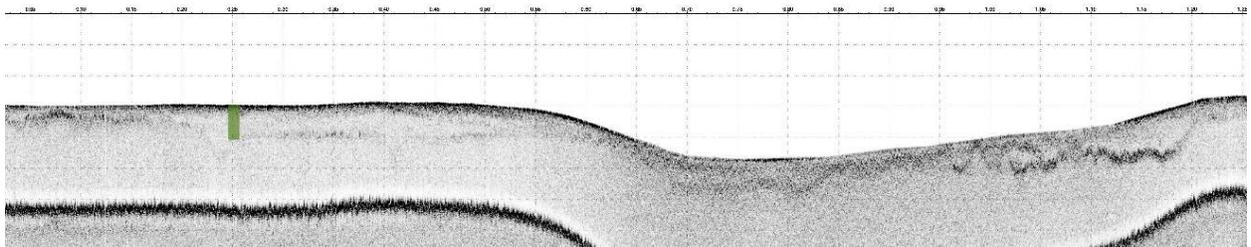


Figure 21: Historic USGS seismic sub-bottom line 188f1 depicting proposed vibracore location (green line) in Study Area 5. Proposed vibracore is targeting a surficial sand deposit, inside of the sand resource area which is bound by a deeper, bathymetric low likely controlled by antecedent bedrock topography (dark reflectors)

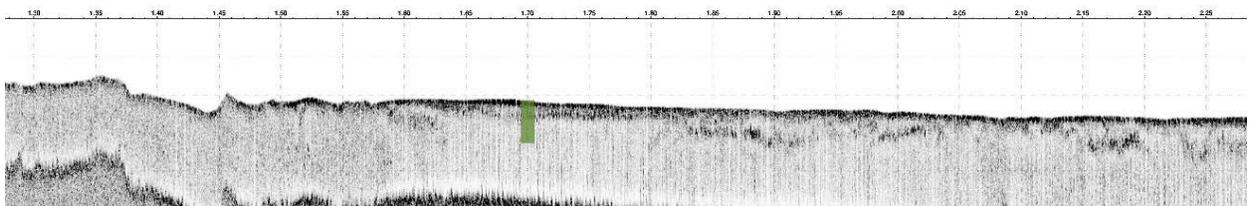


Figure 22: Historic USGS seismic sub-bottom line 1259f2 depicting proposed vibracore location (green line) in Study Area 5. Proposed vibracore is targeting a subsurface, channel-like deposit. The location is away from nearby exposed bedrock (dark reflectors), but does target a darker reflector for characterization

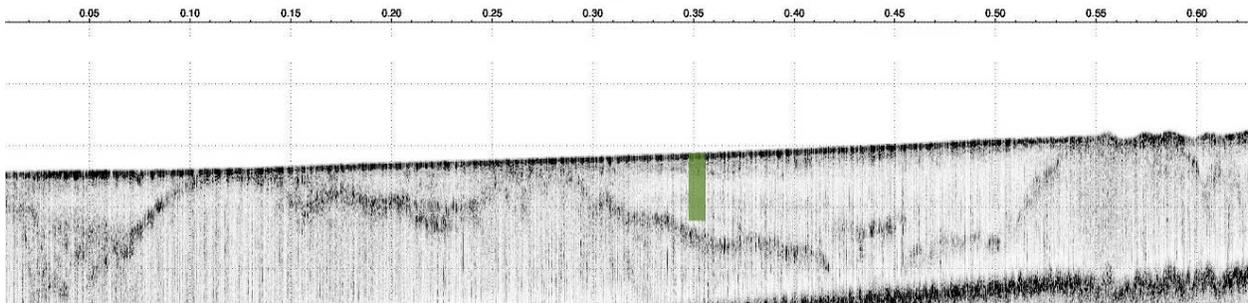


Figure 23: Historic USGS seismic sub-bottom line 1307f1 depicting proposed vibracore location (green line) in Study Area 5. Proposed vibracore is targeting a subsurface, channel-like deposit. The location is away from nearby clear bedrock peaks and exposed bedrock (dark reflectors)



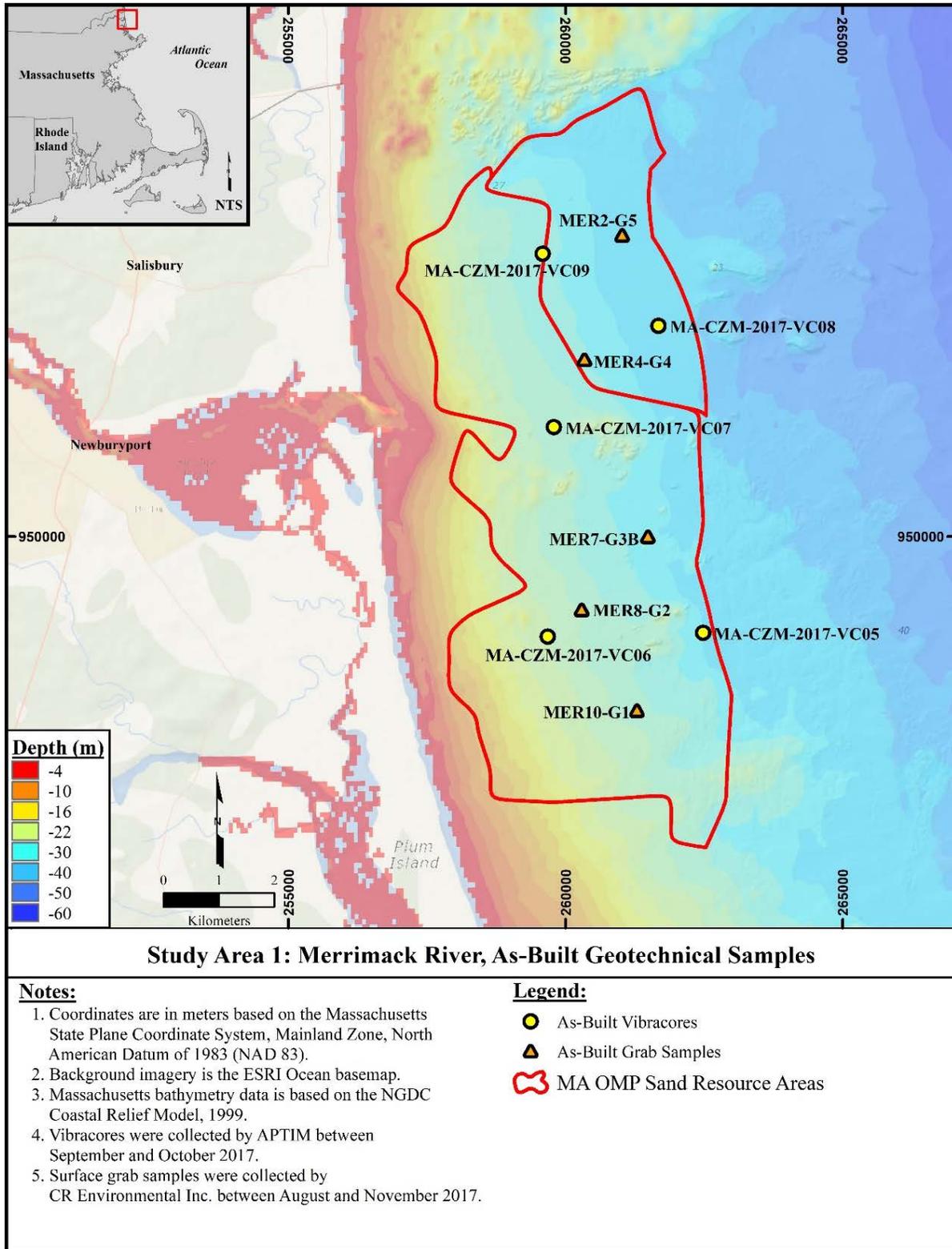


Figure 24: Study Area 1 showing the Massachusetts OMP sand resource area and as-collected vibracores and surface grab sample locations collected by APTIM and CR



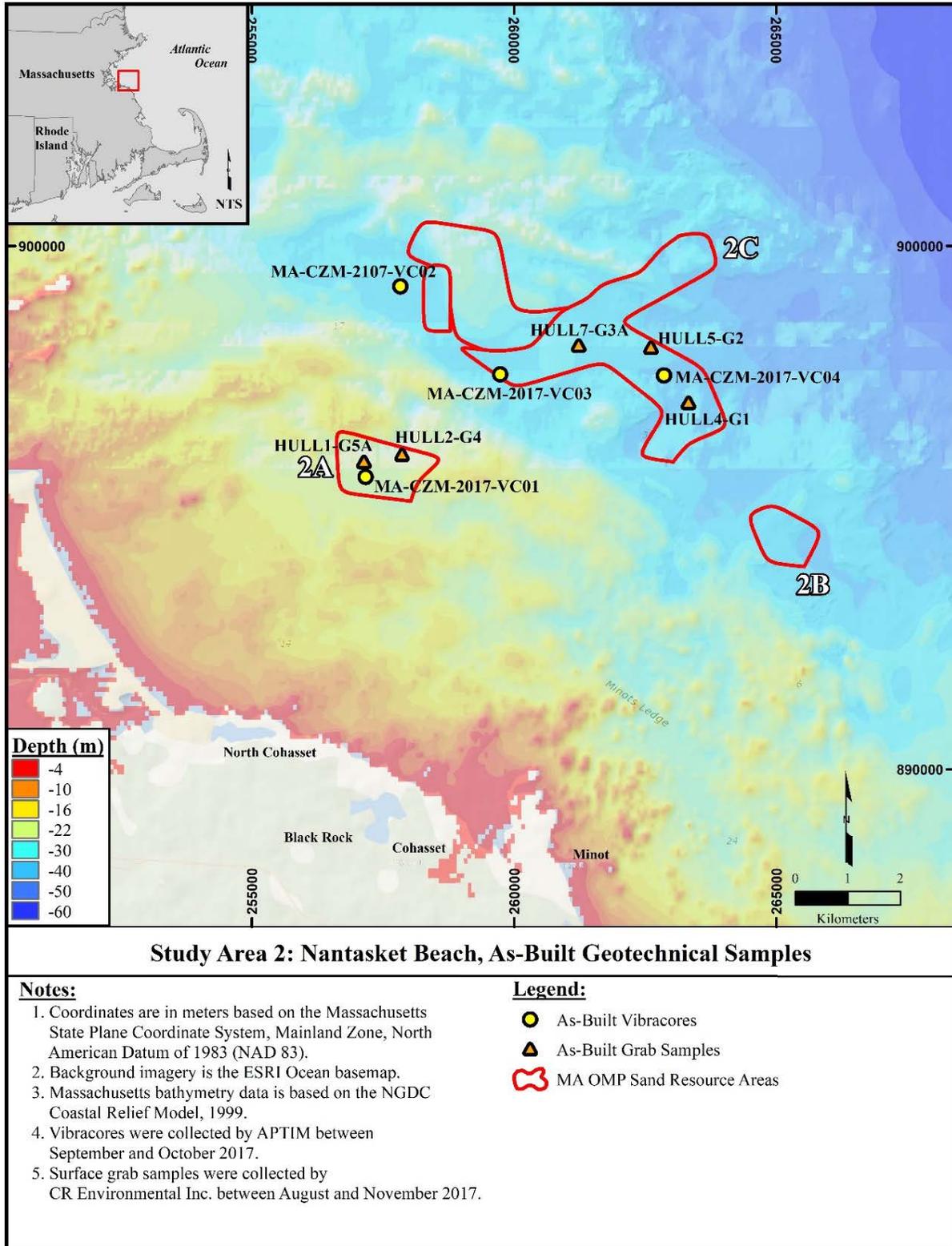


Figure 25: Study Area 2 showing the Massachusetts OMP sand resource area and as-collected vibracores and surface grab sample locations collected by APTIM and CR



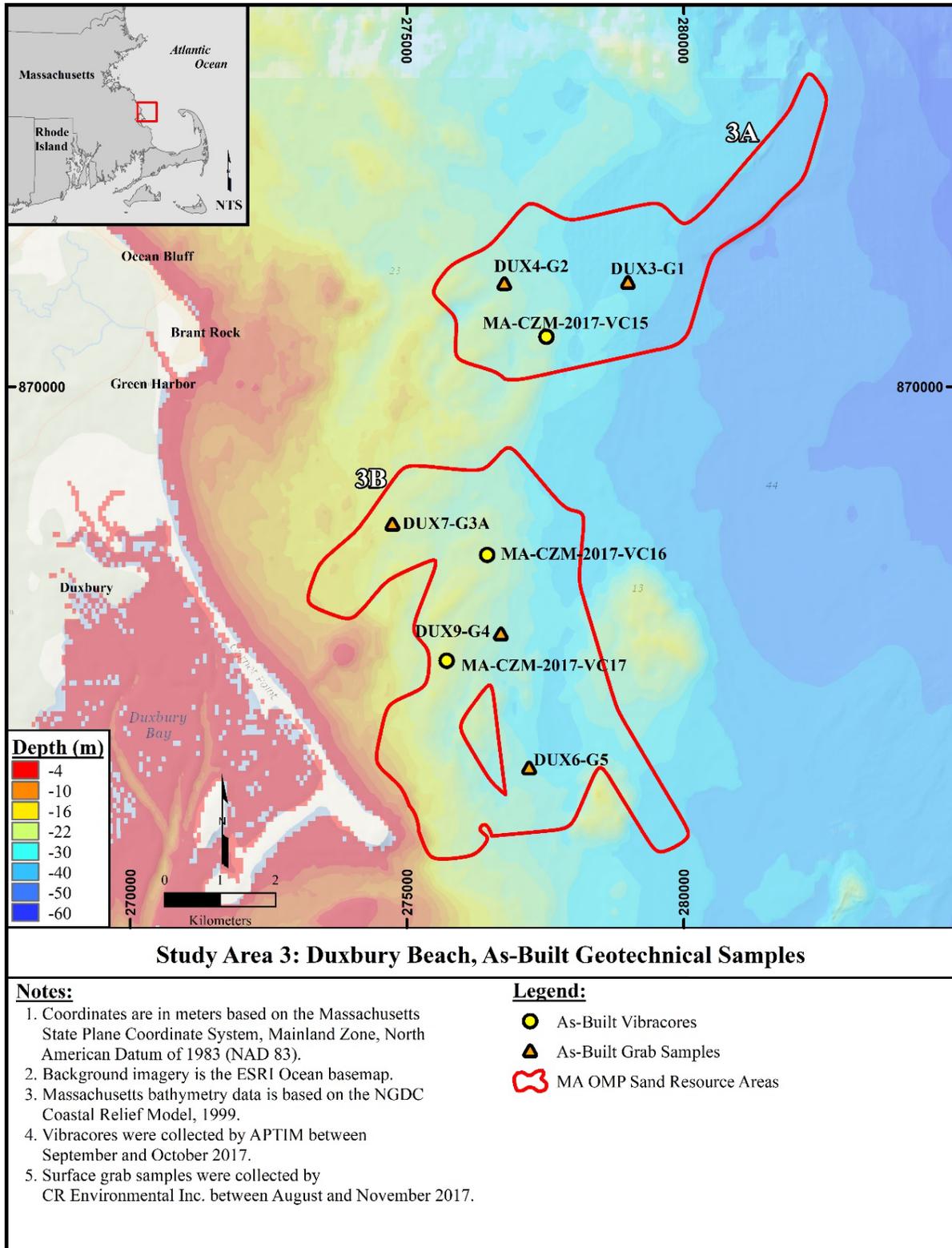
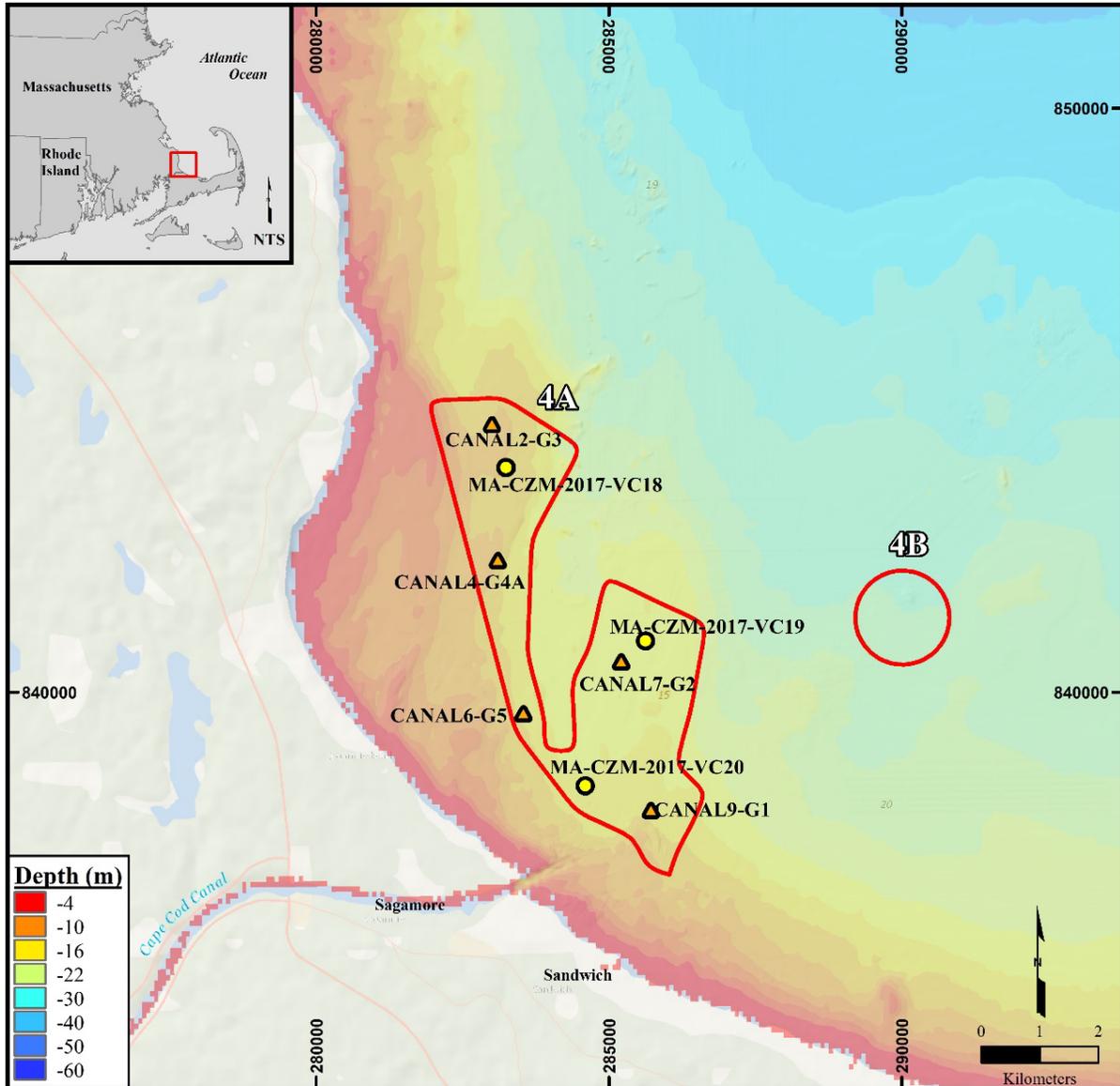


Figure 26: Study Area 3 showing the Massachusetts OMP sand resource area and as-collected vibracores and surface grab sample locations collected by APTIM and CR





Study Area 4: Sandwich, As-Built Geotechnical Samples

Notes:

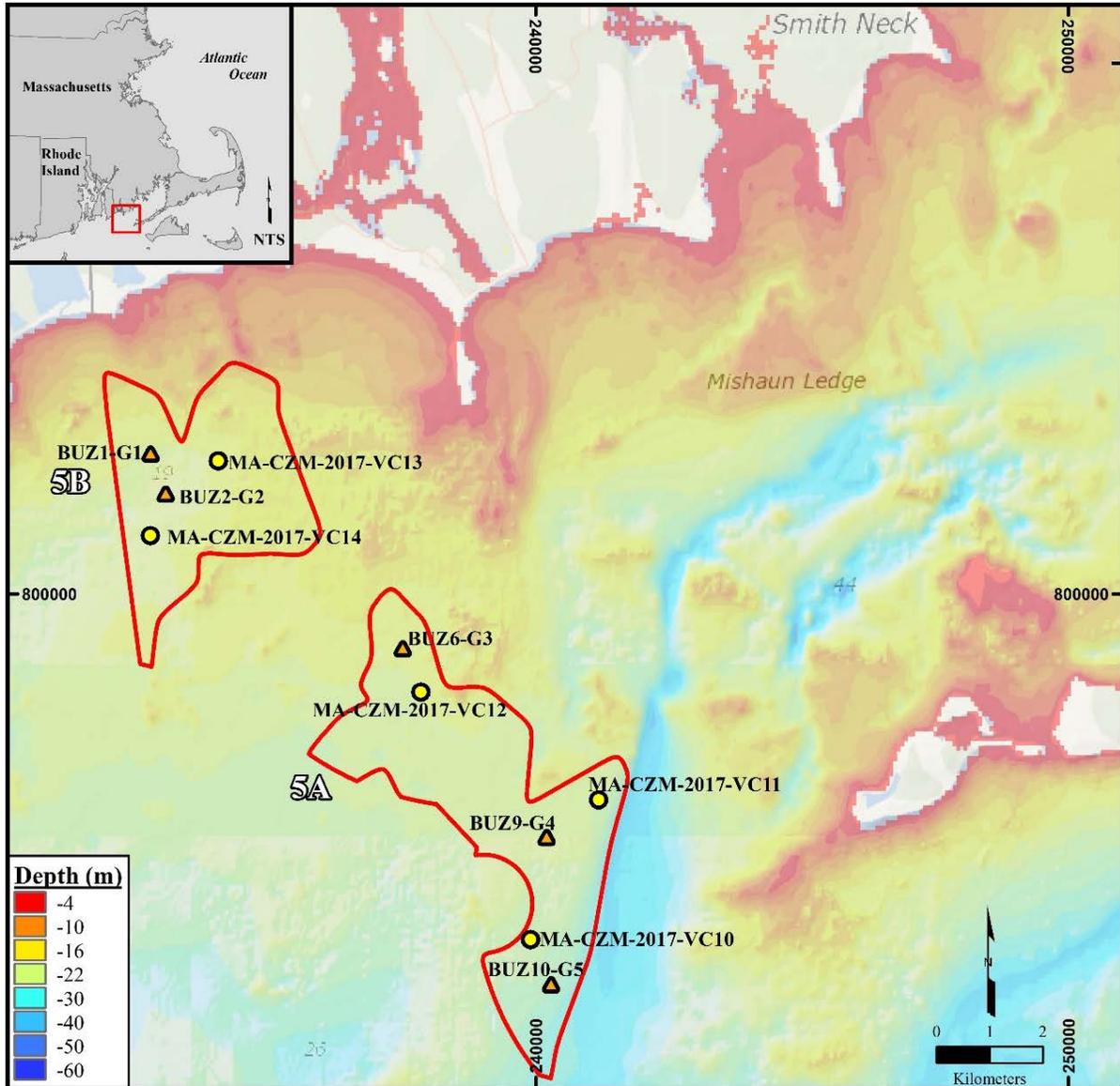
1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
4. Vibracores were collected by APTIM between September and October 2017.
5. Surface grab samples were collected by CR Environmental Inc. between August and November 2017.

Legend:

- As-Built Vibracores
- ▲ As-Built Grab Samples
- ⬮ MA OMP Sand Resource Areas

Figure 27: Study Area 4 showing the Massachusetts OMP sand resource area and as-collected vibracores and surface grab sample locations collected by APTIM and CR





Study Area 5: Cuttyhunk, As-Built Geotechnical Samples

Notes:

1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
4. Vibracores were collected by APTIM between September and October 2017.
5. Surface grab samples were collected by CR Environmental Inc. between August and November 2017.

Legend:

- As-Built Vibracores
- ▲ As-Built Grab Samples
- ⬭ MA OMP Sand Resource Areas

Figure 28: Study Area 5 showing the Massachusetts OMP sand resource area and as-collected vibracores and surface grab sample locations collected by APTIM and CR



CORE LOGGING / SAMPLE PROCESSING

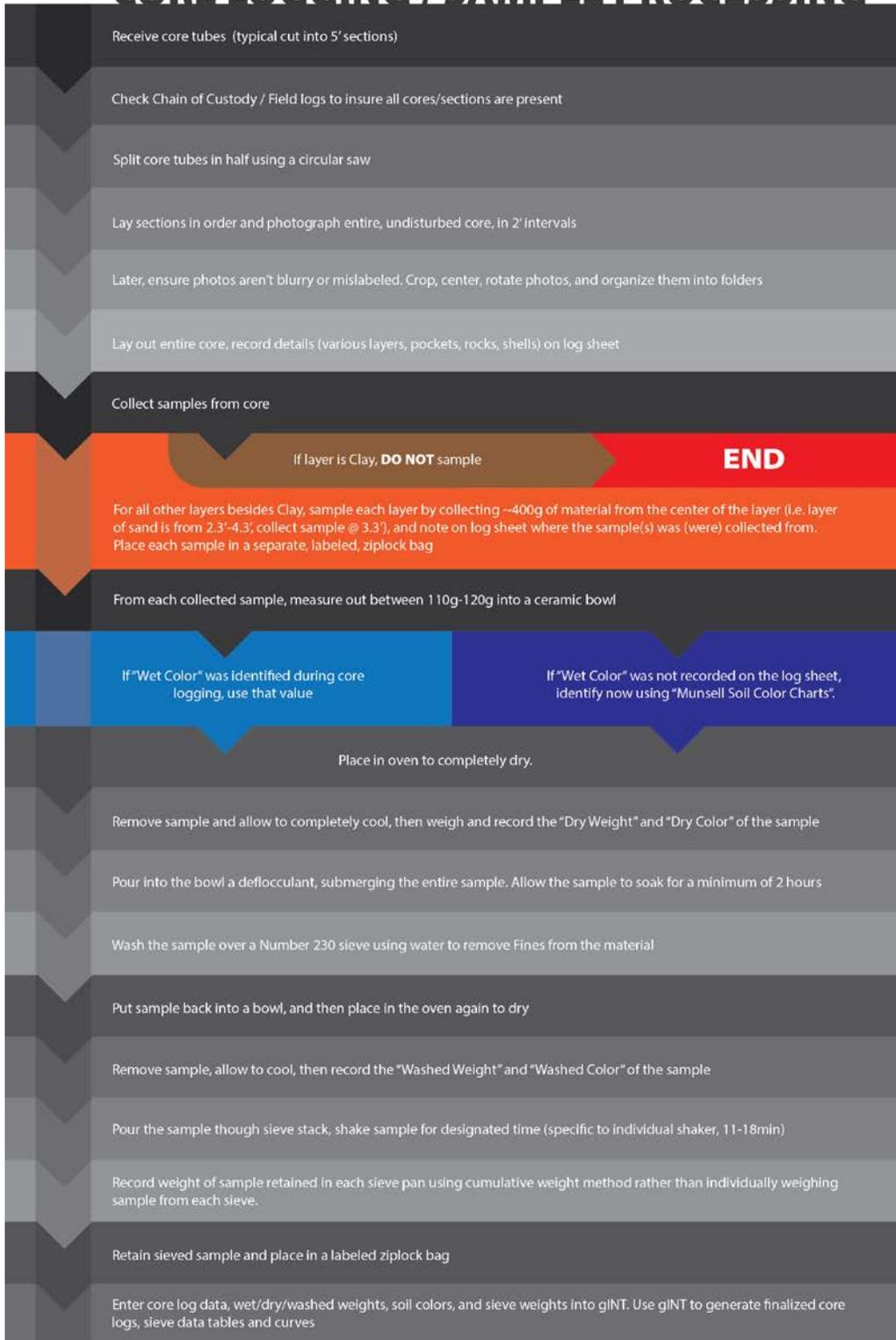
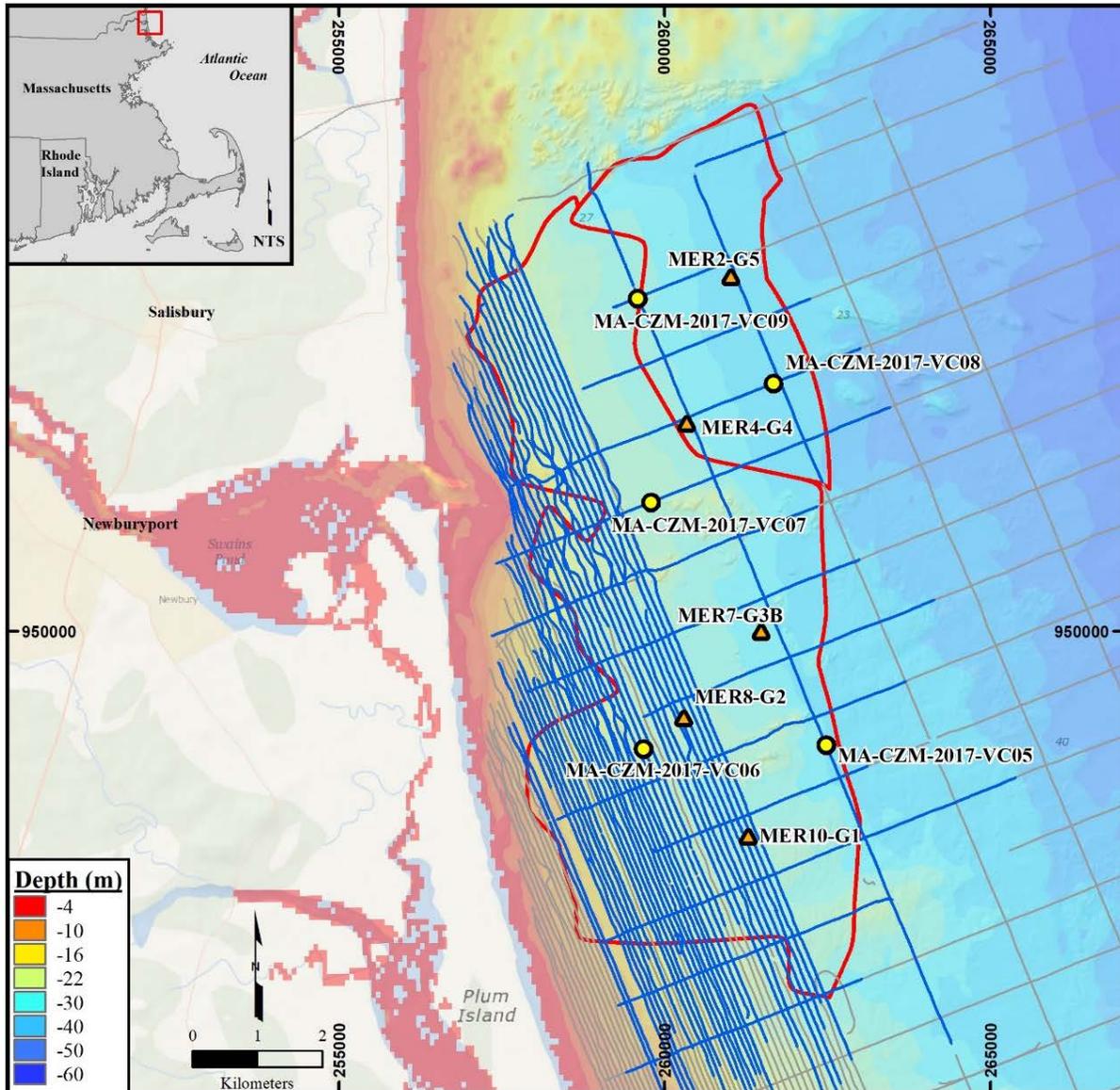


Figure 29: Flow chart depicting the steps for vibracore logging, sampling, and sample analysis.





Study Area 1: Merrimack River, Historic Seismic Sub-bottom Used for Isopach

Notes:

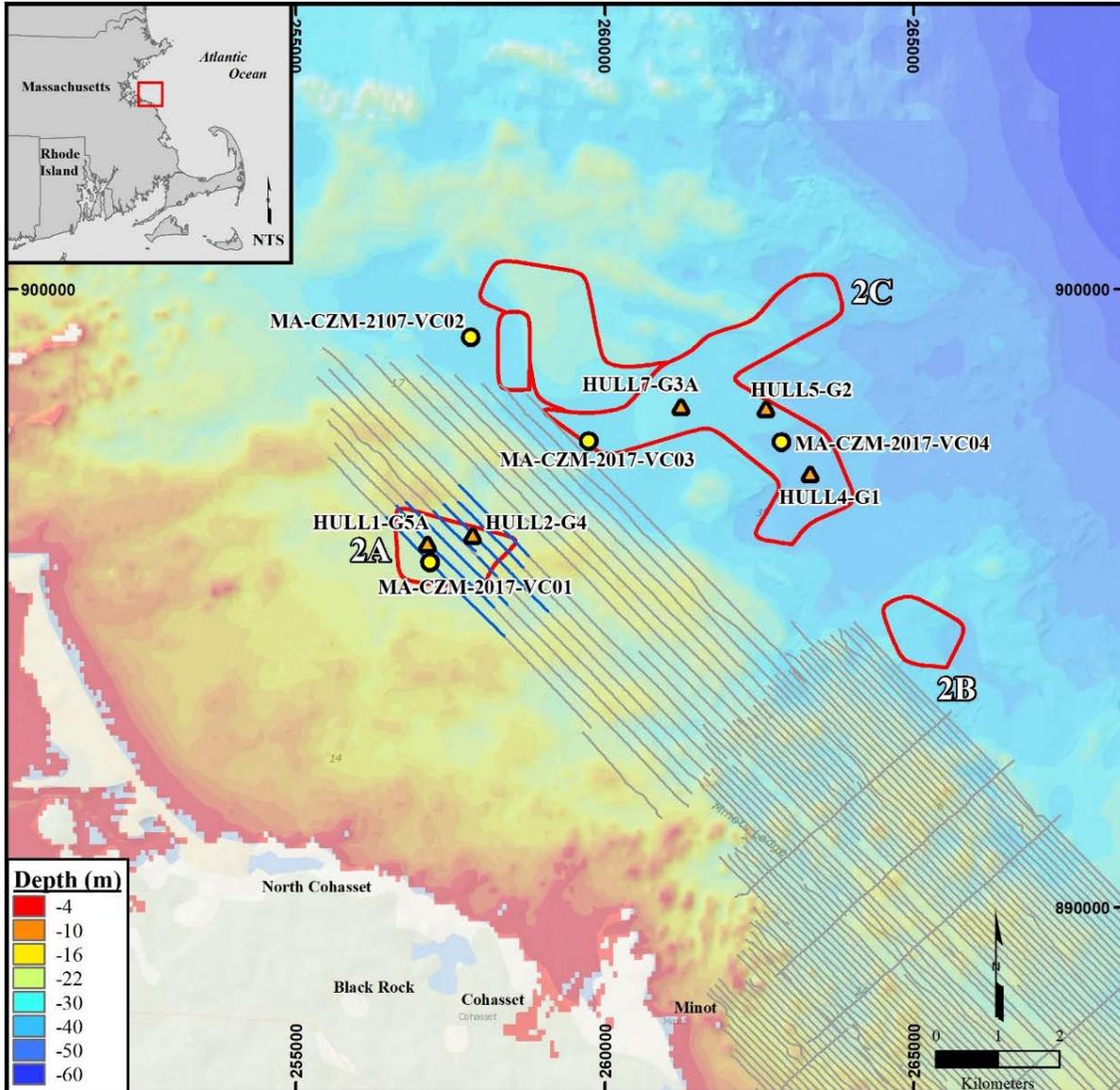
1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
4. Vibracores were collected by APIIM between September and October 2017.
5. Surface grab samples were collected by CR Environmental Inc. between August and November 2017.
6. Historic seismic sub-bottom as-run tracklines are from the U.S. Geological Survey Open-File Report 2007-1373.

Legend:

- Yellow Circle: As-Built Vibracores
- Black Triangle: As-Built Grab Samples
- Blue Line: Processed Seismic Data
- Gray Line: Historic As-Run Seismic Tracklines
- Red Outline: MA OMP Sand Resource Areas

Figure 30: Study Area 1 showing the Massachusetts OMP sand resource area and historic seismic tracklines from the USGS Open File Report 2007-1373 (gray lines) and the historic seismic data coverage used for the development of the isopach maps (blue lines)





Study Area 2: Nantasket Beach, Historic Seismic Sub-bottom Used for Isopach

Notes:

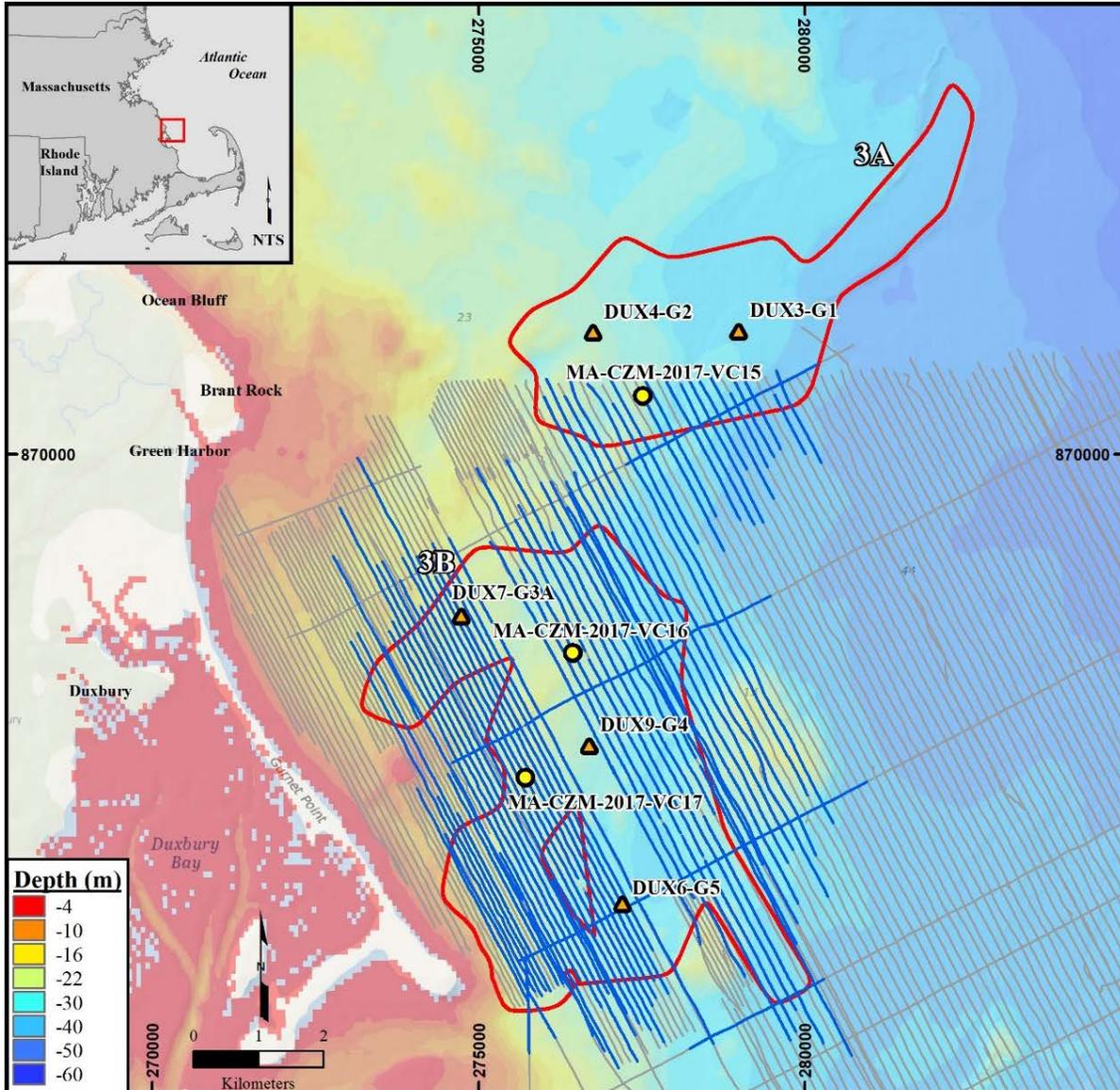
- Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
- Background imagery is the ESRI Ocean basemap.
- Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
- Vibracores were collected by APTIM between September and October 2017.
- Surface grab samples were collected by CR Environmental Inc. between August and November 2017.
- Historic seismic sub-bottom as-run tracklines are from the U.S. Geological Survey Open-File Report 2009-1072.

Legend:

- As-Built Vibracores
- ▲ As-Built Grab Samples
- Processed Seismic Data
- Historic As-Run Seismic Tracklines
- ⬭ MA OMP Sand Resource Areas

Figure 31: Study Area 2 showing the Massachusetts OMP sand resource area and historic seismic tracklines from the USGS Open File Report 2009-1072 (gray lines) and the historic seismic data coverage used for the development of the isopach maps (blue lines)





Study Area 3: Duxbury Beach, Historic Seismic Sub-bottom Used for Isopach

Notes:

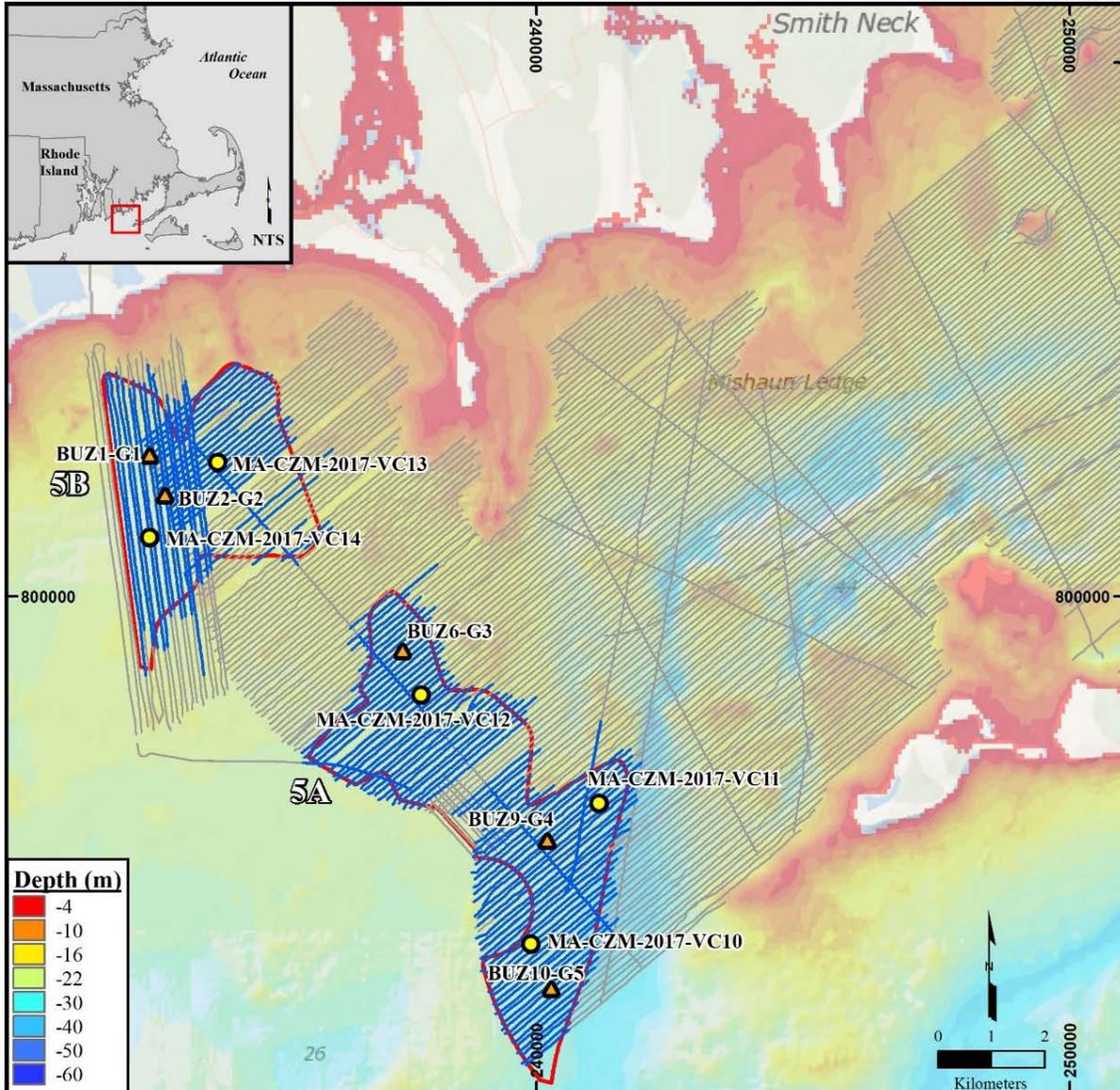
- Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
- Background imagery is the ESRI Ocean basemap.
- Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
- Vibracores were collected by APTIM between September and October 2017.
- Surface grab samples were collected by CR Environmental Inc. between August and November 2017.
- Historic seismic sub-bottom as-run tracklines are from the U.S. Geological Survey Open-File Report 2010-1006.

Legend:

- As-Built Vibracores
- ▲ As-Built Grab Samples
- Processed Seismic Data
- Historic As-Run Seismic Tracklines
- ⊞ MA OMP Sand Resource Areas

Figure 32: Study Area 3 showing the Massachusetts OMP sand resource area and historic seismic tracklines from the USGS Open File Report 2010-1006 (gray lines) and the historic seismic data coverage used for the development of the isopach maps (blue lines)





Study Area 5: Cuttyhunk, Historic Seismic Sub-bottom used for Isopach

Notes:

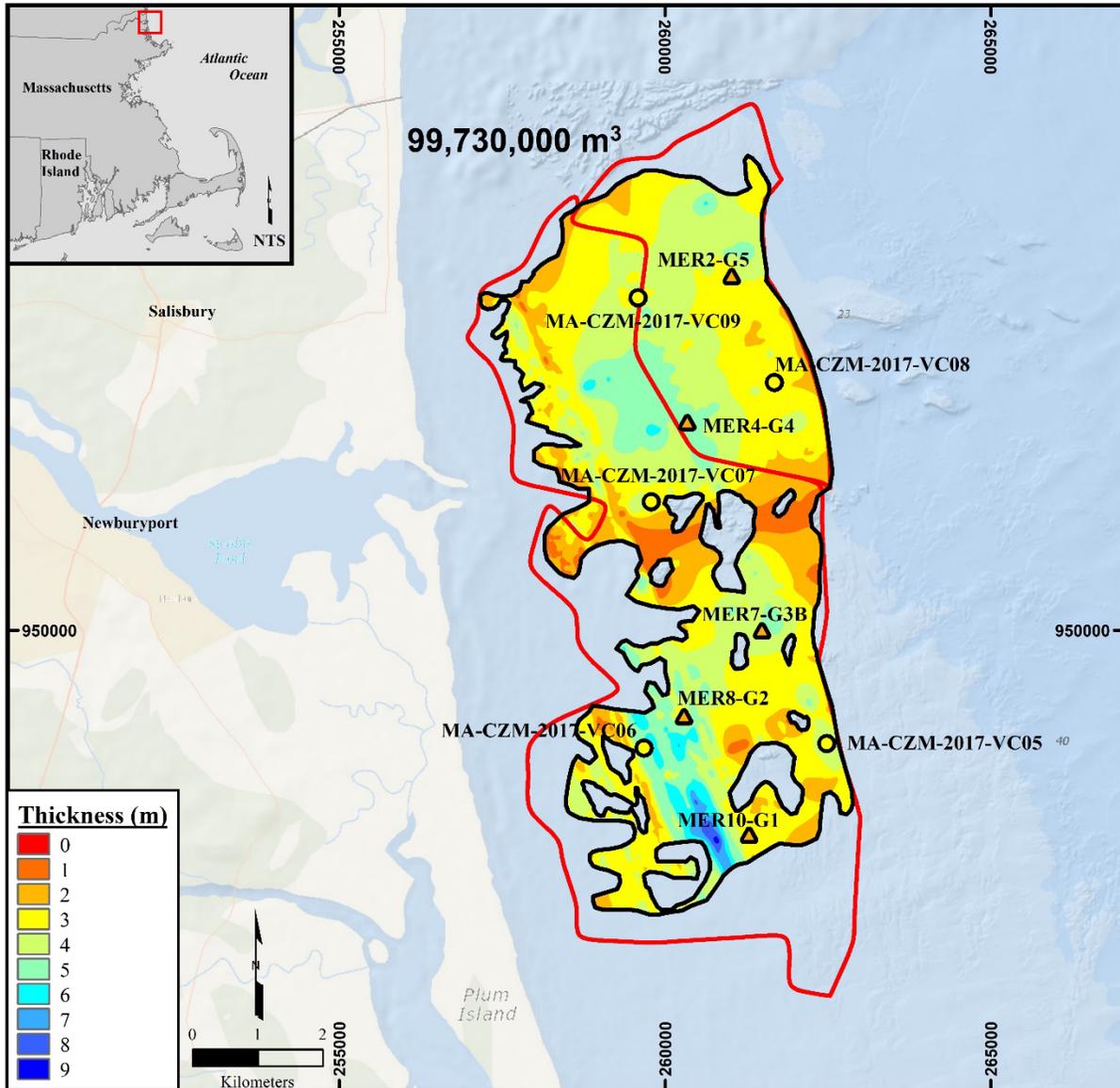
1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Massachusetts bathymetry data is based on the NGDC Coastal Relief Model, 1999.
4. Vibracores were collected by APTIM between September and October 2017.
5. Surface grab samples were collected by CR Environmental Inc. between August and November 2017.
6. Historic seismic sub-bottom as-run tracklines are from the U.S. Geological Survey Open-File Report 2012-1002.

Legend:

- As-Built Vibracores
- ▲ As-Built Grab Samples
- Processed Seismic Data
- Historic As-Run Seismic Tracklines
- MA OMP Sand Resource Areas

Figure 33: Study Area 5 showing the Massachusetts OMP sand resource area and historic seismic tracklines from the USGS Open File Report 2012-1002 (gray lines) and the historic seismic data coverage used for the development of the isopach maps (blue lines)





Study Area 1: Merrimack River, Isopach

Notes:

1. Coordinates are in meters based on the Massachusetts State Plane Coordinate System, Mainland Zone, North American Datum of 1983 (NAD 83).
2. Background imagery is the ESRI Ocean basemap.
3. Isopach interpretations are from vibracores and seismic sub-bottom data collected in 2005 by the USGS and is part of USGS Open-File Report 2007-1373.
4. Vibracores were collected by APTIM between September and October 2017.

Legend:

- As-Built Vibracores
- As-Built Grab Samples
- MA OMP Sand Resource Areas
- Interpreted Sandy Seafloor

Figure 34: Study Area 1 showing Massachusetts OMP area, interpreted sandy seafloor area and as-built vibracores. Isopach surface was created from the interpretations and digitization of the seismic data collected and used by the USGS as part of the Open-File Report 2007-1373



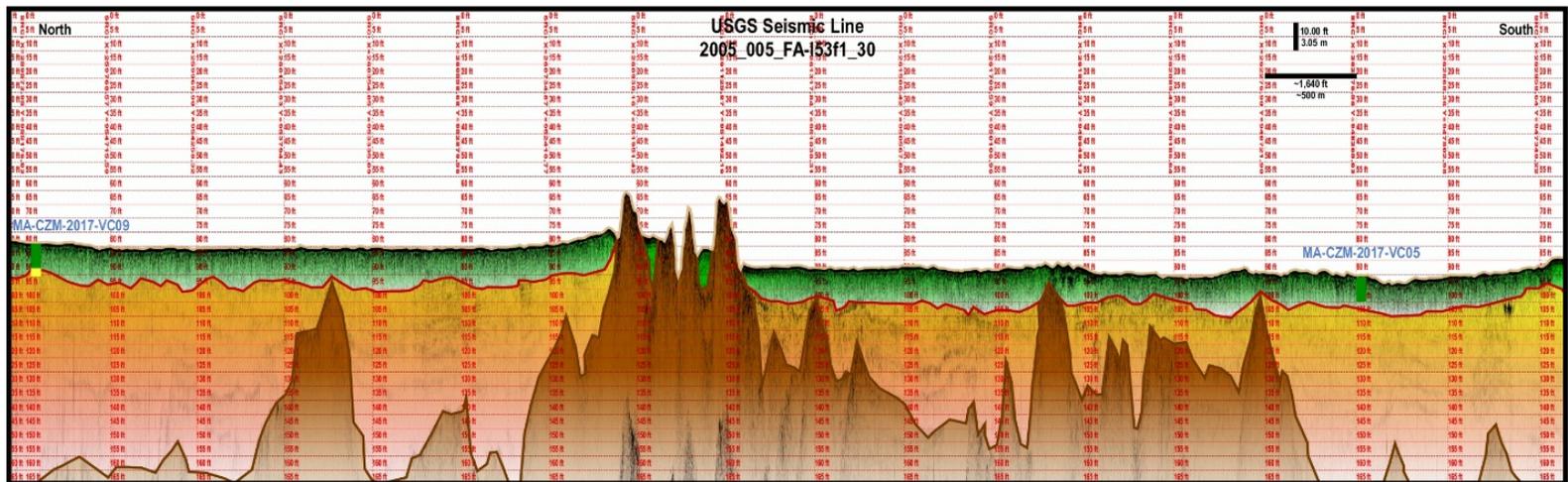
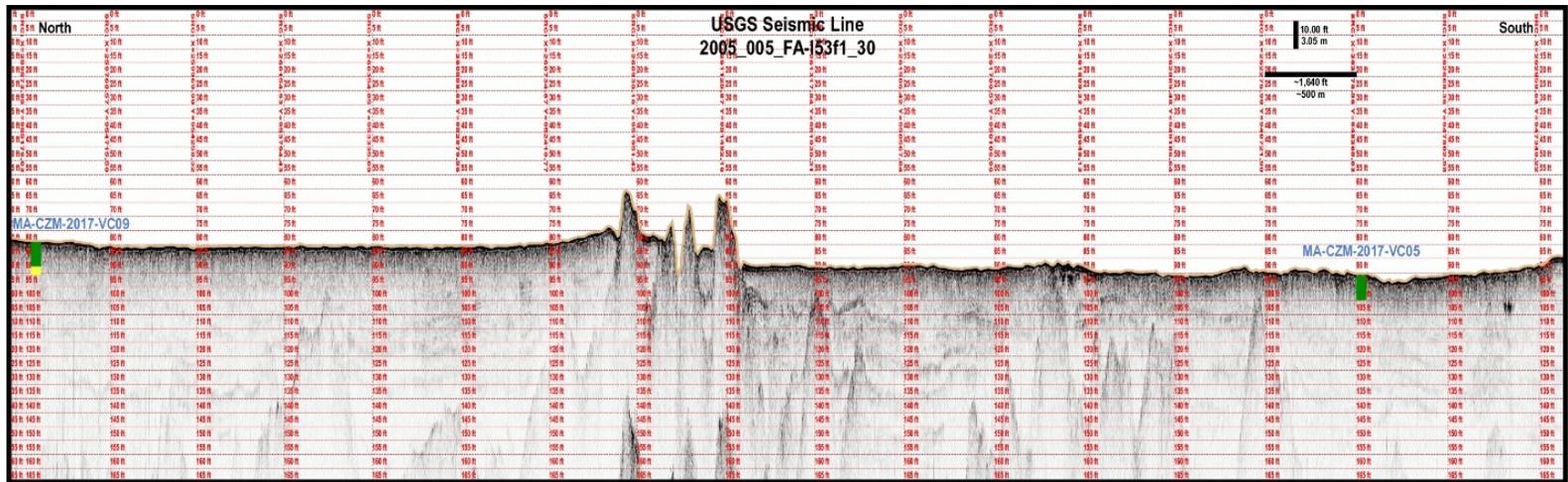


Figure 35: Historic USGS seismic sub-bottom line 2005_005_FA_I53f1_30 (Open-File Report 2007-1373) depicting the location of as-built vibracore MA-CZM-2017-VC05 and MA-CZM-2017-VC09 in Study Area 1. The vibracore is targeting unconsolidated sediments away from clear bedrock peaks (top image). On the lower image the subsurface shaded as green represents the sand portion of the seismic line, while the subsurface geology shaded as red/yellow highlights the sand portion with higher clay content. Areas shaded as brown represent bedrock and outcrop



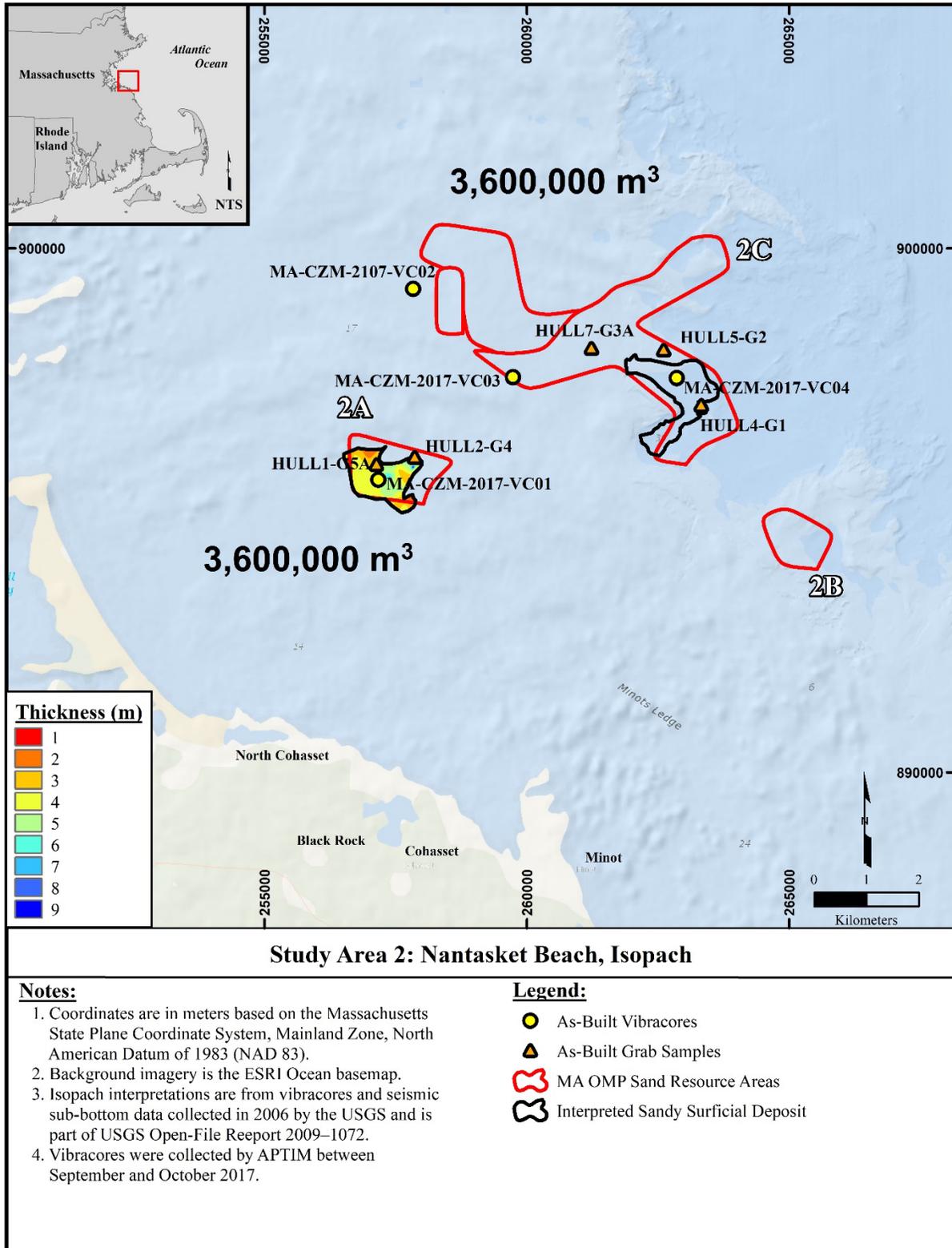


Figure 36: Study Area 2 showing Massachusetts OMP area, interpreted sandy seafloor area and as-built vibracores. Isopach surface was created from the interpretations and digitization of the seismic data collected and used by the USGS as part of the Open-File Report 2009-1072



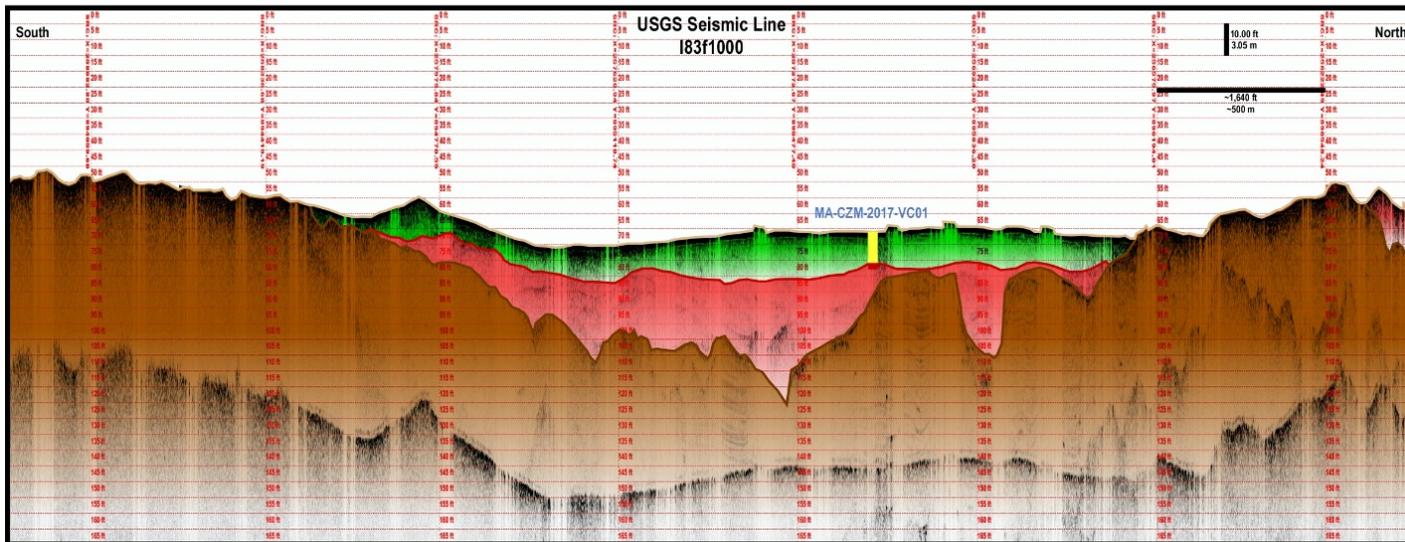
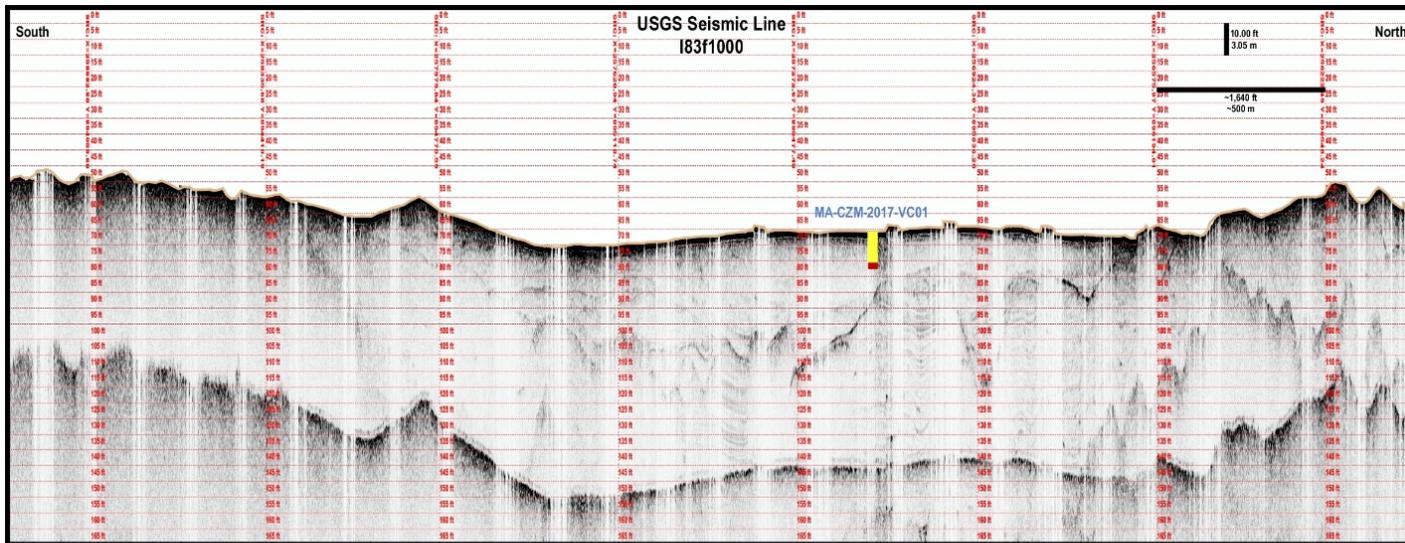


Figure 37: Historic USGS seismic sub-bottom line I83f1000 (Open-File Report 2009-1072) depicting the as-built vibracore MA-CZM-2017-VC01 location in Study Area 2. The vibracore is targeting the subsurface, channel-like deposit (top image). On the lower image the subsurface shaded as green represents the sand portion of the seismic line, while the subsurface geology shaded as red highlights the clay portion of the vibracore. Areas shaded as brown highlight the bedrock (i.e. hard bottom)



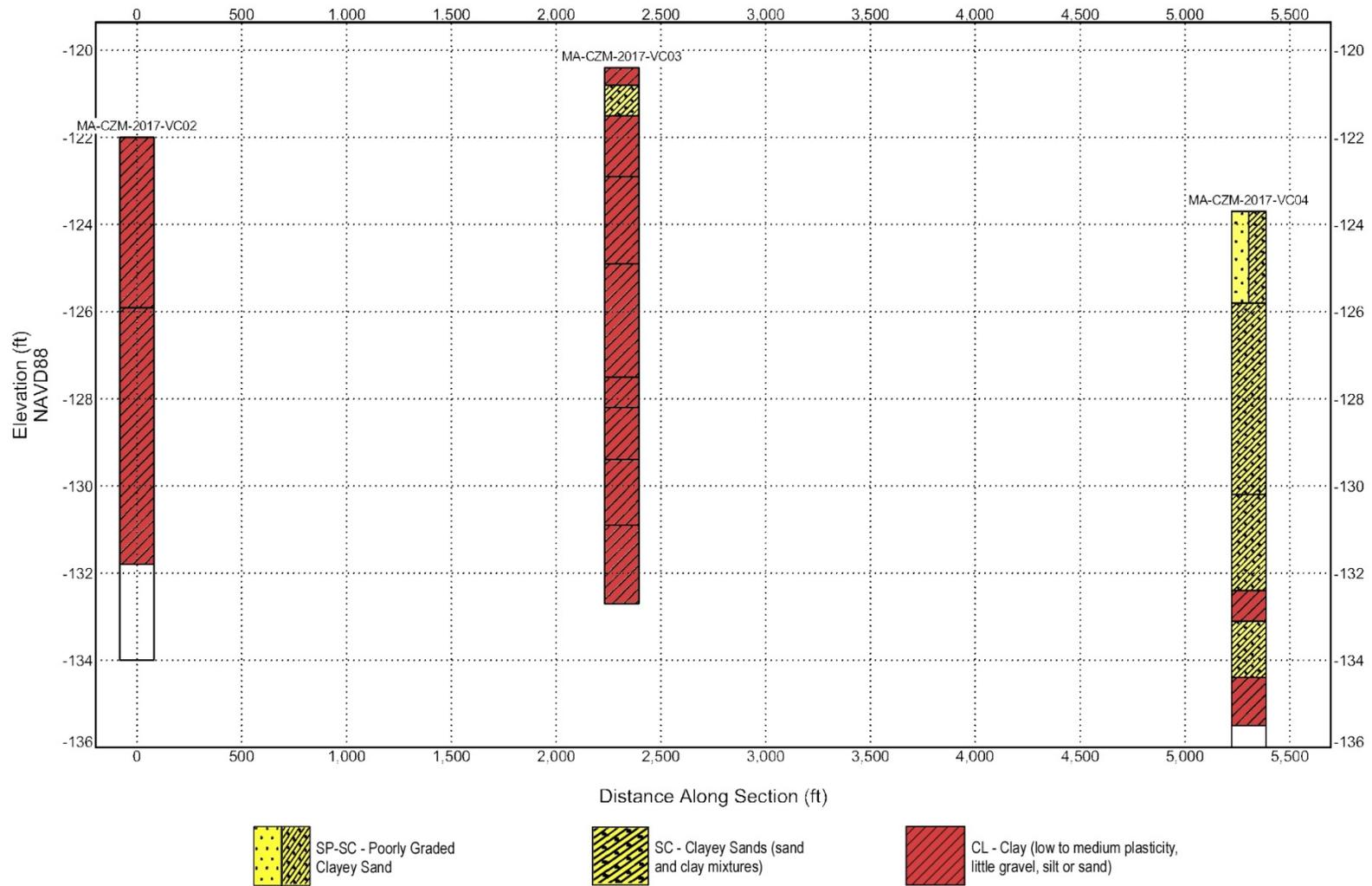


Figure 38: Fence diagram for Study Area 2C showing the correlation between the sand and clay deposits across the collected vibracores in the Study Area. Layers color coded as red indicate portions with high clay content, while layers in yellow indicate sands with less than 10% clay content



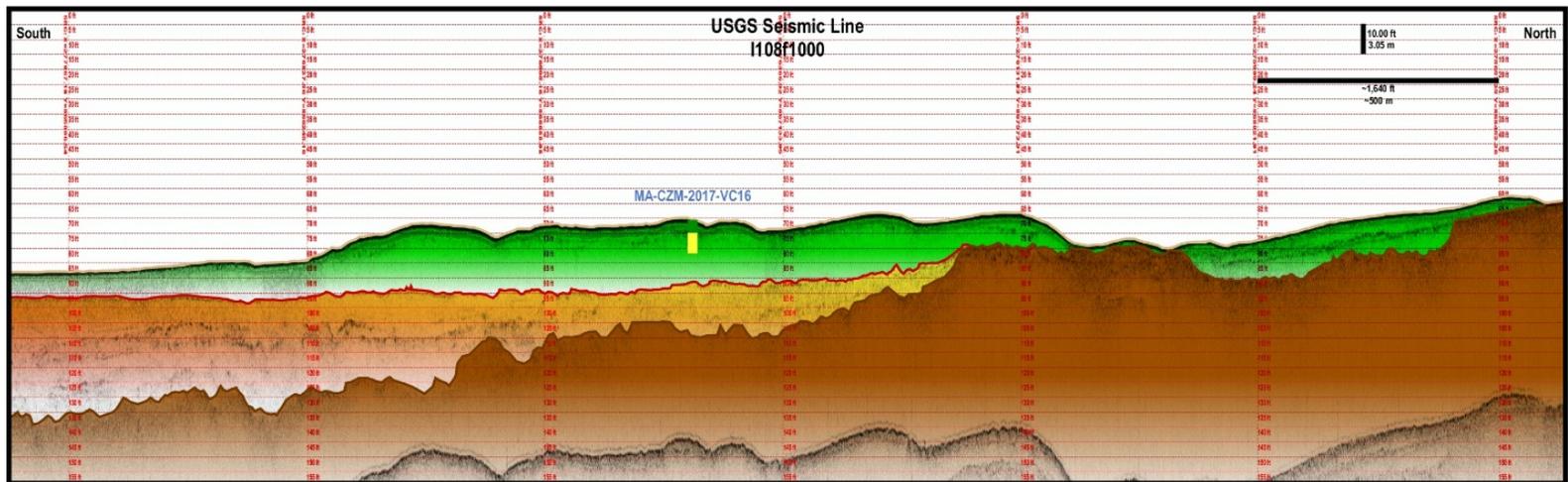
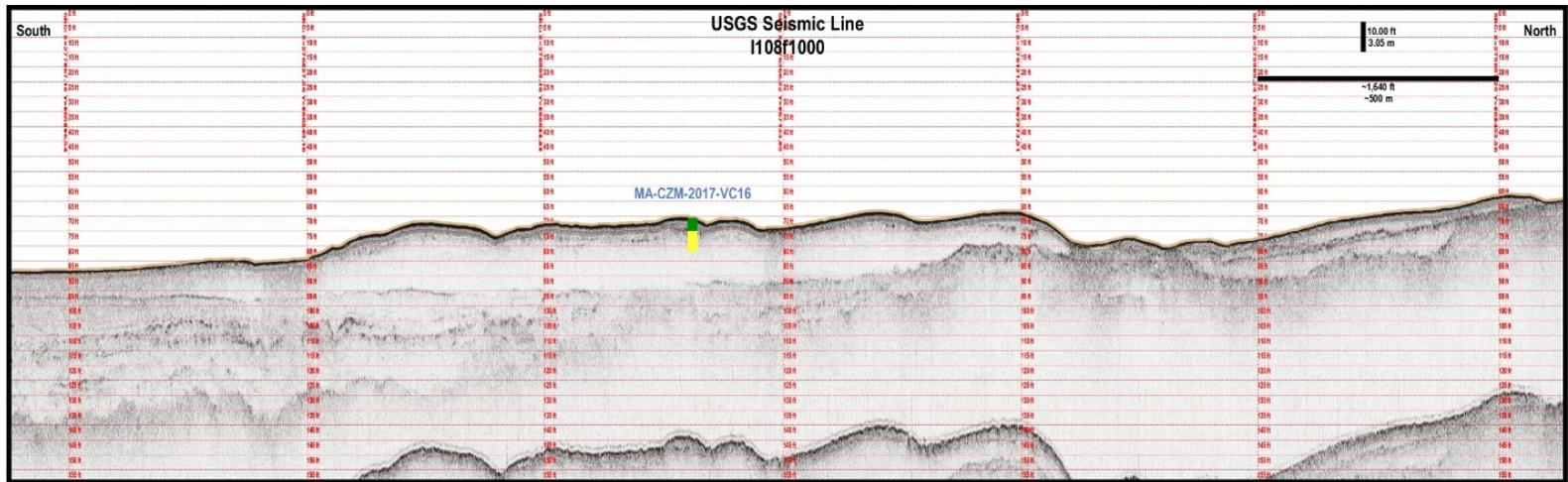


Figure 39: Historic USGS seismic sub-bottom line I108f1000 (Open-File Report 2010-1006) depicting the as-built vibracore MA-CZM-2017-VC16 location in Study Area 3. The vibracore is targeting the sand hill (top image). On the lower image the subsurface shaded as green represents the sand portion of the seismic line, while the subsurface geology shaded as yellow/red highlights the potentially non-beach-compatible deposit. Areas shaded as brown highlight the bedrock (i.e. hard bottom)



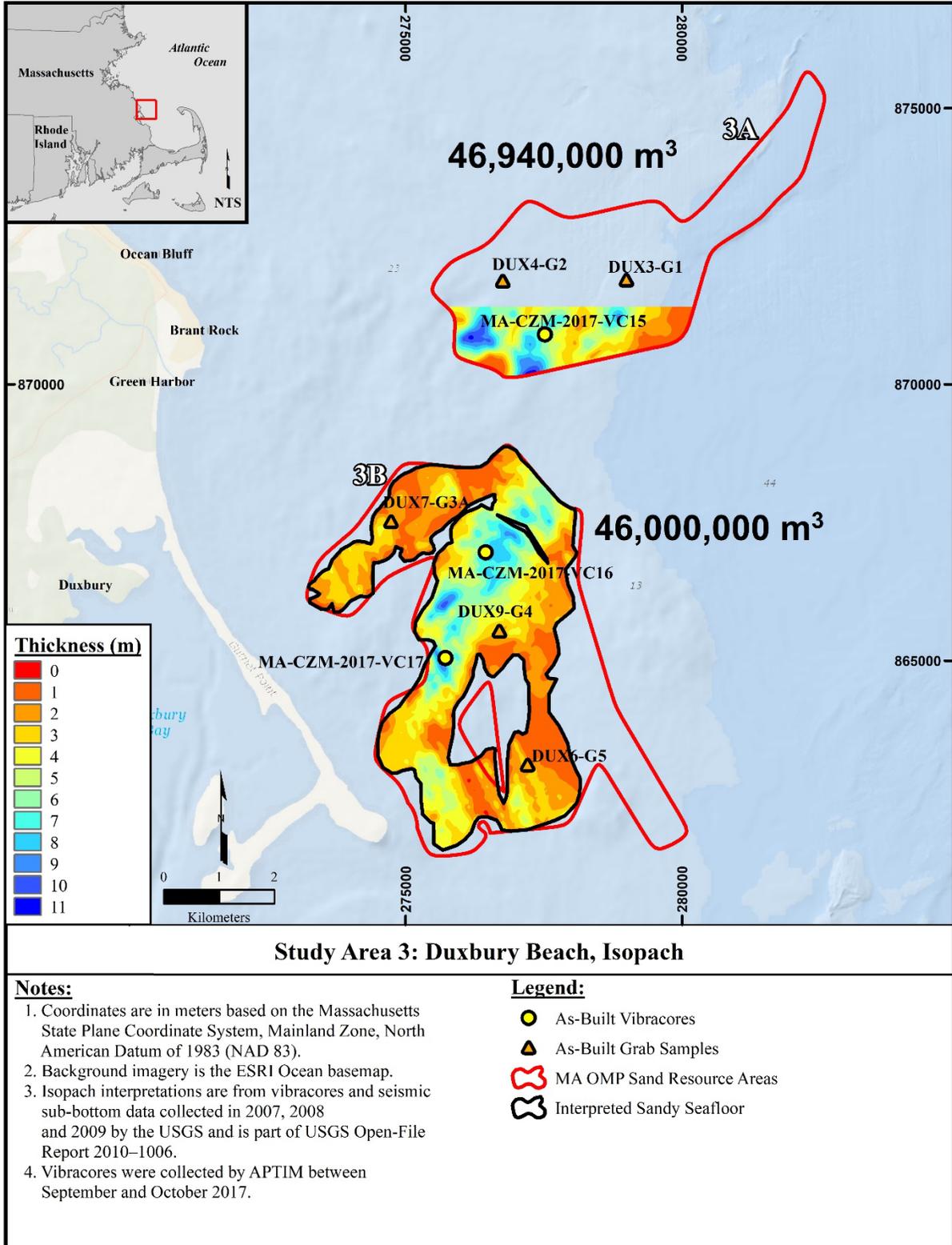


Figure 40: Study Area 3 showing Massachusetts OMP area, interpreted sandy seafloor area and as-built vibracores. Isopach surface was created from the interpretations and digitization of the seismic data collected and used by the USGS as part of the Open-File Report 2010-1006



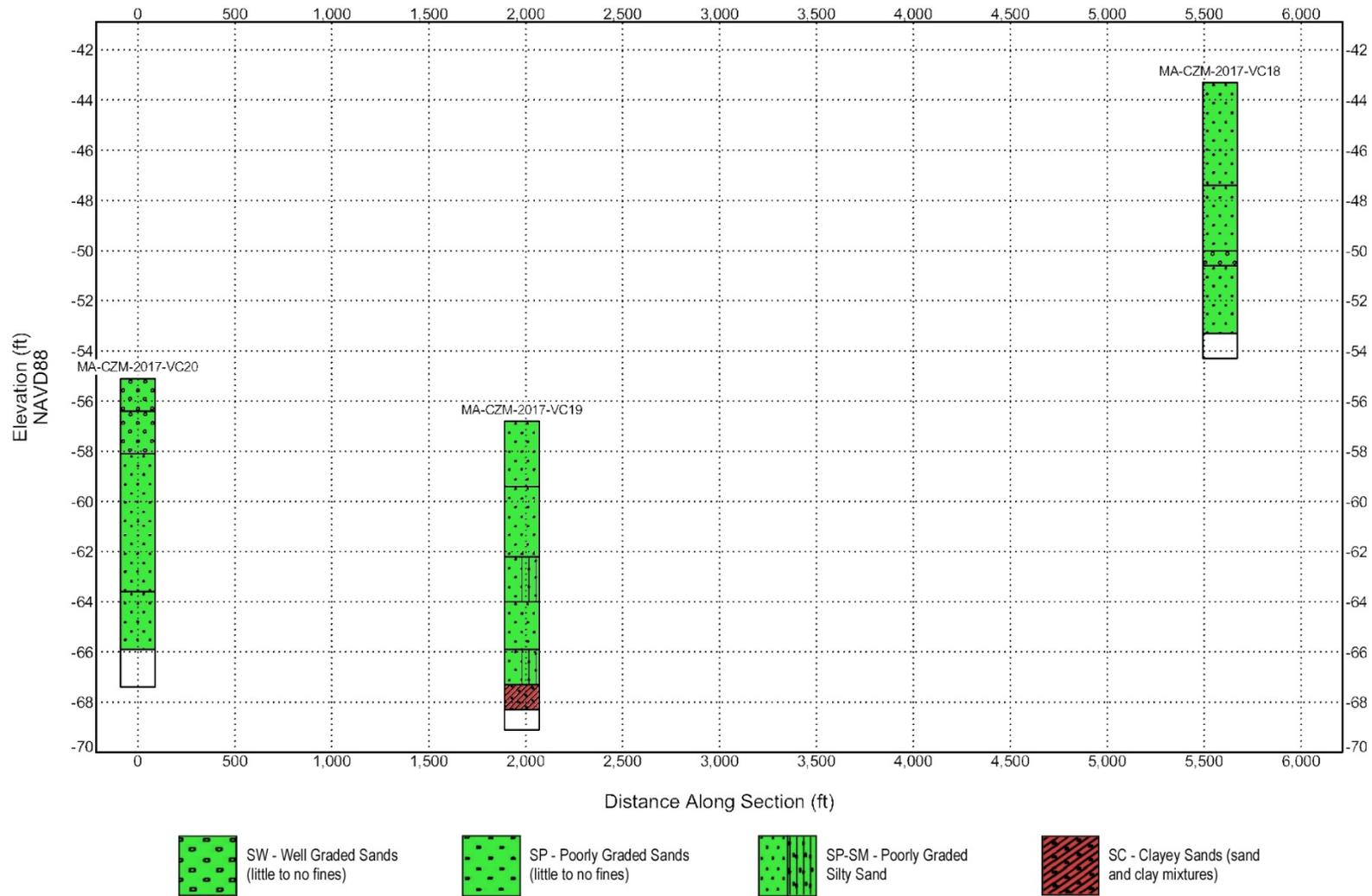


Figure 41: Fence diagram for Study Area 4A showing the correlation between the sand and clayey sand deposits across the collected vibracores in the Study Area. Layers color coded as green indicate portions with less than 5% fine grain content, while layers in red indicate sands with more than 10% clay content



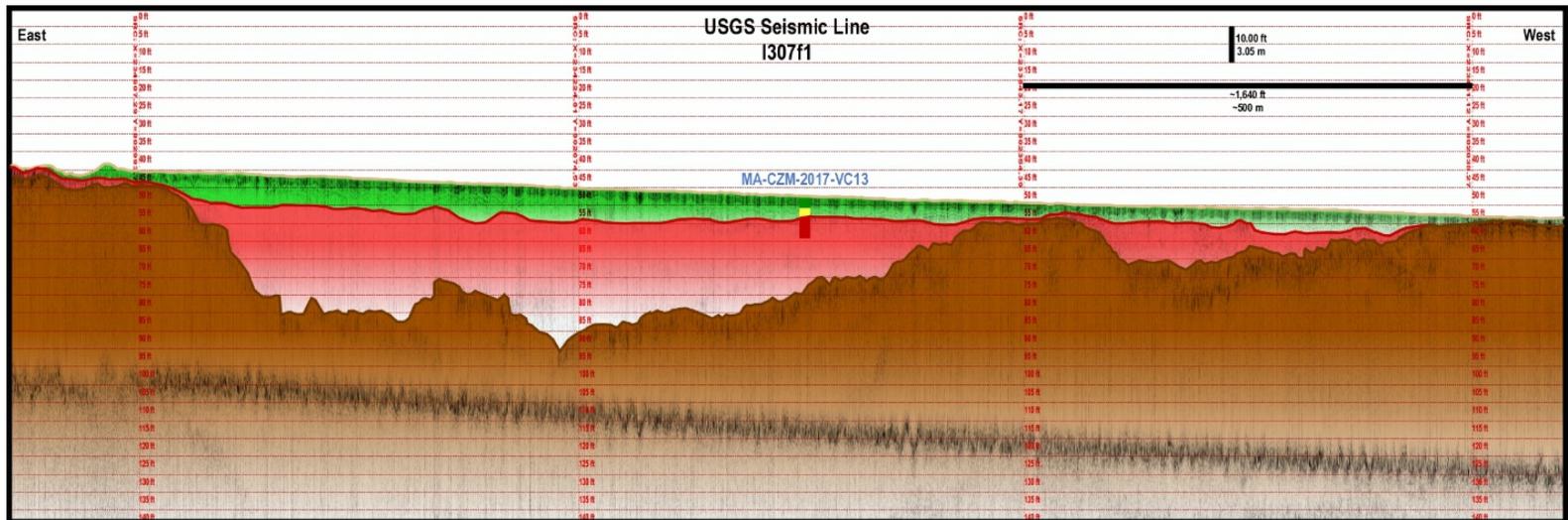
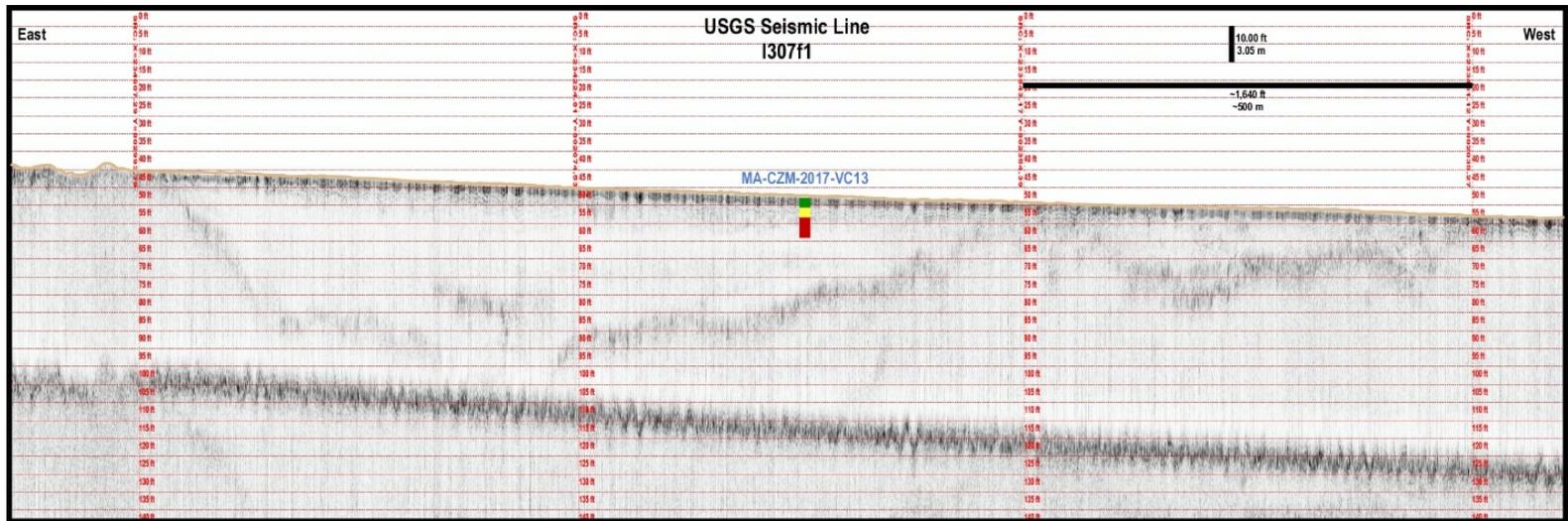


Figure 42: Historic USGS seismic sub-bottom line I307f1 (Open-File Report 2012-1002) depicting the as-built vibracore MA-CZM-2017-VC13 location in Study Area 5B. The vibracore is targeting the subsurface, channel-like deposit (top image). On the lower image the subsurface shaded as green represents the sand portion of the seismic line, while the subsurface geology shaded as red highlights the potentially non-beach-compatible deposit (high clay content). Areas shaded as brown highlight the bedrock (i.e. hard bottom)



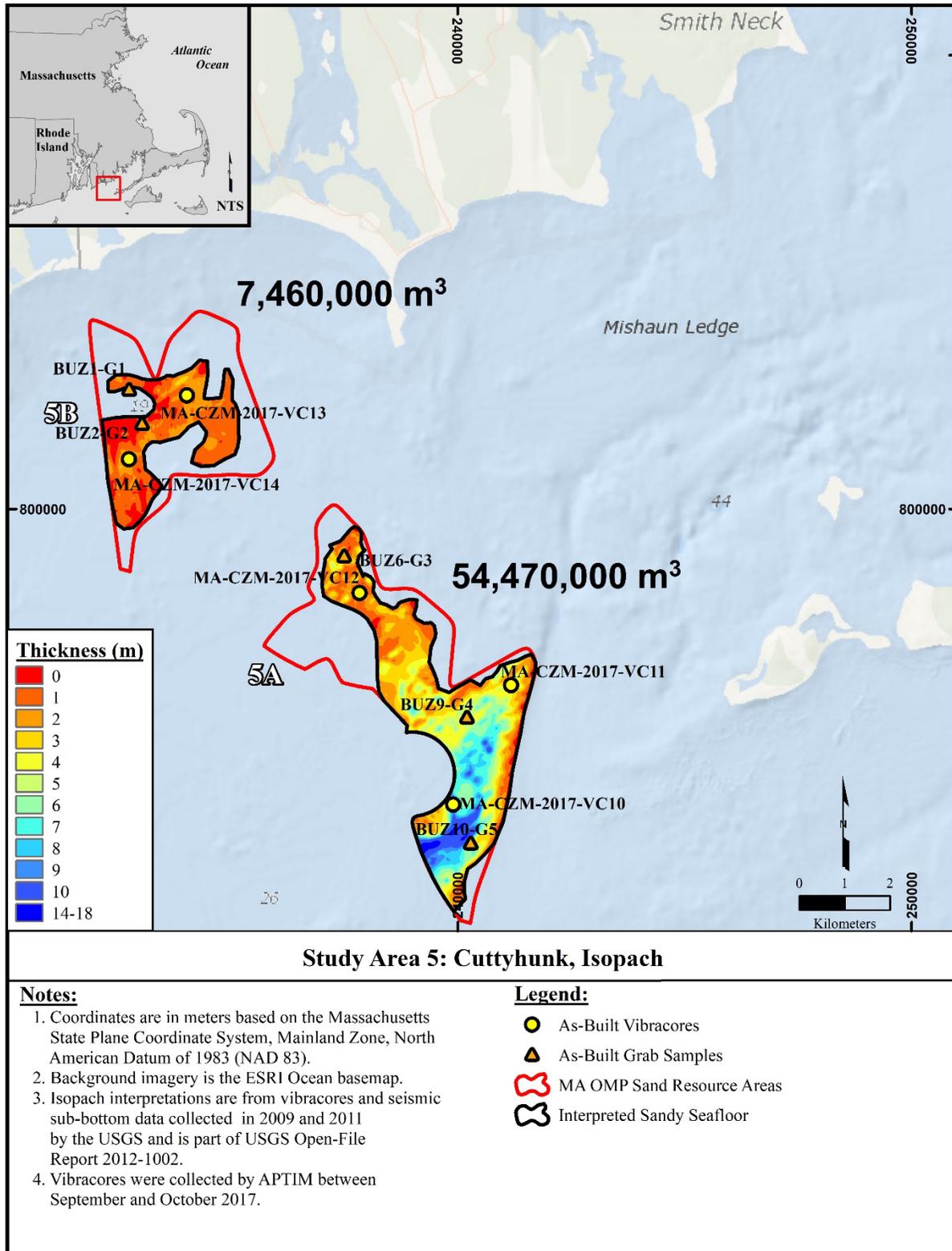
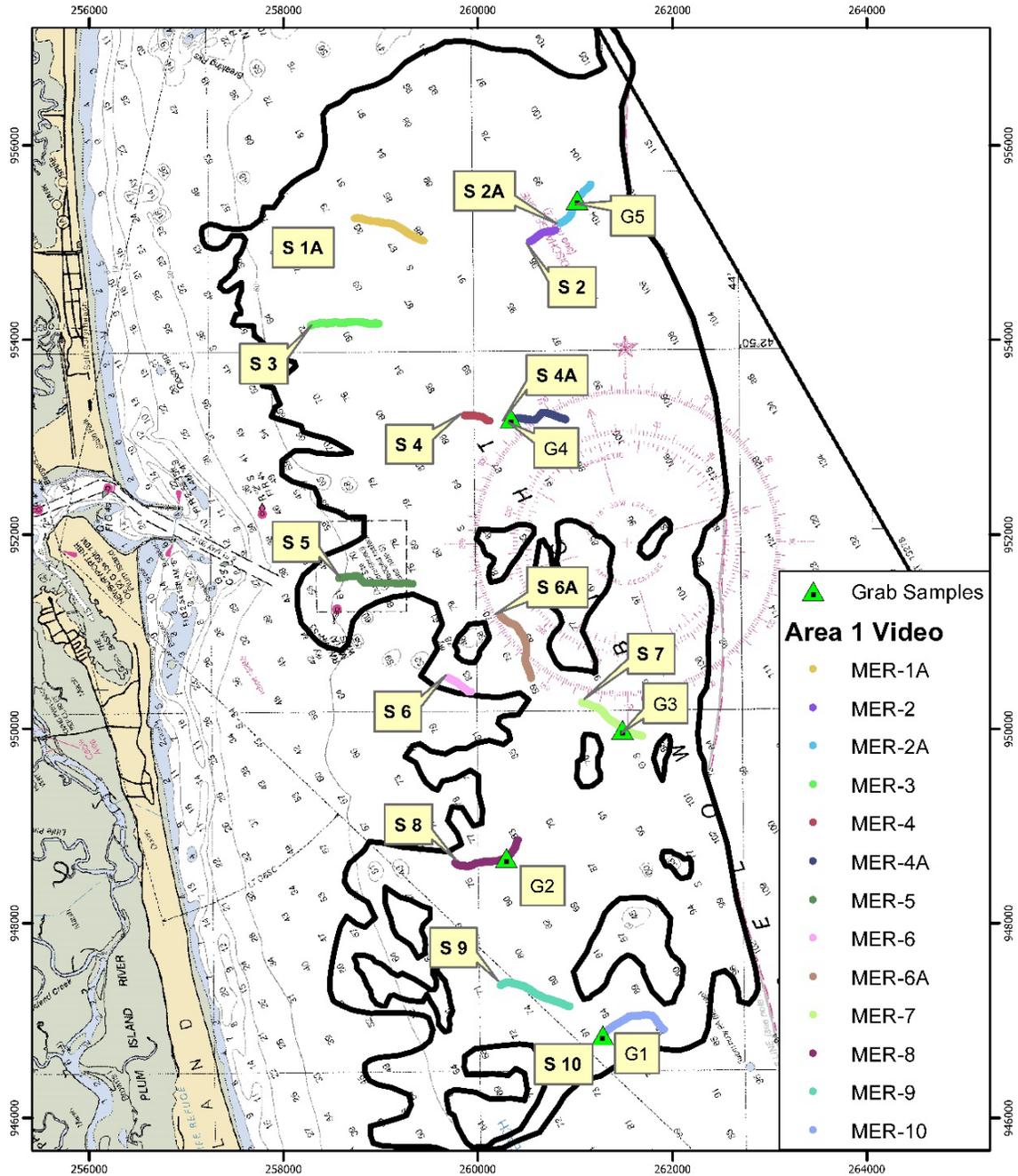


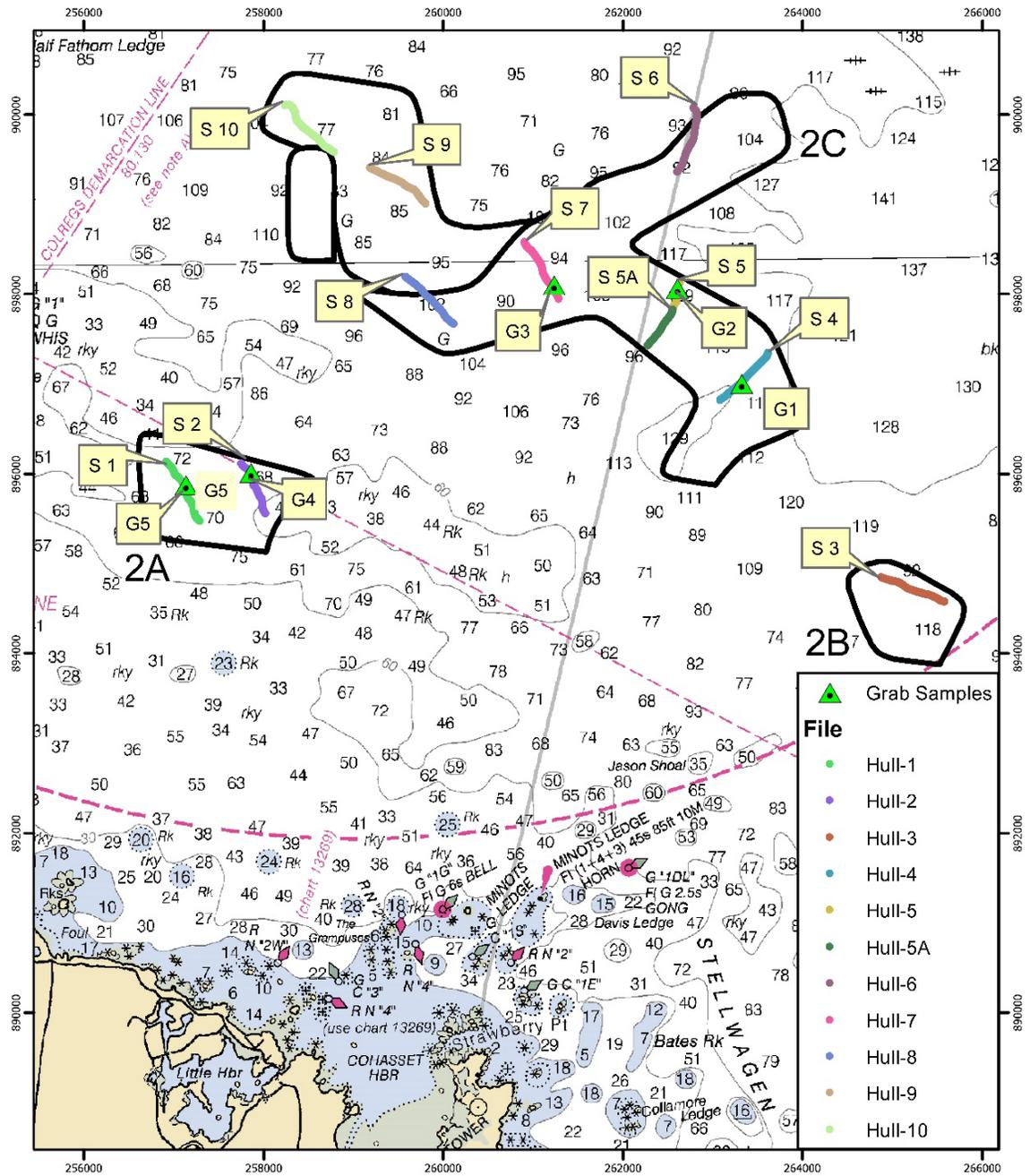
Figure 43: Study Area 5 showing Massachusetts OMP area, interpreted sandy seafloor area and as-built vibracores. Isopach surface was created from the interpretations and digitization of the seismic data collected and used by the USGS as part of the Open-File Report 2012-1002





 www.crenvironmental.com	<p>Underwater Video Tracklines and Samples East of the Mouth of the Merrimack River, Gulf of Maine - September 12-13, 2017 Preliminary Characterization of Offshore Sand Resources, MA CZM</p>	
	<p>NOTES: 1) Grid MA State Plane NAD 83 Meters 2) "S X" indicates the start point of transect X.</p>	

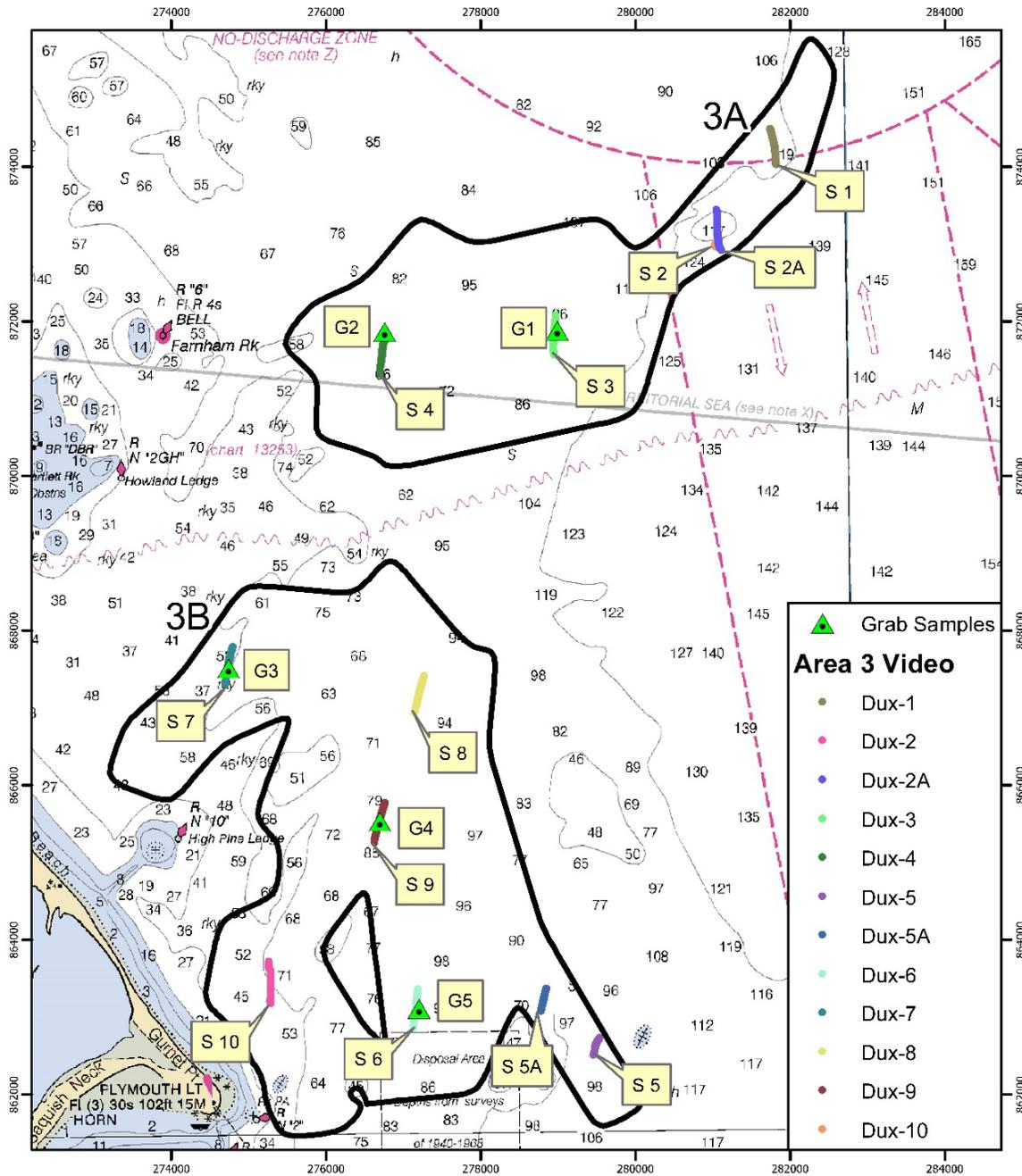
Figure 44: Study Area 1 showing the interpreted sandy seafloor area along with as-run video transects and grab samples collected by CR



 www.crenvironmental.com	<p>Underwater Video Tracklines and Samples off Nantasket Beach Massachusetts Bay, Hull, MA August 16-17, 2017 Preliminary Characterization of Offshore Sand Resources, MA CZM</p>	
	<p>NOTES: 1) Grid MA State Plane NAD 83 Meters 2) "S X" indicates the start point of transect X.</p> <p style="text-align: center;">Kilometers </p>	

Figure 45: Study Area 2 showing the interpreted sandy seafloor area along with as-run video transects and grab samples collected by CR

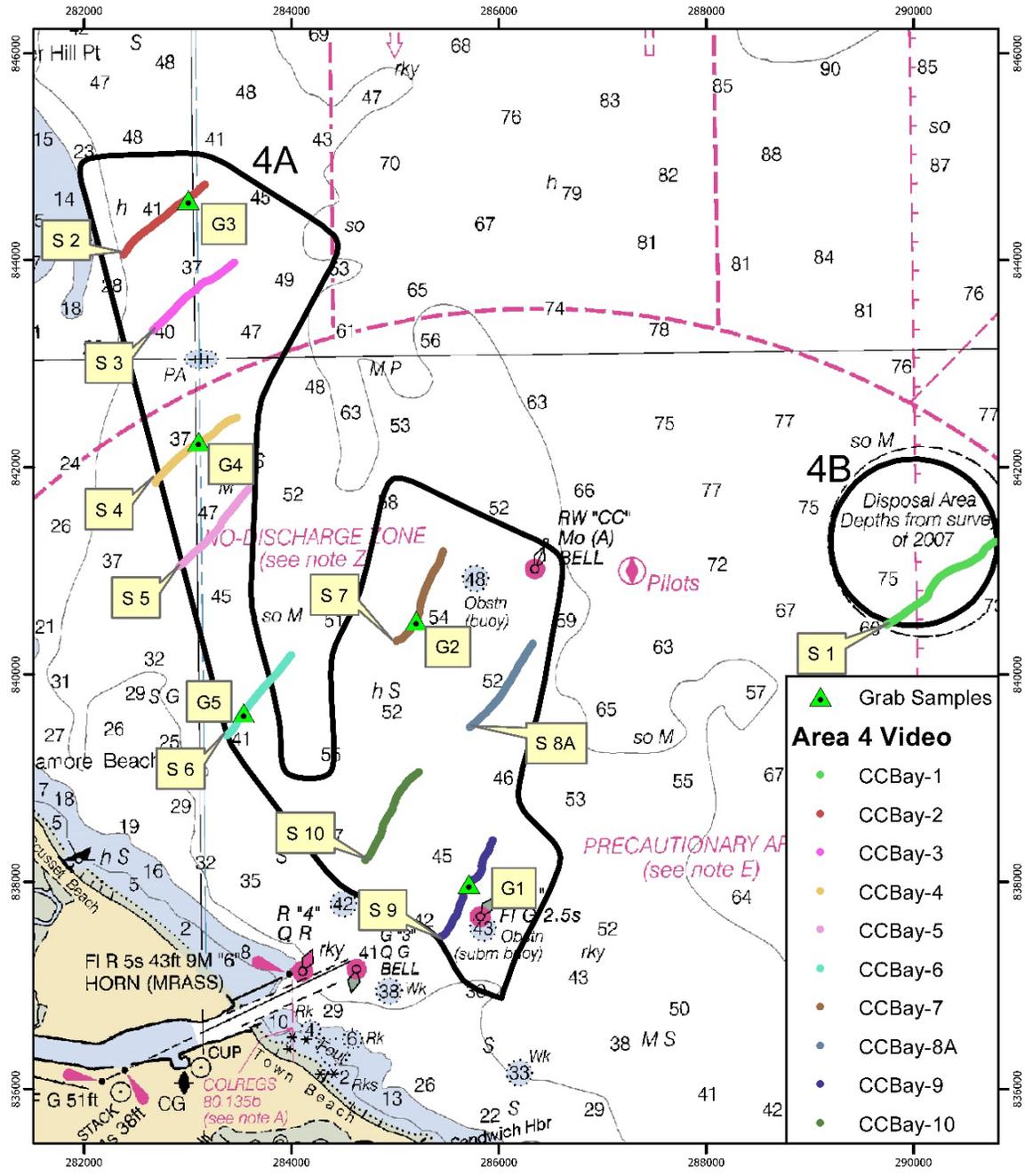




 www.crenvironmental.com	<p>Underwater Video Tracklines and Samples outside Duxbury Bay, Cape Cod Bay, MA November 3, 2017 Preliminary Characterization of Offshore Sand Resources, MA CZM</p>	
	<p>NOTES: 1) Grid MA State Plane NAD 83 Meters 2) "S X" indicates the start point of transect X.</p> <p style="text-align: right;">Kilometers 0 0.5 1 1.5 2</p> 	

Figure 46: Study Area 3 showing the Massachusetts OMP Sand Resource Areas along with as-run video and grab samples transects collected by CR





 www.crenvironmental.com	<p>Underwater Video Tracklines and Samples in Cape Cod Bay East of the Cape Cod Canal, August 2, 2017 Preliminary Characterization of Offshore Sand Resources, MA CZM</p>	
	<p>NOTES: 1) Grid MA State Plane NAD 83 Meters 2) "S X" indicates the start point of transect X.</p>	

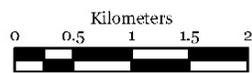
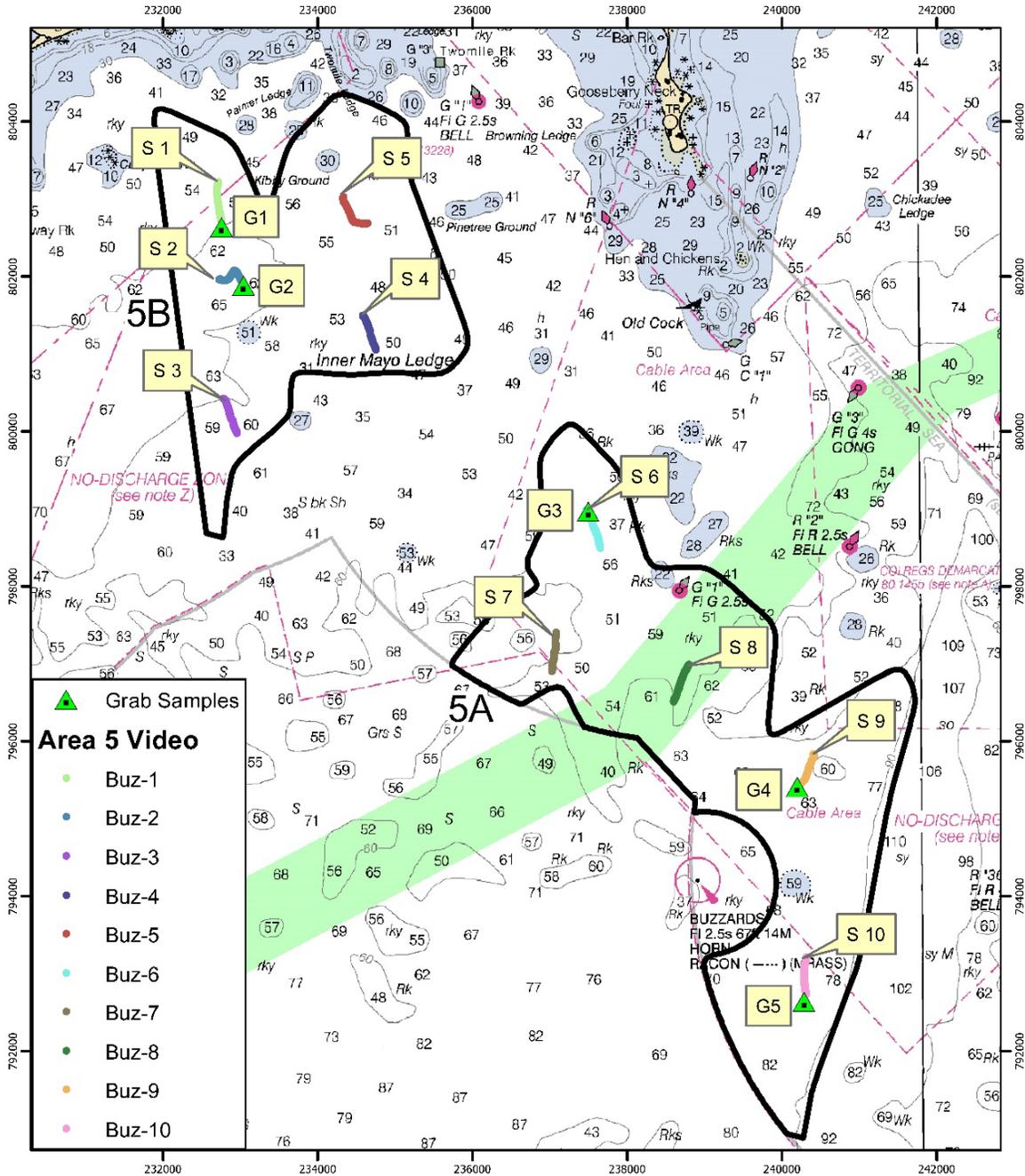


Figure 47: Study Area 4 showing the Massachusetts OMP Sand Resource Areas along with as-run video transects and grab samples collected by CR





 www.crenvironmental.com	<p>Underwater Video Tracklines and Samples Buzzards Bay off Cuttyhunk, MA November 9, 2017 Preliminary Characterization of Offshore Sand Resources, MA CZM</p>	
	<p>NOTES: 1) Grid MA State Plane NAD 83 Meters 2) "S X" indicates the start point of transect X.</p> <p>Kilometers 0 0.5 1 1.5 2</p> 	

Figure 48: Study Area 5 showing Massachusetts OMP Sand Resource Areas along with as-run video transects and grab samples collected by CR



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20.0 Appendices



Appendix A

Vibracore Logs



DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In. 10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC01		LOCATION COORDINATES (m) X = 257,169 Y = 895,590		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Francis Stankiewicz			12. TOTAL SAMPLES DISTURBED: 3 UNDISTURBED (UD)	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED: 09-17-17 10:38 COMPLETED: 09-17-17 10:39	
8. TOTAL DEPTH OF BORING 12.0 Ft.			16. ELEVATION TOP OF BORING -76.1 Ft.	
			17. TOTAL RECOVERY FOR BORING 12 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-76.1	0.0					
			SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", (1.5" x 0.75") rock @ 0.1' and shell fragment @ 4.6', 1.0" shell fragment @ 0.4', 3.0" whole shell @ 0.5', (2.5" x 2.0") shell fragment @ 0.7', very dark gray (5Y-3/1), (SP-SM).		1	Sample #1, Depth = 2.5' Mean (mm): 0.14, Phi Sorting: 0.63 Fines (230): 9.16% (SP-SM)
-81.2	5.1		SAND, fine grained, quartz, trace clay, trace organics, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments and rocks up to (0.75" x 0.5"), very dark gray (5Y-3/1), (SP-SM).		2	Sample #2, Depth = 7.4' Mean (mm): 0.16, Phi Sorting: 0.83 Fines (230): 8.84% (SP-SM)
-86.0	9.9		SAND, fine grained, quartz, little clay, trace rock, trace shell hash, trace silt, rocks up to 1.5", (1.5" x 1.0") shell fragment @ 9.9', (1.0" x 0.5") shell fragment @ 10.1', (2.0" x 1.25") rock @ 10.5', greenish black (10Y-2.5/1), (SC).		3	Sample #3, Depth = 11.0' Mean (mm): 0.19, Phi Sorting: 1.62 Fines (230): 19.71% (SC)
-88.1	12.0		End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
2. BORING DESIGNATION MA-CZM-2017-VC02			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER	
4. NAME OF DRILLER Francis Stankiewicz			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 0	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED COMPLETED 09-17-17 12:25 09-17-17 12:28	
8. TOTAL DEPTH OF BORING 12.0 Ft.			16. ELEVATION TOP OF BORING -122.0 Ft.	
			17. TOTAL RECOVERY FOR BORING 9.8 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-122.0	0.0					
-125.9	3.9		Sandy CLAY, very soft, trace shell fragments, trace shell hash, shell fragments up to (0.5" x 0.25"), (0.5" x 0.25") rock @ 0.9', (2.0" x 1.0") shell fragment @ 2.0', (2.0" x 1.5") and (3.0" x 2.0") shell fragments @ 2.2', very dark greenish gray (10Y-3/1), (CL).			
-131.8	9.8		CLAY, soft, some sand, sand distributed in sandy pockets up to (3.0" x 2.0"), greenish gray (10Y-5/1), (CL).			
-134.0	12.0		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In. 10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC03		LOCATION COORDINATES (m) X = 259,735 Y = 897,547		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Francis Stankiewicz				
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
6. THICKNESS OF OVERBURDEN N/A		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 0		
7. DEPTH DRILLED INTO ROCK N/A		13. TOTAL NUMBER CORE BOXES		
8. TOTAL DEPTH OF BORING 12.2 Ft.				
14. ELEVATION GROUND WATER				
15. DATE BORING		STARTED 09-17-17 13:49	COMPLETED 09-17-17 13:51	
16. ELEVATION TOP OF BORING -120.4 Ft.				
17. TOTAL RECOVERY FOR BORING 12.3 Ft.				
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-120.4	0.0					
-120.8	0.4		Sandy CLAY, very soft, trace organics, trace shell fragments, shell fragments up to 1.5", (1.0" x 0.5") and (2.0" x 1.0") rocks @ 0.2', greenish black (10Y-2.5/1), (CL).			
-121.5	1.1		Clayey SAND, fine grained, quartz, trace shell fragments, trace shell hash, shell fragments up to (1.0" x 0.5"), (1.5" x 1.0") shell fragment @ 0.6', (2.0" x 1.5") shell fragment @ 1.0', greenish black (10Y-2.5/1), (SC).			
-122.9	2.5		Sandy CLAY, very soft, trace organics, trace rock, trace shell hash, rocks up to (2.5" x 1.5"), partially lithified from 1.6' to 2.1', very dark greenish gray (10Y-3/1), (CL).			
-124.9	4.5		CLAY, very soft, some sand, dark greenish gray (10Y-4/1), (CL).			
			Sandy CLAY, very soft to soft, material missing from 4.9' to 5.4', partially lithified from 6.1' to 6.5', very dark greenish gray (10Y-3/1), (CL).			
-127.5	7.1		CLAY, firm, some sand, partially lithified, very dark greenish gray (10Y-3/1), (CL).			
-128.2	7.8		Sandy CLAY, very soft, partially lithified from 8.4' to 8.6', very dark greenish gray (10Y-3/1), (CL).			
-129.4	9.0		CLAY, firm to hard, some sand, sand distributed in pockets up to 2.0", dark greenish gray (10Y-4/1), (CL).			
-130.9	10.5		CLAY, hard, trace sand, sand distributed in pockets up to 0.5", partially lithified, Expansion within core = 0.1', dark greenish gray (10Y-4/1), (CL).			
-132.7	12.3		End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC04		LOCATION COORDINATES (m) X = 262,858 Y = 897,530		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 3 3
4. NAME OF DRILLER Francis Stankiewicz				
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES
6. THICKNESS OF OVERBURDEN N/A		14. ELEVATION GROUND WATER		15. DATE BORING STARTED COMPLETED 09-17-17 15:41 09-17-17 15:41
7. DEPTH DRILLED INTO ROCK N/A		16. ELEVATION TOP OF BORING -123.7 Ft.		17. TOTAL RECOVERY FOR BORING 11.8 Ft.
8. TOTAL DEPTH OF BORING 12.3 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-123.7	0.0					
-125.8	2.1		SAND, fine grained, quartz, trace clay, trace organics, trace shell fragments, trace shell hash, shell fragments up to 1.0", 1.5" clayey pockets @ 0.0' and 1.9', (0.5" x 0.25") rock @ 0.5', 2.5" shell fragment pockets @ 1.4' and 2.0'- shell fragments up to (2.5" x 1.5"), colors are mottled (10Y-3/1) and, black (N-2.5/0), (SP-SC).		1	Sample #1, Depth = 1.0' Mean (mm): 0.17, Phi Sorting: 0.68 Fines (230): 7.62% (SP-SC)
-130.2	6.5		SAND, fine grained, quartz, little clay, trace shell fragments, trace shell hash, shell fragments up to 0.5", 2 (1.5") shell fragments and (1.0" x 0.5") rock @ 2.2', (2.0" x 0.75") whole shell and (1.25" x 0.75") rock @ 2.5', very dark greenish gray (10Y-3/1), (SC).		2	Sample #2, Depth = 4.3' Mean (mm): 0.15, Phi Sorting: 0.61 Fines (230): 11.50% (SC)
-132.4	8.7		SAND, fine grained, quartz, little clay, trace shell hash, 0.5" shell fragment @ 8.1', very dark greenish gray (10Y-3/1), (SC).		3	Sample #3, Depth = 7.6' Mean (mm): 0.16, Phi Sorting: 0.61 Fines (230): 13.63% (SC)
-133.1	9.4		Sandy CLAY, very soft, trace shell hash, very dark greenish gray (10Y-3/1), (CL).			
-134.4	10.7		SAND, fine grained, quartz, little clay, trace shell hash, very dark greenish gray (10Y-3/1), (SC).		3	
-135.5	11.8		Sandy CLAY, very soft, very dark greenish gray (10Y-3/1), (CL).			
-136.0	12.3		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC05		LOCATION COORDINATES (m) X = 262,482 Y = 948,257		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Francis Stankiewicz				
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES				
14. ELEVATION GROUND WATER				
6. THICKNESS OF OVERBURDEN N/A		15. DATE BORING	STARTED 09-18-17 12:22	COMPLETED 09-18-17 12:24
7. DEPTH DRILLED INTO ROCK N/A		16. ELEVATION TOP OF BORING -104.0 Ft.		
8. TOTAL DEPTH OF BORING 8.6 Ft.		17. TOTAL RECOVERY FOR BORING 8.7 Ft.		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-104.0	0.0					
-104.8	0.8		SAND, fine grained, quartz, trace coarse grains, trace shell hash, trace silt, Disturbed sample from 0.0' to 0.2', dark grayish brown (2.5Y-4/2), (SW).		1	Sample #1, Depth = 0.4' Mean (mm): 0.38, Phi Sorting: 0.95 Fines (230): 1.35% (SW)
-106.1	2.1		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace shell hash, trace silt, rocks up to (0.75" x 0.5"), 3.0" rocky coarse grained pocket @ 0.9'- rocks up to (1.25" x 0.75"), 2 (0.75" x 0.5") and (2.5" x 2.0") shell fragments @ 1.9', 2.0" medium to coarse grained pocket @ 2.0', very dark gray (2.5Y-3/1), (SW).		2	Sample #2, Depth = 1.5' Mean (mm): 0.50, Phi Sorting: 1.32 Fines (230): 1.17% (SW)
-110.2	6.2		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), rocks up to 0.25", (1.25" x 1.0") shell fragments @ 2.6', 2.7', 5.0' (3) and 5.5', very dark gray (2.5Y-3/1), (SW).		3	Sample #3, Depth = 4.1' Mean (mm): 0.44, Phi Sorting: 1.09 Fines (230): 1.25% (SW)
-112.7	8.7		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments up to (2.0" x 1.25"), rocks up to 0.75", (3.0" x 2.0") shell fragment @ 8.2', Expansion within core = 0.1', very dark gray (2.5Y-3/1), (SW).		4	Sample #4, Depth = 7.3' Mean (mm): 0.70, Phi Sorting: 1.48 Fines (230): 0.77% (SW)
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC06		LOCATION COORDINATES (m) X = 259,678 Y = 948,190		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Alexandra Valente			12. TOTAL SAMPLES DISTURBED: 3 UNDISTURBED (UD)	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED: 09-18-17 14:31 COMPLETED: 09-18-17 14:42	
8. TOTAL DEPTH OF BORING 12.3 Ft.			16. ELEVATION TOP OF BORING -79.7 Ft.	
			17. TOTAL RECOVERY FOR BORING 12.2 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-79.7	0.0					
-82.3	2.6		SAND, fine grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments and rocks up to (0.75" x 0.5"), (2.5" x 2.0") and (1.0" x 0.75") shell fragments @ 2.5', (1.5" x 1.0") coarse grained pocket @ 2.6', light olive brown (2.5Y-5/3), (SW).		1	Sample #1, Depth = 1.3' Mean (mm): 0.27, Phi Sorting: 1.37 Fines (230): 2.36% (SW)
-84.0	4.3		SAND, fine grained, quartz, trace silt, 0.25" clay pockets @ 2.7' and 2.9', light olive brown (2.5Y-5/3), (SP).		2	Sample #2, Depth = 3.4' Mean (mm): 0.24, Phi Sorting: 0.78 Fines (230): 1.51% (SP)
-89.8	10.1		SAND, fine grained, quartz, trace coarse grains, trace silt, 1.0" clayey pocket @ 8.0', light yellowish brown (2.5Y-6/3), (SP).		3	Sample #3, Depth = 7.2' Mean (mm): 0.16, Phi Sorting: 0.46 Fines (230): 2.45% (SP)
-91.9	12.2				2	
-92.0	12.3		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In. 10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC07		LOCATION COORDINATES (m) X = 259,788 Y = 951,977		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Alexandra Valente				
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
6. THICKNESS OF OVERBURDEN N/A		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 6 6 0		
7. DEPTH DRILLED INTO ROCK N/A				
8. TOTAL DEPTH OF BORING 11.5 Ft.				
13. TOTAL NUMBER CORE BOXES				
14. ELEVATION GROUND WATER				
15. DATE BORING		STARTED	COMPLETED	
		09-18-17 17:23	09-18-17 17:26	
16. ELEVATION TOP OF BORING -86.0 Ft.				
17. TOTAL RECOVERY FOR BORING 10.8 Ft.				
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-86.0	0.0					
-86.4	0.4		SAND, medium to coarse grained, quartz, trace silt, 1.5" shell fragment @ 0.1', dark brown (10YR-3/3), (SW).		1	Sample #1, Depth = 0.2' Mean (mm): 0.77, Phi Sorting: 0.97 Fines (230): 0.96% (SW)
-87.5	1.5		SAND, fine to medium grained, quartz, trace coarse grains, trace silt, colors are mottled (2.5Y-4/3) and, very dark gray (2.5Y-3/1), (SP).		2	Sample #2, Depth = 1.0' Mean (mm): 0.52, Phi Sorting: 0.76 Fines (230): 2.15% (SP)
-90.0	4.0		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.25", (1.25" x 0.5") clayey pocket @ 2.2', very dark gray (2.5Y-3/1), (SW).		3	Sample #3, Depth = 2.7' Mean (mm): 0.57, Phi Sorting: 0.97 Fines (230): 1.98% (SW)
-93.6	7.6		SAND, fine to medium grained, quartz, trace coarse grains, trace shell hash, trace silt, 1.5" silty pocket @ 6.8', dark gray (2.5Y-4/1), (SP).		4	Sample #4, Depth = 5.8' Mean (mm): 0.38, Phi Sorting: 0.75 Fines (230): 1.57% (SP)
-94.3	8.3		SAND, fine grained, quartz, some silt, trace organics, dark gray (5Y-4/1), (SM).		5	Sample #5, Depth = 8.0' Mean (mm): 0.19, Phi Sorting: 1.09 Fines (230): 29.45% (SM)
-95.8	9.8		SAND, fine to medium grained, quartz, trace coarse grains, trace shell hash, trace silt, 1.0" silty pocket @ 9.2', dark gray (2.5Y-4/1), (SP).		4	
-96.8	10.8		SAND, medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.5", gray (2.5Y-5/1), (SW).		6	Sample #6, Depth = 10.3' Mean (mm): 0.84, Phi Sorting: 1.19 Fines (230): 0.93% (SW)
-97.5	11.5		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas				9. SIZE AND TYPE OF BIT 3.5 In.
2. BORING DESIGNATION MA-CZM-2017-VC08		LOCATION COORDINATES (m) X = 261,677 Y = 953,809		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		HORIZONTAL NAD 1983 VERTICAL NAVD88
4. NAME OF DRILLER Alexandra Valente		11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		<input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	12. TOTAL SAMPLES 3 DISTURBED UNDISTURBED (UD)
6. THICKNESS OF OVERBURDEN N/A		13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER
7. DEPTH DRILLED INTO ROCK N/A		15. DATE BORING		STARTED 09-18-17 18:16 COMPLETED 09-18-17 18:25
8. TOTAL DEPTH OF BORING 12.3 Ft.		16. ELEVATION TOP OF BORING -107.6 Ft.		17. TOTAL RECOVERY FOR BORING 12.3 Ft.
		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-107.6	0.0					
-109.1	1.5		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.5", 1.5" rock pocket @ 0.1'- rocks up to (1.5" x 0.75"), brown (10YR-4/3), (SP).		1	Sample #1, Depth = 0.8' Mean (mm): 0.54, Phi Sorting: 0.82 Fines (230): 1.24% (SP)
-116.2	8.6		SAND, medium grained, quartz, little rock, trace coarse grains, trace silt, rocks up to (1.0" x 0.75"), brown (10YR-4/3), (SW).		2	Sample #2, Depth = 5.0' Mean (mm): 0.84, Phi Sorting: 1.09 Fines (230): 0.82% (SW)
-117.4	9.8		SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.25", (1.0" x 0.25") rock @ 9.0', brown (10YR-5/3), (SW).		3	Sample #3, Depth = 9.2' Mean (mm): 0.46, Phi Sorting: 0.92 Fines (230): 1.49% (SW)
-118.2	10.6		SAND, medium grained, quartz, little rock, trace coarse grains, trace silt, rocks up to 0.5", brown (10YR-4/3), (SW).		2	
-119.9	12.3		CLAY, soft, trace sand, 3.0" silty sand pocket @ 11.5', Bit Sample from 12.0' to 12.3', dark greenish gray (10Y-4/1), (CL).			
			End of Boring			

MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In. 10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC09		LOCATION COORDINATES (m) X = 259,585 Y = 955,110		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 4 4 0
4. NAME OF DRILLER Alexandra Valente				
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES
6. THICKNESS OF OVERBURDEN N/A		14. ELEVATION GROUND WATER	15. DATE BORING STARTED COMPLETED 09-18-17 20:48 09-18-17 20:52	
7. DEPTH DRILLED INTO ROCK N/A		16. ELEVATION TOP OF BORING -92.5 Ft.	17. TOTAL RECOVERY FOR BORING 12 Ft.	
8. TOTAL DEPTH OF BORING 12.3 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-92.5	0.0					
			SAND, medium to coarse grained, quartz, little rock, trace silt, rocks up to 0.75", some rocks from 3.1' to 3.6', 1.5" rock @ 3.5', dark grayish brown (2.5Y-4/2), (SW).		1	Sample #1, Depth = 2.1' Mean (mm): 0.81, Phi Sorting: 1.53 Fines (230): 0.33% (SW)
-96.7	4.2					
-97.6	5.1		SAND, fine to medium grained, quartz, trace organics, trace rock, trace silt, rocks up to (0.5" x 0.25"), (3.0" x 1.0") silty organic pocket @ 4.9', (2.0" x 1.0") wood fragment @ 5.0', black (5Y-2.5/1), (SW).		2	Sample #2, Depth = 4.7' Mean (mm): 0.54, Phi Sorting: 1.38 Fines (230): 0.74% (SW)
			SAND, fine to medium grained, quartz, trace coarse grains, trace organics, trace rock, trace silt, rocks up to 0.25", gray (5Y-5/1), (SW).		3	Sample #3, Depth = 7.0' Mean (mm): 0.37, Phi Sorting: 1.45 Fines (230): 3.03% (SW)
-101.3	8.8					
			SAND, fine grained, quartz, trace organics, trace silt, (1.0" x 0.25") wood fragment @ 9.5', dark gray (5Y-4/1), (SP-SM).		4	Sample #4, Depth = 10.4' Mean (mm): 0.18, Phi Sorting: 0.80 Fines (230): 7.41% (SP-SM)
-104.5	12.0					
-104.8	12.3		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS				
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.					
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>NAVD88</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	NAVD88
HORIZONTAL	VERTICAL							
MA State Plane Mainland	NAVD88							
2. BORING DESIGNATION MA-CZM-2017-VC10		LOCATION COORDINATES (m) X = 239,899 Y = 793,491		11. MANUFACTURER'S DESIGNATION OF DRILL <table border="1"> <tr> <td><input type="checkbox"/> AUTO HAMMER</td> </tr> <tr> <td><input type="checkbox"/> MANUAL HAMMER</td> </tr> </table>	<input type="checkbox"/> AUTO HAMMER	<input type="checkbox"/> MANUAL HAMMER		
<input type="checkbox"/> AUTO HAMMER								
<input type="checkbox"/> MANUAL HAMMER								
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>2</td> <td></td> </tr> </table>	DISTURBED	UNDISTURBED (UD)	2	
DISTURBED	UNDISTURBED (UD)							
2								
4. NAME OF DRILLER Alexandra Valente								
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING					
13. TOTAL NUMBER CORE BOXES								
14. ELEVATION GROUND WATER								
6. THICKNESS OF OVERBURDEN N/A		15. DATE BORING	STARTED	COMPLETED				
7. DEPTH DRILLED INTO ROCK N/A		09-25-17 09:36	09-25-17 09:43	09-25-17 09:43				
8. TOTAL DEPTH OF BORING 11.5 Ft.		16. ELEVATION TOP OF BORING -71.9 Ft.						
17. TOTAL RECOVERY FOR BORING 6.8 Ft.								
18. SIGNATURE AND TITLE OF INSPECTOR KM								

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-71.9	0.0					
-77.1	5.2		SAND, fine grained, quartz, trace shell hash, trace silt, (0.5" x 0.25") whole shells @ 0.3' and 2.1' and shell fragment @ 0.4', colors are mottled with (5Y-4/2) from 0.0' to 0.7', gray (5Y-5/1), (SP).		1	Sample #1, Depth = 2.6' Mean (mm): 0.20, Phi Sorting: 0.53 Fines (230): 2.07% (SP)
-78.7	6.8		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", olive gray (5Y-5/2), (SP).		2	Sample #2, Depth = 6.0' Mean (mm): 0.28, Phi Sorting: 0.78 Fines (230): 1.06% (SP)
			No Recovery.			
-83.4	11.5		End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In. 10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC11		LOCATION COORDINATES (m) X = 241,178 Y = 796,123		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Alexandra Valente			12. TOTAL SAMPLES DISTURBED: 5 UNDISTURBED (UD)	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED: 09-25-17 11:42 COMPLETED: 09-25-17 11:52	
8. TOTAL DEPTH OF BORING 9.9 Ft.			16. ELEVATION TOP OF BORING -66.6 Ft.	
			17. TOTAL RECOVERY FOR BORING 9.9 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-66.6	0.0					
-67.2	0.6		SAND, fine grained, quartz, trace clay, trace coarse grains, trace shell hash, (3.0" x 1.0")		1	Sample #1, Depth = 0.3' Mean (mm): 0.33, Phi Sorting: 1.33 Fines (230): 2.80% (SW)
-67.6	1.0		rocky coarse grained pocket @ 0.6'- rocks up to 0.5", very dark grayish brown (2.5Y-3/2), (SW).		2	Sample #2, Depth = 0.8' Mean (mm): 1.04, Phi Sorting: 2.07 Fines (230): 0.63% (SW)
			SAND, fine to coarse grained, quartz, little rock, trace shell fragments, trace shell hash, trace silt, shell fragments and rocks up to 0.5", 0.75" whole shell and rock @ 0.7', 2.0" rock @ 0.8', 2 (0.75") whole shells @ 1.0', grayish brown (2.5Y-5/2), (SW).			
			SAND, fine to medium grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments and rocks up to (0.5" x 0.25"), 1.5" whole shell @ 4.7', (1.5" x 1.0") whole shell @ 4.9', light brownish gray (2.5Y-6/2), (SP).		3	Sample #3, Depth = 4.1' Mean (mm): 0.36, Phi Sorting: 0.72 Fines (230): 1.11% (SP)
-73.9	7.3		SAND, fine to medium grained, quartz, trace coarse grains, trace silt, 1.25" and (1.5" x 0.5") shell fragments @ 7.9', grayish brown (2.5Y-5/2), (SP).		4	Sample #4, Depth = 7.9' Mean (mm): 0.36, Phi Sorting: 0.62 Fines (230): 0.94% (SP)
-75.2	8.6		SAND, medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.5", grayish brown (2.5Y-5/2), (SW).		5	Sample #5, Depth = 9.2' Mean (mm): 0.63, Phi Sorting: 1.31 Fines (230): 0.57% (SW)
-76.5	9.9		End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas 			9. SIZE AND TYPE OF BIT 3.5 In.	
2. BORING DESIGNATION MA-CZM-2017-VC12		LOCATION COORDINATES (m) X = 237,839 Y = 798,152		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		HORIZONTAL NAD 1983 VERTICAL NAVD88
4. NAME OF DRILLER Alexandra Valente			11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	12. TOTAL SAMPLES 3 DISTURBED UNDISTURBED (UD)
6. THICKNESS OF OVERBURDEN N/A		13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER
7. DEPTH DRILLED INTO ROCK N/A		15. DATE BORING		STARTED 10-03-17 11:34 COMPLETED 10-03-17 11:42
8. TOTAL DEPTH OF BORING 12.3 Ft.		16. ELEVATION TOP OF BORING -58.4 Ft.		17. TOTAL RECOVERY FOR BORING 8.4 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-58.4	0.0					
-58.9	0.5		SAND, fine to medium grained, quartz, trace clay, trace coarse grains, trace shell hash, (2.0" x 1.0") and 1.0" shell fragments @ 0.4', very dark grayish brown (2.5Y-3/2), (SP).		1	Sample #1, Depth = 0.2' Mean (mm): 0.36, Phi Sorting: 0.76 Fines (230): 1.44% (SP)
-59.6	1.2				2	Sample #2, Depth = 0.8' Mean (mm): 0.31, Phi Sorting: 0.76 Fines (230): 1.73% (SP)
			SAND, fine to medium grained, quartz, trace clay, trace shell fragments, trace shell hash, shell fragments up to (0.5" x 0.25"), dark gray (5Y-4/1), (SP).			
			SAND, fine grained, quartz, trace clay, trace shell hash, clay distributed within layer and clayey pockets up to 0.5", 0.5" shell fragment @ 6.0', (2.0" x 0.5") clayey pocket @ 7.7', Bit Sample from 8.2' to 8.4', dark greenish gray (10Y-4/1), (SP).		3	Sample #3, Depth = 4.8' Mean (mm): 0.18, Phi Sorting: 0.49 Fines (230): 3.79% (SP)
-66.8	8.4					
			No Recovery.			
-70.7	12.3					
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
2. BORING DESIGNATION MA-CZM-2017-VC13			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER Alexandra Valente			<input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			12. TOTAL SAMPLES 3	
6. THICKNESS OF OVERBURDEN N/A			13. TOTAL NUMBER CORE BOXES	
7. DEPTH DRILLED INTO ROCK N/A			14. ELEVATION GROUND WATER	
8. TOTAL DEPTH OF BORING 12.3 Ft.			15. DATE BORING 10-03-17 10:31	
			16. ELEVATION TOP OF BORING -56.8 Ft.	
			17. TOTAL RECOVERY FOR BORING 11.5 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-56.8	0.0					
-57.2	0.4		SAND, fine grained, quartz, trace clay, trace shell hash, very dark grayish brown (2.5Y-3/2), (SW).		VC11 S#1	
-59.7	2.9		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, shell fragments up to 0.75", 2.0" little shell hash pocket @ 2.5', dark gray (5Y-4/1), (SP).		1	Sample #1, Depth = 1.6' Mean (mm): 0.24, Phi Sorting: 0.78 Fines (230): 3.65% (SP)
-61.9	5.1		SAND, fine grained, quartz, little shell hash, trace clay, trace shell fragments, shell fragments up to 1.0", (1.5" x 1.0") shell fragment @ 5.0', (1.0" x 0.25") organic pocket @ 4.0', clay decreases with depth, dark greenish gray (10Y-4/1), (SW-SC).		2	Sample #2, Depth = 4.0' Mean (mm): 0.22, Phi Sorting: 1.38 Fines (230): 7.80% (SW-SC)
-62.6	5.8		SAND, fine grained, quartz, some shell hash, trace clay, trace shell fragments, shell fragments up to 1.0", very dark greenish gray (10Y-3/1), (SW-SC).		3	Sample #3, Depth = 5.4' Mean (mm): 0.27, Phi Sorting: 1.27 Fines (230): 8.19% (SW-SC)
-63.6	6.8		Clayey SAND, fine grained, quartz, trace shell hash, (1.0" x 0.5") whole shell @ 6.2', 0.5" whole shell @ 6.6', very dark greenish gray (10Y-3/1), (SC).			
-64.7	7.9		Sandy CLAY, soft, trace shell hash, very dark greenish gray (10Y-3/1), (CL).			
-68.3	11.5		CLAY, soft, trace sand, very dark greenish gray (10Y-3/1), (CL).			
-69.1	12.3		No Recovery.			
			End of Boring			

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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC14		LOCATION COORDINATES (m) X = 232,757 Y = 801,103		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Alexandra Valente			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 2 2	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED COMPLETED 10-03-17 09:46 10-03-17 09:48	
8. TOTAL DEPTH OF BORING 10.5 Ft.			16. ELEVATION TOP OF BORING -62.3 Ft.	
			17. TOTAL RECOVERY FOR BORING 10.5 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-62.3	0.0					
-63.6	1.3		SAND, fine grained, quartz, trace clay, trace organics, trace shell fragments, trace shell hash, shell fragments up to 0.75", (1.5" x 1.0") shell fragment @ 1.1', colors are mottled (10Y-3/1) and, black (N-2.5/0), (SW-SC).		1	Sample #1, Depth = 0.6' Mean (mm): 0.24, Phi Sorting: 0.86 Fines (230): 5.25% (SW-SC)
-65.6	3.3		SAND, fine grained, quartz, trace clay, trace shell fragments, trace shell hash, shell fragments up to 0.75", 1.25" whole shell @ 2.3', (1.25" x 1.0") shell fragment @ 2.3', dark greenish gray (5GY-4/1), (SW-SC).		2	Sample #2, Depth = 2.3' Mean (mm): 0.23, Phi Sorting: 0.95 Fines (230): 5.82% (SW-SC)
-70.5	8.2		Clayey SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace whole shell, shell fragments up to 0.75", whole shells up to (1.25" x 1.0"), (2.0" x 1.0") and (2.0" x 1.5") shell fragments @ 8.0', dark greenish gray (5GY-4/1), (SC).			
-72.8	10.5		SAND, fine grained, quartz, some clay, trace shell fragments, trace shell hash, shell fragments up to (0.5" x 0.25"), 0.75" shell fragment @ 8.9', (1.0" x 0.5") rock @ 9.0', very dark greenish gray (10Y-3/1), (SC).			
			End of Boring			

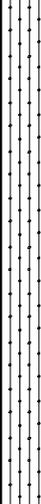
MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland HORIZONTAL: NAD 1983 VERTICAL: NAVD88	
2. BORING DESIGNATION MA-CZM-2017-VC15		LOCATION COORDINATES (m) X = 277,516 Y = 870,903		11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER APTIM SEAS VC-700 Vibracore <input type="checkbox"/> MANUAL HAMMER
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		
4. NAME OF DRILLER Alexandra Valente			12. TOTAL SAMPLES DISTURBED: 2 UNDISTURBED (UD)	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING STARTED: 10-02-17 12:46 COMPLETED: 10-02-17 12:56	
8. TOTAL DEPTH OF BORING 11.0 Ft.			16. ELEVATION TOP OF BORING -80.1 Ft.	
			17. TOTAL RECOVERY FOR BORING 10.7 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-80.1	0.0					
-81.3	1.2		SAND, fine to medium grained, quartz, trace coarse grains, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", 1.0" shell fragment @ 0.4', (2.0" x 1.5") (2.5Y-5/1) pocket @ 0.7', grayish brown (2.5Y-5/2), (SW).		1	Sample #1, Depth = 0.6' Mean (mm): 0.50, Phi Sorting: 0.99 Fines (230): 0.81% (SW)
			SAND, fine grained, quartz, trace shell hash, trace silt, 1.5" shell fragment pocket @ 4.0'-shell fragments up to 1.0", 2.0" shell fragment pocket @ 8.3'- shell fragments up to (1.5" x 1.0"), 1.5" shell fragment pocket @ 10.5'- shell fragments up to 1.5", 2.5" fine to medium grained pocket @ 9.4', gray (5Y-5/1), (SP).		2	Sample #2, Depth = 6.0' Mean (mm): 0.22, Phi Sorting: 0.57 Fines (230): 1.63% (SP)
-90.8	10.7					
-91.1	11.0		No Recovery.			
			End of Boring			

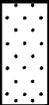
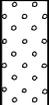
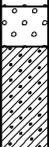
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DRILLING LOG		DIVISION	INSTALLATION	SHEET 1
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas				
2. BORING DESIGNATION MA-CZM-2017-VC16		LOCATION COORDINATES (m) X = 276,446 Y = 866,962		9. SIZE AND TYPE OF BIT 3.5 In.
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland
4. NAME OF DRILLER Alexandra Valente		11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		HORIZONTAL NAD 1983 VERTICAL NAVD88
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	<input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER
6. THICKNESS OF OVERBURDEN N/A		7. DEPTH DRILLED INTO ROCK N/A		12. TOTAL SAMPLES 4 DISTURBED UNDISTURBED (UD)
8. TOTAL DEPTH OF BORING 12.2 Ft.		13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER
		15. DATE BORING		STARTED 10-02-17 14:03 COMPLETED 10-02-17 14:09
		16. ELEVATION TOP OF BORING -78.4 Ft.		17. TOTAL RECOVERY FOR BORING 11.2 Ft.
		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-78.4	0.0					
-79.8	1.4		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.5" x 0.25"), (1.5" x 1.0") shell fragment @ 1.2', dark gray (5Y-4/1), (SP).		1	Sample #1, Depth = 0.7' Mean (mm): 0.30, Phi Sorting: 0.76 Fines (230): 1.23% (SP)
-81.4	3.0		SAND, fine grained, quartz, trace shell hash, trace silt, (3.0" x 0.5") silty pocket @ 2.9', dark gray (5Y-4/1), (SP).		2	Sample #2, Depth = 2.2' Mean (mm): 0.24, Phi Sorting: 0.61 Fines (230): 1.72% (SP)
-82.7	4.3		SAND, fine to medium grained, quartz, little shell fragments, little shell hash, trace coarse grains, trace silt, shell fragments up to (1.0" x 0.75"), 1.0" whole shell @ 3.7', 1.5" shell fragment @ 3.6', 1.0" clayey pocket @ 4.2', dark gray (5Y-4/1), (SW).		3	Sample #3, Depth = 3.6' Mean (mm): 0.59, Phi Sorting: 1.57 Fines (230): 1.22% (SW)
-89.6	11.2		SAND, fine grained, quartz, little silt, trace clay, trace shell hash, (1.0" x 0.5") shell fragments @ 4.4' and 5.1', (0.75" x 0.5") shell fragments @ 6.3' and 8.6', 1.5" shell fragment pocket @ 8.9'-shell fragments up to 1.25", dark gray (5Y-4/1), (SM).		4	Sample #4, Depth = 7.8' Mean (mm): 0.16, Phi Sorting: 0.63 Fines (230): 14.68% (SM)
-90.6	12.2		No Recovery.			
			End of Boring			

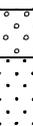
MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS					
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.						
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>NAVD88</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	NAVD88	
HORIZONTAL	VERTICAL								
MA State Plane Mainland	NAVD88								
2. BORING DESIGNATION MA-CZM-2017-VC17		LOCATION COORDINATES (m) X = 275,721 Y = 865,048		11. MANUFACTURER'S DESIGNATION OF DRILL <table border="1"> <tr> <td><input type="checkbox"/> AUTO HAMMER</td> </tr> <tr> <td><input type="checkbox"/> MANUAL HAMMER</td> </tr> </table>		<input type="checkbox"/> AUTO HAMMER	<input type="checkbox"/> MANUAL HAMMER		
<input type="checkbox"/> AUTO HAMMER									
<input type="checkbox"/> MANUAL HAMMER									
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>3</td> <td></td> </tr> </table>		DISTURBED	UNDISTURBED (UD)	3	
DISTURBED	UNDISTURBED (UD)								
3									
4. NAME OF DRILLER Alexandra Valente									
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			DEG. FROM VERTICAL						
			BEARING						
6. THICKNESS OF OVERBURDEN N/A									
7. DEPTH DRILLED INTO ROCK N/A									
8. TOTAL DEPTH OF BORING 11.0 Ft.									
13. TOTAL NUMBER CORE BOXES									
14. ELEVATION GROUND WATER									
15. DATE BORING <table border="1"> <tr> <td>STARTED</td> <td>COMPLETED</td> </tr> <tr> <td>10-02-17 14:57</td> <td>10-02-17 15:00</td> </tr> </table>					STARTED	COMPLETED	10-02-17 14:57	10-02-17 15:00	
STARTED	COMPLETED								
10-02-17 14:57	10-02-17 15:00								
16. ELEVATION TOP OF BORING -71.5 Ft.									
17. TOTAL RECOVERY FOR BORING 11 Ft.									
18. SIGNATURE AND TITLE OF INSPECTOR KM									

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-71.5	0.0					
-72.8	1.3		SAND, fine grained, quartz, trace shell hash, trace silt, (1.0" x 0.25") shell fragment @ 0.0', (3.0" x 0.75") silty pocket @ 1.2', dark gray (5Y-4/1), (SP).		VC16 S#2	
-74.2	2.7		SAND, fine to medium grained, quartz, trace coarse grains, trace shell hash, trace silt, (3.0" x 2.0") medium to coarse grained shell fragment pocket @ 1.4'- shell fragments up to (1.5" x 1.0"), 0.75" shell fragment @ 2.4', dark gray (5Y-4/1), (SW).		1	Sample #1, Depth = 2.0' Mean (mm): 0.37, Phi Sorting: 0.90 Fines (230): 0.79% (SW)
-74.7	3.2		SAND, medium to coarse grained, quartz, little rock, little shell hash, trace shell fragments, trace silt, shell fragments and rocks up to 0.5", (1.25" x 0.75") shell fragment @ 2.8', very dark gray (N-3/0), (SW).		2	Sample #2, Depth = 2.9' Mean (mm): 1.45, Phi Sorting: 1.67 Fines (230): 0.67% (SW)
			SAND, fine grained, quartz, little clay, trace rock, trace silt, rocks up to (0.75" x 0.5"), 2.5" shell fragment pocket @ 4.4'- shell fragments up to (2.0" x 1.25"), 1.25" shell fragment pockets @ 5.1' and 9.8'- shell fragments up to 0.75", (2.0" x 1.0") shell fragment pockets @ 6.7' and 9.3'- shell fragments up to 1.25", very dark greenish gray (10Y-3/1), (SC).		3	Sample #3, Depth = 7.1' Mean (mm): 0.13, Phi Sorting: 0.56 Fines (230): 17.25% (SC)
-82.5	11.0		End of Boring			

MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas				9. SIZE AND TYPE OF BIT 3.5 In.
2. BORING DESIGNATION MA-CZM-2017-VC18		LOCATION COORDINATES (m) X = 283,242 Y = 843,847		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		HORIZONTAL NAD 1983
4. NAME OF DRILLER Alexandra Valente		11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	<input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER
6. THICKNESS OF OVERBURDEN N/A		12. TOTAL SAMPLES 4		DISTURBED
7. DEPTH DRILLED INTO ROCK N/A		13. TOTAL NUMBER CORE BOXES		UNDISTURBED (UD)
8. TOTAL DEPTH OF BORING 11.0 Ft.		14. ELEVATION GROUND WATER		15. DATE BORING 10-02-17 16:34
		16. ELEVATION TOP OF BORING -43.3 Ft.		COMPLETED 10-02-17 16:40
		17. TOTAL RECOVERY FOR BORING 10 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR KM

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-43.3	0.0					
-47.4	4.1		SAND, fine to medium grained, quartz, trace coarse grains, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.5" x 1.0"), (1.5" x 1.0") shell fragment pocket @ 0.0'-shell fragments up to (1.0" x 0.5"), (1.25" x 0.5") shell fragment @ 0.2', colors are mottled with (2.5Y-4/2) from 0.2' to 0.7', (2.0" x 1.25") shell fragment @ 2.2', colors are mottled (5Y-4/1) and, very dark gray (5Y-3/1), (SP).		1	Sample #1, Depth = 2.0' Mean (mm): 0.50, Phi Sorting: 0.66 Fines (230): 0.91% (SP)
-50.0	6.7		SAND, fine to medium grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 1.0", (1.5" x 1.25") shell fragment @ 5.0', (2.0" x 1.25") shell fragments @ 5.3' and 5.9', dark gray (5Y-4/1), (SP).		2	Sample #2, Depth = 5.4' Mean (mm): 0.44, Phi Sorting: 0.79 Fines (230): 0.97% (SP)
-50.6	7.3		SAND, fine to medium grained, quartz, little shell hash, trace shell fragments, trace silt, shell fragments up to 1.0", 2 (1.0") whole shells @ 6.9', (1.5" x 1.0") shell fragment @ 7.1', dark gray (5Y-4/1), (SW).		3	Sample #3, Depth = 7.0' Mean (mm): 0.45, Phi Sorting: 1.05 Fines (230): 1.59% (SW)
-53.3	10.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", 1.25" shell fragment pockets @ 7.6' and 8.0'- shell fragments up to 0.5", dark gray (5Y-4/1), (SP).		4	Sample #4, Depth = 8.7' Mean (mm): 0.34, Phi Sorting: 0.48 Fines (230): 1.13% (SP)
-54.3	11.0		No Recovery.			
			End of Boring			

MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT 3.5 In.	
2. BORING DESIGNATION MA-CZM-2017-VC19			10. COORDINATE SYSTEM/DATUM MA State Plane Mainland	
3. DRILLING AGENCY APTIM			11. MANUFACTURER'S DESIGNATION OF DRILL <input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER APTIM SEAS VC-700 Vibracore	
4. NAME OF DRILLER Alexandra Valente			12. TOTAL SAMPLES 4	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER	
7. DEPTH DRILLED INTO ROCK N/A			15. DATE BORING 10-02-17 17:33	
8. TOTAL DEPTH OF BORING 12.3 Ft.			16. ELEVATION TOP OF BORING -56.8 Ft.	
			17. TOTAL RECOVERY FOR BORING 11.5 Ft.	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-56.8	0.0					
-59.4	2.6		SAND, fine grained, quartz, trace shell hash, trace silt, (1.5" x 1.0") shell fragment @ 0.1', 2.0" shell fragment @ 0.9', 2 (1.25") shell fragments @ 1.3', 1.25" little shell hash pocket @ 2.4', very dark greenish gray (10Y-3/1), (SP).		1	Sample #1, Depth = 1.3' Mean (mm): 0.26, Phi Sorting: 0.76 Fines (230): 3.79% (SP)
-62.2	5.4		SAND, fine to medium grained, quartz, trace shell fragments, trace shell hash, trace silt, trace whole shell, shell fragments up to (0.75" x 0.5"), whole shells up to (0.5" x 0.25"), 3.0" shelly pocket @ 3.3'- shell components are shell hash, shell fragments up to 0.5" and whole shells up to 0.25", dark greenish gray (10Y-4/1), (SP).		2	Sample #2, Depth = 4.0' Mean (mm): 0.42, Phi Sorting: 0.78 Fines (230): 1.27% (SP)
-64.0	7.2		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", 1.25" shell fragment pocket @ 6.4'- shell fragments up to (1.0" x 0.75"), (1.0" x 0.75") shell fragment @ 6.7', (3.0" x 1.0") clayey pocket @ 7.1', dark greenish gray (10Y-4/1), (SP-SM).		3	Sample #3, Depth = 6.3' Mean (mm): 0.25, Phi Sorting: 0.74 Fines (230): 5.49% (SP-SM)
-65.9	9.1		SAND, fine grained, quartz, trace shell hash, trace silt, 1.25" shell fragment pockets @ 8.4' and 8.9'- shell fragments up to (0.75" x 0.5"), dark gray (5Y-4/1), (SP).		VC18 S#4	
-67.3	10.5		SAND, fine grained, quartz, trace clay, trace silt, 1.0" shell fragment pocket @ 9.1'- shell fragments up to 0.5", dark greenish gray (10Y-4/1), (SP-SM).		4	Sample #4, Depth = 9.8' Mean (mm): 0.25, Phi Sorting: 0.67 Fines (230): 5.82% (SP-SM)
-68.3	11.5		Clayey SAND, fine grained, quartz, trace shell hash, very dark greenish gray (10Y-3/1), (SC).			
-69.1	12.3		No Recovery.			
			End of Boring			

MA_CZM_2017_VC.GPJ 12/8/17

DRILLING LOG		DIVISION	INSTALLATION	SHEET 1
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas				9. SIZE AND TYPE OF BIT 3.5 In.
2. BORING DESIGNATION MA-CZM-2017-VC20		LOCATION COORDINATES (m) X = 284,592 Y = 838,399		10. COORDINATE SYSTEM/DATUM MA State Plane Mainland
3. DRILLING AGENCY APTIM		CONTRACTOR FILE NO.		HORIZONTAL NAD 1983
4. NAME OF DRILLER Alexandra Valente		11. MANUFACTURER'S DESIGNATION OF DRILL APTIM SEAS VC-700 Vibracore		VERTICAL NAVD88
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	<input type="checkbox"/> AUTO HAMMER <input type="checkbox"/> MANUAL HAMMER
6. THICKNESS OF OVERBURDEN N/A		12. TOTAL SAMPLES		DISTURBED 4
7. DEPTH DRILLED INTO ROCK N/A		13. TOTAL NUMBER CORE BOXES		UNDISTURBED (UD)
8. TOTAL DEPTH OF BORING 12.3 Ft.		14. ELEVATION GROUND WATER		15. DATE BORING
				STARTED 10-02-17 18:21
				COMPLETED 10-02-17 18:26
		16. ELEVATION TOP OF BORING -55.1 Ft.		17. TOTAL RECOVERY FOR BORING 10.8 Ft.
		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-55.1	0.0					
-56.4	1.3		SAND, fine to medium grained, quartz, little rock, trace coarse grains, trace silt, rocks up to 0.75", (3.0" x 2.0") gravel pocket @ 1.1'- gravel components are shell fragments up to 1.5" and rocks up to (2.0" x 1.5"), very dark gray (2.5Y-3/1), (SW).		1	Sample #1, Depth = 0.6' Mean (mm): 0.52, Phi Sorting: 1.19 Fines (230): 1.69% (SW)
-58.1	3.0		SAND, fine grained, quartz, trace coarse grains, trace rock, trace shell hash, trace silt, rocks up to 0.5", 3 (1.0" x 0.5") shell fragments @ 1.3', 1.5" shell fragment pocket @ 1.6'- shell fragments up to (1.5" x 1.0"), (1.0" x 0.75") rock @ 1.7', (2.0" x 1.5") medium to coarse grained pocket and (2.0" x 1.0") shell fragment @ 2.9', dark gray (5Y-4/1), (SW).		2	Sample #2, Depth = 2.1' Mean (mm): 0.40, Phi Sorting: 1.98 Fines (230): 2.83% (SW)
-63.6	8.5		SAND, fine grained, quartz, trace coarse grains, trace shell hash, trace silt, 1.5" rocky pocket @ 3.7'- rocks up to (1.0" x 0.75"), 0.75" rocks @ 3.2' and 7.3', (0.5" x 0.25") rock @ 4.5', (3.0" x 1.0") medium to coarse grained rocky pocket @ 7.4'- rocks up to 0.5", organic lamina @ 8.5', dark gray (5Y-4/1), (SP).		3	Sample #3, Depth = 5.8' Mean (mm): 0.22, Phi Sorting: 0.45 Fines (230): 1.38% (SP)
-65.9	10.8		SAND, fine grained, quartz, trace shell hash, trace silt, 2 (0.5") shell fragments @ 9.6', (3.0" x 0.75") clayey pocket @ 10.6' and organic pocket @ 10.7', dark gray (5Y-4/1), (SP).		4	Sample #4, Depth = 9.6' Mean (mm): 0.19, Phi Sorting: 0.40 Fines (230): 3.54% (SP)
-67.4	12.3		No Recovery.			
			End of Boring			

MA_CZM_2017_VC.GPJ 12/8/17

Appendix B

Vibracore Granulometric Reports



Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC01 #1

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 257,169	Northing (m): 895,590	Coordinate System: MA State Plane Mainland	Elevation (ft): -78.6 NAVD88
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USCS: SP-SM	Munsell: Wet - 5Y-3/1 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.30	Wash Weight (g): 82.01	Pan Retained (g): 0.89	Sieve Loss (%): 0.00	Fines (%): #200 - 11.74 #230 - 9.16	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.34	0.38	0.34	0.38
4	-2.25	4.76	0.00	0.00	0.34	0.38
5	-2.00	4.00	0.00	0.00	0.34	0.38
7	-1.50	2.83	0.10	0.11	0.44	0.49
10	-1.00	2.00	0.12	0.13	0.56	0.62
14	-0.50	1.41	0.08	0.09	0.64	0.71
18	0.00	1.00	0.08	0.09	0.72	0.80
25	0.50	0.71	0.14	0.16	0.86	0.96
35	1.00	0.50	0.19	0.21	1.05	1.17
45	1.50	0.35	0.36	0.40	1.41	1.57
60	2.00	0.25	1.34	1.50	2.75	3.07
80	2.50	0.18	8.59	9.62	11.34	12.69
120	3.00	0.13	38.68	43.31	50.02	56.00
170	3.50	0.09	26.25	29.40	76.27	85.40
200	3.75	0.07	2.55	2.86	78.82	88.26
230	4.00	0.06	2.30	2.58	81.12	90.84

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.48	3.32	2.93	2.64	2.54	2.10
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.85	0.14	0.63	-4.24	34.59	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC01 #2

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 257,169	Northing (m): 895,590	Coordinate System: MA State Plane Mainland	Elevation (ft): -83.5 NAVD88
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USCS: SP-SM	Munsell: Wet - 5Y-3/1 Dry - 5Y-5/1 Washed - 5Y-5/1	Comments:
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Dry Weight (g): 93.27	Wash Weight (g): 86.47	Pan Retained (g): 1.42	Sieve Loss (%): 0.04	Fines (%): #200 - 11.76 #230 - 8.84	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.49	0.53	0.49	0.53
4	-2.25	4.76	0.00	0.00	0.49	0.53
5	-2.00	4.00	0.10	0.11	0.59	0.64
7	-1.50	2.83	0.06	0.06	0.65	0.70
10	-1.00	2.00	0.04	0.04	0.69	0.74
14	-0.50	1.41	0.21	0.23	0.90	0.97
18	0.00	1.00	0.29	0.31	1.19	1.28
25	0.50	0.71	0.65	0.70	1.84	1.98
35	1.00	0.50	1.78	1.91	3.62	3.89
45	1.50	0.35	2.28	2.44	5.90	6.33
60	2.00	0.25	5.50	5.90	11.40	12.23
80	2.50	0.18	15.89	17.04	27.29	29.27
120	3.00	0.13	32.92	35.30	60.21	64.57
170	3.50	0.09	19.38	20.78	79.59	85.35
200	3.75	0.07	2.70	2.89	82.29	88.24
230	4.00	0.06	2.72	2.92	85.01	91.16

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.47	3.25	2.79	2.37	2.11	1.23
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.61	0.16	0.83	-2.55	14.73	

MA_CZM_2017_VC.GPJ 12/8/17

Granulometric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC01 #3

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 257,169	Northing (m): 895,590	Coordinate System: MA State Plane Mainland	Elevation (ft): -87.1 NAVD88
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USCS: SC	Munsell: Wet - 10Y-2.5/1 Dry - 5Y-5/1 Washed - 5Y-5/1	Comments:
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Dry Weight (g): 91.00	Wash Weight (g): 74.29	Pan Retained (g): 1.16	Sieve Loss (%): 0.07	Fines (%): #200 - 23.06 #230 - 19.71	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	4.31	4.74	4.31	4.74
3.5	-2.50	5.66	0.67	0.74	4.98	5.48
4	-2.25	4.76	0.00	0.00	4.98	5.48
5	-2.00	4.00	0.00	0.00	4.98	5.48
7	-1.50	2.83	0.14	0.15	5.12	5.63
10	-1.00	2.00	0.11	0.12	5.23	5.75
14	-0.50	1.41	0.14	0.15	5.37	5.90
18	0.00	1.00	0.09	0.10	5.46	6.00
25	0.50	0.71	0.24	0.26	5.70	6.26
35	1.00	0.50	0.45	0.49	6.15	6.75
45	1.50	0.35	0.75	0.82	6.90	7.57
60	2.00	0.25	2.73	3.00	9.63	10.57
80	2.50	0.18	13.01	14.30	22.64	24.87
120	3.00	0.13	26.69	29.33	49.33	54.20
170	3.50	0.09	18.41	20.23	67.74	74.43
200	3.75	0.07	2.28	2.51	70.02	76.94
230	4.00	0.06	3.05	3.35	73.07	80.29

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.56	2.93	2.50	2.19	-2.65
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.36	0.19	1.62	-2.71	9.54	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC04 #1

Analysis Date: 11-03-17; Analyzed By: SMT

Easting (m): 262,858	Northing (m): 897,530	Coordinate System: MA State Plane Mainland	Elevation (ft): -124.7 NAVD88
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USCS: SP-SC	Munsell: Wet - N-2.5/0 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 86.35	Wash Weight (g): 80.13	Pan Retained (g): 0.17	Sieve Loss (%): 0.21	Fines (%): #200 - 8.38 #230 - 7.62	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.07	0.08	0.07	0.08
7	-1.50	2.83	0.22	0.25	0.29	0.33
10	-1.00	2.00	0.38	0.44	0.67	0.77
14	-0.50	1.41	0.30	0.35	0.97	1.12
18	0.00	1.00	0.20	0.23	1.17	1.35
25	0.50	0.71	0.24	0.28	1.41	1.63
35	1.00	0.50	0.52	0.60	1.93	2.23
45	1.50	0.35	1.48	1.71	3.41	3.94
60	2.00	0.25	4.79	5.55	8.20	9.49
80	2.50	0.18	18.44	21.35	26.64	30.84
120	3.00	0.13	38.21	44.25	64.85	75.09
170	3.50	0.09	12.90	14.94	77.75	90.03
200	3.75	0.07	1.37	1.59	79.12	91.62
230	4.00	0.06	0.66	0.76	79.78	92.38

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.30	3.00	2.72	2.36	2.15	1.60
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.57	0.17	0.68	-2.72	15.91	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC04 #2

Analysis Date: 11-03-17; Analyzed By: SMT

Easting (m): 262,858	Northing (m): 897,530	Coordinate System: MA State Plane Mainland	Elevation (ft): -128.0 NAVD88
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USCS: SC	Munsell: Wet - 10Y-3/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.67	Wash Weight (g): 79.79	Pan Retained (g): 0.42	Sieve Loss (%): 0.01	Fines (%): #200 - 12.67 #230 - 11.50	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.06	0.07	0.06	0.07
7	-1.50	2.83	0.14	0.16	0.20	0.23
10	-1.00	2.00	0.14	0.16	0.34	0.39
14	-0.50	1.41	0.12	0.13	0.46	0.52
18	0.00	1.00	0.11	0.12	0.57	0.64
25	0.50	0.71	0.19	0.21	0.76	0.85
35	1.00	0.50	0.34	0.38	1.10	1.23
45	1.50	0.35	1.17	1.30	2.27	2.53
60	2.00	0.25	3.73	4.16	6.00	6.69
80	2.50	0.18	11.99	13.37	17.99	20.06
120	3.00	0.13	36.21	40.38	54.20	60.44
170	3.50	0.09	21.61	24.10	75.81	84.54
200	3.75	0.07	2.50	2.79	78.31	87.33
230	4.00	0.06	1.05	1.17	79.36	88.50

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.49	3.30	2.87	2.56	2.35	1.80
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.74	0.15	0.61	-2.5	16.43	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC04 #3

Analysis Date: 11-03-17; Analyzed By: SMT

Easting (m): 262,858	Northing (m): 897,530	Coordinate System: MA State Plane Mainland	Elevation (ft): -131.3 NAVD88
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USCS: SC	Munsell: Wet - 10Y-3/1 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.21	Wash Weight (g): 77.94	Pan Retained (g): 0.78	Sieve Loss (%): 0.12	Fines (%): #200 - 15.23 #230 - 13.63	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.03	0.03	0.03	0.03
7	-1.50	2.83	0.11	0.12	0.14	0.15
10	-1.00	2.00	0.11	0.12	0.25	0.27
14	-0.50	1.41	0.10	0.11	0.35	0.38
18	0.00	1.00	0.14	0.16	0.49	0.54
25	0.50	0.71	0.24	0.27	0.73	0.81
35	1.00	0.50	0.67	0.75	1.40	1.56
45	1.50	0.35	1.45	1.63	2.85	3.19
60	2.00	0.25	4.26	4.78	7.11	7.97
80	2.50	0.18	13.23	14.83	20.34	22.80
120	3.00	0.13	38.20	42.82	58.54	65.62
170	3.50	0.09	14.77	16.56	73.31	82.18
200	3.75	0.07	2.31	2.59	75.62	84.77
230	4.00	0.06	1.43	1.60	77.05	86.37

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.68	3.28	2.82	2.53	2.27	1.69
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.67	0.16	0.61	-2.05	12.95	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC05 #1

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 262,482	Northing (m): 948,257	Coordinate System: MA State Plane Mainland	Elevation (ft): -104.4 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 98.60	Wash Weight (g): 97.34	Pan Retained (g): 0.03	Sieve Loss (%): 0.04	Fines (%): #200 - 1.52 #230 - 1.35	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.19	0.19	0.19	0.19
10	-1.00	2.00	1.17	1.19	1.36	1.38
14	-0.50	1.41	3.50	3.55	4.86	4.93
18	0.00	1.00	3.84	3.89	8.70	8.82
25	0.50	0.71	6.69	6.78	15.39	15.60
35	1.00	0.50	13.86	14.06	29.25	29.66
45	1.50	0.35	20.85	21.15	50.10	50.81
60	2.00	0.25	21.00	21.30	71.10	72.11
80	2.50	0.18	16.43	16.66	87.53	88.77
120	3.00	0.13	7.55	7.66	95.08	96.43
170	3.50	0.09	1.82	1.85	96.90	98.28
200	3.75	0.07	0.20	0.20	97.10	98.48
230	4.00	0.06	0.17	0.17	97.27	98.65

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.91	2.36	2.09	1.48	0.83	0.51	-0.49
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.38	0.38	0.95	-0.52	3.21	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC05 #2

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 262,482	Northing (m): 948,257	Coordinate System: MA State Plane Mainland	Elevation (ft): -105.5 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 90.41	Wash Weight (g): 89.41	Pan Retained (g): 0.02	Sieve Loss (%): 0.02	Fines (%): #200 - 1.32 #230 - 1.17	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.87	0.96	0.87	0.96
3.5	-2.50	5.66	0.00	0.00	0.87	0.96
4	-2.25	4.76	0.40	0.44	1.27	1.40
5	-2.00	4.00	0.48	0.53	1.75	1.93
7	-1.50	2.83	2.67	2.95	4.42	4.88
10	-1.00	2.00	4.27	4.72	8.69	9.60
14	-0.50	1.41	6.24	6.90	14.93	16.50
18	0.00	1.00	4.74	5.24	19.67	21.74
25	0.50	0.71	5.74	6.35	25.41	28.09
35	1.00	0.50	11.03	12.20	36.44	40.29
45	1.50	0.35	16.39	18.13	52.83	58.42
60	2.00	0.25	15.74	17.41	68.57	75.83
80	2.50	0.18	13.09	14.48	81.66	90.31
120	3.00	0.13	5.89	6.51	87.55	96.82
170	3.50	0.09	1.53	1.69	89.08	98.51
200	3.75	0.07	0.15	0.17	89.23	98.68
230	4.00	0.06	0.14	0.15	89.37	98.83

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.86	2.28	1.98	1.27	0.26	-0.54	-1.49
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.99	0.50	1.32	-0.76	3.18	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC05 #3

Analysis Date: 11-03-17; Analyzed By: DA

Easting (m): 262,482	Northing (m): 948,257	Coordinate System: MA State Plane Mainland	Elevation (ft): -108.1 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 89.86	Wash Weight (g): 88.77	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 1.42 #230 - 1.25	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.15	0.17	0.15	0.17
7	-1.50	2.83	1.29	1.44	1.44	1.61
10	-1.00	2.00	2.10	2.34	3.54	3.95
14	-0.50	1.41	4.74	5.27	8.28	9.22
18	0.00	1.00	5.22	5.81	13.50	15.03
25	0.50	0.71	7.38	8.21	20.88	23.24
35	1.00	0.50	13.24	14.73	34.12	37.97
45	1.50	0.35	18.12	20.16	52.24	58.13
60	2.00	0.25	16.11	17.93	68.35	76.06
80	2.50	0.18	12.63	14.06	80.98	90.12
120	3.00	0.13	5.89	6.55	86.87	96.67
170	3.50	0.09	1.55	1.72	88.42	98.39
200	3.75	0.07	0.17	0.19	88.59	98.58
230	4.00	0.06	0.15	0.17	88.74	98.75

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.87	2.28	1.97	1.30	0.56	0.06	-0.90

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.17	0.44	1.09	-0.52	2.98

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC05 #4

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 262,482	Northing (m): 948,257	Coordinate System: MA State Plane Mainland	Elevation (ft): -111.3 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 93.42	Wash Weight (g): 92.74	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 0.84 #230 - 0.77	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.54	0.58	0.54	0.58
4	-2.25	4.76	0.94	1.01	1.48	1.59
5	-2.00	4.00	3.04	3.25	4.52	4.84
7	-1.50	2.83	6.60	7.06	11.12	11.90
10	-1.00	2.00	7.93	8.49	19.05	20.39
14	-0.50	1.41	8.42	9.01	27.47	29.40
18	0.00	1.00	6.76	7.24	34.23	36.64
25	0.50	0.71	6.89	7.38	41.12	44.02
35	1.00	0.50	9.86	10.55	50.98	54.57
45	1.50	0.35	13.32	14.26	64.30	68.83
60	2.00	0.25	11.89	12.73	76.19	81.56
80	2.50	0.18	10.42	11.15	86.61	92.71
120	3.00	0.13	4.47	4.78	91.08	97.49
170	3.50	0.09	1.36	1.46	92.44	98.95
200	3.75	0.07	0.20	0.21	92.64	99.16
230	4.00	0.06	0.07	0.07	92.71	99.23

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.74	2.11	1.74	0.78	-0.74	-1.26	-1.99
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.52	0.70	1.48	-0.24	1.99	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC06 #1

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,678	Northing (m): 948,190	Coordinate System: MA State Plane Mainland	Elevation (ft): -81.0 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-5/3 Dry - 2.5Y-7/3 Washed - 2.5Y-7/3	Comments:
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Dry Weight (g): 91.00	Wash Weight (g): 89.16	Pan Retained (g): 0.30	Sieve Loss (%): 0.01	Fines (%): #200 - 3.60 #230 - 2.36	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.86	0.95	0.86	0.95
3.5	-2.50	5.66	1.25	1.37	2.11	2.32
4	-2.25	4.76	0.53	0.58	2.64	2.90
5	-2.00	4.00	0.39	0.43	3.03	3.33
7	-1.50	2.83	1.23	1.35	4.26	4.68
10	-1.00	2.00	1.25	1.37	5.51	6.05
14	-0.50	1.41	1.70	1.87	7.21	7.92
18	0.00	1.00	1.98	2.18	9.19	10.10
25	0.50	0.71	2.02	2.22	11.21	12.32
35	1.00	0.50	2.87	3.15	14.08	15.47
45	1.50	0.35	3.51	3.86	17.59	19.33
60	2.00	0.25	10.68	11.74	28.27	31.07
80	2.50	0.18	33.09	36.36	61.36	67.43
120	3.00	0.13	16.94	18.62	78.30	86.05
170	3.50	0.09	8.30	9.12	86.60	95.17
200	3.75	0.07	1.12	1.23	87.72	96.40
230	4.00	0.06	1.13	1.24	88.85	97.64

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.49	2.94	2.70	2.26	1.74	1.07	-1.38
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.9	0.27	1.37	-1.88	6.5	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC06 #2

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,678	Northing (m): 948,190	Coordinate System: MA State Plane Mainland	Elevation (ft): -83.1 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-5/3 Dry - 2.5Y-7/3 Washed - 2.5Y-7/3	Comments:
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Dry Weight (g): 91.08	Wash Weight (g): 89.84	Pan Retained (g): 0.10	Sieve Loss (%): 0.03	Fines (%): #200 - 2.19 #230 - 1.51	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.21	0.23	0.21	0.23
10	-1.00	2.00	0.25	0.27	0.46	0.50
14	-0.50	1.41	0.54	0.59	1.00	1.09
18	0.00	1.00	1.00	1.10	2.00	2.19
25	0.50	0.71	2.19	2.40	4.19	4.59
35	1.00	0.50	3.70	4.06	7.89	8.65
45	1.50	0.35	5.50	6.04	13.39	14.69
60	2.00	0.25	18.73	20.56	32.12	35.25
80	2.50	0.18	34.18	37.53	66.30	72.78
120	3.00	0.13	17.44	19.15	83.74	91.93
170	3.50	0.09	4.67	5.13	88.41	97.06
200	3.75	0.07	0.68	0.75	89.09	97.81
230	4.00	0.06	0.62	0.68	89.71	98.49

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.30	2.79	2.56	2.20	1.75	1.53	0.55
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.08	0.24	0.78	-1.26	6.17	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC06 #3

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 259,678	Northing (m): 948,190	Coordinate System: MA State Plane Mainland	Elevation (ft): -86.9 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-6/3 Dry - 2.5Y-7/3 Washed - 2.5Y-8/3	Comments:
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Dry Weight (g): 88.43	Wash Weight (g): 86.86	Pan Retained (g): 0.55	Sieve Loss (%): 0.05	Fines (%): #200 - 3.91 #230 - 2.45	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.03	0.03	0.03	0.03
14	-0.50	1.41	0.04	0.05	0.07	0.08
18	0.00	1.00	0.02	0.02	0.09	0.10
25	0.50	0.71	0.06	0.07	0.15	0.17
35	1.00	0.50	0.07	0.08	0.22	0.25
45	1.50	0.35	0.29	0.33	0.51	0.58
60	2.00	0.25	3.21	3.63	3.72	4.21
80	2.50	0.18	26.70	30.19	30.42	34.40
120	3.00	0.13	37.76	42.70	68.18	77.10
170	3.50	0.09	15.01	16.97	83.19	94.07
200	3.75	0.07	1.79	2.02	84.98	96.09
230	4.00	0.06	1.29	1.46	86.27	97.55

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.62	3.20	2.98	2.68	2.34	2.20	2.01
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.67	0.16	0.46	-0.43	6.85	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #1

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -86.2 NAVD88
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USCS: SW	Munsell: Wet - 10YR-3/3 Dry - 10YR-6/3 Washed - 10YR-7/3	Comments:
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Dry Weight (g): 93.57	Wash Weight (g): 92.70	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 1.07 #230 - 0.96	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.82	0.88	0.82	0.88
4	-2.25	4.76	0.61	0.65	1.43	1.53
5	-2.00	4.00	0.62	0.66	2.05	2.19
7	-1.50	2.83	1.29	1.38	3.34	3.57
10	-1.00	2.00	3.16	3.38	6.50	6.95
14	-0.50	1.41	8.41	8.99	14.91	15.94
18	0.00	1.00	14.73	15.74	29.64	31.68
25	0.50	0.71	19.55	20.89	49.19	52.57
35	1.00	0.50	21.26	22.72	70.45	75.29
45	1.50	0.35	13.13	14.03	83.58	89.32
60	2.00	0.25	6.04	6.46	89.62	95.78
80	2.50	0.18	2.01	2.15	91.63	97.93
120	3.00	0.13	0.59	0.63	92.22	98.56
170	3.50	0.09	0.29	0.31	92.51	98.87
200	3.75	0.07	0.06	0.06	92.57	98.93
230	4.00	0.06	0.10	0.11	92.67	99.04

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.94	1.31	0.99	0.44	-0.21	-0.50	-1.29
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.37	0.77	0.97	-0.33	3.91	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #2

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -87.0 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-6/1	Comments:
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Dry Weight (g): 88.33	Wash Weight (g): 86.53	Pan Retained (g): 0.03	Sieve Loss (%): 0.07	Fines (%): #200 - 2.40 #230 - 2.15	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.20	0.23	0.20	0.23
10	-1.00	2.00	0.40	0.45	0.60	0.68
14	-0.50	1.41	1.83	2.07	2.43	2.75
18	0.00	1.00	5.48	6.20	7.91	8.95
25	0.50	0.71	14.36	16.26	22.27	25.21
35	1.00	0.50	25.34	28.69	47.61	53.90
45	1.50	0.35	23.42	26.51	71.03	80.41
60	2.00	0.25	10.40	11.77	81.43	92.18
80	2.50	0.18	2.35	2.66	83.78	94.84
120	3.00	0.13	1.22	1.38	85.00	96.22
170	3.50	0.09	1.01	1.14	86.01	97.36
200	3.75	0.07	0.21	0.24	86.22	97.60
230	4.00	0.06	0.22	0.25	86.44	97.85

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.56	1.65	1.40	0.93	0.49	0.22	-0.32
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.93	0.52	0.76	0.31	4.5	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #3

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -88.7 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-5/2 Washed - 2.5Y-6/1	Comments:
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Dry Weight (g): 93.83	Wash Weight (g): 92.14	Pan Retained (g): 0.06	Sieve Loss (%): 0.10	Fines (%): #200 - 2.08 #230 - 1.98	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.06	0.06	0.06	0.06
7	-1.50	2.83	1.35	1.44	1.41	1.50
10	-1.00	2.00	2.98	3.18	4.39	4.68
14	-0.50	1.41	5.85	6.23	10.24	10.91
18	0.00	1.00	8.25	8.79	18.49	19.70
25	0.50	0.71	12.37	13.18	30.86	32.88
35	1.00	0.50	18.29	19.49	49.15	52.37
45	1.50	0.35	21.21	22.60	70.36	74.97
60	2.00	0.25	14.56	15.52	84.92	90.49
80	2.50	0.18	5.07	5.40	89.99	95.89
120	3.00	0.13	1.50	1.60	91.49	97.49
170	3.50	0.09	0.35	0.37	91.84	97.86
200	3.75	0.07	0.06	0.06	91.90	97.92
230	4.00	0.06	0.09	0.10	91.99	98.02

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.42	1.79	1.50	0.94	0.20	-0.21	-0.97
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.8	0.57	0.97	-0.39	2.99	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
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Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #4

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -91.8 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-6/2 Washed - 2.5Y-7/1	Comments:
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Dry Weight (g): 91.52	Wash Weight (g): 90.20	Pan Retained (g): 0.02	Sieve Loss (%): 0.11	Fines (%): #200 - 1.74 #230 - 1.57	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.17	0.19	0.17	0.19
10	-1.00	2.00	0.33	0.36	0.50	0.55
14	-0.50	1.41	1.04	1.14	1.54	1.69
18	0.00	1.00	2.77	3.03	4.31	4.72
25	0.50	0.71	6.31	6.89	10.62	11.61
35	1.00	0.50	10.47	11.44	21.09	23.05
45	1.50	0.35	22.51	24.60	43.60	47.65
60	2.00	0.25	32.10	35.07	75.70	82.72
80	2.50	0.18	10.87	11.88	86.57	94.60
120	3.00	0.13	1.95	2.13	88.52	96.73
170	3.50	0.09	1.17	1.28	89.69	98.01
200	3.75	0.07	0.23	0.25	89.92	98.26
230	4.00	0.06	0.16	0.17	90.08	98.43

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.59	2.05	1.89	1.53	1.04	0.69	0.02
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.41	0.38	0.75	-0.58	4.39	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



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Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #5

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -94.0 NAVD88
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USCS: SM	Munsell: Wet - 5Y-4/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 86.41	Wash Weight (g): 61.95	Pan Retained (g): 0.88	Sieve Loss (%): 0.13	Fines (%): #200 - 34.02 #230 - 29.45	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.14	0.16	0.14	0.16
10	-1.00	2.00	0.34	0.39	0.48	0.55
14	-0.50	1.41	0.58	0.67	1.06	1.22
18	0.00	1.00	1.09	1.26	2.15	2.48
25	0.50	0.71	1.94	2.25	4.09	4.73
35	1.00	0.50	3.15	3.65	7.24	8.38
45	1.50	0.35	3.96	4.58	11.20	12.96
60	2.00	0.25	5.65	6.54	16.85	19.50
80	2.50	0.18	11.48	13.29	28.33	32.79
120	3.00	0.13	11.82	13.68	40.15	46.47
170	3.50	0.09	11.31	13.09	51.46	59.56
200	3.75	0.07	5.55	6.42	57.01	65.98
230	4.00	0.06	3.95	4.57	60.96	70.55

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
			3.13	2.21	1.73	0.54
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.41	0.19	1.09	-0.98	3.79	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC07 #6

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 259,788	Northing (m): 951,977	Coordinate System: MA State Plane Mainland	Elevation (ft): -96.3 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-5/1 Dry - 2.5Y-6/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 91.72	Wash Weight (g): 90.87	Pan Retained (g): 0.01	Sieve Loss (%): 0.01	Fines (%): #200 - 1.00 #230 - 0.93	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	1.60	1.74	1.60	1.74
4	-2.25	4.76	0.91	0.99	2.51	2.73
5	-2.00	4.00	1.52	1.66	4.03	4.39
7	-1.50	2.83	4.31	4.70	8.34	9.09
10	-1.00	2.00	5.92	6.45	14.26	15.54
14	-0.50	1.41	8.26	9.01	22.52	24.55
18	0.00	1.00	10.91	11.89	33.43	36.44
25	0.50	0.71	14.80	16.14	48.23	52.58
35	1.00	0.50	18.12	19.76	66.35	72.34
45	1.50	0.35	14.13	15.41	80.48	87.75
60	2.00	0.25	5.93	6.47	86.41	94.22
80	2.50	0.18	2.18	2.38	88.59	96.60
120	3.00	0.13	1.40	1.53	89.99	98.13
170	3.50	0.09	0.69	0.75	90.68	98.88
200	3.75	0.07	0.11	0.12	90.79	99.00
230	4.00	0.06	0.06	0.07	90.85	99.07

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.16	1.38	1.09	0.42	-0.48	-0.97	-1.94

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.26	0.84	1.19	-0.3	3

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC08 #1

Analysis Date: 11-06-17; Analyzed By: SMT

Easting (m): 261,677	Northing (m): 953,809	Coordinate System: MA State Plane Mainland	Elevation (ft): -108.4 NAVD88
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USCS: SP	Munsell: Wet - 10YR-4/3 Dry - 10YR-6/4 Washed - 10YR-7/4	Comments:
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Dry Weight (g): 92.14	Wash Weight (g): 91.06	Pan Retained (g): 0.01	Sieve Loss (%): 0.07	Fines (%): #200 - 1.34 #230 - 1.24	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.25	0.27	0.25	0.27
10	-1.00	2.00	1.14	1.24	1.39	1.51
14	-0.50	1.41	3.82	4.15	5.21	5.66
18	0.00	1.00	7.89	8.56	13.10	14.22
25	0.50	0.71	12.17	13.21	25.27	27.43
35	1.00	0.50	20.23	21.96	45.50	49.39
45	1.50	0.35	27.02	29.32	72.52	78.71
60	2.00	0.25	13.81	14.99	86.33	93.70
80	2.50	0.18	2.26	2.45	88.59	96.15
120	3.00	0.13	1.60	1.74	90.19	97.89
170	3.50	0.09	0.59	0.64	90.78	98.53
200	3.75	0.07	0.12	0.13	90.90	98.66
230	4.00	0.06	0.09	0.10	90.99	98.76

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.27	1.68	1.44	1.01	0.41	0.07	-0.58
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.9	0.54	0.82	-0.2	3.55	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC08 #2

Analysis Date: 11-09-17; Analyzed By: DA

Easting (m): 261,677	Northing (m): 953,809	Coordinate System: MA State Plane Mainland	Elevation (ft): -112.6 NAVD88
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USCS: SW	Munsell: Wet - 10YR-4/3 Dry - 10YR-6/3 Washed - 10YR-6/3	Comments:
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Dry Weight (g): 91.60	Wash Weight (g): 90.88	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 0.85 #230 - 0.82	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	2.35	2.57	2.35	2.57
3.5	-2.50	5.66	0.00	0.00	2.35	2.57
4	-2.25	4.76	0.36	0.39	2.71	2.96
5	-2.00	4.00	0.45	0.49	3.16	3.45
7	-1.50	2.83	2.19	2.39	5.35	5.84
10	-1.00	2.00	4.31	4.71	9.66	10.55
14	-0.50	1.41	8.25	9.01	17.91	19.56
18	0.00	1.00	13.94	15.22	31.85	34.78
25	0.50	0.71	18.97	20.71	50.82	55.49
35	1.00	0.50	18.99	20.73	69.81	76.22
45	1.50	0.35	11.70	12.77	81.51	88.99
60	2.00	0.25	6.89	7.52	88.40	96.51
80	2.50	0.18	1.96	2.14	90.36	98.65
120	3.00	0.13	0.30	0.33	90.66	98.98
170	3.50	0.09	0.15	0.16	90.81	99.14
200	3.75	0.07	0.01	0.01	90.82	99.15
230	4.00	0.06	0.03	0.03	90.85	99.18

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.90	1.30	0.97	0.37	-0.32	-0.70	-1.68
Moment Statistics	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
	0.26	0.84	1.09	-0.8	4.41	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC08 #3

Analysis Date: 11-09-17; Analyzed By: DA

Easting (m): 261,677	Northing (m): 953,809	Coordinate System: MA State Plane Mainland	Elevation (ft): -116.8 NAVD88
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USCS: SW	Munsell: Wet - 10YR-5/3 Dry - 2.5Y-6/3 Washed - 2.5Y-7/3	Comments:
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Dry Weight (g): 92.15	Wash Weight (g): 90.84	Pan Retained (g): 0.03	Sieve Loss (%): 0.02	Fines (%): #200 - 1.62 #230 - 1.49	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.44	0.48	0.44	0.48
5	-2.00	4.00	0.18	0.20	0.62	0.68
7	-1.50	2.83	0.27	0.29	0.89	0.97
10	-1.00	2.00	1.02	1.11	1.91	2.08
14	-0.50	1.41	3.30	3.58	5.21	5.66
18	0.00	1.00	5.52	5.99	10.73	11.65
25	0.50	0.71	7.55	8.19	18.28	19.84
35	1.00	0.50	15.01	16.29	33.29	36.13
45	1.50	0.35	26.47	28.72	59.76	64.85
60	2.00	0.25	18.80	20.40	78.56	85.25
80	2.50	0.18	7.67	8.32	86.23	93.57
120	3.00	0.13	3.58	3.88	89.81	97.45
170	3.50	0.09	0.74	0.80	90.55	98.25
200	3.75	0.07	0.12	0.13	90.67	98.38
230	4.00	0.06	0.12	0.13	90.79	98.51

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.68	1.97	1.75	1.24	0.66	0.27	-0.59
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.13	0.46	0.92	-0.64	4.12	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC09 #1

Analysis Date: 11-09-17; Analyzed By: DA

Easting (m): 259,585	Northing (m): 955,110	Coordinate System: MA State Plane Mainland	Elevation (ft): -94.6 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-4/2 Dry - 2.5Y-6/2 Washed - 2.5Y-7/1	Comments:
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Dry Weight (g): 99.78	Wash Weight (g): 99.46	Pan Retained (g): 0.01	Sieve Loss (%): 0.00	Fines (%): #200 - 0.40 #230 - 0.33	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.07	1.07	1.07	1.07
3.5	-2.50	5.66	4.08	4.09	5.15	5.16
4	-2.25	4.76	1.87	1.87	7.02	7.03
5	-2.00	4.00	1.98	1.98	9.00	9.01
7	-1.50	2.83	6.85	6.87	15.85	15.88
10	-1.00	2.00	6.08	6.09	21.93	21.97
14	-0.50	1.41	7.58	7.60	29.51	29.57
18	0.00	1.00	8.95	8.97	38.46	38.54
25	0.50	0.71	11.48	11.51	49.94	50.05
35	1.00	0.50	13.13	13.16	63.07	63.21
45	1.50	0.35	12.26	12.29	75.33	75.50
60	2.00	0.25	11.01	11.03	86.34	86.53
80	2.50	0.18	7.46	7.48	93.80	94.01
120	3.00	0.13	4.45	4.46	98.25	98.47
170	3.50	0.09	0.99	0.99	99.24	99.46
200	3.75	0.07	0.14	0.14	99.38	99.60
230	4.00	0.06	0.07	0.07	99.45	99.67

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.61	1.89	1.48	0.50	-0.80	-1.49	-2.52

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.3	0.81	1.53	-0.33	2.33

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC09 #2

Analysis Date: 11-09-17; Analyzed By: DA

Easting (m): 259,585	Northing (m): 955,110	Coordinate System: MA State Plane Mainland	Elevation (ft): -97.2 NAVD88
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USCS: SW	Munsell: Wet - 5Y-2.5/1 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 90.58	Wash Weight (g): 90.00	Pan Retained (g): 0.00	Sieve Loss (%): 0.07	Fines (%): #200 - 0.83 #230 - 0.74	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.66	1.83	1.66	1.83
5/16"	-3.00	8.00	1.58	1.74	3.24	3.57
3.5	-2.50	5.66	0.39	0.43	3.63	4.00
4	-2.25	4.76	0.91	1.00	4.54	5.00
5	-2.00	4.00	0.18	0.20	4.72	5.20
7	-1.50	2.83	0.46	0.51	5.18	5.71
10	-1.00	2.00	1.58	1.74	6.76	7.45
14	-0.50	1.41	2.92	3.22	9.68	10.67
18	0.00	1.00	4.90	5.41	14.58	16.08
25	0.50	0.71	11.28	12.45	25.86	28.53
35	1.00	0.50	20.16	22.26	46.02	50.79
45	1.50	0.35	16.19	17.87	62.21	68.66
60	2.00	0.25	8.20	9.05	70.41	77.71
80	2.50	0.18	10.32	11.39	80.73	89.10
120	3.00	0.13	7.70	8.50	88.43	97.60
170	3.50	0.09	1.29	1.42	89.72	99.02
200	3.75	0.07	0.14	0.15	89.86	99.17
230	4.00	0.06	0.08	0.09	89.94	99.26

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.85	2.28	1.85	0.98	0.36	-0.01	-2.25
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.9	0.54	1.38	-1.18	5.19	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC09 #3

Analysis Date: 11-13-17; Analyzed By: DA

Easting (m): 259,585	Northing (m): 955,110	Coordinate System: MA State Plane Mainland	Elevation (ft): -99.5 NAVD88
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USCS: SW	Munsell: Wet - 5Y-5/1 Dry - 5Y-6/2 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 91.14	Wash Weight (g): 88.56	Pan Retained (g): 0.18	Sieve Loss (%): 0.02	Fines (%): #200 - 3.85 #230 - 3.03	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.17	0.19	0.17	0.19
5	-2.00	4.00	0.98	1.08	1.15	1.27
7	-1.50	2.83	2.35	2.58	3.50	3.85
10	-1.00	2.00	3.03	3.32	6.53	7.17
14	-0.50	1.41	5.42	5.95	11.95	13.12
18	0.00	1.00	6.82	7.48	18.77	20.60
25	0.50	0.71	5.32	5.84	24.09	26.44
35	1.00	0.50	5.80	6.36	29.89	32.80
45	1.50	0.35	7.08	7.77	36.97	40.57
60	2.00	0.25	7.26	7.97	44.23	48.54
80	2.50	0.18	21.76	23.88	65.99	72.42
120	3.00	0.13	15.07	16.54	81.06	88.96
170	3.50	0.09	5.32	5.84	86.38	94.80
200	3.75	0.07	1.23	1.35	87.61	96.15
230	4.00	0.06	0.75	0.82	88.36	96.97

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.54	2.85	2.58	2.03	0.38	-0.31	-1.33
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.43	0.37	1.45	-0.68	2.43	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC09 #4

Analysis Date: 11-06-17; Analyzed By: DA

Easting (m): 259,585	Northing (m): 955,110	Coordinate System: MA State Plane Mainland	Elevation (ft): -102.9 NAVD88
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USCS: SP-SM	Munsell: Wet - 5Y-4/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 90.79	Wash Weight (g): 85.55	Pan Retained (g): 1.46	Sieve Loss (%): 0.04	Fines (%): #200 - 10.96 #230 - 7.41	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.12	0.13	0.12	0.13
10	-1.00	2.00	0.17	0.19	0.29	0.32
14	-0.50	1.41	0.45	0.50	0.74	0.82
18	0.00	1.00	0.88	0.97	1.62	1.79
25	0.50	0.71	1.38	1.52	3.00	3.31
35	1.00	0.50	1.65	1.82	4.65	5.13
45	1.50	0.35	2.88	3.17	7.53	8.30
60	2.00	0.25	4.66	5.13	12.19	13.43
80	2.50	0.18	28.59	31.49	40.78	44.92
120	3.00	0.13	26.62	29.32	67.40	74.24
170	3.50	0.09	10.31	11.36	77.71	85.60
200	3.75	0.07	3.12	3.44	80.83	89.04
230	4.00	0.06	3.22	3.55	84.05	92.59

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.43	3.03	2.59	2.18	2.04	0.96
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.47	0.18	0.8	-1.4	6.94	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC10 #1

Analysis Date: 11-13-17; Analyzed By: DA

Easting (m): 239,899	Northing (m): 793,491	Coordinate System: MA State Plane Mainland	Elevation (ft): -74.5 NAVD88
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USCS: SP	Munsell: Wet - 5Y-5/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 88.29	Wash Weight (g): 86.52	Pan Retained (g): 0.05	Sieve Loss (%): 0.00	Fines (%): #200 - 2.43 #230 - 2.07	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.02	0.02	0.02	0.02
14	-0.50	1.41	0.04	0.05	0.06	0.07
18	0.00	1.00	0.03	0.03	0.09	0.10
25	0.50	0.71	0.23	0.26	0.32	0.36
35	1.00	0.50	1.18	1.34	1.50	1.70
45	1.50	0.35	4.55	5.15	6.05	6.85
60	2.00	0.25	10.74	12.16	16.79	19.01
80	2.50	0.18	36.25	41.06	53.04	60.07
120	3.00	0.13	27.59	31.25	80.63	91.32
170	3.50	0.09	5.11	5.79	85.74	97.11
200	3.75	0.07	0.41	0.46	86.15	97.57
230	4.00	0.06	0.32	0.36	86.47	97.93

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.32	2.88	2.74	2.38	2.07	1.88	1.32
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.34	0.20	0.53	-0.74	5.02	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC10 #2

Analysis Date: 11-13-17; Analyzed By: DA

Easting (m): 239,899	Northing (m): 793,491	Coordinate System: MA State Plane Mainland	Elevation (ft): -77.9 NAVD88
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USCS: SP	Munsell: Wet - 5Y-5/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 91.13	Wash Weight (g): 90.21	Pan Retained (g): 0.00	Sieve Loss (%): 0.04	Fines (%): #200 - 1.16 #230 - 1.06	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.02	0.02	0.02	0.02
5	-2.00	4.00	0.03	0.03	0.05	0.05
7	-1.50	2.83	0.28	0.31	0.33	0.36
10	-1.00	2.00	0.20	0.22	0.53	0.58
14	-0.50	1.41	0.45	0.49	0.98	1.07
18	0.00	1.00	0.89	0.98	1.87	2.05
25	0.50	0.71	2.66	2.92	4.53	4.97
35	1.00	0.50	7.33	8.04	11.86	13.01
45	1.50	0.35	14.51	15.92	26.37	28.93
60	2.00	0.25	23.76	26.07	50.13	55.00
80	2.50	0.18	23.74	26.05	73.87	81.05
120	3.00	0.13	14.04	15.41	87.91	96.46
170	3.50	0.09	2.06	2.26	89.97	98.72
200	3.75	0.07	0.11	0.12	90.08	98.84
230	4.00	0.06	0.09	0.10	90.17	98.94

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.95	2.60	2.38	1.90	1.38	1.09	0.50
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.82	0.28	0.78	-0.91	4.96	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC11 #1

Analysis Date: 11-13-17; Analyzed By: DA

Easting (m): 241,178	Northing (m): 796,123	Coordinate System: MA State Plane Mainland	Elevation (ft): -66.9 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/2 Dry - 2.5Y-6/3 Washed - 2.5Y-7/3	Comments:
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Dry Weight (g): 87.61	Wash Weight (g): 85.25	Pan Retained (g): 0.07	Sieve Loss (%): 0.03	Fines (%): #200 - 3.11 #230 - 2.80	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	2.44	2.79	2.44	2.79
4	-2.25	4.76	1.36	1.55	3.80	4.34
5	-2.00	4.00	0.57	0.65	4.37	4.99
7	-1.50	2.83	1.18	1.35	5.55	6.34
10	-1.00	2.00	0.92	1.05	6.47	7.39
14	-0.50	1.41	1.09	1.24	7.56	8.63
18	0.00	1.00	0.87	0.99	8.43	9.62
25	0.50	0.71	0.96	1.10	9.39	10.72
35	1.00	0.50	4.34	4.95	13.73	15.67
45	1.50	0.35	14.52	16.57	28.25	32.24
60	2.00	0.25	14.33	16.36	42.58	48.60
80	2.50	0.18	26.85	30.65	69.43	79.25
120	3.00	0.13	12.78	14.59	82.21	93.84
170	3.50	0.09	2.38	2.72	84.59	96.56
200	3.75	0.07	0.29	0.33	84.88	96.89
230	4.00	0.06	0.27	0.31	85.15	97.20

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.21	2.66	2.43	2.02	1.28	1.01	-2.00
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.61	0.33	1.33	-1.85	6.27	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC11 #2

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 241,178	Northing (m): 796,123	Coordinate System: MA State Plane Mainland	Elevation (ft): -67.4 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-7/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 91.75	Wash Weight (g): 91.20	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 0.65 #230 - 0.63	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	5.63	6.14	5.63	6.14
5/16"	-3.00	8.00	3.06	3.34	8.69	9.48
3.5	-2.50	5.66	9.90	10.79	18.59	20.27
4	-2.25	4.76	5.10	5.56	23.69	25.83
5	-2.00	4.00	4.31	4.70	28.00	30.53
7	-1.50	2.83	3.76	4.10	31.76	34.63
10	-1.00	2.00	1.97	2.15	33.73	36.78
14	-0.50	1.41	1.15	1.25	34.88	38.03
18	0.00	1.00	0.66	0.72	35.54	38.75
25	0.50	0.71	0.73	0.80	36.27	39.55
35	1.00	0.50	5.25	5.72	41.52	45.27
45	1.50	0.35	22.55	24.58	64.07	69.85
60	2.00	0.25	20.04	21.84	84.11	91.69
80	2.50	0.18	5.42	5.91	89.53	97.60
120	3.00	0.13	1.34	1.46	90.87	99.06
170	3.50	0.09	0.25	0.27	91.12	99.33
200	3.75	0.07	0.02	0.02	91.14	99.35
230	4.00	0.06	0.02	0.02	91.16	99.37

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.28	1.82	1.62	1.10	-2.29	-2.70	-3.64
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	-0.06	1.04	2.07	-0.52	1.62	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC11 #3

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 241,178	Northing (m): 796,123	Coordinate System: MA State Plane Mainland	Elevation (ft): -70.7 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-6/2 Dry - 2.5Y-7/3 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 89.90	Wash Weight (g): 88.92	Pan Retained (g): 0.00	Sieve Loss (%): 0.02	Fines (%): #200 - 1.17 #230 - 1.11	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.25	0.28	0.25	0.28
7	-1.50	2.83	0.66	0.73	0.91	1.01
10	-1.00	2.00	1.14	1.27	2.05	2.28
14	-0.50	1.41	1.04	1.16	3.09	3.44
18	0.00	1.00	0.89	0.99	3.98	4.43
25	0.50	0.71	1.15	1.28	5.13	5.71
35	1.00	0.50	5.38	5.98	10.51	11.69
45	1.50	0.35	30.26	33.66	40.77	45.35
60	2.00	0.25	34.54	38.42	75.31	83.77
80	2.50	0.18	11.48	12.77	86.79	96.54
120	3.00	0.13	1.71	1.90	88.50	98.44
170	3.50	0.09	0.30	0.33	88.80	98.77
200	3.75	0.07	0.05	0.06	88.85	98.83
230	4.00	0.06	0.05	0.06	88.90	98.89

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.44	2.01	1.89	1.56	1.20	1.06	0.22
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.47	0.36	0.72	-1.91	9.42	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC11 #4

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 241,178	Northing (m): 796,123	Coordinate System: MA State Plane Mainland	Elevation (ft): -74.5 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-7/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 84.73	Wash Weight (g): 83.93	Pan Retained (g): 0.00	Sieve Loss (%): 0.01	Fines (%): #200 - 0.95 #230 - 0.94	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.45	0.53	0.45	0.53
4	-2.25	4.76	0.09	0.11	0.54	0.64
5	-2.00	4.00	0.00	0.00	0.54	0.64
7	-1.50	2.83	0.15	0.18	0.69	0.82
10	-1.00	2.00	0.38	0.45	1.07	1.27
14	-0.50	1.41	0.28	0.33	1.35	1.60
18	0.00	1.00	0.29	0.34	1.64	1.94
25	0.50	0.71	0.78	0.92	2.42	2.86
35	1.00	0.50	6.93	8.18	9.35	11.04
45	1.50	0.35	33.34	39.35	42.69	50.39
60	2.00	0.25	30.80	36.35	73.49	86.74
80	2.50	0.18	9.15	10.80	82.64	97.54
120	3.00	0.13	1.09	1.29	83.73	98.83
170	3.50	0.09	0.15	0.18	83.88	99.01
200	3.75	0.07	0.03	0.04	83.91	99.05
230	4.00	0.06	0.01	0.01	83.92	99.06

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.38	1.96	1.84	1.50	1.18	1.06	0.63
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.46	0.36	0.62	-2.5	17.19	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC11 #5

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 241,178	Northing (m): 796,123	Coordinate System: MA State Plane Mainland	Elevation (ft): -75.8 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-7/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 95.78	Wash Weight (g): 95.25	Pan Retained (g): 0.00	Sieve Loss (%): 0.02	Fines (%): #200 - 0.57 #230 - 0.57	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	1.24	1.29	1.24	1.29
3.5	-2.50	5.66	3.18	3.32	4.42	4.61
4	-2.25	4.76	1.80	1.88	6.22	6.49
5	-2.00	4.00	1.20	1.25	7.42	7.74
7	-1.50	2.83	3.32	3.47	10.74	11.21
10	-1.00	2.00	2.37	2.47	13.11	13.68
14	-0.50	1.41	3.40	3.55	16.51	17.23
18	0.00	1.00	3.53	3.69	20.04	20.92
25	0.50	0.71	3.32	3.47	23.36	24.39
35	1.00	0.50	14.42	15.06	37.78	39.45
45	1.50	0.35	38.32	40.01	76.10	79.46
60	2.00	0.25	15.30	15.97	91.40	95.43
80	2.50	0.18	3.37	3.52	94.77	98.95
120	3.00	0.13	0.40	0.42	95.17	99.37
170	3.50	0.09	0.06	0.06	95.23	99.43
200	3.75	0.07	0.00	0.00	95.23	99.43
230	4.00	0.06	0.00	0.00	95.23	99.43

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.99	1.64	1.44	1.13	0.52	-0.67	-2.45
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.67	0.63	1.31	-1.46	4.23	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC12 #1

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 237,839	Northing (m): 798,152	Coordinate System: MA State Plane Mainland	Elevation (ft): -58.6 NAVD88
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USCS: SP	Munsell: Wet - 2.5Y-3/2 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 93.93	Wash Weight (g): 92.65	Pan Retained (g): 0.02	Sieve Loss (%): 0.04	Fines (%): #200 - 1.49 #230 - 1.44	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.16	0.17	0.16	0.17
3.5	-2.50	5.66	0.13	0.14	0.29	0.31
4	-2.25	4.76	0.14	0.15	0.43	0.46
5	-2.00	4.00	0.03	0.03	0.46	0.49
7	-1.50	2.83	0.38	0.40	0.84	0.89
10	-1.00	2.00	0.36	0.38	1.20	1.27
14	-0.50	1.41	0.45	0.48	1.65	1.75
18	0.00	1.00	0.71	0.76	2.36	2.51
25	0.50	0.71	2.46	2.62	4.82	5.13
35	1.00	0.50	11.87	12.64	16.69	17.77
45	1.50	0.35	29.84	31.77	46.53	49.54
60	2.00	0.25	26.84	28.57	73.37	78.11
80	2.50	0.18	12.76	13.58	86.13	91.69
120	3.00	0.13	5.23	5.57	91.36	97.26
170	3.50	0.09	1.11	1.18	92.47	98.44
200	3.75	0.07	0.07	0.07	92.54	98.51
230	4.00	0.06	0.05	0.05	92.59	98.56

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.80	2.22	1.95	1.51	1.11	0.93	0.48
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.49	0.36	0.76	-1.29	9.22	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC12 #2

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 237,839	Northing (m): 798,152	Coordinate System: MA State Plane Mainland	Elevation (ft): -59.2 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 88.44	Wash Weight (g): 86.94	Pan Retained (g): 0.02	Sieve Loss (%): 0.02	Fines (%): #200 - 1.80 #230 - 1.73	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.26	0.29	0.26	0.29
5	-2.00	4.00	0.04	0.05	0.30	0.34
7	-1.50	2.83	0.27	0.31	0.57	0.65
10	-1.00	2.00	0.16	0.18	0.73	0.83
14	-0.50	1.41	0.24	0.27	0.97	1.10
18	0.00	1.00	0.63	0.71	1.60	1.81
25	0.50	0.71	2.04	2.31	3.64	4.12
35	1.00	0.50	7.85	8.88	11.49	13.00
45	1.50	0.35	22.54	25.49	34.03	38.49
60	2.00	0.25	25.12	28.40	59.15	66.89
80	2.50	0.18	15.89	17.97	75.04	84.86
120	3.00	0.13	10.13	11.45	85.17	96.31
170	3.50	0.09	1.58	1.79	86.75	98.10
200	3.75	0.07	0.09	0.10	86.84	98.20
230	4.00	0.06	0.06	0.07	86.90	98.27

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.94	2.48	2.23	1.70	1.24	1.06	0.55
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.68	0.31	0.76	-0.9	6.6	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC12 #3

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 237,839	Northing (m): 798,152	Coordinate System: MA State Plane Mainland	Elevation (ft): -63.2 NAVD88
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USCS: SP	Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 88.32	Wash Weight (g): 85.10	Pan Retained (g): 0.09	Sieve Loss (%): 0.03	Fines (%): #200 - 4.27 #230 - 3.79	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.01	0.01	0.01	0.01
10	-1.00	2.00	0.02	0.02	0.03	0.03
14	-0.50	1.41	0.02	0.02	0.05	0.05
18	0.00	1.00	0.03	0.03	0.08	0.08
25	0.50	0.71	0.09	0.10	0.17	0.18
35	1.00	0.50	0.37	0.42	0.54	0.60
45	1.50	0.35	2.05	2.32	2.59	2.92
60	2.00	0.25	8.74	9.90	11.33	12.82
80	2.50	0.18	26.01	29.45	37.34	42.27
120	3.00	0.13	38.60	43.70	75.94	85.97
170	3.50	0.09	7.99	9.05	83.93	95.02
200	3.75	0.07	0.63	0.71	84.56	95.73
230	4.00	0.06	0.42	0.48	84.98	96.21

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.50	2.98	2.87	2.59	2.21	2.05	1.61
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.5	0.18	0.49	-0.82	5.95	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC13 #1

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 234,032	Northing (m): 802,508	Coordinate System: MA State Plane Mainland	Elevation (ft): -58.4 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 85.13	Wash Weight (g): 82.17	Pan Retained (g): 0.13	Sieve Loss (%): 0.04	Fines (%): #200 - 4.40 #230 - 3.65	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.29	0.34	0.29	0.34
4	-2.25	4.76	0.03	0.04	0.32	0.38
5	-2.00	4.00	0.04	0.05	0.36	0.43
7	-1.50	2.83	0.14	0.16	0.50	0.59
10	-1.00	2.00	0.16	0.19	0.66	0.78
14	-0.50	1.41	0.24	0.28	0.90	1.06
18	0.00	1.00	0.30	0.35	1.20	1.41
25	0.50	0.71	0.55	0.65	1.75	2.06
35	1.00	0.50	2.56	3.01	4.31	5.07
45	1.50	0.35	10.14	11.91	14.45	16.98
60	2.00	0.25	23.59	27.71	38.04	44.69
80	2.50	0.18	22.89	26.89	60.93	71.58
120	3.00	0.13	13.49	15.85	74.42	87.43
170	3.50	0.09	6.17	7.25	80.59	94.68
200	3.75	0.07	0.78	0.92	81.37	95.60
230	4.00	0.06	0.64	0.75	82.01	96.35

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.59	2.89	2.61	2.10	1.64	1.46	0.99
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.05	0.24	0.78	-1.33	9.52	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC13 #2

Analysis Date: 11-14-17; Analyzed By: DA

Easting (m): 234,032	Northing (m): 802,508	Coordinate System: MA State Plane Mainland	Elevation (ft): -60.8 NAVD88
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USCS: SW-SC	Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 87.42	Wash Weight (g): 80.94	Pan Retained (g): 0.29	Sieve Loss (%): 0.05	Fines (%): #200 - 9.28 #230 - 7.80	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	2.18	2.49	2.18	2.49
3.5	-2.50	5.66	0.08	0.09	2.26	2.58
4	-2.25	4.76	0.05	0.06	2.31	2.64
5	-2.00	4.00	0.43	0.49	2.74	3.13
7	-1.50	2.83	0.58	0.66	3.32	3.79
10	-1.00	2.00	0.64	0.73	3.96	4.52
14	-0.50	1.41	0.99	1.13	4.95	5.65
18	0.00	1.00	0.97	1.11	5.92	6.76
25	0.50	0.71	1.28	1.46	7.20	8.22
35	1.00	0.50	2.46	2.81	9.66	11.03
45	1.50	0.35	3.89	4.45	13.55	15.48
60	2.00	0.25	6.85	7.84	20.40	23.32
80	2.50	0.18	16.24	18.58	36.64	41.90
120	3.00	0.13	26.70	30.54	63.34	72.44
170	3.50	0.09	14.37	16.44	77.71	88.88
200	3.75	0.07	1.61	1.84	79.32	90.72
230	4.00	0.06	1.29	1.48	80.61	92.20

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.35	3.08	2.63	2.05	1.53	-0.79
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.18	0.22	1.38	-2.29	8.68	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC13 #3

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 234,032	Northing (m): 802,508	Coordinate System: MA State Plane Mainland	Elevation (ft): -62.2 NAVD88
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USCS: SW-SC	Munsell: Wet - 10Y-3/1 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 90.92	Wash Weight (g): 83.79	Pan Retained (g): 0.27	Sieve Loss (%): 0.04	Fines (%): #200 - 9.49 #230 - 8.19	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.39	0.43	0.39	0.43
4	-2.25	4.76	0.23	0.25	0.62	0.68
5	-2.00	4.00	0.15	0.16	0.77	0.84
7	-1.50	2.83	0.92	1.01	1.69	1.85
10	-1.00	2.00	0.73	0.80	2.42	2.65
14	-0.50	1.41	1.39	1.53	3.81	4.18
18	0.00	1.00	2.08	2.29	5.89	6.47
25	0.50	0.71	3.77	4.15	9.66	10.62
35	1.00	0.50	10.29	11.32	19.95	21.94
45	1.50	0.35	13.83	15.21	33.78	37.15
60	2.00	0.25	7.05	7.75	40.83	44.90
80	2.50	0.18	6.82	7.50	47.65	52.40
120	3.00	0.13	17.93	19.72	65.58	72.12
170	3.50	0.09	15.13	16.64	80.71	88.76
200	3.75	0.07	1.59	1.75	82.30	90.51
230	4.00	0.06	1.18	1.30	83.48	91.81

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.36	3.09	2.34	1.10	0.74	-0.32
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.87	0.27	1.27	-0.83	3.56	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC14 #1

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 232,757	Northing (m): 801,103	Coordinate System: MA State Plane Mainland	Elevation (ft): -62.9 NAVD88
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USCS: SW-SC	Munsell: Wet - N-2.5/0 Dry - 2.5Y-5/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 91.17	Wash Weight (g): 86.46	Pan Retained (g): 0.03	Sieve Loss (%): 0.04	Fines (%): #200 - 5.57 #230 - 5.25	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.25	0.27	0.25	0.27
4	-2.25	4.76	0.20	0.22	0.45	0.49
5	-2.00	4.00	0.13	0.14	0.58	0.63
7	-1.50	2.83	0.35	0.38	0.93	1.01
10	-1.00	2.00	0.35	0.38	1.28	1.39
14	-0.50	1.41	0.48	0.53	1.76	1.92
18	0.00	1.00	0.70	0.77	2.46	2.69
25	0.50	0.71	1.90	2.08	4.36	4.77
35	1.00	0.50	2.47	2.71	6.83	7.48
45	1.50	0.35	6.35	6.97	13.18	14.45
60	2.00	0.25	18.01	19.75	31.19	34.20
80	2.50	0.18	31.36	34.40	62.55	68.60
120	3.00	0.13	18.09	19.84	80.64	88.44
170	3.50	0.09	4.75	5.21	85.39	93.65
200	3.75	0.07	0.71	0.78	86.10	94.43
230	4.00	0.06	0.29	0.32	86.39	94.75

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.89	2.66	2.23	1.77	1.54	0.54
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.06	0.24	0.86	-1.98	9.92	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC14 #2

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 232,757	Northing (m): 801,103	Coordinate System: MA State Plane Mainland	Elevation (ft): -64.6 NAVD88
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USCS: SW-SC	Munsell: Wet - 5GY-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 85.11	Wash Weight (g): 80.27	Pan Retained (g): 0.05	Sieve Loss (%): 0.06	Fines (%): #200 - 6.25 #230 - 5.82	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.30	0.35	0.30	0.35
5/16"	-3.00	8.00	0.25	0.29	0.55	0.64
3.5	-2.50	5.66	0.00	0.00	0.55	0.64
4	-2.25	4.76	0.25	0.29	0.80	0.93
5	-2.00	4.00	0.23	0.27	1.03	1.20
7	-1.50	2.83	0.40	0.47	1.43	1.67
10	-1.00	2.00	0.62	0.73	2.05	2.40
14	-0.50	1.41	0.54	0.63	2.59	3.03
18	0.00	1.00	0.41	0.48	3.00	3.51
25	0.50	0.71	0.38	0.45	3.38	3.96
35	1.00	0.50	0.89	1.05	4.27	5.01
45	1.50	0.35	4.41	5.18	8.68	10.19
60	2.00	0.25	16.18	19.01	24.86	29.20
80	2.50	0.18	31.00	36.42	55.86	65.62
120	3.00	0.13	18.62	21.88	74.48	87.50
170	3.50	0.09	4.55	5.35	79.03	92.85
200	3.75	0.07	0.77	0.90	79.80	93.75
230	4.00	0.06	0.37	0.43	80.17	94.18

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.92	2.71	2.29	1.89	1.65	1.00
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.11	0.23	0.95	-2.9	15.36	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC15 #1

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 277,516	Northing (m): 870,903	Coordinate System: MA State Plane Mainland	Elevation (ft): -80.7 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-7/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 96.21	Wash Weight (g): 95.46	Pan Retained (g): 0.01	Sieve Loss (%): 0.01	Fines (%): #200 - 0.82 #230 - 0.81	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.27	0.28	0.27	0.28
5	-2.00	4.00	0.46	0.48	0.73	0.76
7	-1.50	2.83	1.33	1.38	2.06	2.14
10	-1.00	2.00	1.68	1.75	3.74	3.89
14	-0.50	1.41	3.36	3.49	7.10	7.38
18	0.00	1.00	6.66	6.92	13.76	14.30
25	0.50	0.71	11.95	12.42	25.71	26.72
35	1.00	0.50	17.93	18.64	43.64	45.36
45	1.50	0.35	20.11	20.90	63.75	66.26
60	2.00	0.25	16.86	17.52	80.61	83.78
80	2.50	0.18	11.58	12.04	92.19	95.82
120	3.00	0.13	2.90	3.01	95.09	98.83
170	3.50	0.09	0.31	0.32	95.40	99.15
200	3.75	0.07	0.03	0.03	95.43	99.18
230	4.00	0.06	0.01	0.01	95.44	99.19

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.47	2.01	1.75	1.11	0.43	0.07	-0.84
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.01	0.50	0.99	-0.63	3.46	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC15 #2

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 277,516	Northing (m): 870,903	Coordinate System: MA State Plane Mainland	Elevation (ft): -86.1 NAVD88
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USCS: SP	Munsell: Wet - 5Y-5/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.81	Wash Weight (g): 88.38	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 1.79 #230 - 1.63	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.14	0.16	0.14	0.16
4	-2.25	4.76	0.00	0.00	0.14	0.16
5	-2.00	4.00	0.15	0.17	0.29	0.33
7	-1.50	2.83	0.05	0.06	0.34	0.39
10	-1.00	2.00	0.04	0.04	0.38	0.43
14	-0.50	1.41	0.05	0.06	0.43	0.49
18	0.00	1.00	0.13	0.14	0.56	0.63
25	0.50	0.71	0.21	0.23	0.77	0.86
35	1.00	0.50	0.91	1.01	1.68	1.87
45	1.50	0.35	4.67	5.20	6.35	7.07
60	2.00	0.25	17.64	19.64	23.99	26.71
80	2.50	0.18	41.01	45.66	65.00	72.37
120	3.00	0.13	20.43	22.75	85.43	95.12
170	3.50	0.09	2.61	2.91	88.04	98.03
200	3.75	0.07	0.16	0.18	88.20	98.21
230	4.00	0.06	0.14	0.16	88.34	98.37

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.00	2.76	2.56	2.26	1.96	1.73	1.30
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.2	0.22	0.57	-2.38	18.97	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC16 #1

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 276,446	Northing (m): 866,962	Coordinate System: MA State Plane Mainland	Elevation (ft): -79.1 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 90.75	Wash Weight (g): 89.68	Pan Retained (g): 0.00	Sieve Loss (%): 0.03	Fines (%): #200 - 1.34 #230 - 1.23	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.14	0.15	0.14	0.15
4	-2.25	4.76	0.00	0.00	0.14	0.15
5	-2.00	4.00	0.33	0.36	0.47	0.51
7	-1.50	2.83	0.34	0.37	0.81	0.88
10	-1.00	2.00	0.33	0.36	1.14	1.24
14	-0.50	1.41	0.21	0.23	1.35	1.47
18	0.00	1.00	0.29	0.32	1.64	1.79
25	0.50	0.71	2.92	3.22	4.56	5.01
35	1.00	0.50	3.49	3.85	8.05	8.86
45	1.50	0.35	22.36	24.64	30.41	33.50
60	2.00	0.25	28.79	31.72	59.20	65.22
80	2.50	0.18	19.10	21.05	78.30	86.27
120	3.00	0.13	9.03	9.95	87.33	96.22
170	3.50	0.09	2.10	2.31	89.43	98.53
200	3.75	0.07	0.12	0.13	89.55	98.66
230	4.00	0.06	0.10	0.11	89.65	98.77

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.94	2.45	2.23	1.76	1.33	1.14	0.50
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.73	0.30	0.76	-1.33	8.53	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC16 #2

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 276,446	Northing (m): 866,962	Coordinate System: MA State Plane Mainland	Elevation (ft): -80.6 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 86.13	Wash Weight (g): 84.75	Pan Retained (g): 0.07	Sieve Loss (%): 0.03	Fines (%): #200 - 1.93 #230 - 1.72	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.05	0.06	0.05	0.06
10	-1.00	2.00	0.03	0.03	0.08	0.09
14	-0.50	1.41	0.11	0.13	0.19	0.22
18	0.00	1.00	0.15	0.17	0.34	0.39
25	0.50	0.71	0.53	0.62	0.87	1.01
35	1.00	0.50	2.51	2.91	3.38	3.92
45	1.50	0.35	10.93	12.69	14.31	16.61
60	2.00	0.25	21.05	24.44	35.36	41.05
80	2.50	0.18	30.15	35.01	65.51	76.06
120	3.00	0.13	15.64	18.16	81.15	94.22
170	3.50	0.09	3.11	3.61	84.26	97.83
200	3.75	0.07	0.21	0.24	84.47	98.07
230	4.00	0.06	0.18	0.21	84.65	98.28

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.11	2.72	2.48	2.13	1.67	1.48	1.04
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.06	0.24	0.61	-0.57	4.66	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC16 #3

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 276,446	Northing (m): 866,962	Coordinate System: MA State Plane Mainland	Elevation (ft): -82.0 NAVD88
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USCS: SW	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 94.63	Wash Weight (g): 93.57	Pan Retained (g): 0.01	Sieve Loss (%): 0.08	Fines (%): #200 - 1.25 #230 - 1.22	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	4.77	5.04	4.77	5.04
5/16"	-3.00	8.00	1.77	1.87	6.54	6.91
3.5	-2.50	5.66	0.16	0.17	6.70	7.08
4	-2.25	4.76	0.17	0.18	6.87	7.26
5	-2.00	4.00	0.64	0.68	7.51	7.94
7	-1.50	2.83	1.88	1.99	9.39	9.93
10	-1.00	2.00	1.78	1.88	11.17	11.81
14	-0.50	1.41	2.09	2.21	13.26	14.02
18	0.00	1.00	3.51	3.71	16.77	17.73
25	0.50	0.71	9.16	9.68	25.93	27.41
35	1.00	0.50	17.56	18.56	43.49	45.97
45	1.50	0.35	18.36	19.40	61.85	65.37
60	2.00	0.25	15.93	16.83	77.78	82.20
80	2.50	0.18	10.06	10.63	87.84	92.83
120	3.00	0.13	4.78	5.05	92.62	97.88
170	3.50	0.09	0.75	0.79	93.37	98.67
200	3.75	0.07	0.08	0.08	93.45	98.75
230	4.00	0.06	0.03	0.03	93.48	98.78

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.71	2.08	1.79	1.10	0.38	-0.23	-3.51
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.76	0.59	1.57	-1.47	4.93	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC16 #4

Analysis Date: 11-15-17; Analyzed By: DA

Easting (m): 276,446	Northing (m): 866,962	Coordinate System: MA State Plane Mainland	Elevation (ft): -86.2 NAVD88
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USCS: SM	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 85.04	Wash Weight (g): 72.75	Pan Retained (g): 0.19	Sieve Loss (%): 0.01	Fines (%): #200 - 16.20 #230 - 14.68	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.13	0.15	0.13	0.15
10	-1.00	2.00	0.24	0.28	0.37	0.43
14	-0.50	1.41	0.09	0.11	0.46	0.54
18	0.00	1.00	0.08	0.09	0.54	0.63
25	0.50	0.71	0.27	0.32	0.81	0.95
35	1.00	0.50	0.66	0.78	1.47	1.73
45	1.50	0.35	1.28	1.51	2.75	3.24
60	2.00	0.25	2.23	2.62	4.98	5.86
80	2.50	0.18	14.96	17.59	19.94	23.45
120	3.00	0.13	35.08	41.25	55.02	64.70
170	3.50	0.09	13.28	15.62	68.30	80.32
200	3.75	0.07	2.96	3.48	71.26	83.80
230	4.00	0.06	1.29	1.52	72.55	85.32

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.78	3.33	2.82	2.52	2.29	1.84
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.68	0.16	0.63	-2.24	14.29	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC17 #1

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 275,721	Northing (m): 865,048	Coordinate System: MA State Plane Mainland	Elevation (ft): -73.5 NAVD88
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USCS: SW	Munsell: Wet - 5Y-4/1 Dry - 5Y-5/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 93.54	Wash Weight (g): 92.83	Pan Retained (g): 0.01	Sieve Loss (%): 0.01	Fines (%): #200 - 0.85 #230 - 0.79	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.14	0.15	0.14	0.15
7	-1.50	2.83	0.59	0.63	0.73	0.78
10	-1.00	2.00	0.29	0.31	1.02	1.09
14	-0.50	1.41	0.78	0.83	1.80	1.92
18	0.00	1.00	2.02	2.16	3.82	4.08
25	0.50	0.71	7.49	8.01	11.31	12.09
35	1.00	0.50	19.97	21.35	31.28	33.44
45	1.50	0.35	18.89	20.19	50.17	53.63
60	2.00	0.25	13.73	14.68	63.90	68.31
80	2.50	0.18	17.63	18.85	81.53	87.16
120	3.00	0.13	10.06	10.75	91.59	97.91
170	3.50	0.09	1.08	1.15	92.67	99.06
200	3.75	0.07	0.08	0.09	92.75	99.15
230	4.00	0.06	0.06	0.06	92.81	99.21

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.86	2.42	2.18	1.41	0.80	0.59	0.06
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.43	0.37	0.9	-0.4	3.42	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC17 #2

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 275,721	Northing (m): 865,048	Coordinate System: MA State Plane Mainland	Elevation (ft): -74.4 NAVD88
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USCS: SW	Munsell: Wet - N-3/0 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 104.58	Wash Weight (g): 103.90	Pan Retained (g): 0.01	Sieve Loss (%): 0.05	Fines (%): #200 - 0.72 #230 - 0.67	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.43	1.37	1.43	1.37
5/16"	-3.00	8.00	1.69	1.62	3.12	2.99
3.5	-2.50	5.66	6.93	6.63	10.05	9.62
4	-2.25	4.76	4.19	4.01	14.24	13.63
5	-2.00	4.00	7.12	6.81	21.36	20.44
7	-1.50	2.83	15.25	14.58	36.61	35.02
10	-1.00	2.00	11.74	11.23	48.35	46.25
14	-0.50	1.41	10.76	10.29	59.11	56.54
18	0.00	1.00	8.50	8.13	67.61	64.67
25	0.50	0.71	8.39	8.02	76.00	72.69
35	1.00	0.50	8.33	7.97	84.33	80.66
45	1.50	0.35	4.65	4.45	88.98	85.11
60	2.00	0.25	2.74	2.62	91.72	87.73
80	2.50	0.18	5.25	5.02	96.97	92.75
120	3.00	0.13	5.79	5.54	102.76	98.29
170	3.50	0.09	0.96	0.92	103.72	99.21
200	3.75	0.07	0.07	0.07	103.79	99.28
230	4.00	0.06	0.05	0.05	103.84	99.33

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.70	1.38	0.64	-0.82	-1.84	-2.16	-2.85

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.54	1.45	1.67	0.46	2.37

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC17 #3

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 275,721	Northing (m): 865,048	Coordinate System: MA State Plane Mainland	Elevation (ft): -78.6 NAVD88
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USCS: SC	Munsell: Wet - 10Y-3/1 Dry - 5Y-6/2 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 88.48	Wash Weight (g): 74.34	Pan Retained (g): 1.07	Sieve Loss (%): 0.06	Fines (%): #200 - 22.64 #230 - 17.25	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.09	0.10	0.09	0.10
10	-1.00	2.00	0.07	0.08	0.16	0.18
14	-0.50	1.41	0.12	0.14	0.28	0.32
18	0.00	1.00	0.09	0.10	0.37	0.42
25	0.50	0.71	0.22	0.25	0.59	0.67
35	1.00	0.50	0.31	0.35	0.90	1.02
45	1.50	0.35	0.42	0.47	1.32	1.49
60	2.00	0.25	0.57	0.64	1.89	2.13
80	2.50	0.18	3.51	3.97	5.40	6.10
120	3.00	0.13	36.50	41.25	41.90	47.35
170	3.50	0.09	20.94	23.67	62.84	71.02
200	3.75	0.07	5.61	6.34	68.45	77.36
230	4.00	0.06	4.77	5.39	73.22	82.75

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.66	3.06	2.73	2.62	2.36
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.96	0.13	0.56	-2.4	18.31	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC18 #1

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 283,242	Northing (m): 843,847	Coordinate System: MA State Plane Mainland	Elevation (ft): -45.3 NAVD88
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USCS: SP	Munsell: Wet - 5Y-3/1 Dry - 5Y-6/2 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 90.40	Wash Weight (g): 89.60	Pan Retained (g): 0.00	Sieve Loss (%): 0.02	Fines (%): #200 - 0.93 #230 - 0.91	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.08	0.09	0.08	0.09
5	-2.00	4.00	0.29	0.32	0.37	0.41
7	-1.50	2.83	0.49	0.54	0.86	0.95
10	-1.00	2.00	0.43	0.48	1.29	1.43
14	-0.50	1.41	1.10	1.22	2.39	2.65
18	0.00	1.00	2.73	3.02	5.12	5.67
25	0.50	0.71	9.62	10.64	14.74	16.31
35	1.00	0.50	25.51	28.22	40.25	44.53
45	1.50	0.35	35.07	38.79	75.32	83.32
60	2.00	0.25	11.04	12.21	86.36	95.53
80	2.50	0.18	2.71	3.00	89.07	98.53
120	3.00	0.13	0.35	0.39	89.42	98.92
170	3.50	0.09	0.11	0.12	89.53	99.04
200	3.75	0.07	0.03	0.03	89.56	99.07
230	4.00	0.06	0.02	0.02	89.58	99.09

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.98	1.53	1.39	1.07	0.65	0.49	-0.11

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.99	0.50	0.66	-1.04	6.82

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC18 #2

Analysis Date: 11-16-17; Analyzed By: DA

Easting (m): 283,242	Northing (m): 843,847	Coordinate System: MA State Plane Mainland	Elevation (ft): -48.7 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/2 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.92	Wash Weight (g): 89.08	Pan Retained (g): 0.00	Sieve Loss (%): 0.03	Fines (%): #200 - 1.01 #230 - 0.97	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.30	0.33	0.30	0.33
5/16"	-3.00	8.00	0.00	0.00	0.30	0.33
3.5	-2.50	5.66	0.00	0.00	0.30	0.33
4	-2.25	4.76	0.12	0.13	0.42	0.46
5	-2.00	4.00	0.08	0.09	0.50	0.55
7	-1.50	2.83	0.86	0.96	1.36	1.51
10	-1.00	2.00	0.65	0.72	2.01	2.23
14	-0.50	1.41	0.63	0.70	2.64	2.93
18	0.00	1.00	1.73	1.92	4.37	4.85
25	0.50	0.71	6.25	6.95	10.62	11.80
35	1.00	0.50	18.05	20.07	28.67	31.87
45	1.50	0.35	32.08	35.68	60.75	67.55
60	2.00	0.25	19.05	21.19	79.80	88.74
80	2.50	0.18	7.74	8.61	87.54	97.35
120	3.00	0.13	1.05	1.17	88.59	98.52
170	3.50	0.09	0.32	0.36	88.91	98.88
200	3.75	0.07	0.10	0.11	89.01	98.99
230	4.00	0.06	0.04	0.04	89.05	99.03

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.36	1.89	1.68	1.25	0.83	0.60	0.01
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.19	0.44	0.79	-1.59	9.94	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC18 #3

Analysis Date: 11-17-17; Analyzed By: DA

Easting (m): 283,242	Northing (m): 843,847	Coordinate System: MA State Plane Mainland	Elevation (ft): -50.3 NAVD88
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USCS: SW	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 90.39	Wash Weight (g): 89.02	Pan Retained (g): 0.03	Sieve Loss (%): 0.06	Fines (%): #200 - 1.90 #230 - 1.59	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	1.02	1.13	1.02	1.13
4	-2.25	4.76	0.54	0.60	1.56	1.73
5	-2.00	4.00	0.99	1.10	2.55	2.83
7	-1.50	2.83	2.73	3.02	5.28	5.85
10	-1.00	2.00	1.10	1.22	6.38	7.07
14	-0.50	1.41	0.70	0.77	7.08	7.84
18	0.00	1.00	0.91	1.01	7.99	8.85
25	0.50	0.71	3.47	3.84	11.46	12.69
35	1.00	0.50	13.35	14.77	24.81	27.46
45	1.50	0.35	28.90	31.97	53.71	59.43
60	2.00	0.25	25.73	28.47	79.44	87.90
80	2.50	0.18	7.97	8.82	87.41	96.72
120	3.00	0.13	0.70	0.77	88.11	97.49
170	3.50	0.09	0.28	0.31	88.39	97.80
200	3.75	0.07	0.27	0.30	88.66	98.10
230	4.00	0.06	0.28	0.31	88.94	98.41

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.40	1.93	1.77	1.35	0.92	0.61	-1.64
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.14	0.45	1.05	-1.75	6.8	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC18 #4

Analysis Date: 11-17-17; Analyzed By: DA

Easting (m): 283,242	Northing (m): 843,847	Coordinate System: MA State Plane Mainland	Elevation (ft): -52.0 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 93.71	Wash Weight (g): 92.70	Pan Retained (g): 0.02	Sieve Loss (%): 0.03	Fines (%): #200 - 1.24 #230 - 1.13	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.14	0.15	0.14	0.15
10	-1.00	2.00	0.05	0.05	0.19	0.20
14	-0.50	1.41	0.03	0.03	0.22	0.23
18	0.00	1.00	0.11	0.12	0.33	0.35
25	0.50	0.71	1.08	1.15	1.41	1.50
35	1.00	0.50	7.70	8.22	9.11	9.72
45	1.50	0.35	28.64	30.56	37.75	40.28
60	2.00	0.25	43.03	45.92	80.78	86.20
80	2.50	0.18	10.89	11.62	91.67	97.82
120	3.00	0.13	0.69	0.74	92.36	98.56
170	3.50	0.09	0.15	0.16	92.51	98.72
200	3.75	0.07	0.04	0.04	92.55	98.76
230	4.00	0.06	0.10	0.11	92.65	98.87

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.38	1.98	1.88	1.61	1.25	1.10	0.71
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.56	0.34	0.48	-0.7	7.88	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC19 #1

Analysis Date: 11-17-17; Analyzed By: DA

Easting (m): 285,624	Northing (m): 840,878	Coordinate System: MA State Plane Mainland	Elevation (ft): -58.1 NAVD88
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USCS: SP	Munsell: Wet - 10Y-3/1 Dry - 5Y-5/2 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 87.00	Wash Weight (g): 83.79	Pan Retained (g): 0.07	Sieve Loss (%): 0.02	Fines (%): #200 - 4.26 #230 - 3.79	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.55	0.63	0.55	0.63
3.5	-2.50	5.66	0.00	0.00	0.55	0.63
4	-2.25	4.76	0.00	0.00	0.55	0.63
5	-2.00	4.00	0.10	0.11	0.65	0.74
7	-1.50	2.83	0.20	0.23	0.85	0.97
10	-1.00	2.00	0.11	0.13	0.96	1.10
14	-0.50	1.41	0.08	0.09	1.04	1.19
18	0.00	1.00	0.08	0.09	1.12	1.28
25	0.50	0.71	0.38	0.44	1.50	1.72
35	1.00	0.50	2.80	3.22	4.30	4.94
45	1.50	0.35	10.46	12.02	14.76	16.96
60	2.00	0.25	28.36	32.60	43.12	49.56
80	2.50	0.18	27.70	31.84	70.82	81.40
120	3.00	0.13	9.99	11.48	80.81	92.88
170	3.50	0.09	2.11	2.43	82.92	95.31
200	3.75	0.07	0.37	0.43	83.29	95.74
230	4.00	0.06	0.41	0.47	83.70	96.21

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.44	2.61	2.40	2.01	1.62	1.46	1.00
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.93	0.26	0.76	-2.59	18.7	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC19 #2

Analysis Date: 11-17-17; Analyzed By: DA

Easting (m): 285,624	Northing (m): 840,878	Coordinate System: MA State Plane Mainland	Elevation (ft): -60.8 NAVD88
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USCS: SP	Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 96.85	Wash Weight (g): 95.65	Pan Retained (g): 0.00	Sieve Loss (%): 0.03	Fines (%): #200 - 1.37 #230 - 1.27	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.16	0.17	0.16	0.17
3.5	-2.50	5.66	0.42	0.43	0.58	0.60
4	-2.25	4.76	0.13	0.13	0.71	0.73
5	-2.00	4.00	0.26	0.27	0.97	1.00
7	-1.50	2.83	0.50	0.52	1.47	1.52
10	-1.00	2.00	0.26	0.27	1.73	1.79
14	-0.50	1.41	0.26	0.27	1.99	2.06
18	0.00	1.00	0.49	0.51	2.48	2.57
25	0.50	0.71	3.16	3.26	5.64	5.83
35	1.00	0.50	25.03	25.84	30.67	31.67
45	1.50	0.35	35.76	36.92	66.43	68.59
60	2.00	0.25	17.13	17.69	83.56	86.28
80	2.50	0.18	7.16	7.39	90.72	93.67
120	3.00	0.13	3.55	3.67	94.27	97.34
170	3.50	0.09	1.14	1.18	95.41	98.52
200	3.75	0.07	0.11	0.11	95.52	98.63
230	4.00	0.06	0.10	0.10	95.62	98.73

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.68	1.94	1.68	1.25	0.87	0.70	0.37
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.26	0.42	0.78	-1.19	9.98	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC19 #3

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 285,624	Northing (m): 840,878	Coordinate System: MA State Plane Mainland	Elevation (ft): -63.1 NAVD88
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USCS: SP-SM	Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 90.87	Wash Weight (g): 86.42	Pan Retained (g): 0.53	Sieve Loss (%): 0.01	Fines (%): #200 - 6.40 #230 - 5.49	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.28	0.31	0.28	0.31
3.5	-2.50	5.66	0.08	0.09	0.36	0.40
4	-2.25	4.76	0.00	0.00	0.36	0.40
5	-2.00	4.00	0.00	0.00	0.36	0.40
7	-1.50	2.83	0.13	0.14	0.49	0.54
10	-1.00	2.00	0.22	0.24	0.71	0.78
14	-0.50	1.41	0.12	0.13	0.83	0.91
18	0.00	1.00	0.11	0.12	0.94	1.03
25	0.50	0.71	0.14	0.15	1.08	1.18
35	1.00	0.50	2.11	2.32	3.19	3.50
45	1.50	0.35	14.98	16.49	18.17	19.99
60	2.00	0.25	25.66	28.24	43.83	48.23
80	2.50	0.18	25.05	27.57	68.88	75.80
120	3.00	0.13	12.30	13.54	81.18	89.34
170	3.50	0.09	3.21	3.53	84.39	92.87
200	3.75	0.07	0.66	0.73	85.05	93.60
230	4.00	0.06	0.83	0.91	85.88	94.51

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.80	2.49	2.03	1.59	1.38	1.05
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.98	0.25	0.74	-1.59	13.45	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC19 #4

Analysis Date: 11-17-17; Analyzed By: DA

Easting (m): 285,624	Northing (m): 840,878	Coordinate System: MA State Plane Mainland	Elevation (ft): -66.6 NAVD88
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USCS: SP-SM	Munsell: Wet - 10Y-4/1 Dry - 5Y-6/1 Washed - 5Y-6/1	Comments:
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Dry Weight (g): 89.87	Wash Weight (g): 84.85	Pan Retained (g): 0.17	Sieve Loss (%): 0.04	Fines (%): #200 - 6.53 #230 - 5.82	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.12	0.13	0.12	0.13
4	-2.25	4.76	0.00	0.00	0.12	0.13
5	-2.00	4.00	0.00	0.00	0.12	0.13
7	-1.50	2.83	0.10	0.11	0.22	0.24
10	-1.00	2.00	0.08	0.09	0.30	0.33
14	-0.50	1.41	0.20	0.22	0.50	0.55
18	0.00	1.00	0.07	0.08	0.57	0.63
25	0.50	0.71	0.11	0.12	0.68	0.75
35	1.00	0.50	1.87	2.08	2.55	2.83
45	1.50	0.35	13.62	15.16	16.17	17.99
60	2.00	0.25	25.34	28.20	41.51	46.19
80	2.50	0.18	26.52	29.51	68.03	75.70
120	3.00	0.13	11.52	12.82	79.55	88.52
170	3.50	0.09	3.55	3.95	83.10	92.47
200	3.75	0.07	0.90	1.00	84.00	93.47
230	4.00	0.06	0.64	0.71	84.64	94.18

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.82	2.49	2.06	1.62	1.43	1.07
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.02	0.25	0.67	-0.71	8.42	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC20 #1

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 284,592	Northing (m): 838,399	Coordinate System: MA State Plane Mainland	Elevation (ft): -55.7 NAVD88
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USCS: SW	Munsell: Wet - 2.5Y-3/1 Dry - 2.5Y-6/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 95.85	Wash Weight (g): 94.30	Pan Retained (g): 0.05	Sieve Loss (%): 0.01	Fines (%): #200 - 1.99 #230 - 1.69	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	2.32	2.42	2.32	2.42
3.5	-2.50	5.66	0.00	0.00	2.32	2.42
4	-2.25	4.76	0.31	0.32	2.63	2.74
5	-2.00	4.00	0.10	0.10	2.73	2.84
7	-1.50	2.83	0.94	0.98	3.67	3.82
10	-1.00	2.00	1.38	1.44	5.05	5.26
14	-0.50	1.41	2.82	2.94	7.87	8.20
18	0.00	1.00	4.75	4.96	12.62	13.16
25	0.50	0.71	11.36	11.85	23.98	25.01
35	1.00	0.50	22.96	23.95	46.94	48.96
45	1.50	0.35	22.39	23.36	69.33	72.32
60	2.00	0.25	10.34	10.79	79.67	83.11
80	2.50	0.18	6.33	6.60	86.00	89.71
120	3.00	0.13	5.23	5.46	91.23	95.17
170	3.50	0.09	2.34	2.44	93.57	97.61
200	3.75	0.07	0.38	0.40	93.95	98.01
230	4.00	0.06	0.29	0.30	94.24	98.31

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.98	2.07	1.62	1.02	0.50	0.12	-1.09
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.95	0.52	1.19	-0.96	5.61	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC20 #2

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 284,592	Northing (m): 838,399	Coordinate System: MA State Plane Mainland	Elevation (ft): -57.2 NAVD88
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USCS: SW	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/2 Washed - 5Y-7/2	Comments:
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Dry Weight (g): 102.27	Wash Weight (g): 99.48	Pan Retained (g): 0.04	Sieve Loss (%): 0.05	Fines (%): #200 - 3.12 #230 - 2.83	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	6.33	6.19	6.33	6.19
5/16"	-3.00	8.00	2.99	2.92	9.32	9.11
3.5	-2.50	5.66	2.53	2.47	11.85	11.58
4	-2.25	4.76	0.64	0.63	12.49	12.21
5	-2.00	4.00	0.00	0.00	12.49	12.21
7	-1.50	2.83	0.71	0.69	13.20	12.90
10	-1.00	2.00	0.96	0.94	14.16	13.84
14	-0.50	1.41	1.33	1.30	15.49	15.14
18	0.00	1.00	1.33	1.30	16.82	16.44
25	0.50	0.71	2.34	2.29	19.16	18.73
35	1.00	0.50	4.25	4.16	23.41	22.89
45	1.50	0.35	5.27	5.15	28.68	28.04
60	2.00	0.25	13.30	13.00	41.98	41.04
80	2.50	0.18	41.76	40.83	83.74	81.87
120	3.00	0.13	6.67	6.52	90.41	88.39
170	3.50	0.09	8.30	8.12	98.71	96.51
200	3.75	0.07	0.38	0.37	99.09	96.88
230	4.00	0.06	0.30	0.29	99.39	97.17

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.41	2.66	2.42	2.11	1.20	-0.17	-3.64
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.31	0.40	1.98	-1.6	4.31	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC20 #3

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 284,592	Northing (m): 838,399	Coordinate System: MA State Plane Mainland	Elevation (ft): -60.9 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 90.27	Wash Weight (g): 89.05	Pan Retained (g): 0.02	Sieve Loss (%): 0.00	Fines (%): #200 - 1.45 #230 - 1.38	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.00	0.00	0.00	0.00
14	-0.50	1.41	0.01	0.01	0.01	0.01
18	0.00	1.00	0.04	0.04	0.05	0.05
25	0.50	0.71	0.12	0.13	0.17	0.18
35	1.00	0.50	0.84	0.93	1.01	1.11
45	1.50	0.35	2.41	2.67	3.42	3.78
60	2.00	0.25	18.64	20.65	22.06	24.43
80	2.50	0.18	53.74	59.53	75.80	83.96
120	3.00	0.13	6.77	7.50	82.57	91.46
170	3.50	0.09	6.33	7.01	88.90	98.47
200	3.75	0.07	0.07	0.08	88.97	98.55
230	4.00	0.06	0.06	0.07	89.03	98.62

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.25	2.50	2.42	2.21	2.00	1.80	1.53
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.21	0.22	0.45	0.03	5.36	

MA_CZM_2017_VC.GPJ 12/8/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MA-CZM-2017-VC20 #4

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 284,592	Northing (m): 838,399	Coordinate System: MA State Plane Mainland	Elevation (ft): -64.7 NAVD88
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-7/1 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 91.82	Wash Weight (g): 88.64	Pan Retained (g): 0.06	Sieve Loss (%): 0.01	Fines (%): #200 - 3.93 #230 - 3.54	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.00	0.00	0.00	0.00
14	-0.50	1.41	0.04	0.04	0.04	0.04
18	0.00	1.00	0.04	0.04	0.08	0.08
25	0.50	0.71	0.10	0.11	0.18	0.19
35	1.00	0.50	0.28	0.30	0.46	0.49
45	1.50	0.35	0.61	0.66	1.07	1.15
60	2.00	0.25	5.23	5.70	6.30	6.85
80	2.50	0.18	52.95	57.67	59.25	64.52
120	3.00	0.13	23.33	25.41	82.58	89.93
170	3.50	0.09	4.89	5.33	87.47	95.26
200	3.75	0.07	0.74	0.81	88.21	96.07
230	4.00	0.06	0.36	0.39	88.57	96.46

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.48	2.88	2.71	2.37	2.16	2.08	1.84
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.41	0.19	0.4	-0.11	7.89	

MA_CZM_2017_VC.GPJ 12/8/17

Appendix C (digital only)

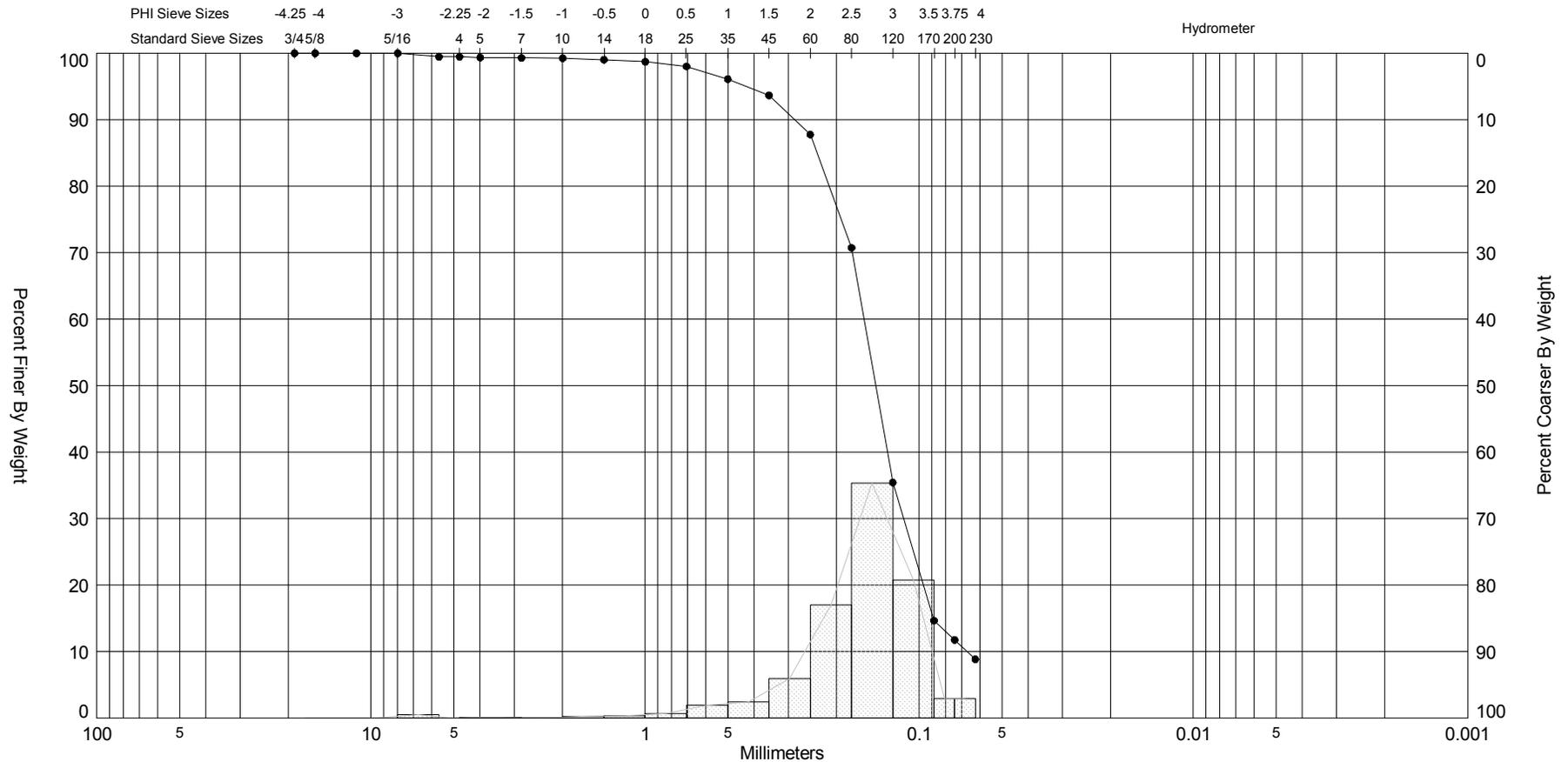
Vibracore Granularmetric Reports



Appendix D

Vibracore Granulometric Curves

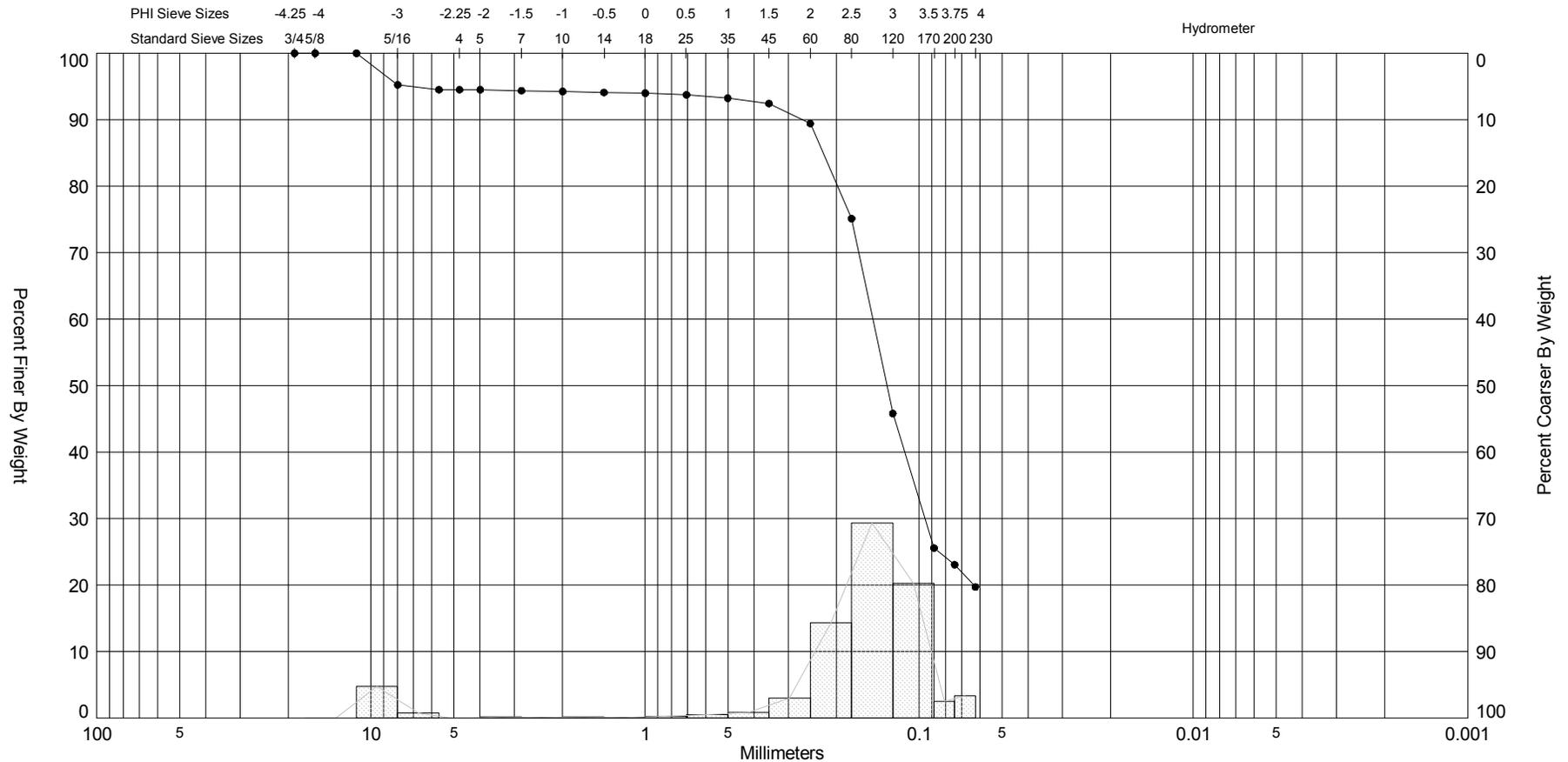




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC01 #2	—●—	-83.5	SP-SM	#200 - 11.76 #230 - 8.84			2.79	2.61	-2.55	14.73	0.83	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	257,169
												Northing (Y, m):	895,590
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

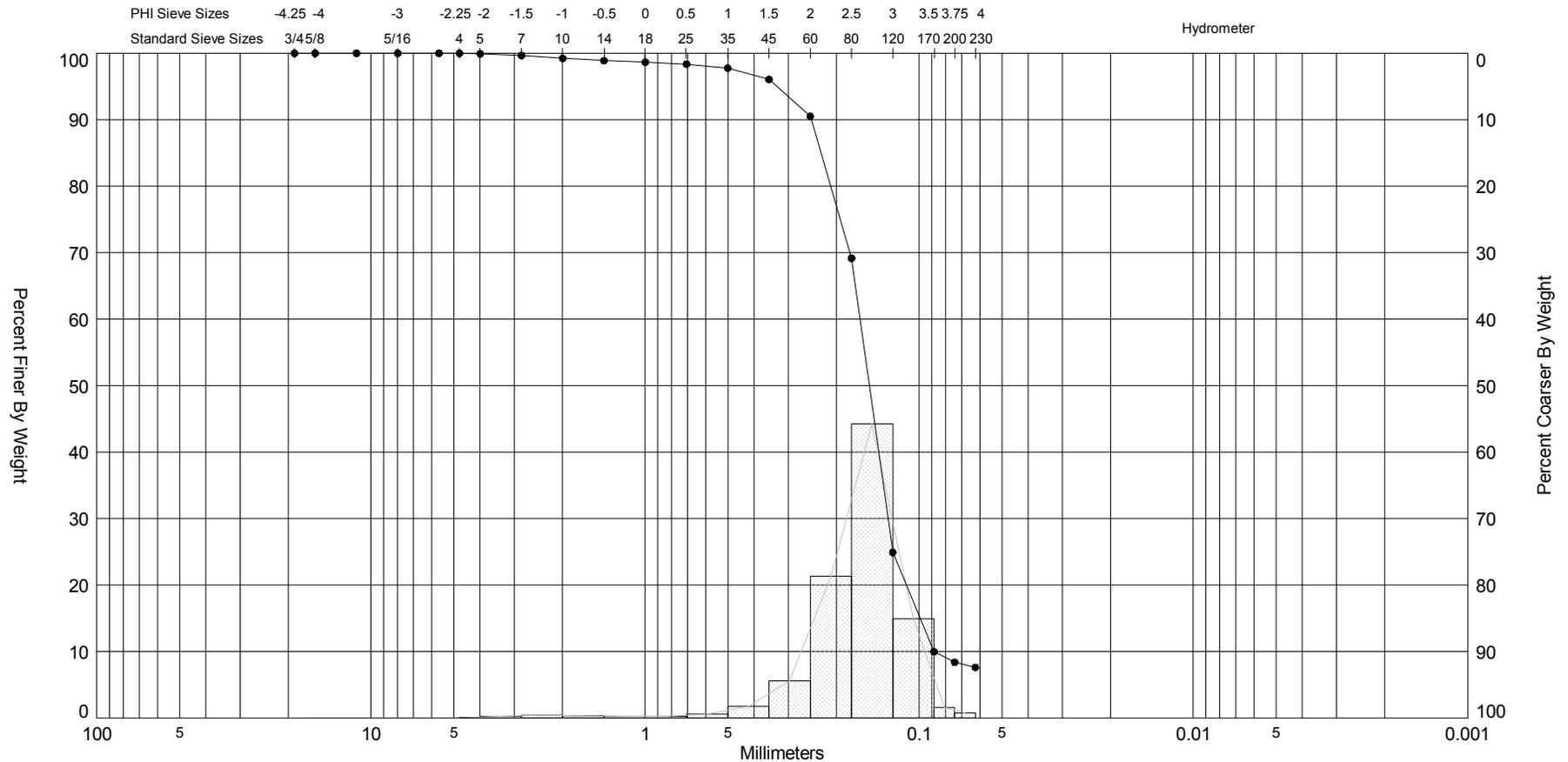
MA-CZM-2017-VC-GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC01 #3	—●—	-87.1	SC	#200 - 23.06 #230 - 19.71			2.93	2.36	-2.71	9.54	1.62	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	257,169
												Northing (Y, m):	895,590
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

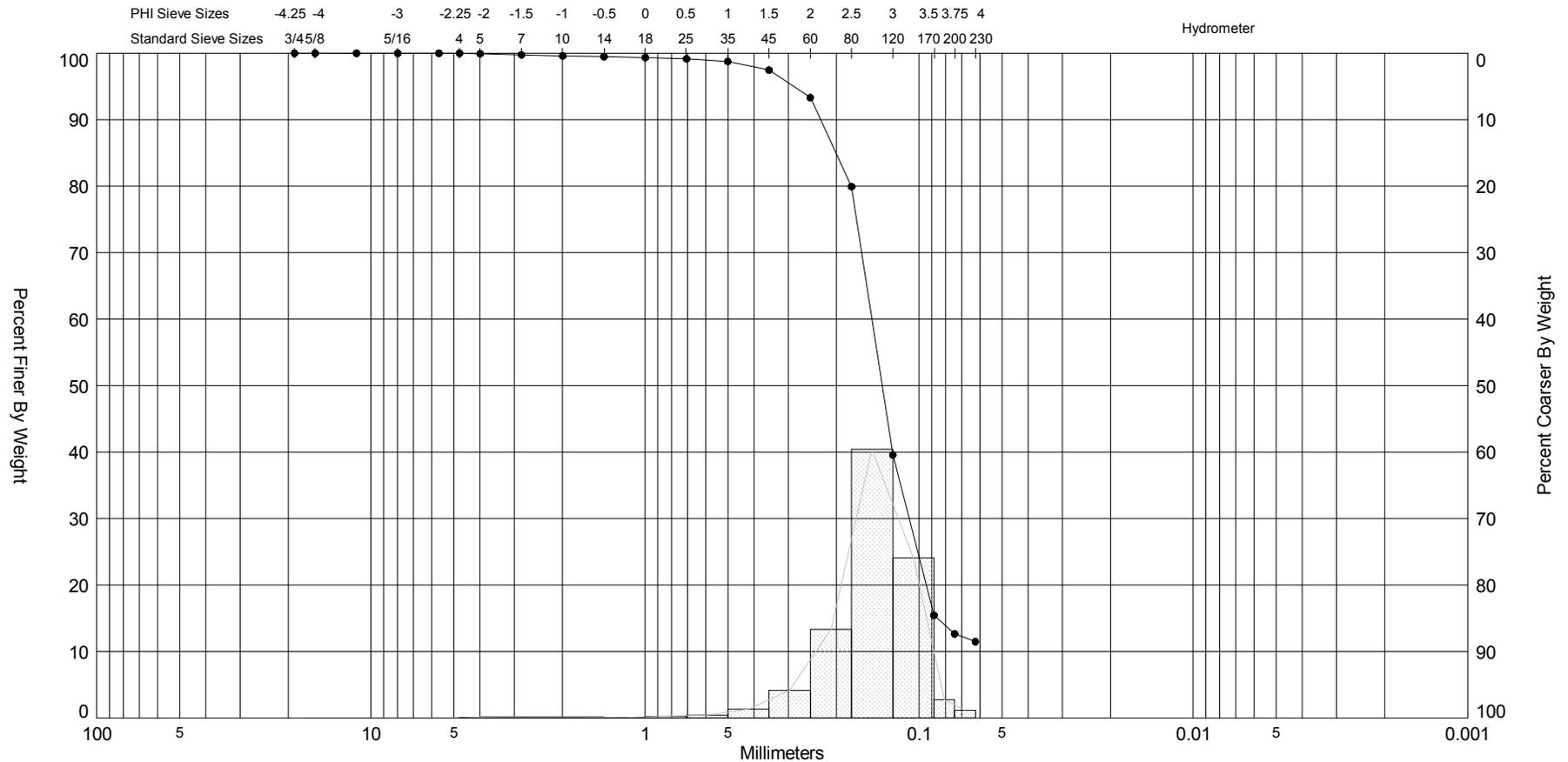
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC04 #1	—●—	-124.7	SP-SC	#200 - 8.38 #230 - 7.62			2.72	2.57	-2.72	15.91	0.68	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	SMT
												Easting (X, m):	262,858
												Northing (Y, m):	897,530
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88
<p style="text-align: center;">APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p>													

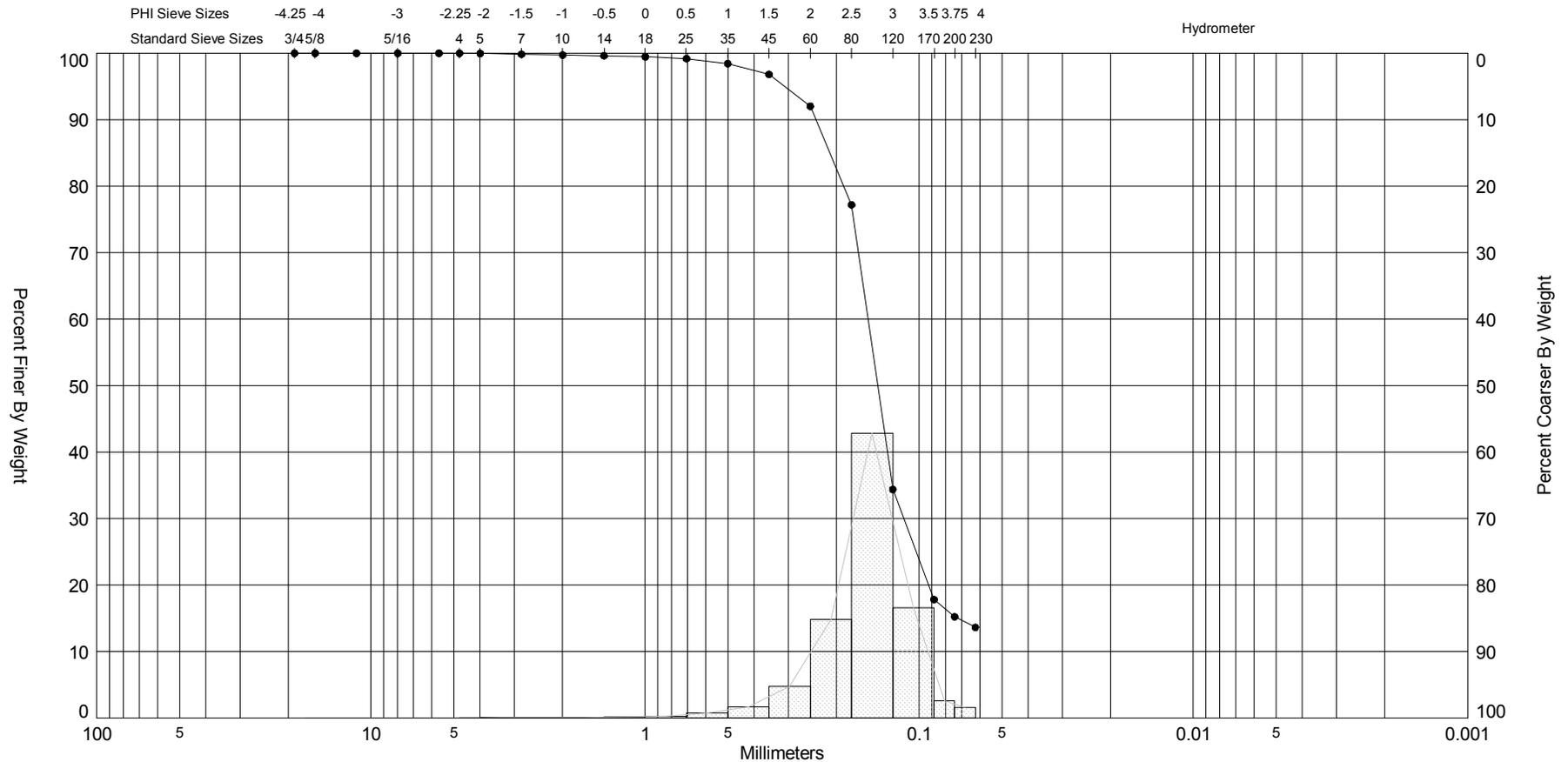
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC04 #2	—●—	-128.0	SC	#200 - 12.67 #230 - 11.50			2.87	2.74	-2.5	16.43	0.61	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	262,858
												Northing (Y, m):	897,530
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

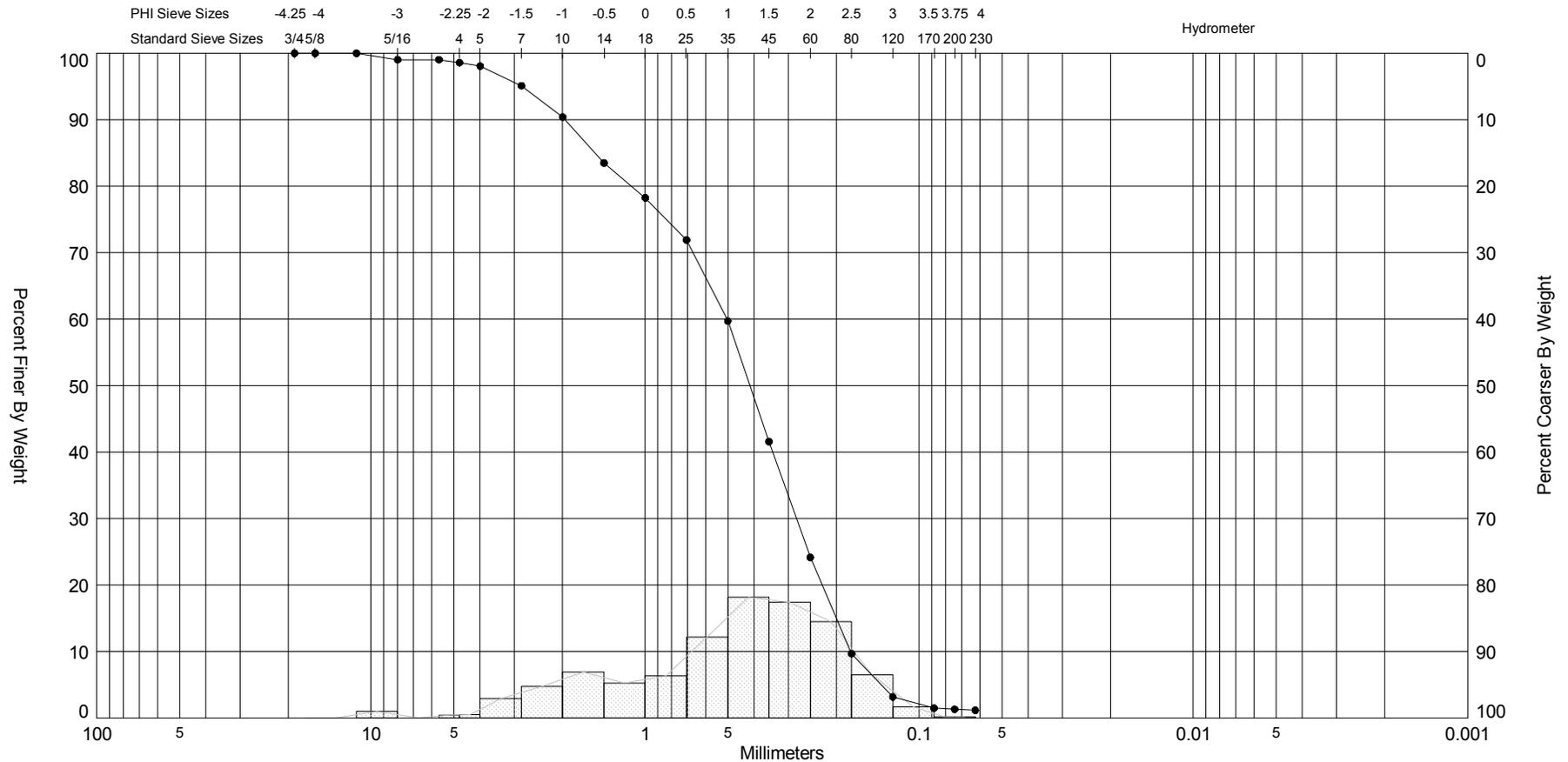
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC04 #3	—●—	-131.3	SC	#200 - 15.23 #230 - 13.63			2.82	2.67	-2.05	12.95	0.61	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	262,858
												Northing (Y, m):	897,530
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

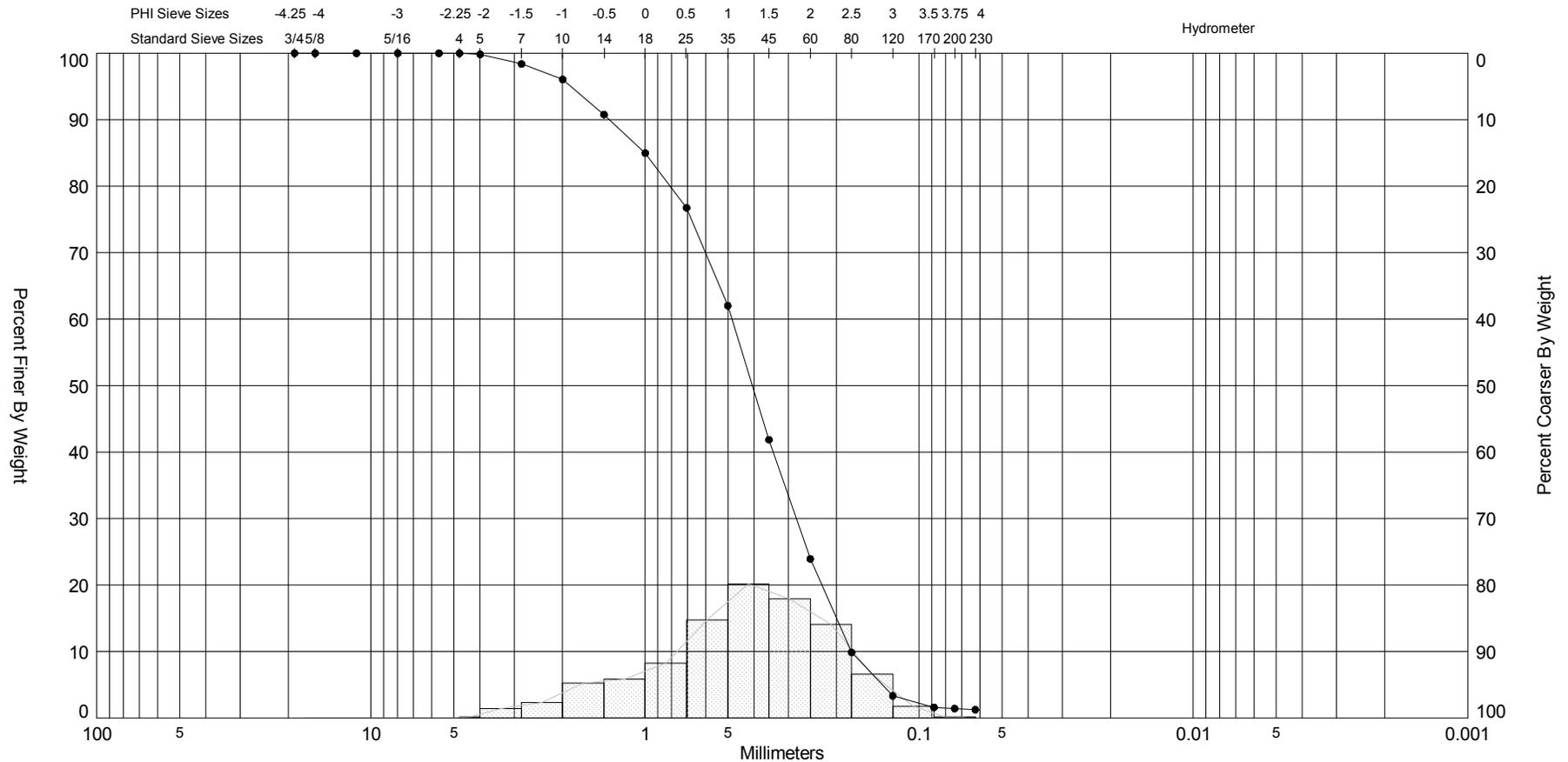
MA_CZM_2017_VC.GPJ 12/8/17

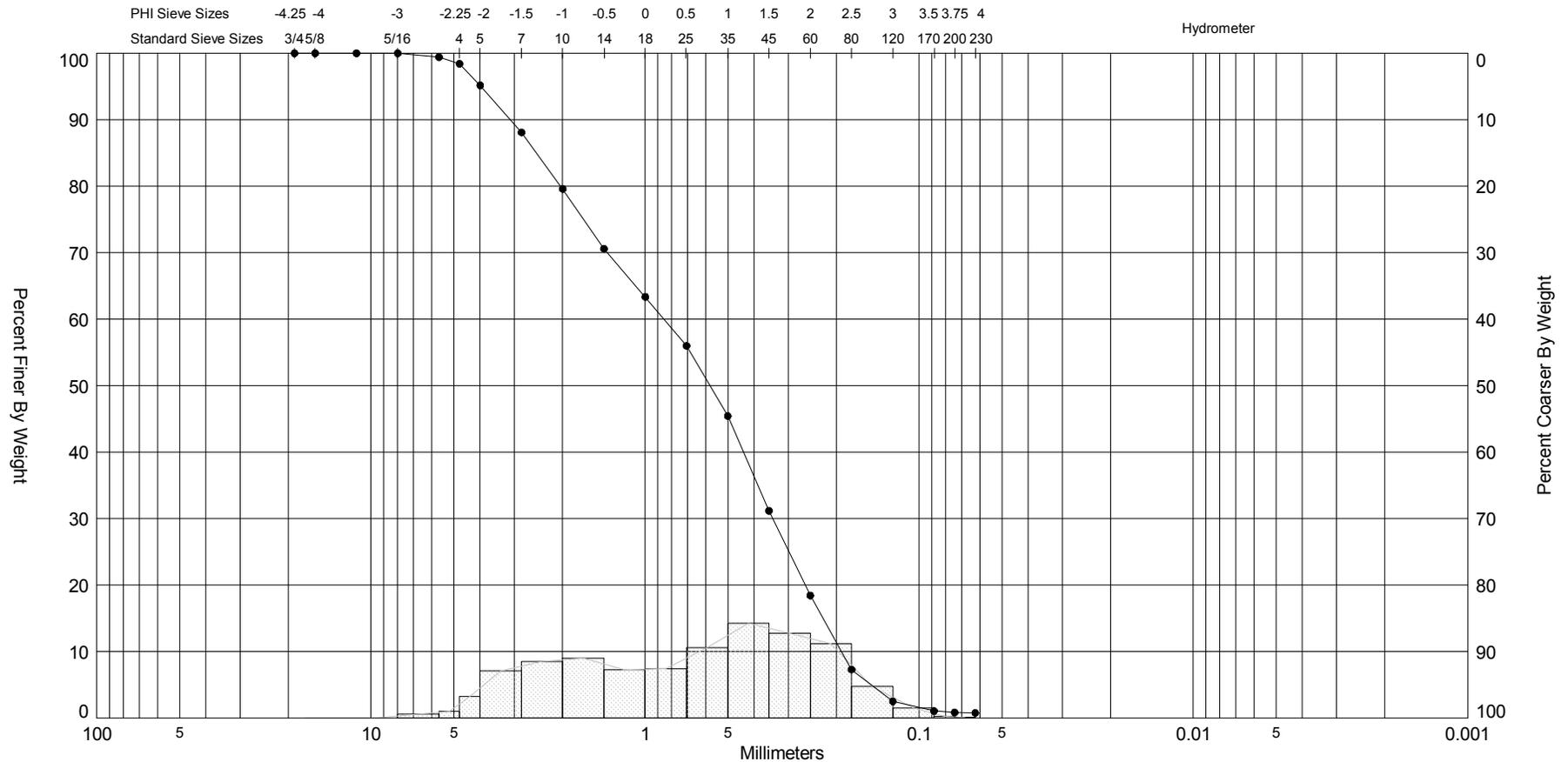


Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC05 #2	—●—	-105.5	SW	#200 - 1.32 #230 - 1.17			1.27	0.99	-0.76	3.18	1.32	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-03-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	262,482
												Northing (Y, m):	948,257
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC.GPJ 12/8/17

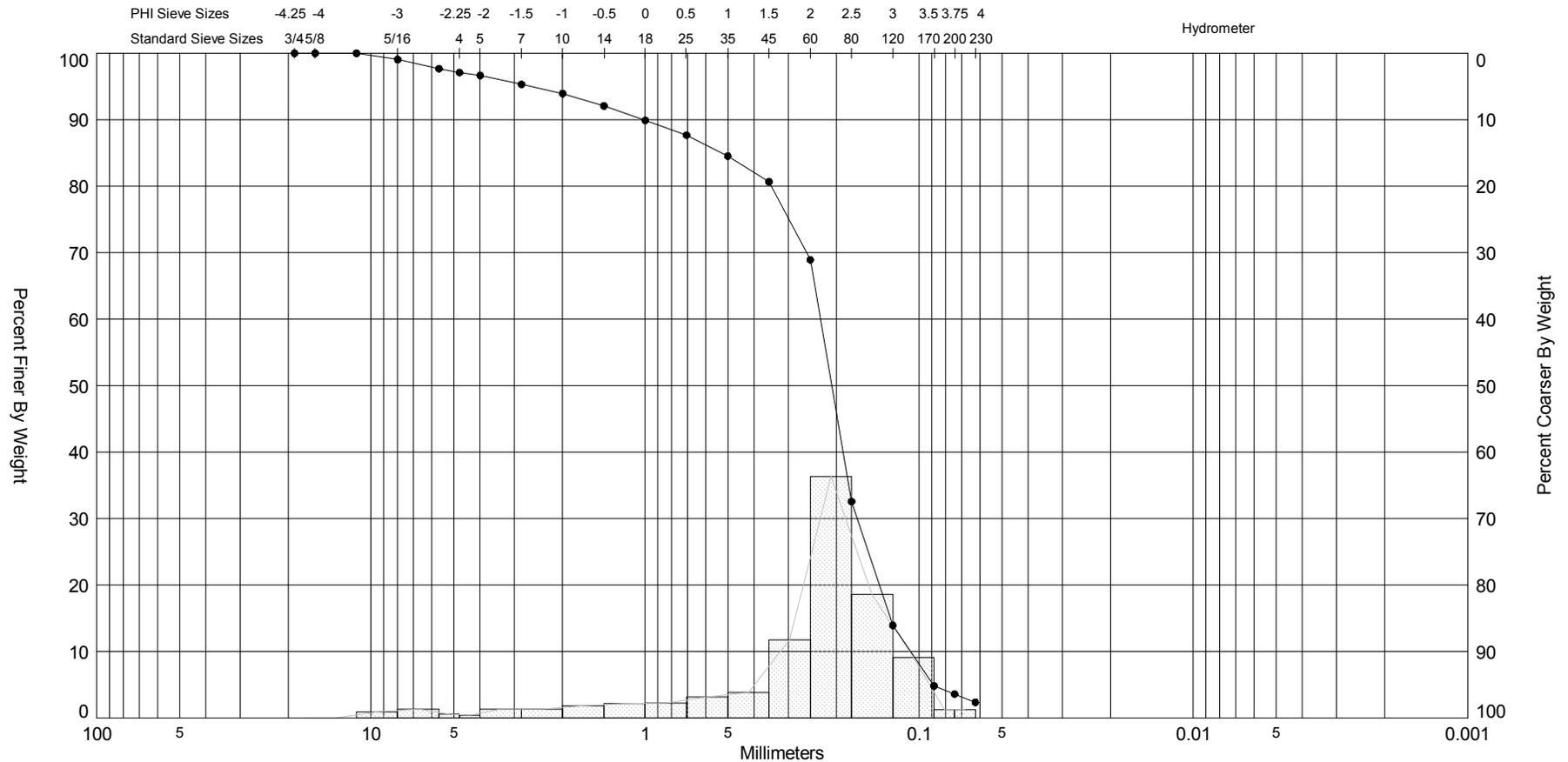




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC05 #4	—●—	-111.3	SW	#200 - 0.84 #230 - 0.77			0.78	0.52	-0.24	1.99	1.48	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	262,482
												Northing (Y, m):	948,257
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

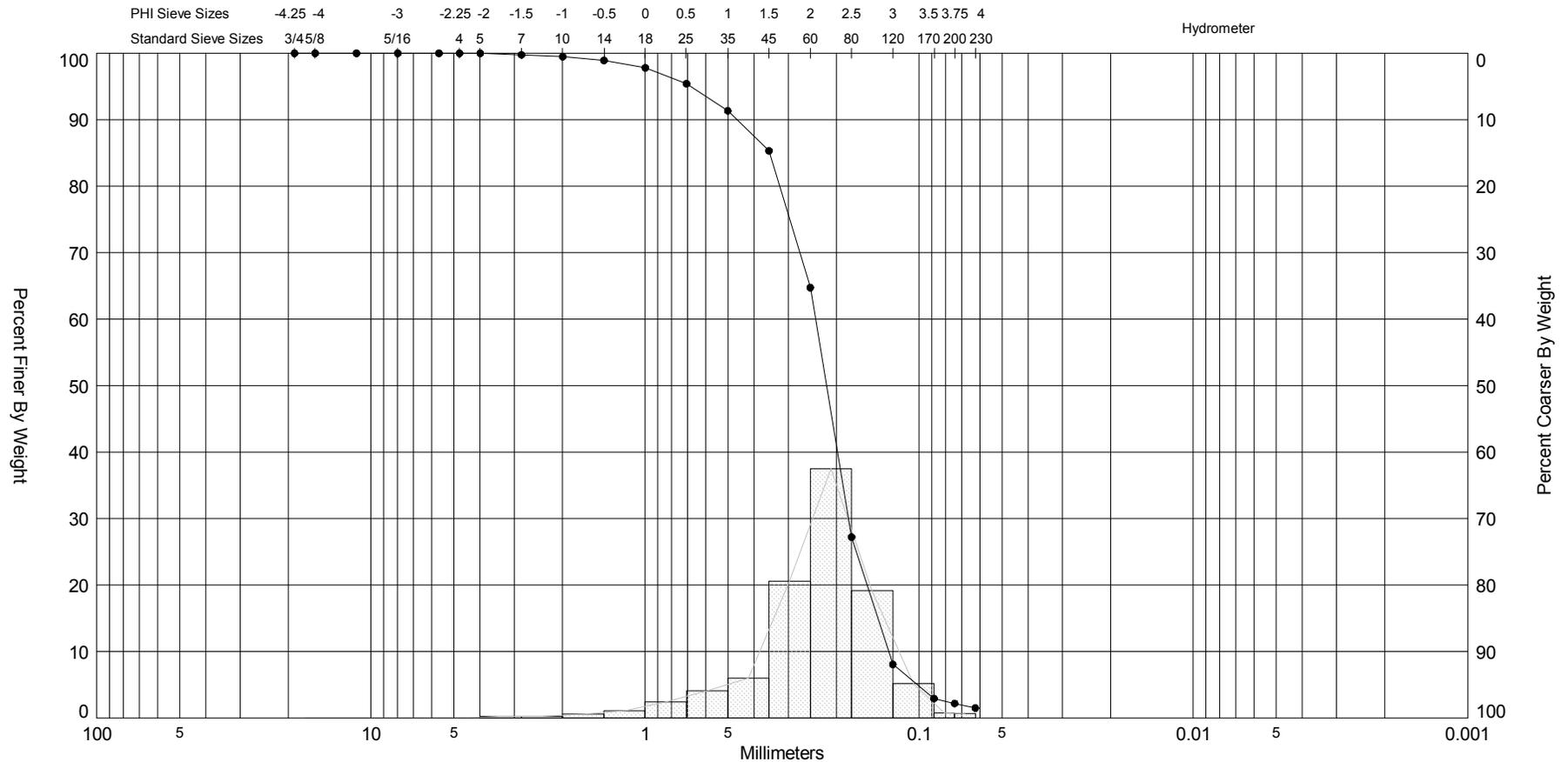
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC06 #1	—●—	-81.0	SW	#200 - 3.60 #230 - 2.36			2.26	1.9	-1.88	6.5	1.37	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	259,678
												Northing (Y, m):	948,190
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

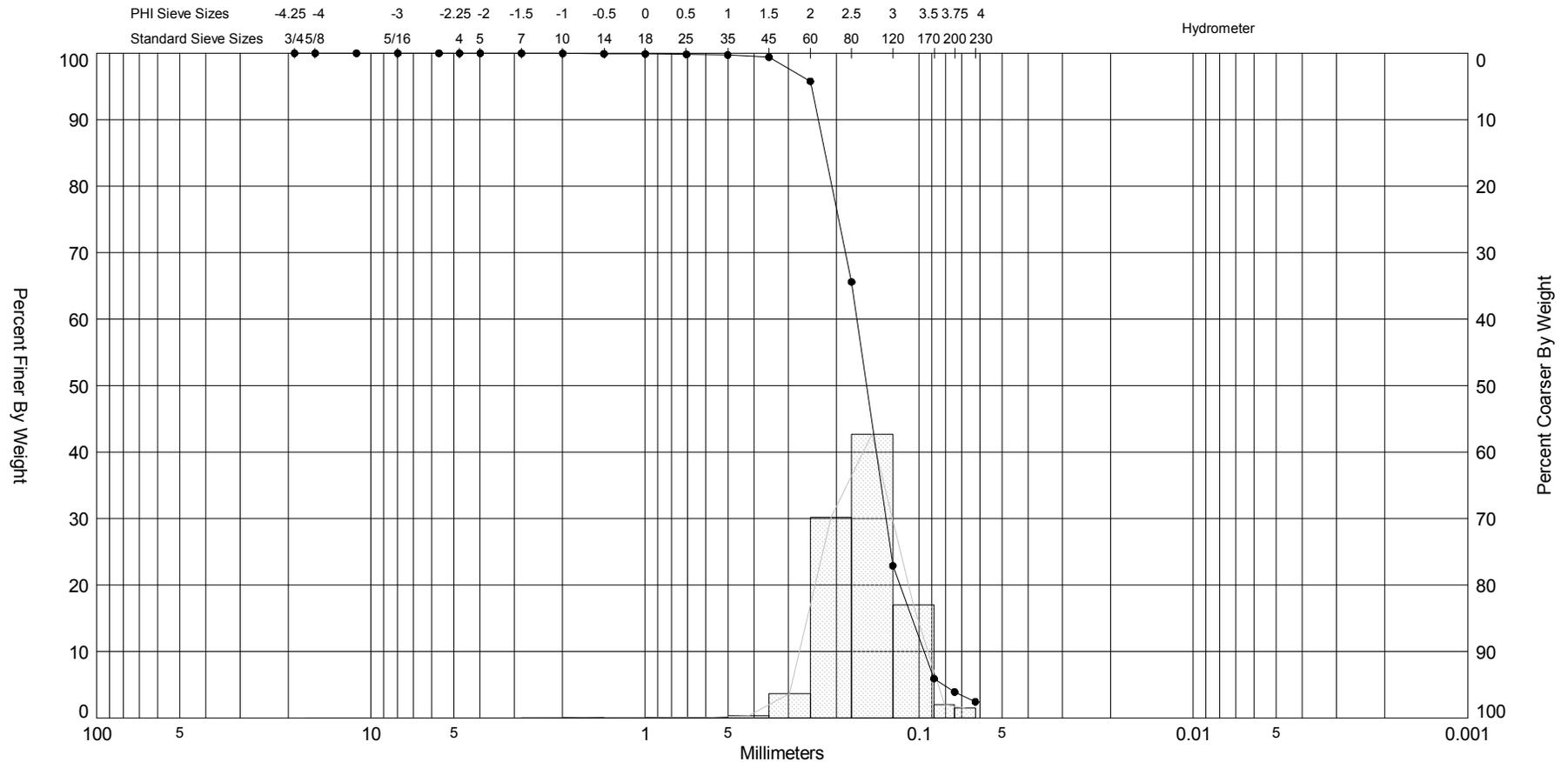
MA_CZM_2017_VC.GPJ 12/8/17

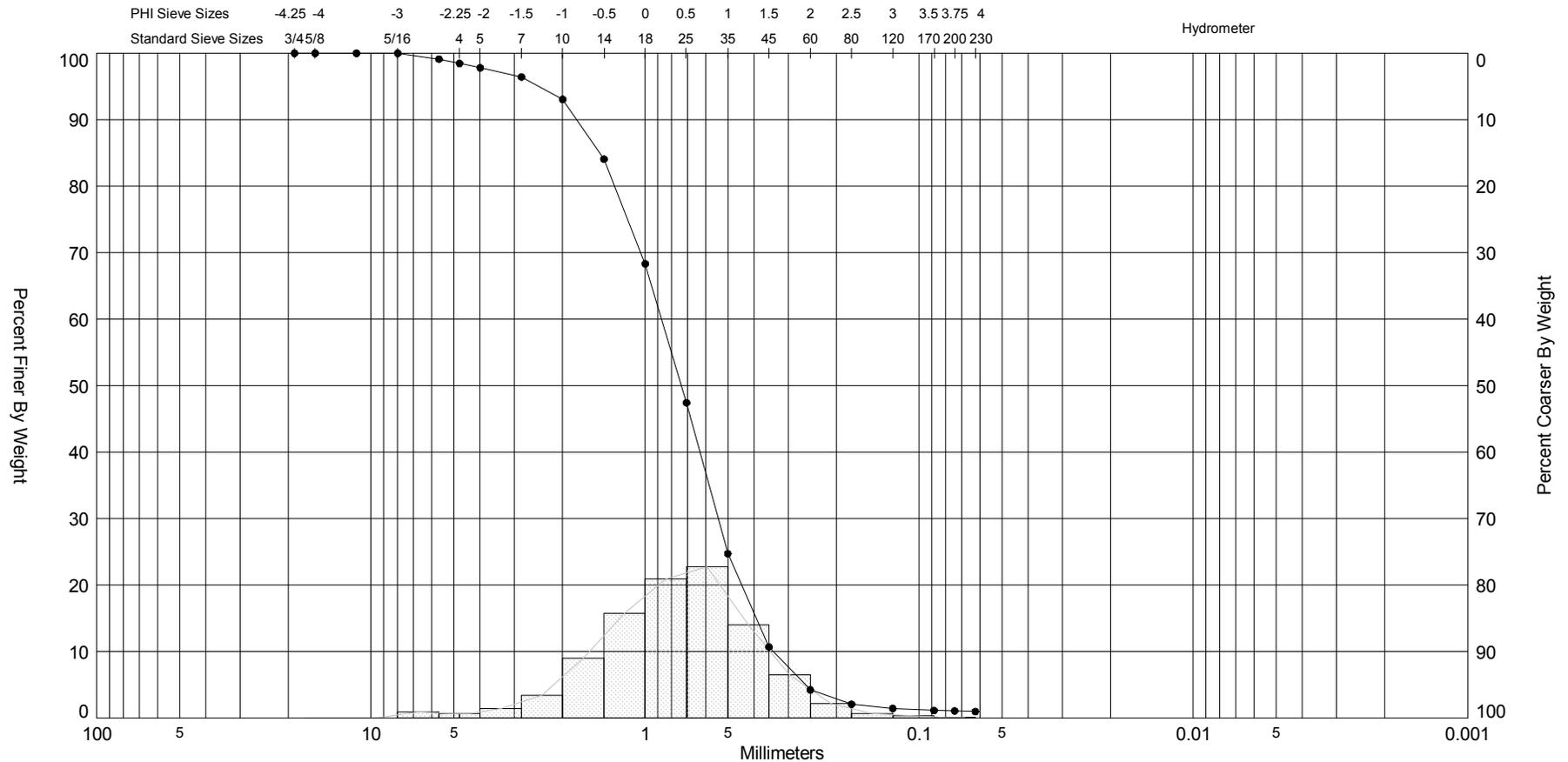


Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC06 #2	—●—	-83.1	SP	#200 - 2.19 #230 - 1.51			2.2	2.08	-1.26	6.17	0.78	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,678
												Northing (Y, m):	948,190
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC_GPJ_12/8/17

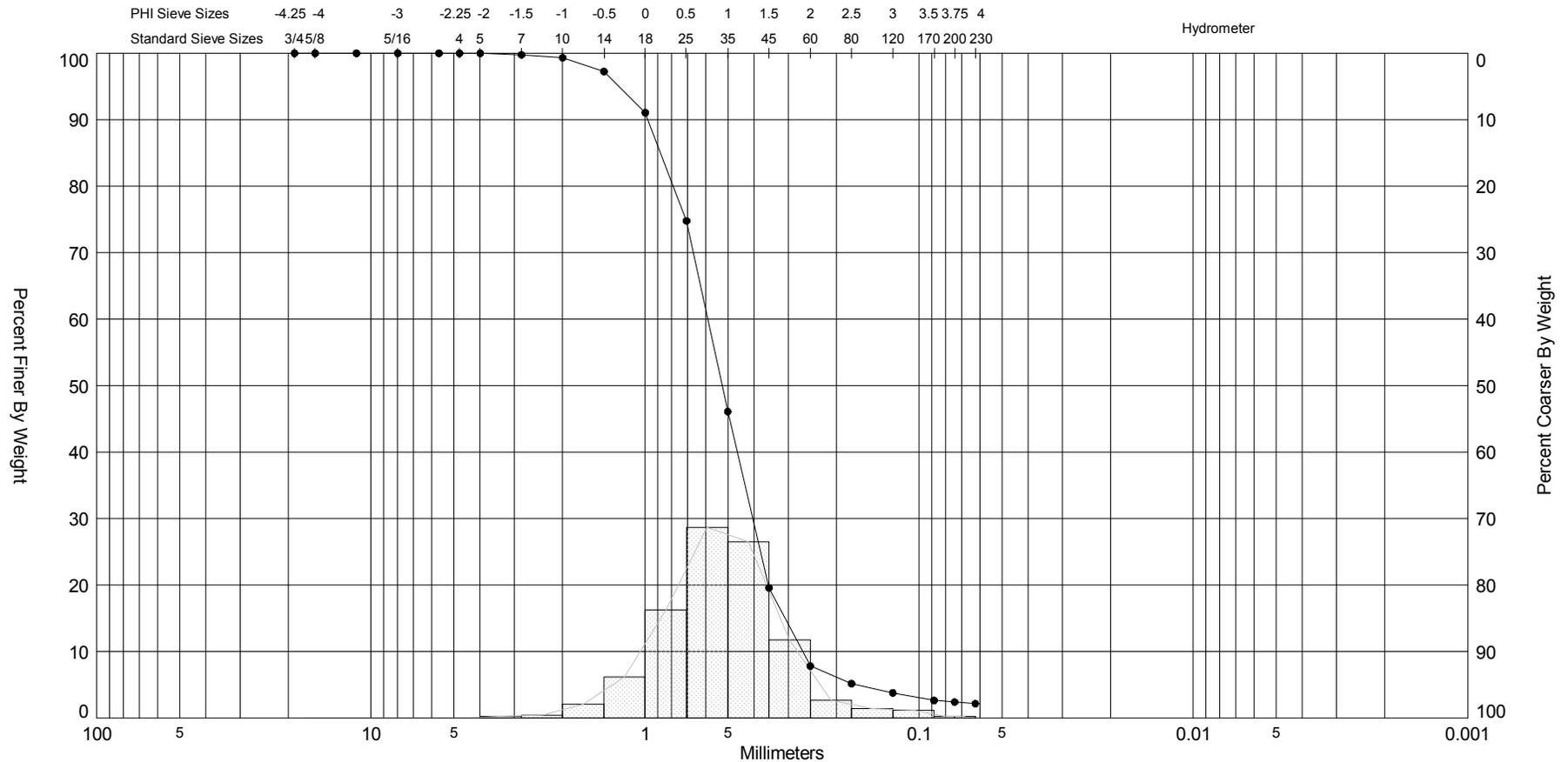




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC07 #1	—●—	-86.2	SW	#200 - 1.07 #230 - 0.96			0.44	0.37	-0.33	3.91	0.97	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,788
												Northing (Y, m):	951,977
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

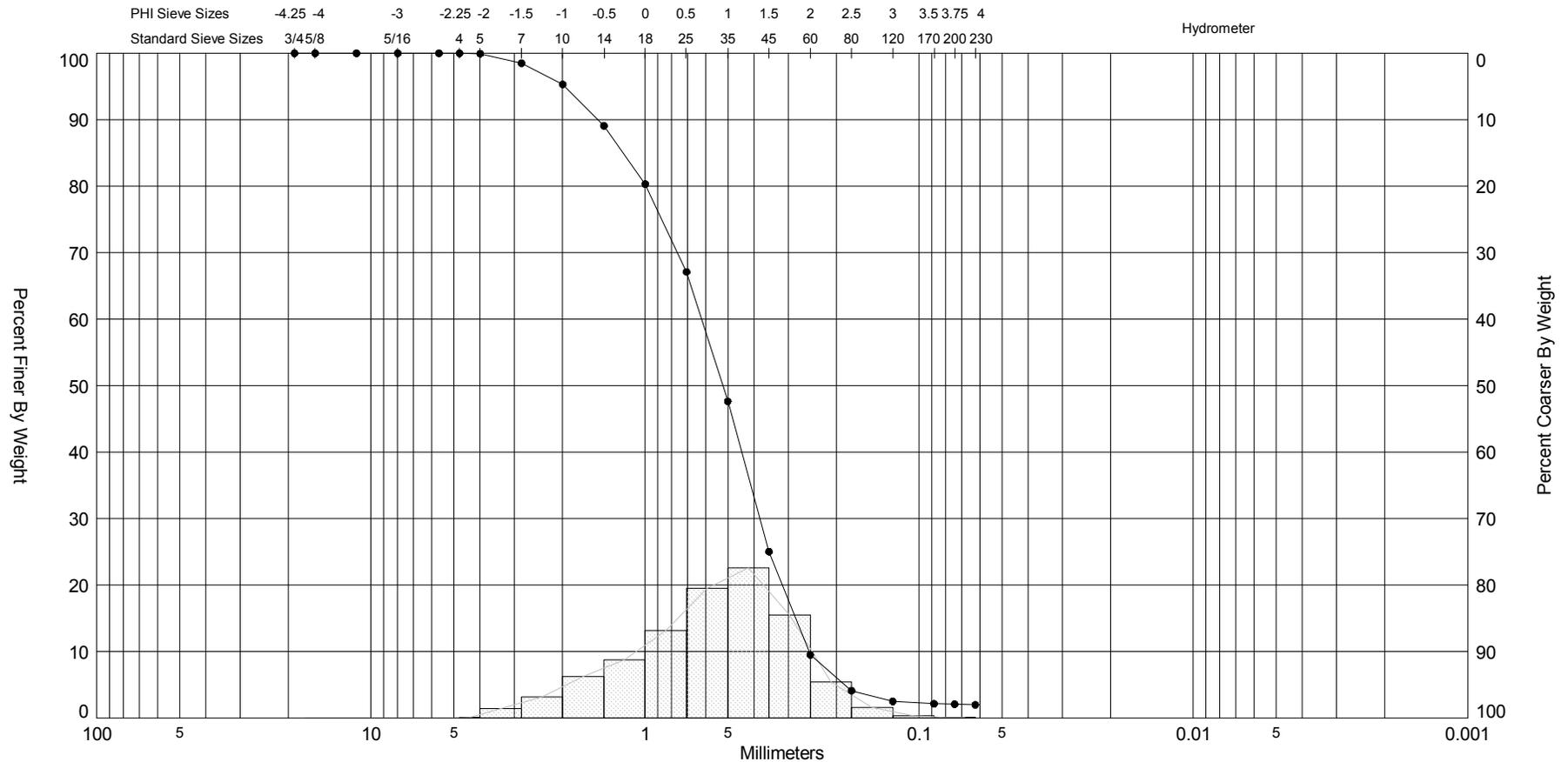
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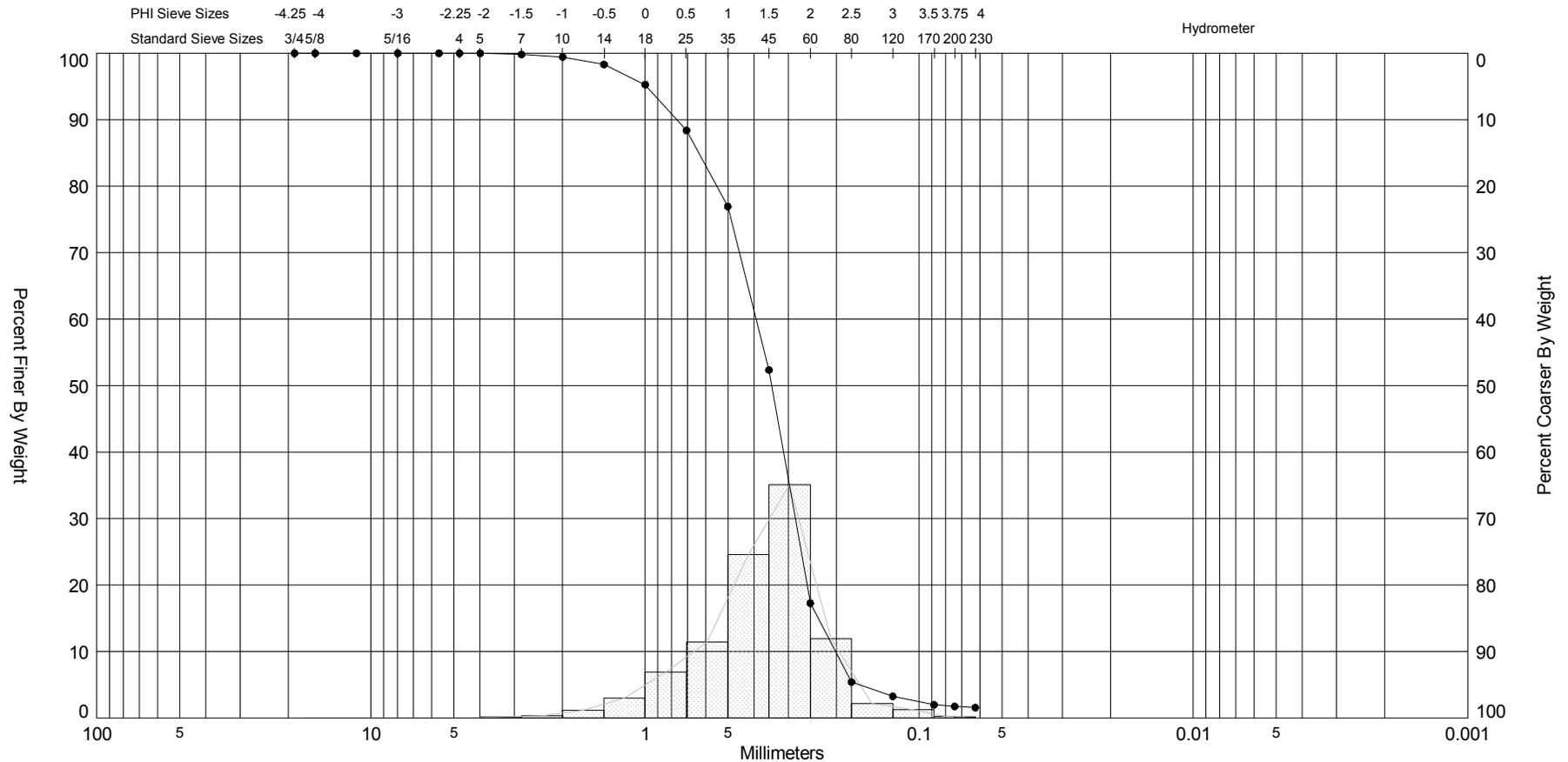


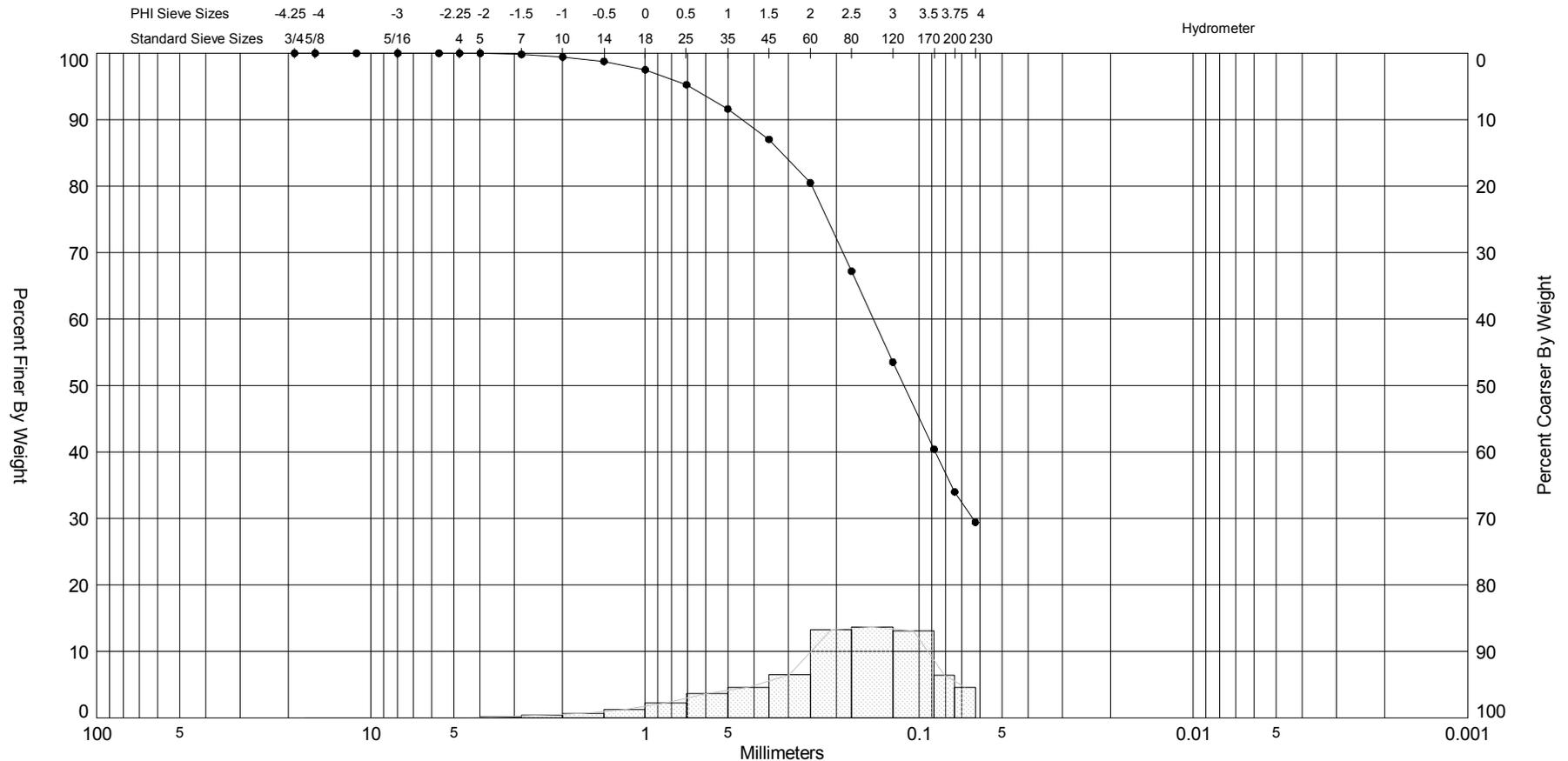
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC07 #2	—●—	-87.0	SP	#200 - 2.40 #230 - 2.15			0.93	0.93	0.31	4.5	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,788
												Northing (Y, m):	951,977
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC.GPJ 12/8/17



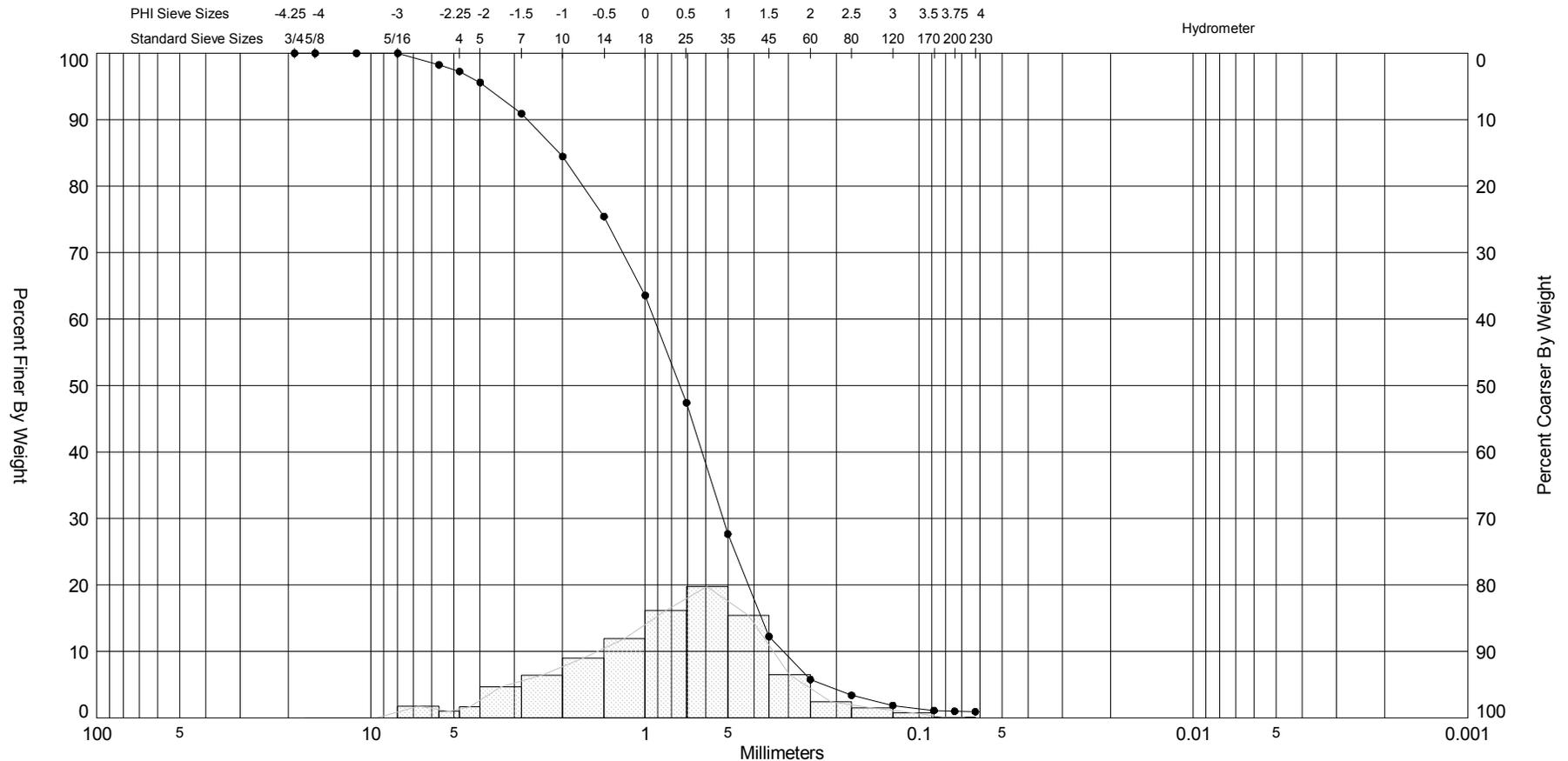




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC07 #5	—●—	-94.0	SM	#200 - 34.02 #230 - 29.45			3.13	2.41	-0.98	3.79	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,788
												Northing (Y, m):	951,977
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

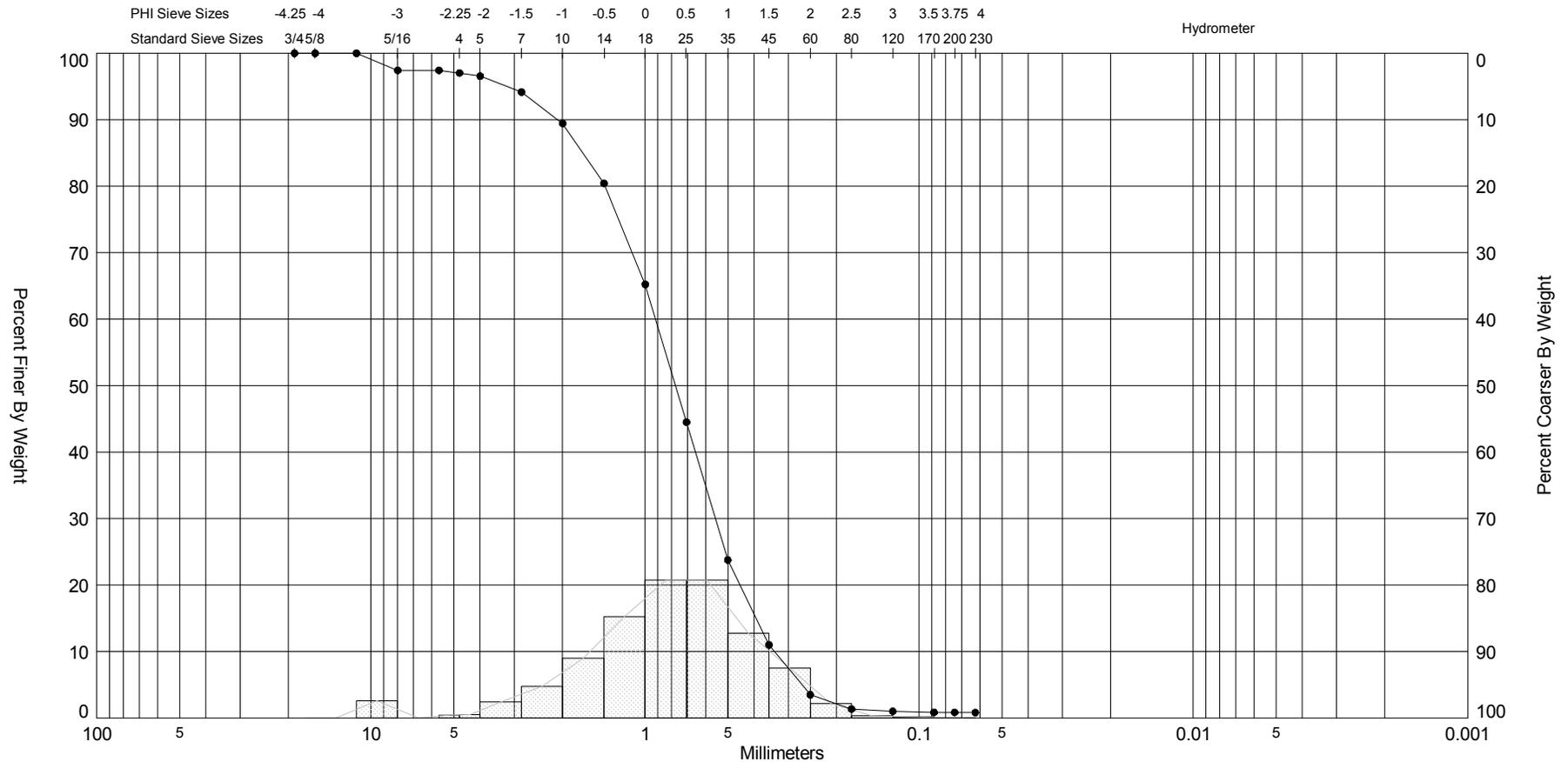
MA-CZM-2017-VC-GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC07 #6	—●—	-96.3	SW	#200 - 1.00 #230 - 0.93			0.42	0.26	-0.3	3	1.19	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-06-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,788
												Northing (Y, m):	951,977
												Horizontal Datum:	NAD 1983
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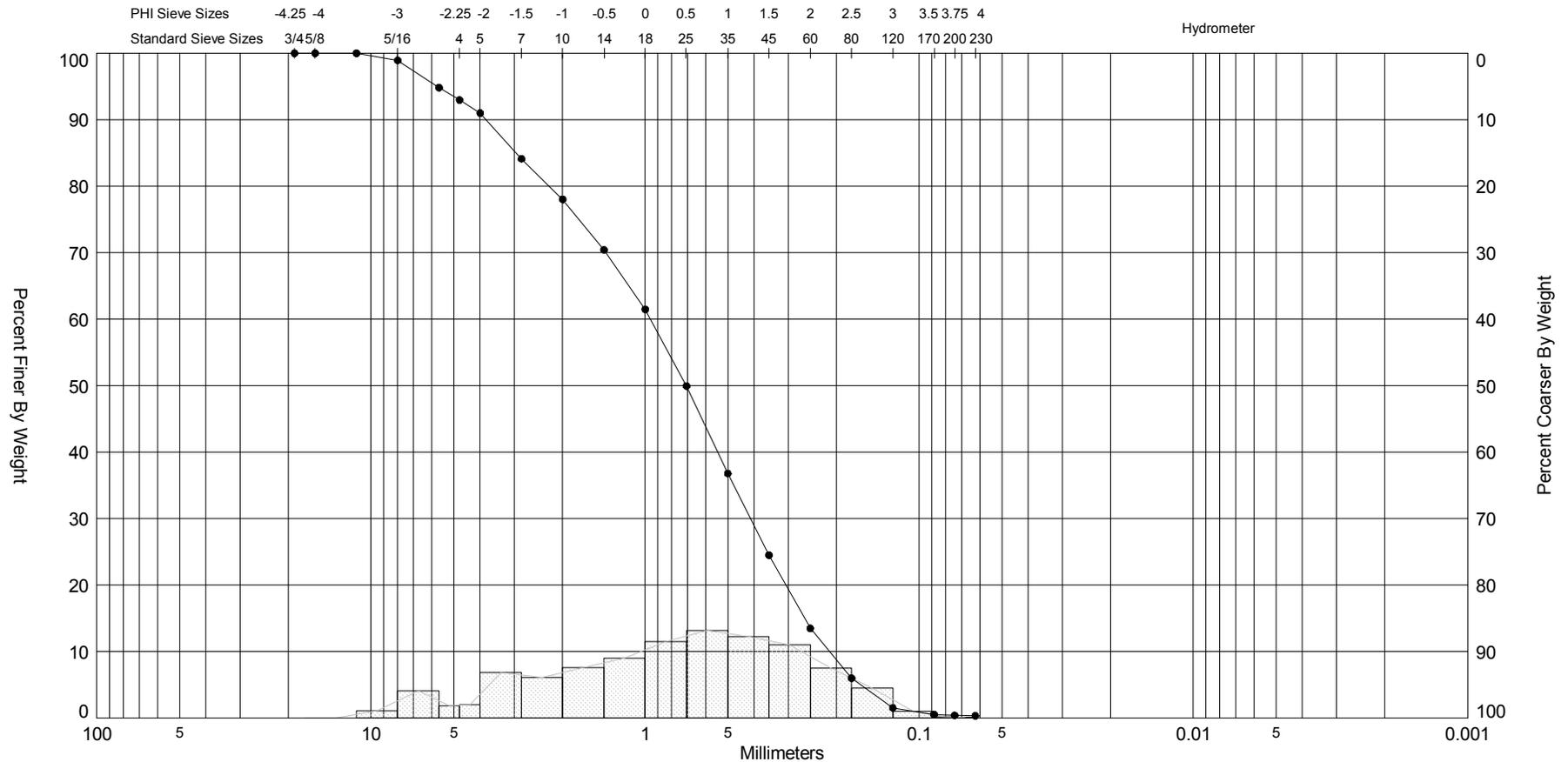
MA_CZM_2017_VC_GPJ_12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC08 #2	—●—	-112.6	SW	#200 - 0.85 #230 - 0.82			0.37	0.26	-0.8	4.41	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-09-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	261,677
												Northing (Y, m):	953,809
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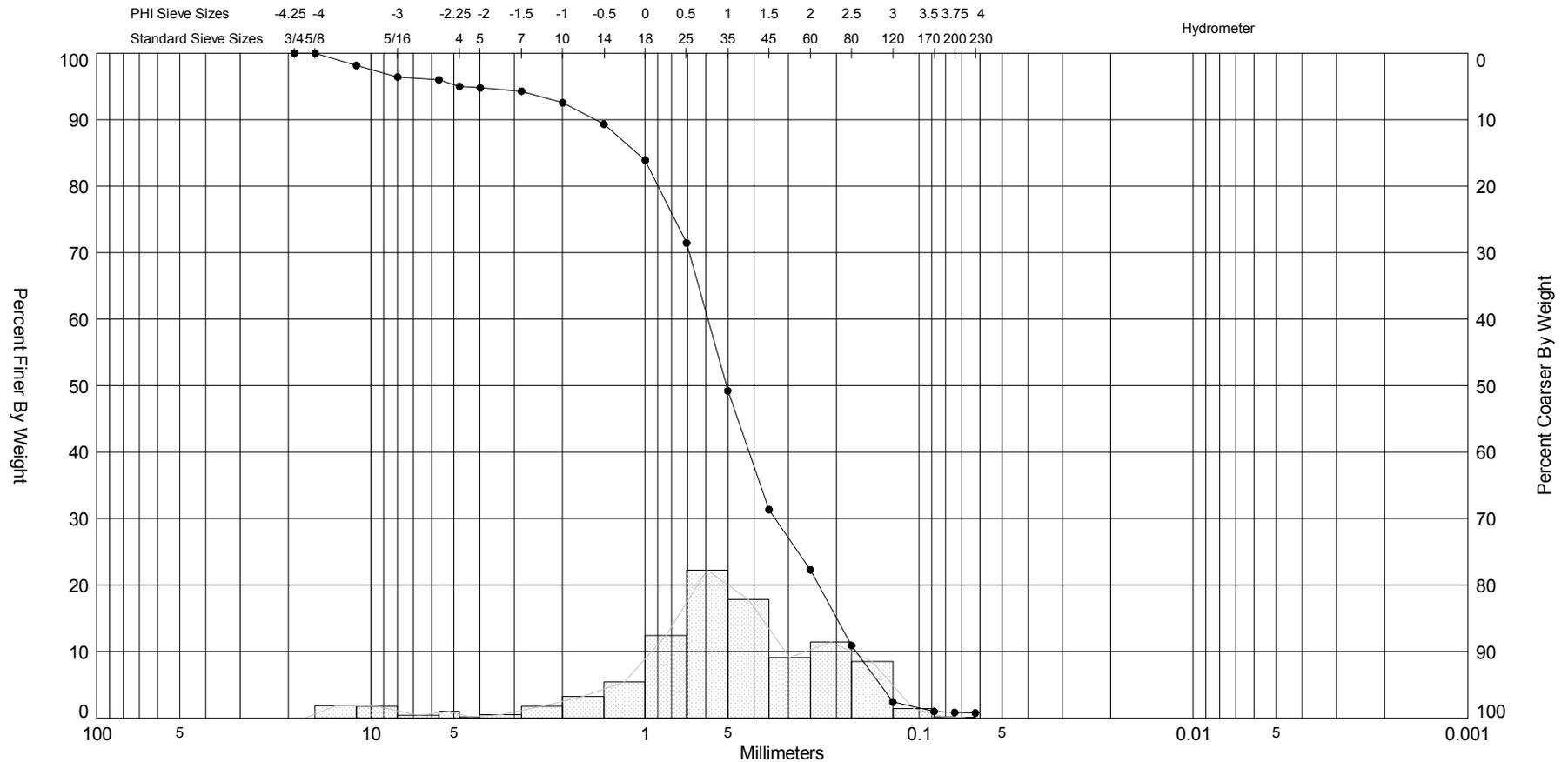
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC09 #1	—●—	-94.6	SW	#200 - 0.40 #230 - 0.33			0.5	0.3	-0.33	2.33	1.53	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-09-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	259,585
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												Horizontal Datum:	NAD 1983
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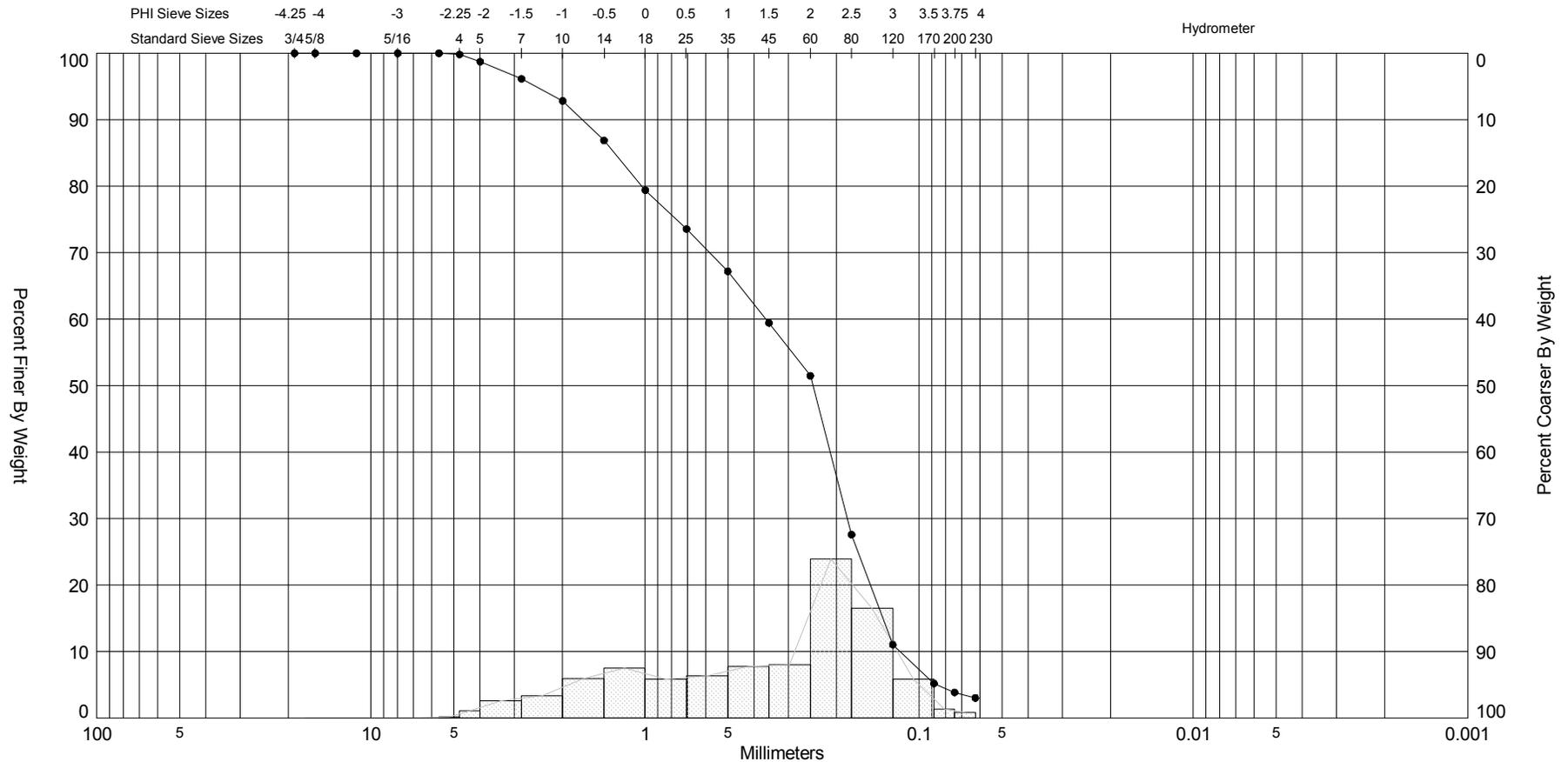
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC09 #2	—●—	-97.2	SW	#200 - 0.83 #230 - 0.74			0.98	0.9	-1.18	5.19	1.38	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-09-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	259,585
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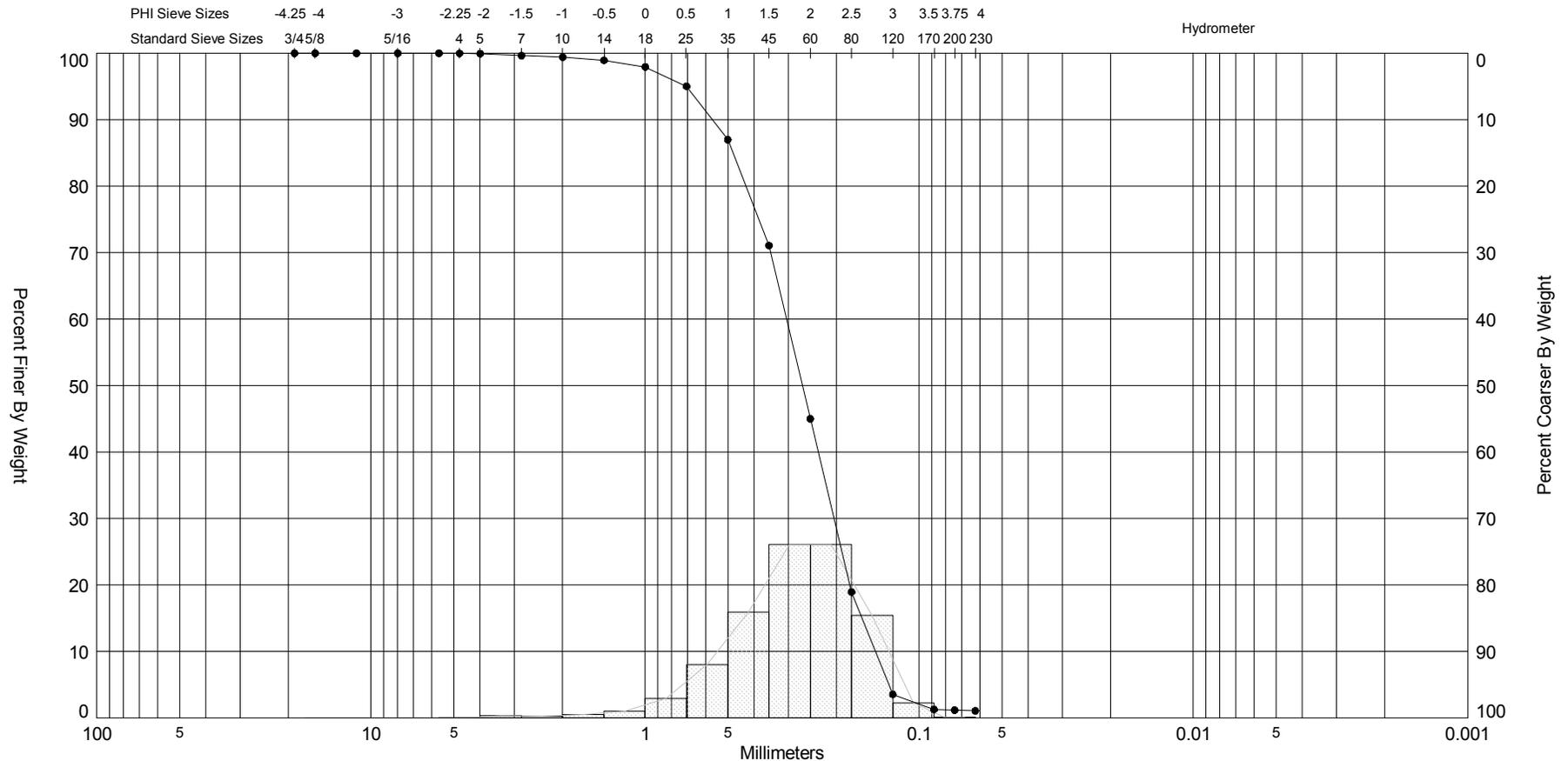
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC09 #3	—●—	-99.5	SW	#200 - 3.85 #230 - 3.03			2.03	1.43	-0.68	2.43	1.45	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-13-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	259,585
												Northing (Y, m):	955,110
												Horizontal Datum:	NAD 1983
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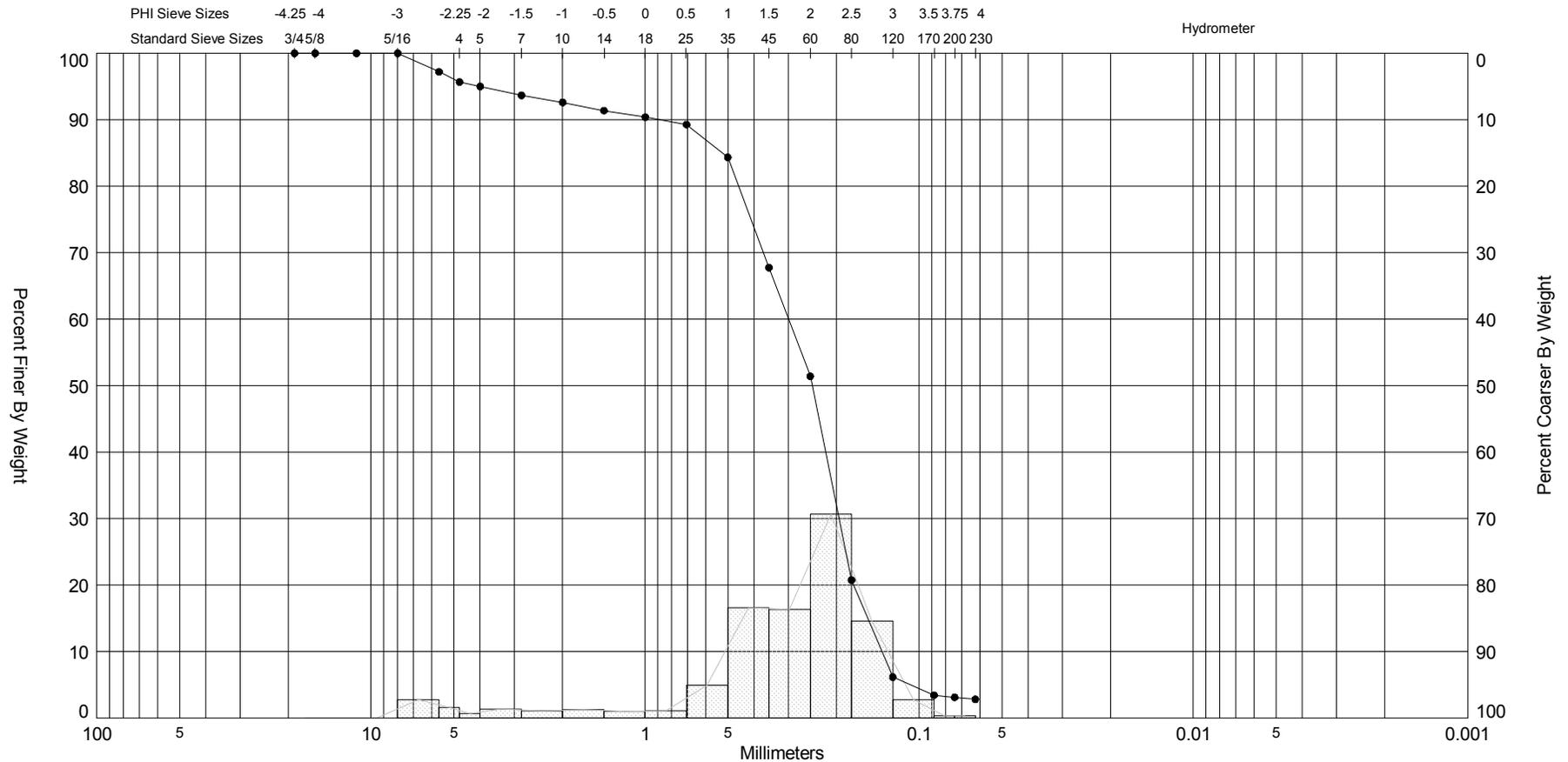
MA_CZM_2017_VC_GPJ_12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC10 #2	—●—	-77.9	SP	#200 - 1.16 #230 - 1.06			1.9	1.82	-0.91	4.96	0.78	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-13-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	239,899
												Northing (Y, m):	793,491
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

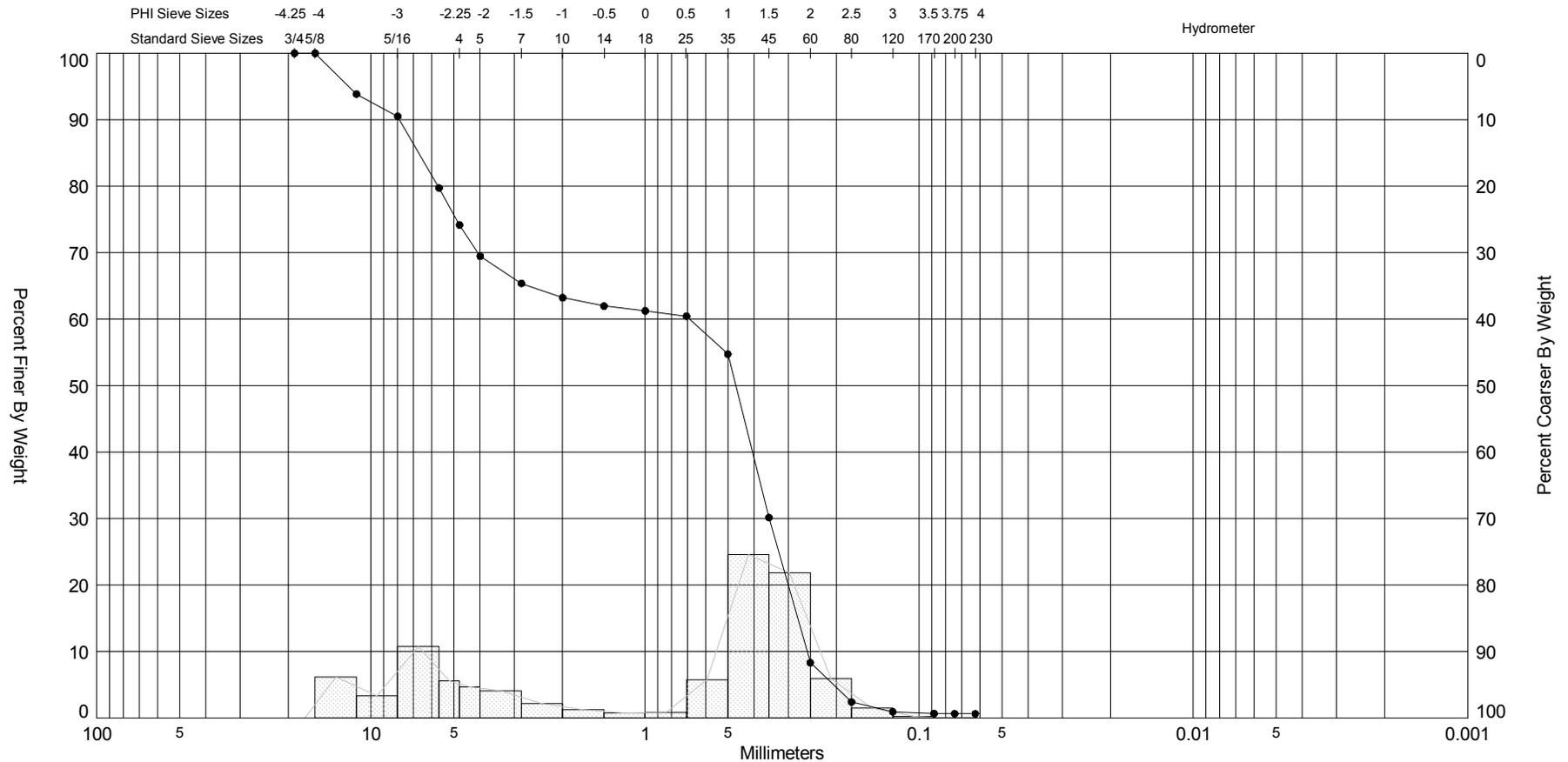
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC11 #1	—●—	-66.9	SW	#200 - 3.11 #230 - 2.80			2.02	1.61	-1.85	6.27	1.33	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-13-17
Depths and elevations based on measured values												Analyzed By:	DA
												Easting (X, m):	241,178
												Northing (Y, m):	796,123
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88
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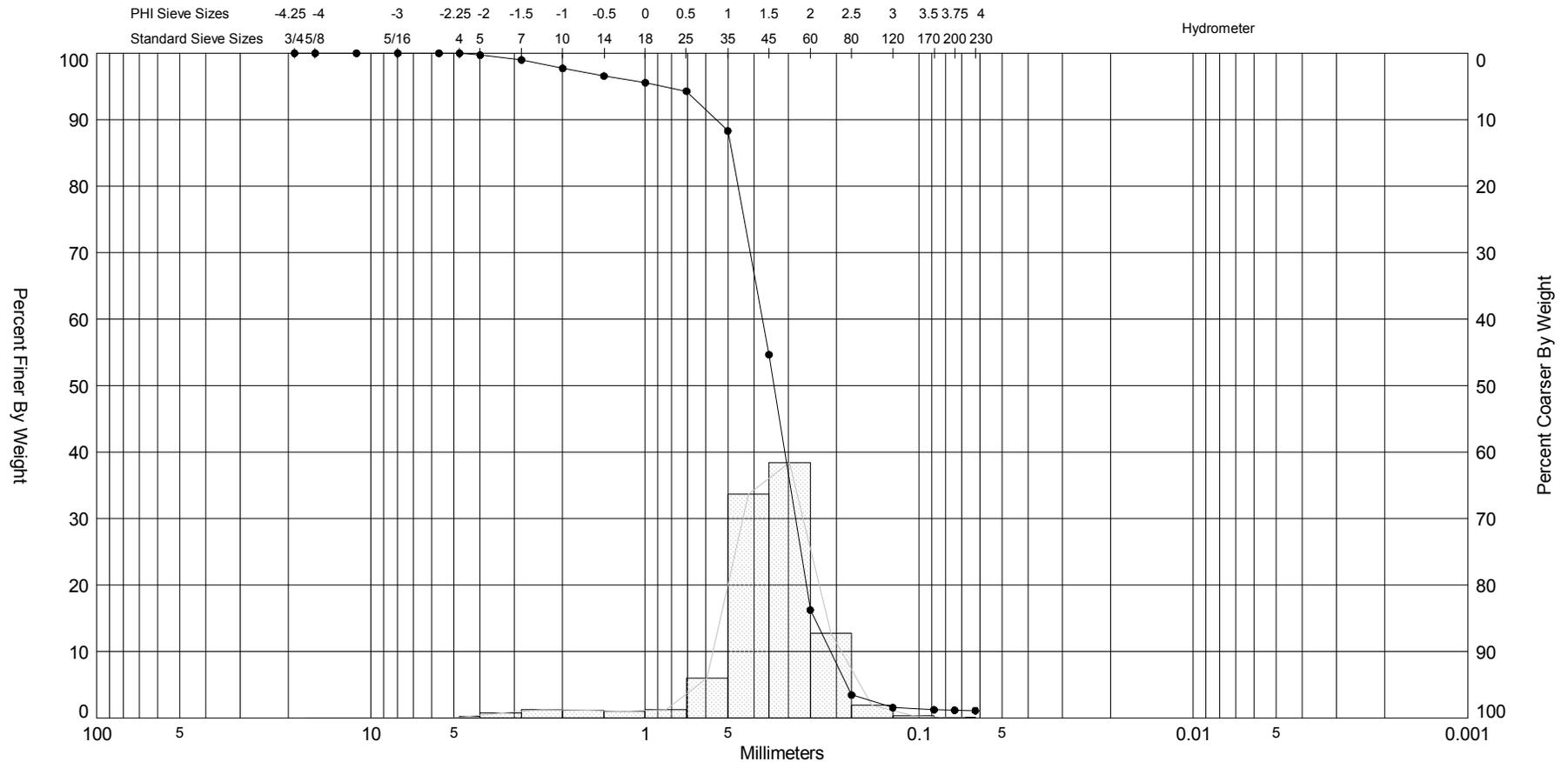
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC11 #2	—●—	-67.4	SW	#200 - 0.65 #230 - 0.63			1.1	-0.06	-0.52	1.62	2.07	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
												Easting (X, m):	241,178
												Northing (Y, m):	796,123
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88
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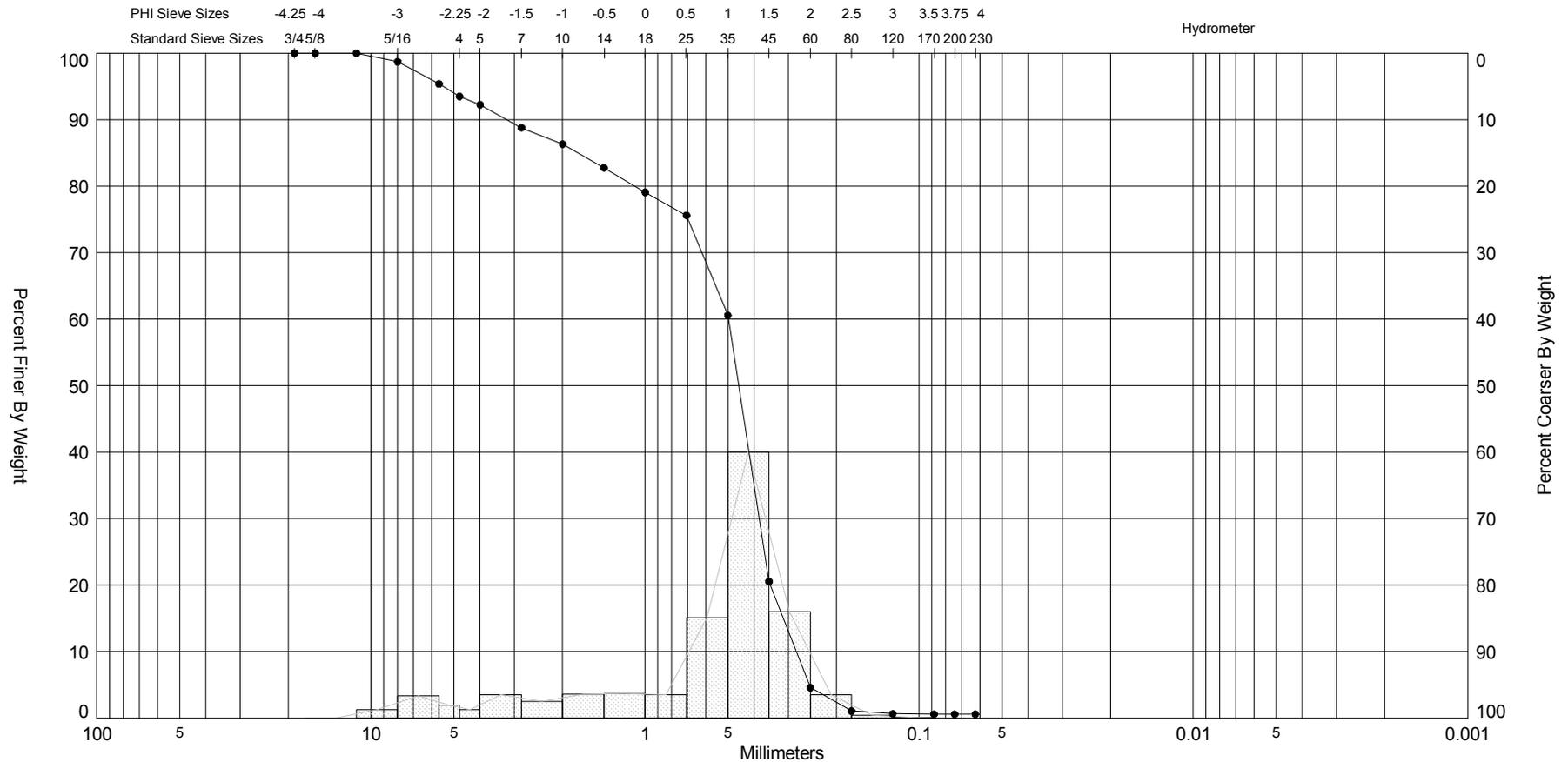
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC11 #3	—●—	-70.7	SP	#200 - 1.17 #230 - 1.11			1.56	1.47	-1.91	9.42	0.72	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	241,178
												Northing (Y, m):	796,123
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

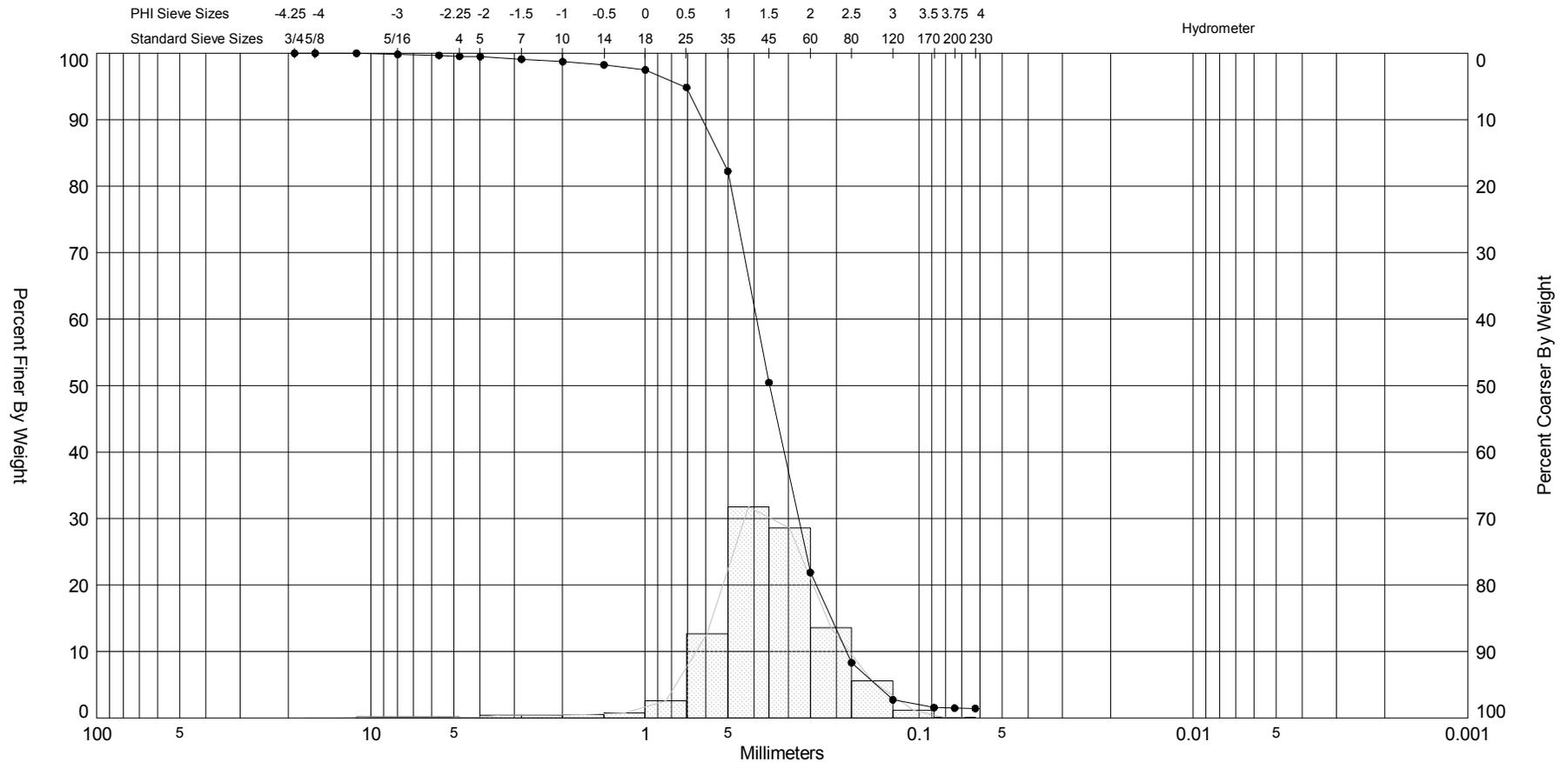
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC11 #5	—●—	-75.8	SW	#200 - 0.57 #230 - 0.57			1.13	0.67	-1.46	4.23	1.31	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	241,178
												Northing (Y, m):	796,123
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

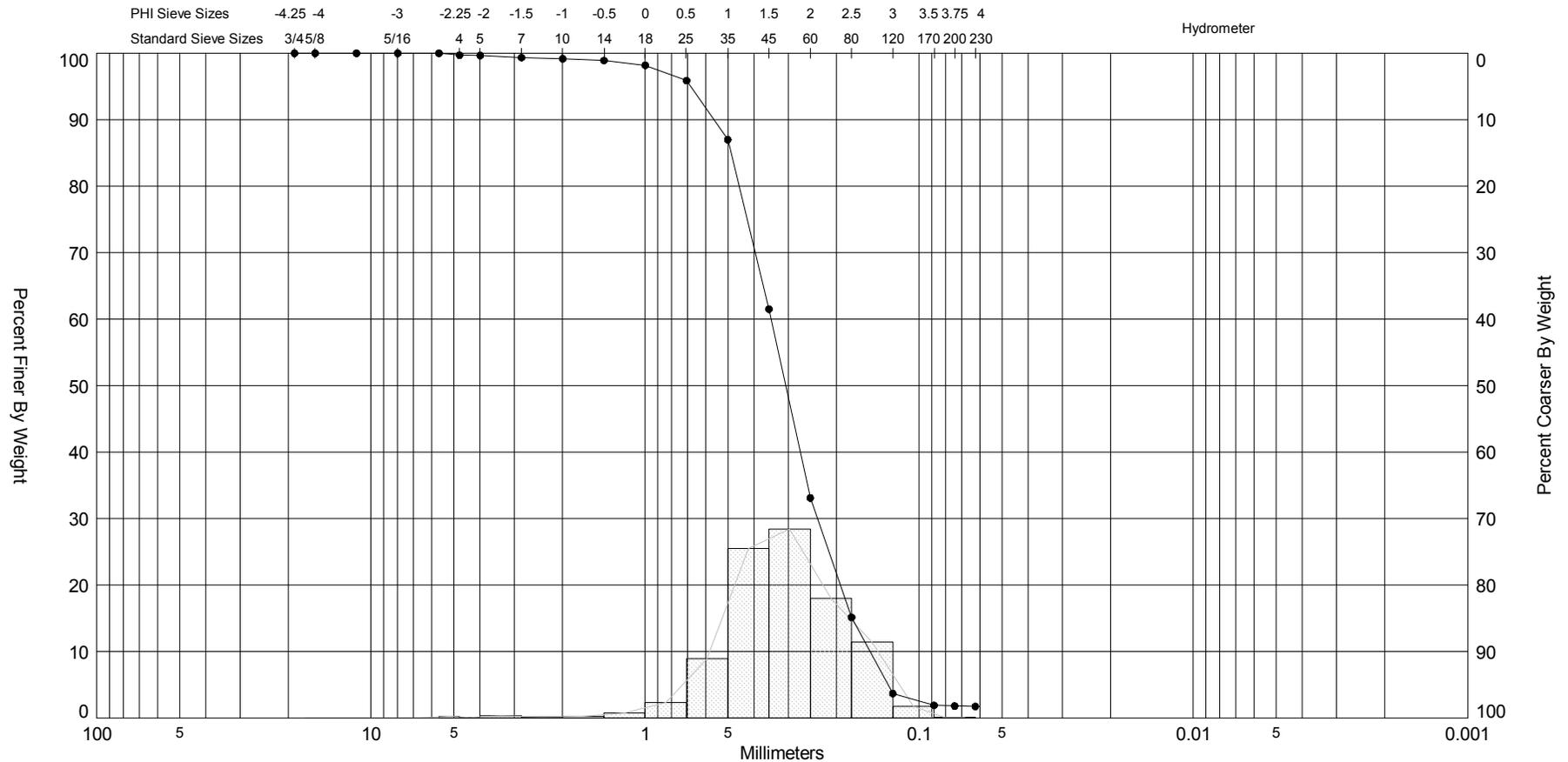
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC12 #1	—●—	-58.6	SP	#200 - 1.49 #230 - 1.44			1.51	1.49	-1.29	9.22	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	237,839
												Northing (Y, m):	798,152
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

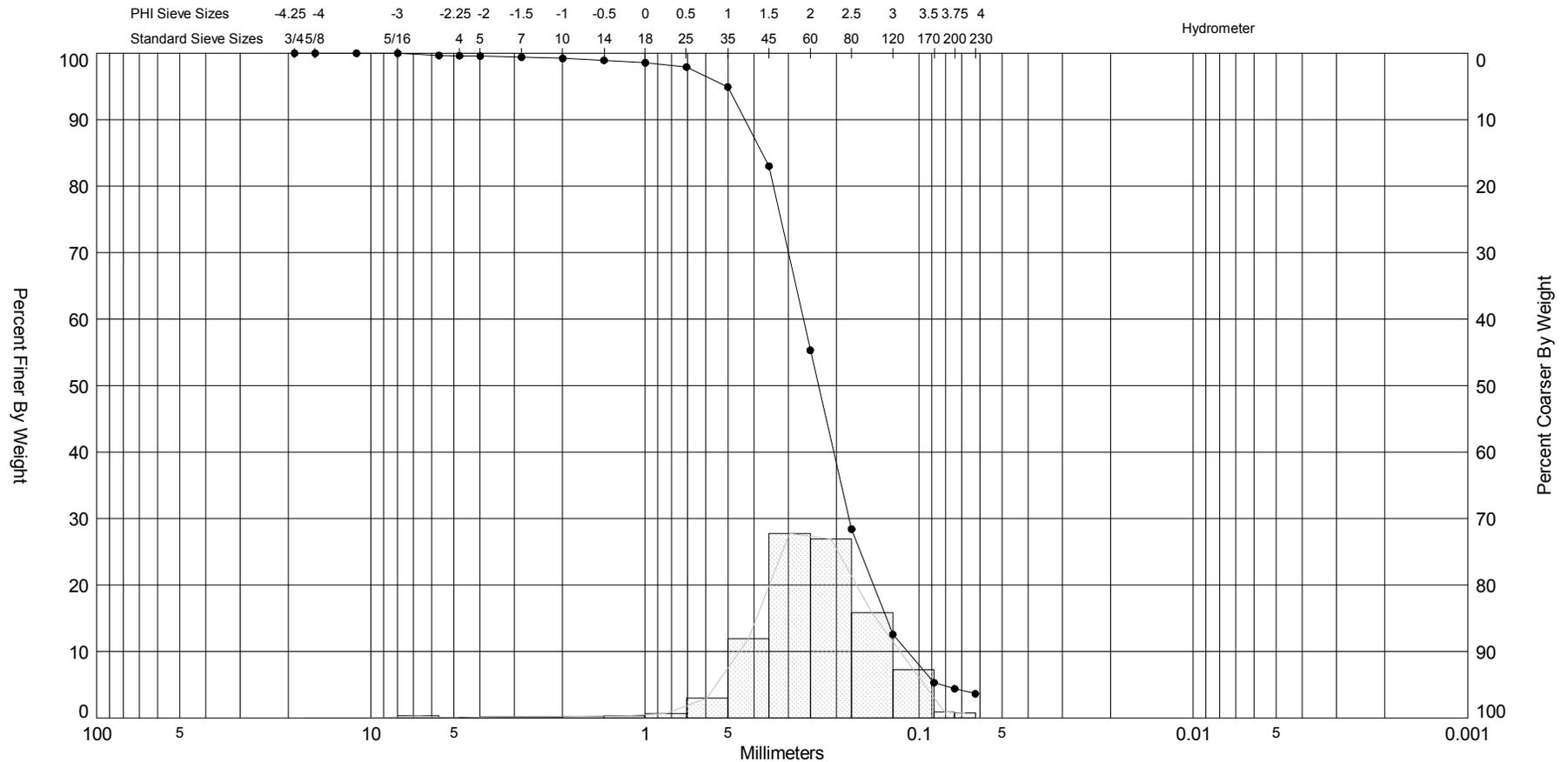
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC12 #2	—●—	-59.2	SP	#200 - 1.80 #230 - 1.73			1.7	1.68	-0.9	6.6	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	237,839
												Northing (Y, m):	798,152
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

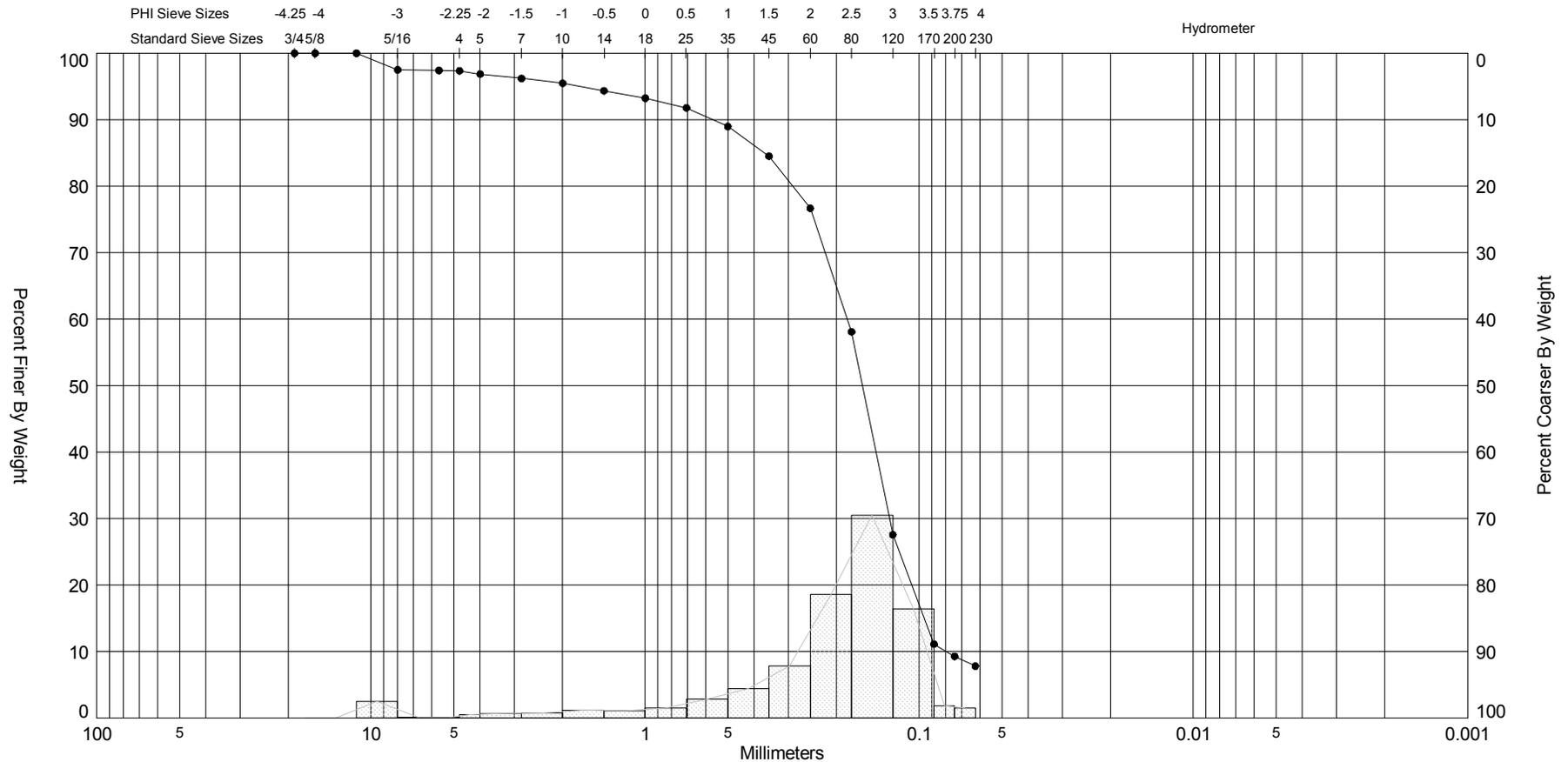
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC13 #1	—●—	-58.4	SP	#200 - 4.40 #230 - 3.65			2.1	2.05	-1.33	9.52	0.78	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	234,032
												Northing (Y, m):	802,508
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

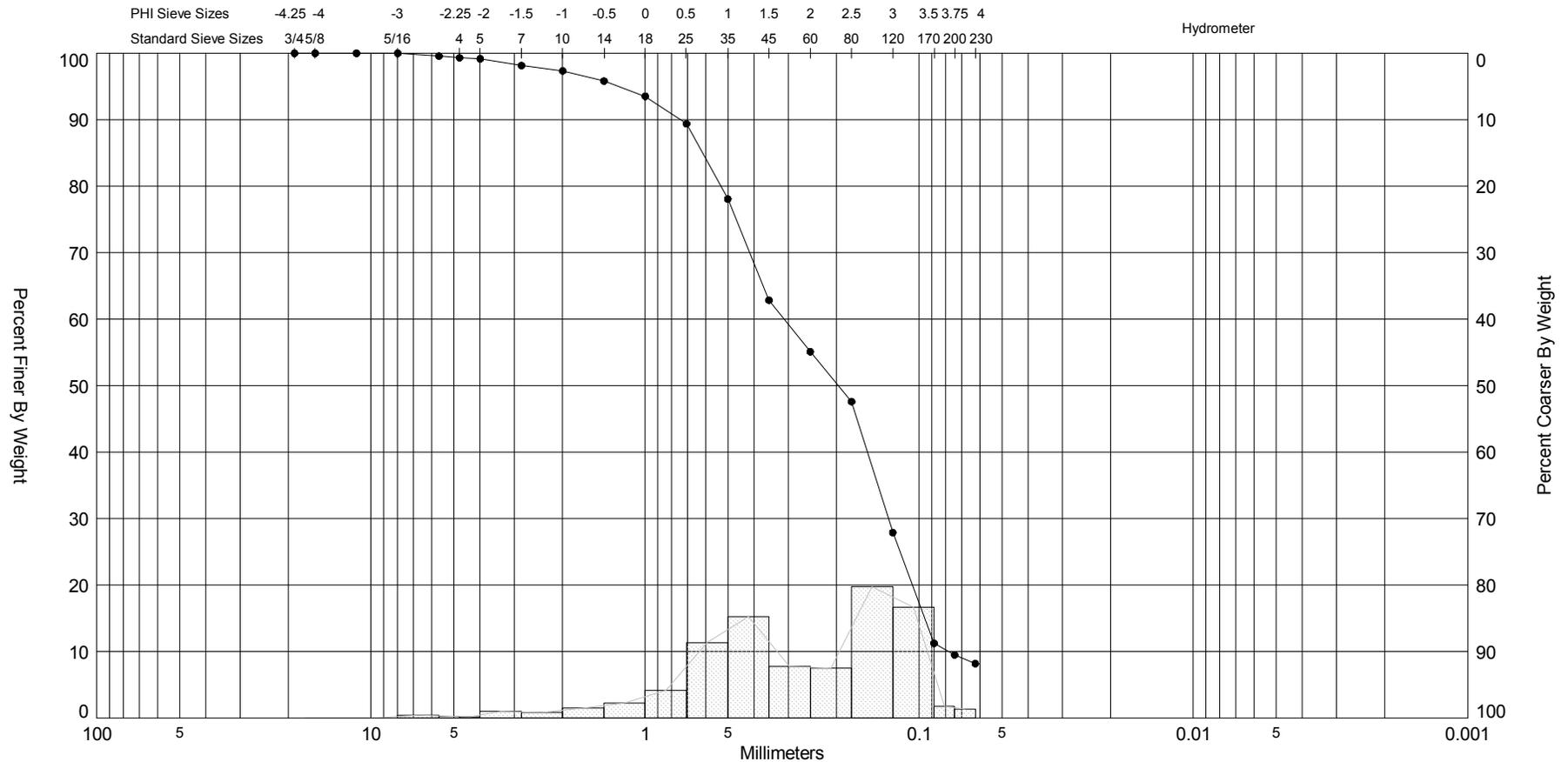
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC13 #2	—●—	-60.8	SW-SC	#200 - 9.28 #230 - 7.80			2.63	2.18	-2.29	8.68	1.38	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-14-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	234,032
												Northing (Y, m):	802,508
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

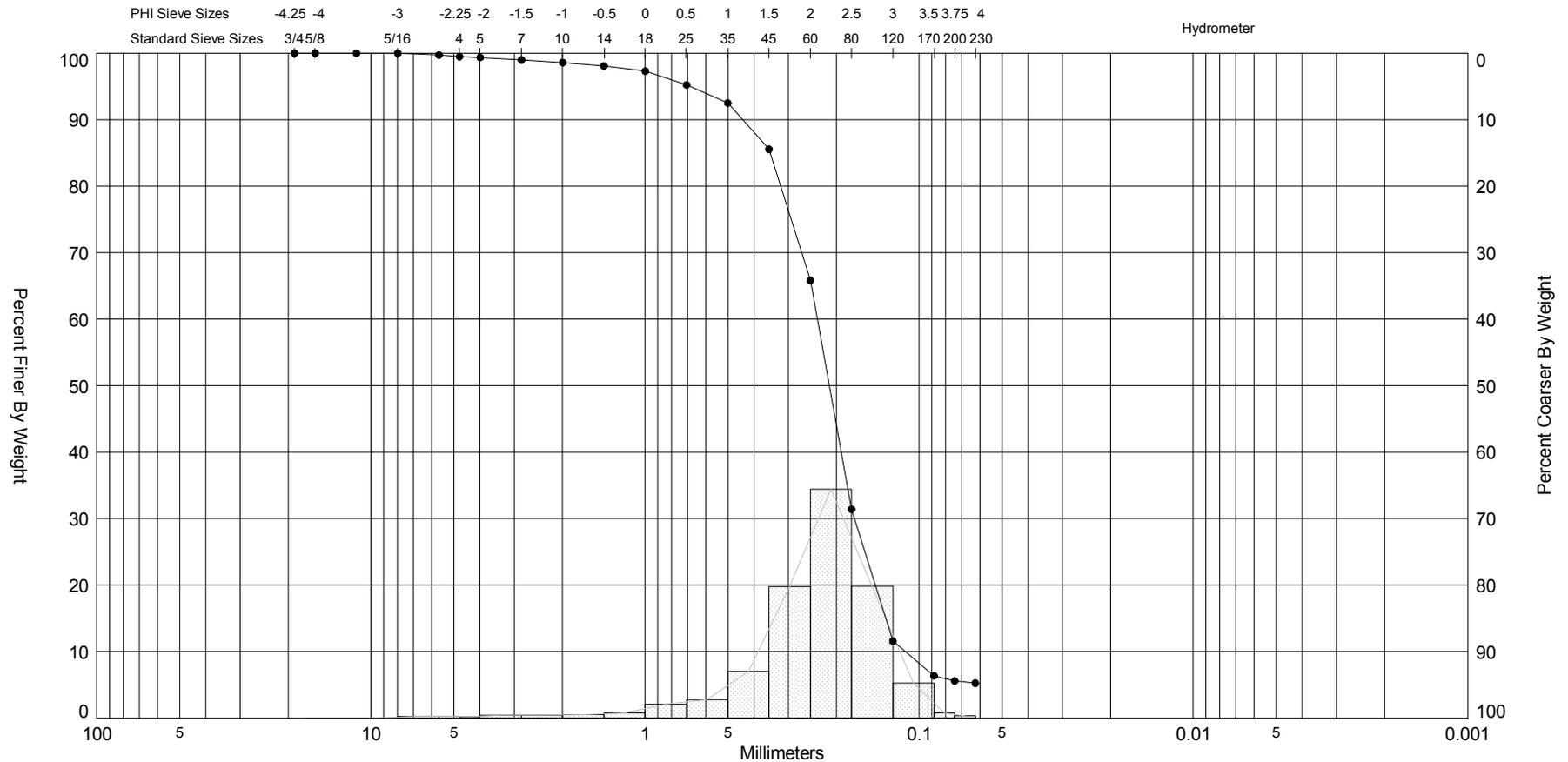
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC13 #3	—●—	-62.2	SW-SC	#200 - 9.49 #230 - 8.19			2.34	1.87	-0.83	3.56	1.27	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-15-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	234,032
												Northing (Y, m):	802,508
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

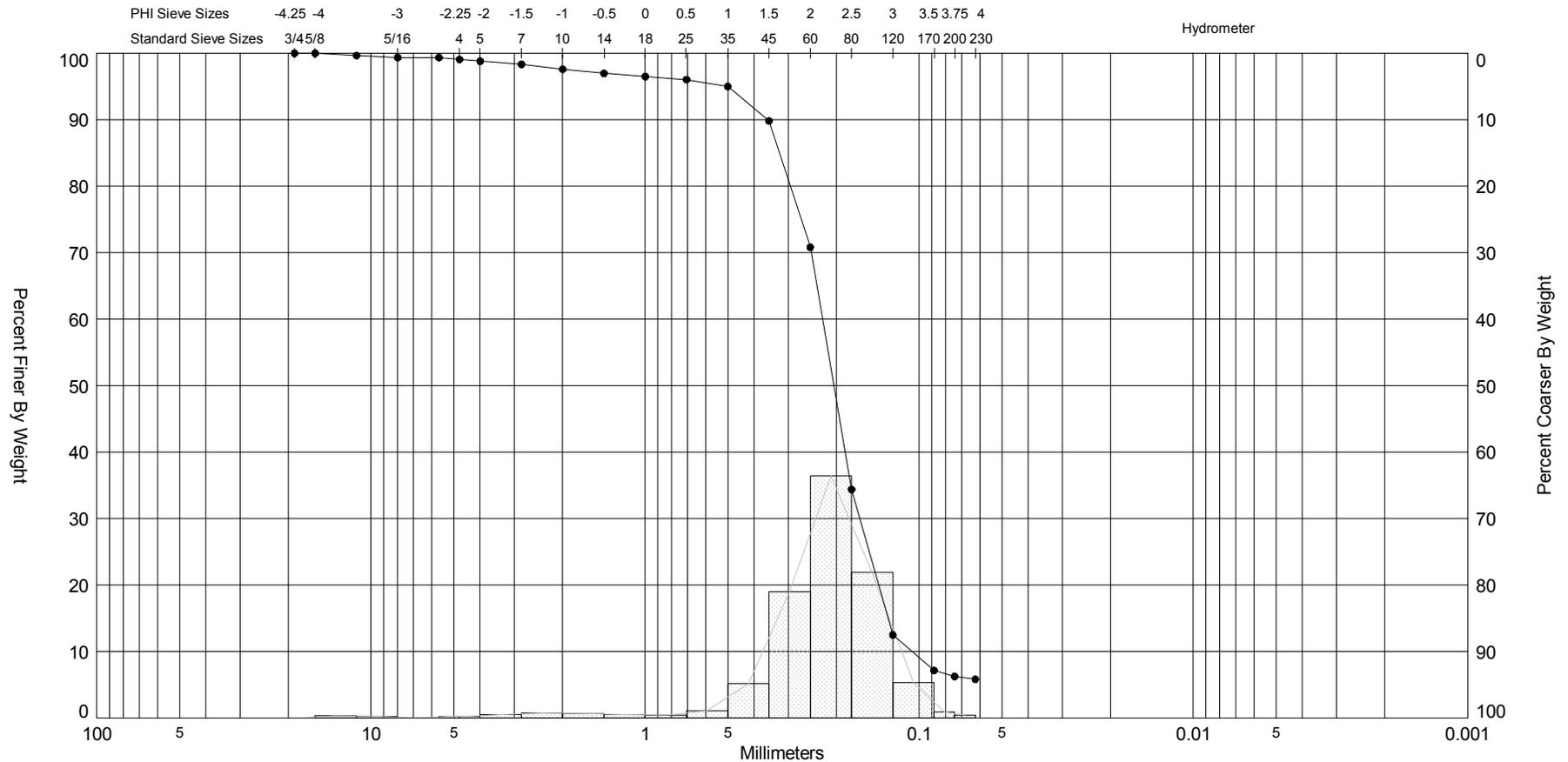
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC14 #1	—●—	-62.9	SW-SC	#200 - 5.57 #230 - 5.25			2.23	2.06	-1.98	9.92	0.86	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-15-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	232,757
												Northing (Y, m):	801,103
												Horizontal Datum:	NAD 1983
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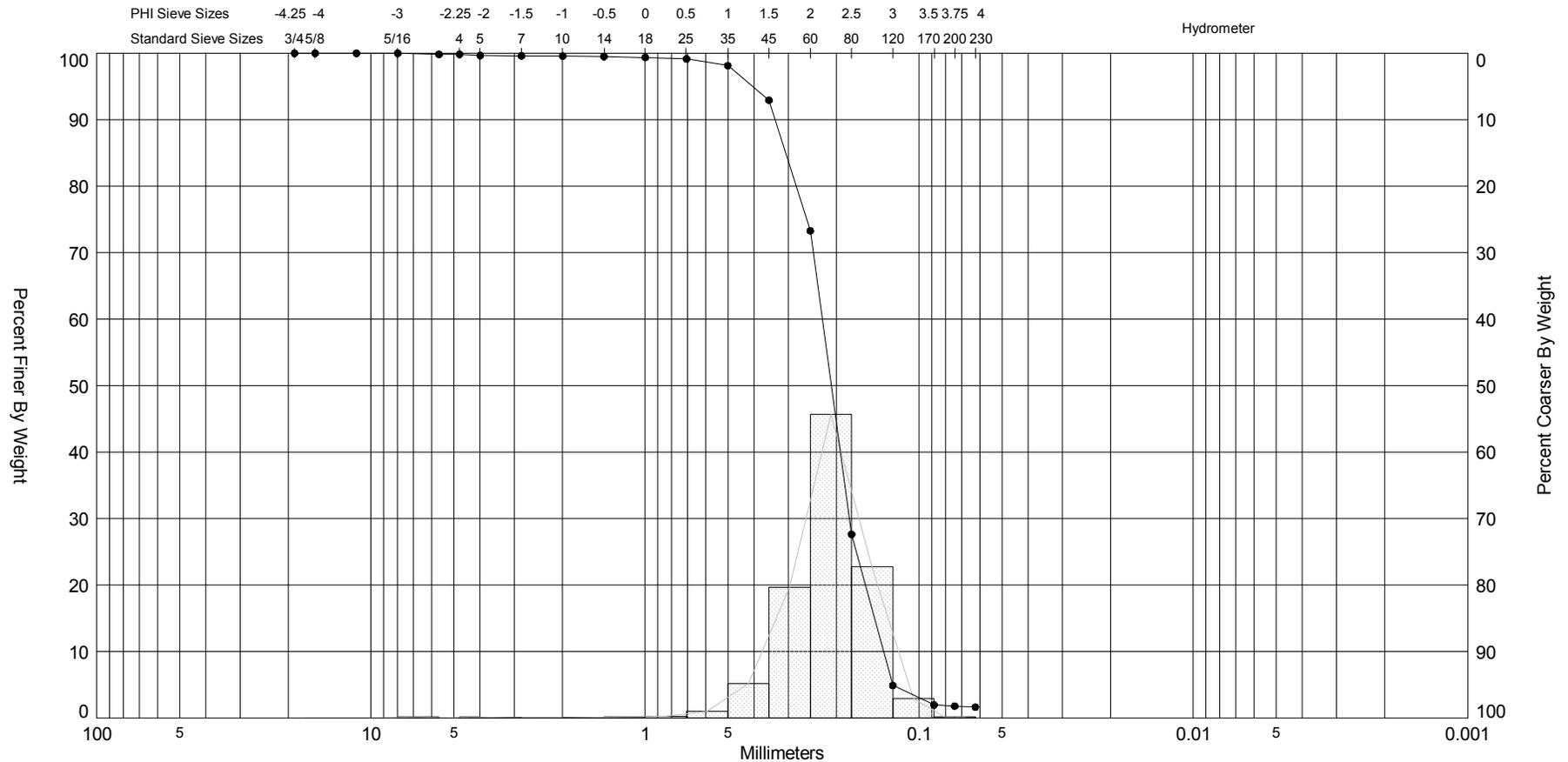
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC14 #2	—●—	-64.6	SW-SC	#200 - 6.25 #230 - 5.82			2.29	2.11	-2.9	15.36	0.95	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-15-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	232,757
												Northing (Y, m):	801,103
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

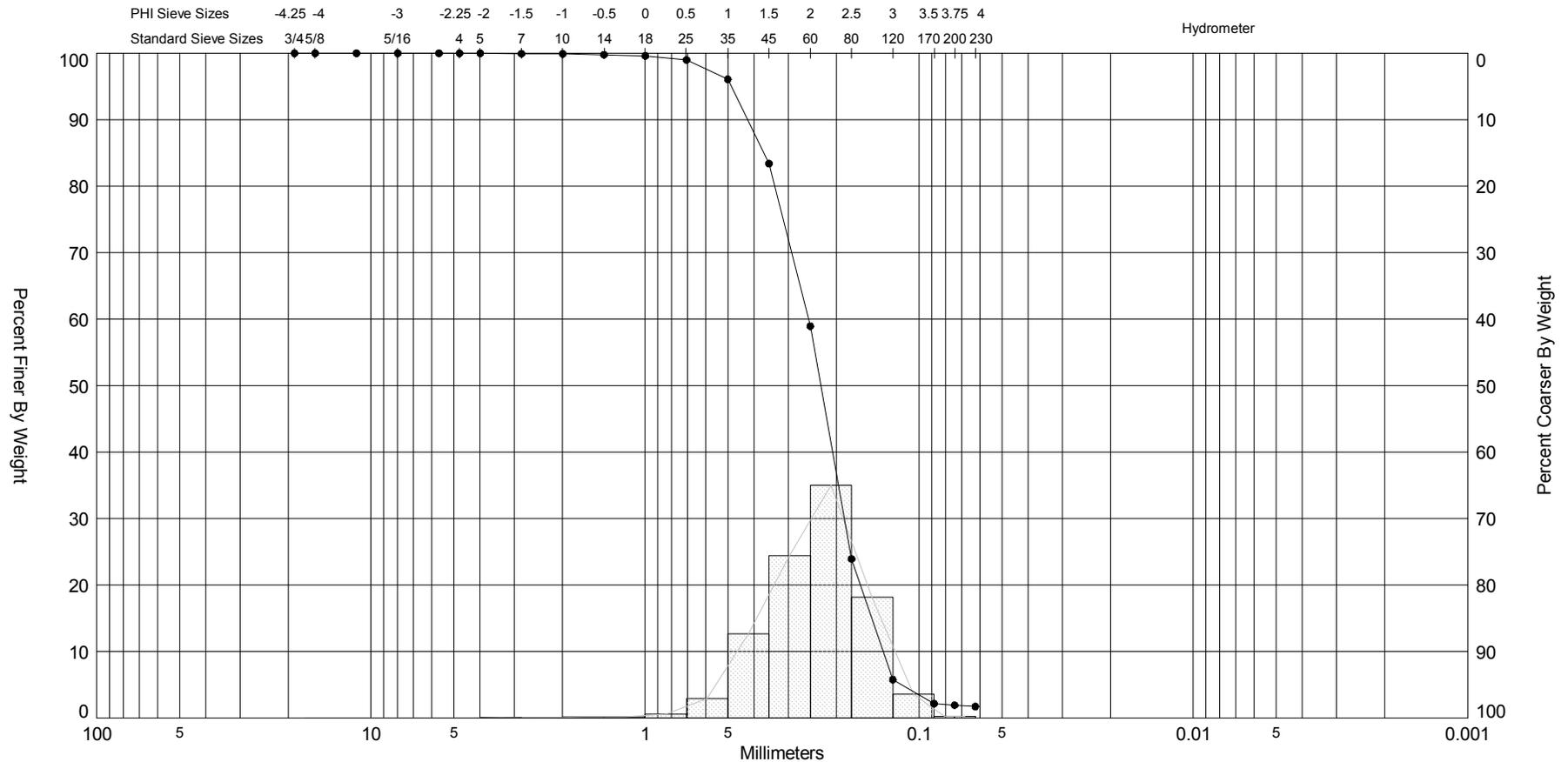
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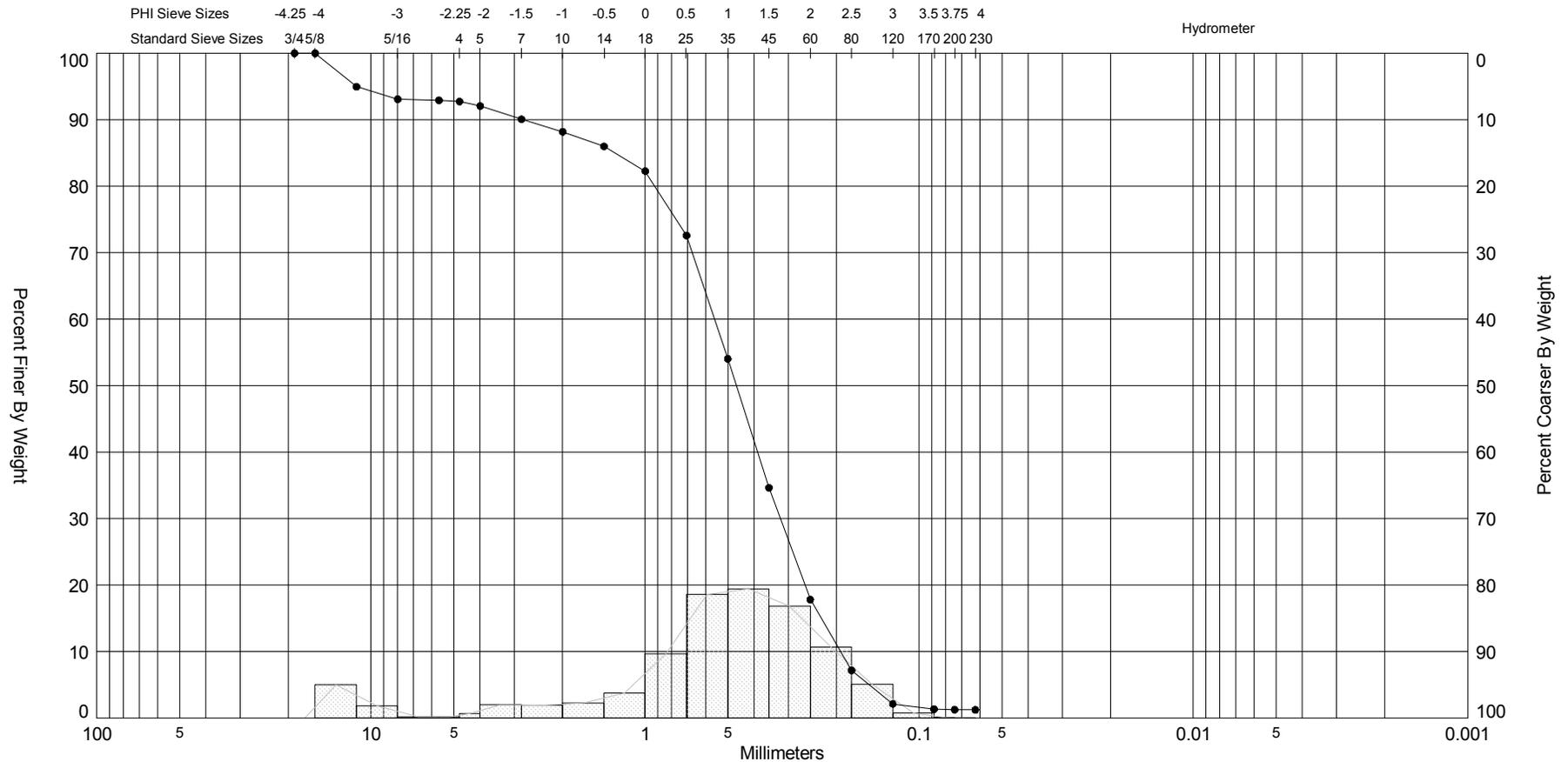


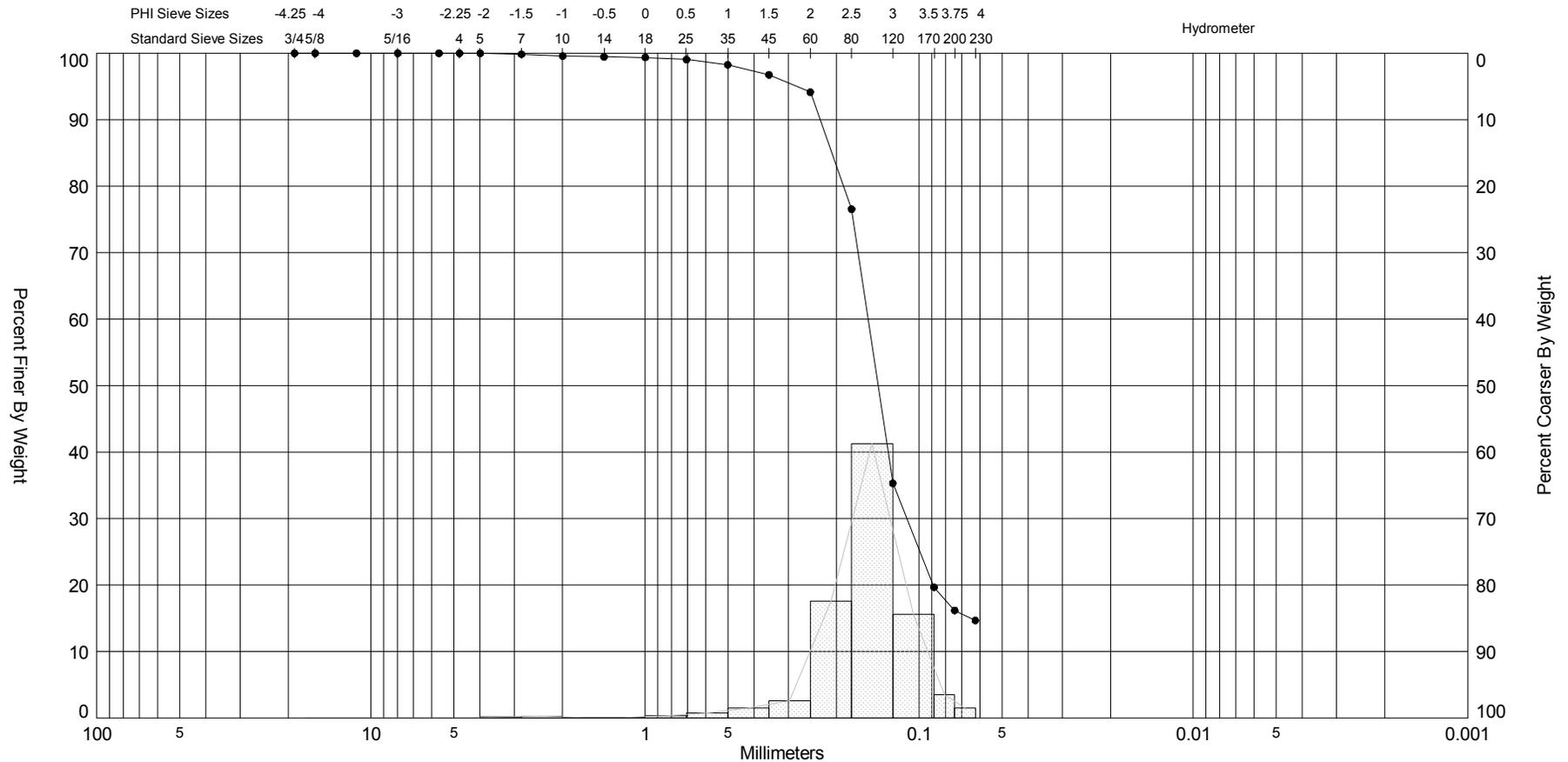
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC15 #2	—●—	-86.1	SP	#200 - 1.79 #230 - 1.63			2.26	2.2	-2.38	18.97	0.57	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-15-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	277,516
												Northing (Y, m):	870,903
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC.GPJ 12/8/17



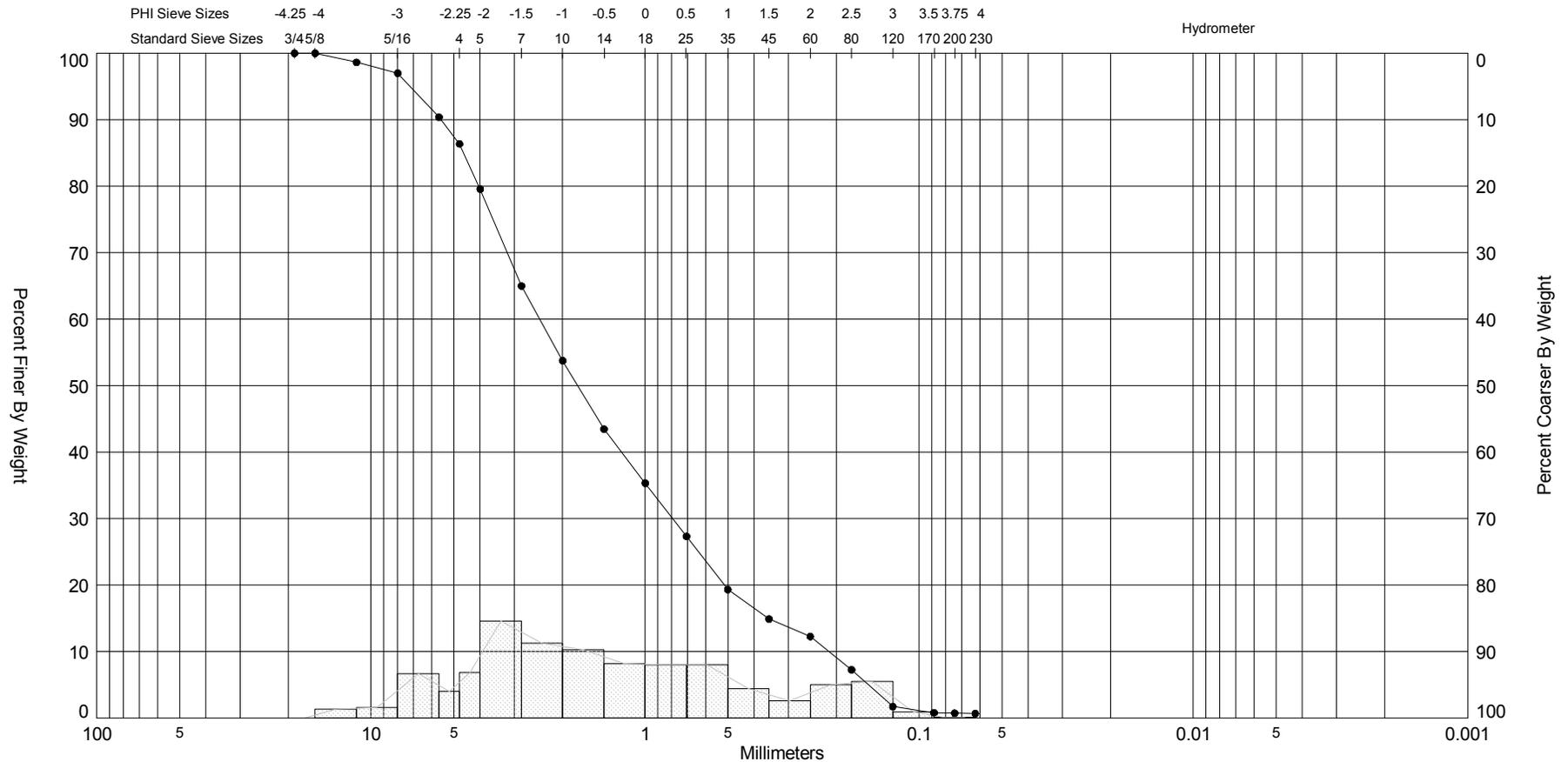




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC16 #4	—●—	-86.2	SM	#200 - 16.20 #230 - 14.68			2.82	2.68	-2.24	14.29	0.63	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-15-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	276,446
												Northing (Y, m):	866,962
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

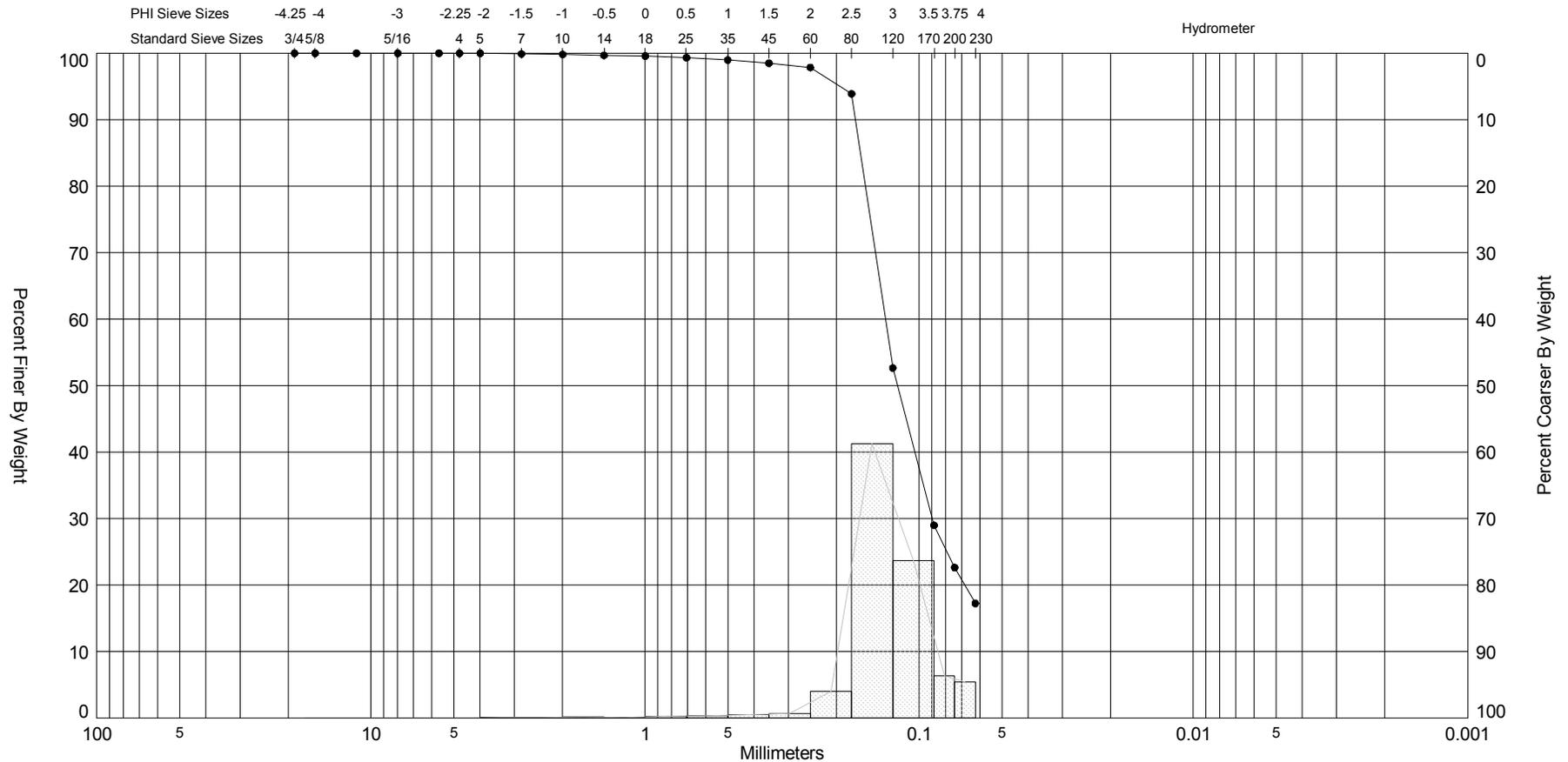
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC17 #2	—●—	-74.4	SW	#200 - 0.72 #230 - 0.67				-0.54	0.46	2.37	1.67	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-16-17
Depths and elevations based on measured values												Analyzed By:	DA
												Easting (X, m):	275,721
												Northing (Y, m):	865,048
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88
<p style="text-align: center;">APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p>													

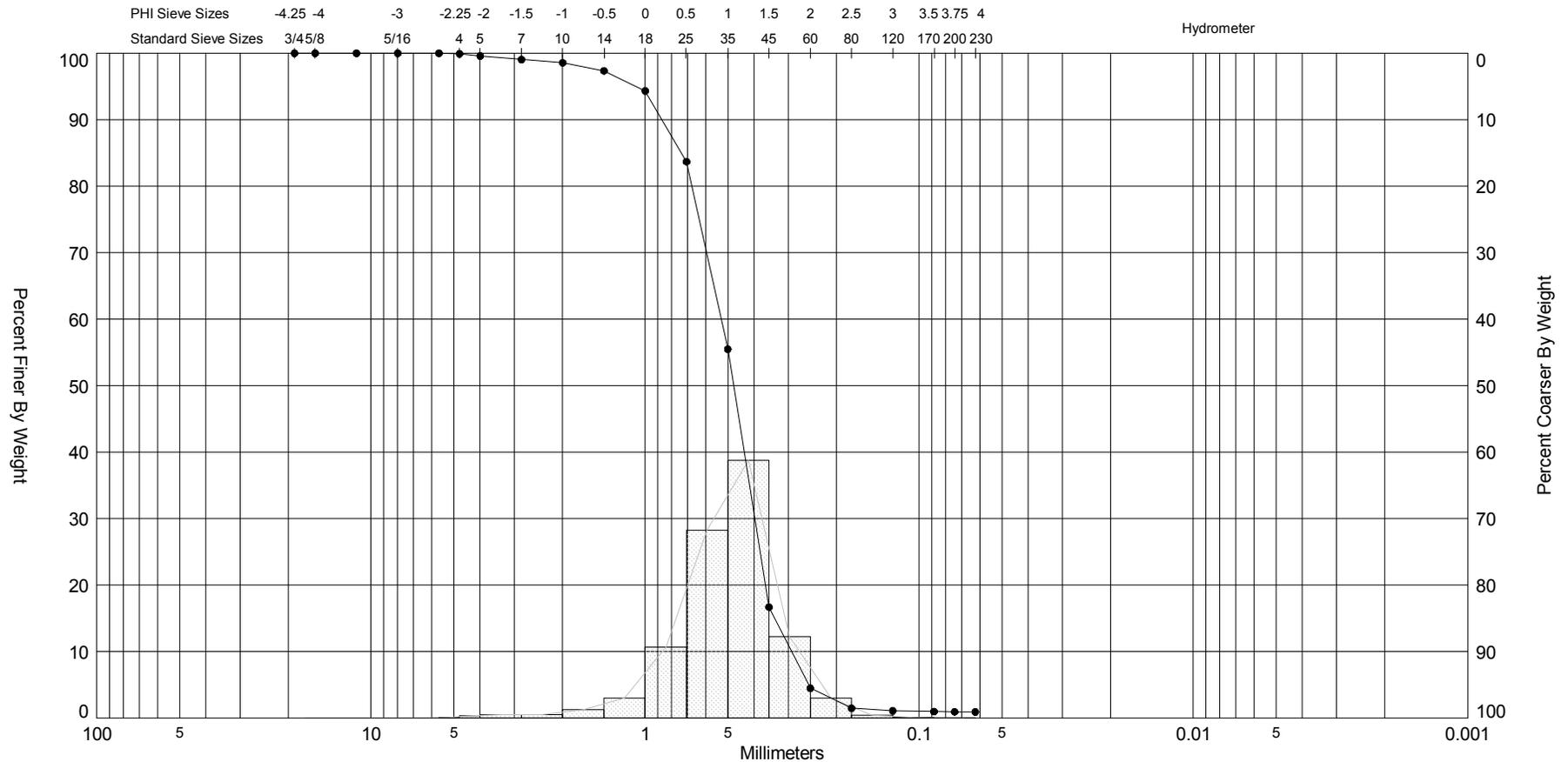
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC17 #3	—●—	-78.6	SC	#200 - 22.64 #230 - 17.25			3.06	2.96	-2.4	18.31	0.56	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-16-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	275,721
												Northing (Y, m):	865,048
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

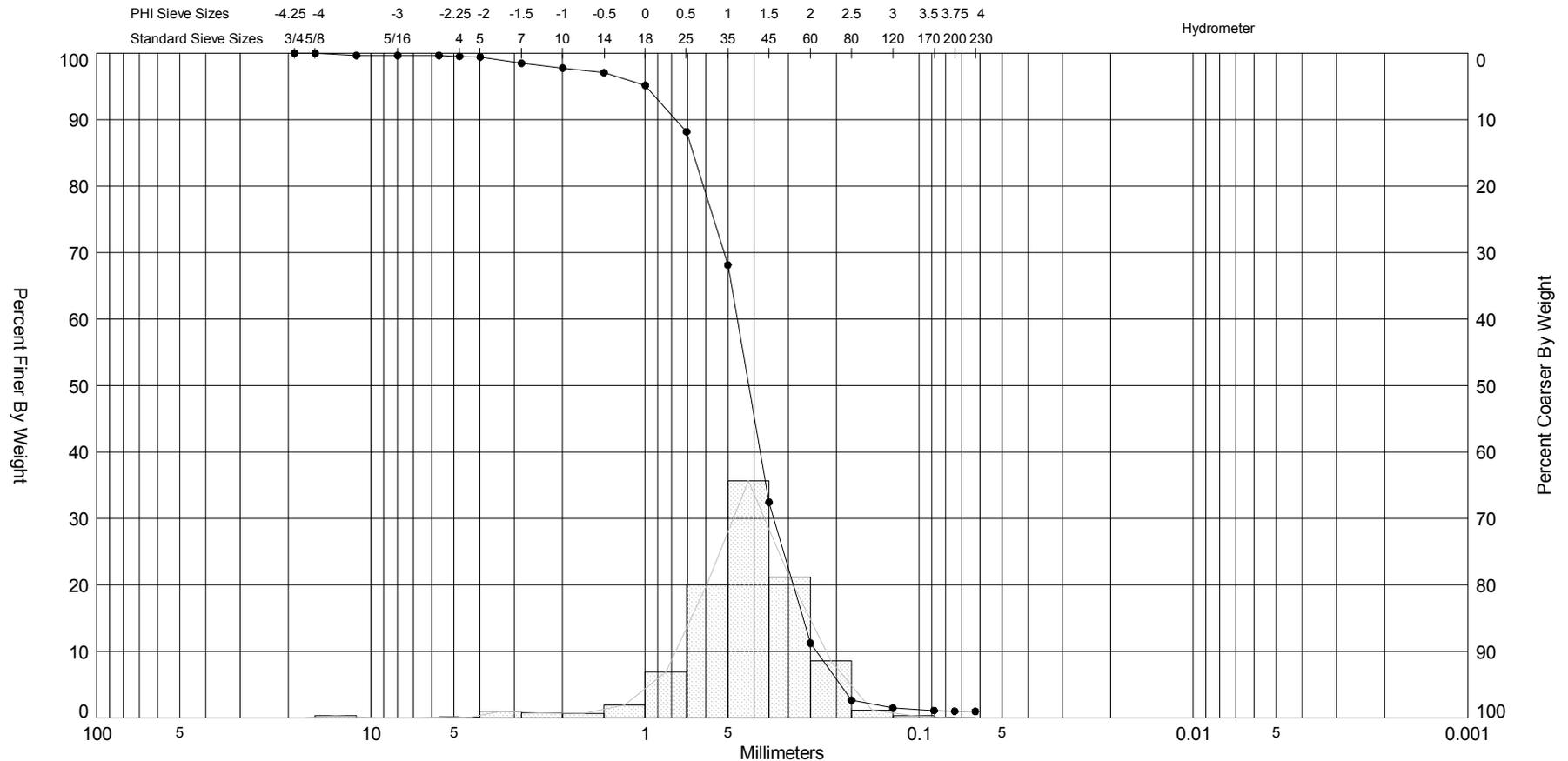
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC18 #1	—●—	-45.3	SP	#200 - 0.93 #230 - 0.91			1.07	0.99	-1.04	6.82	0.66	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-16-17
Depths and elevations based on measured values												Analyzed By:	DA
						APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102						Easting (X, m):	283,242
												Northing (Y, m):	843,847
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

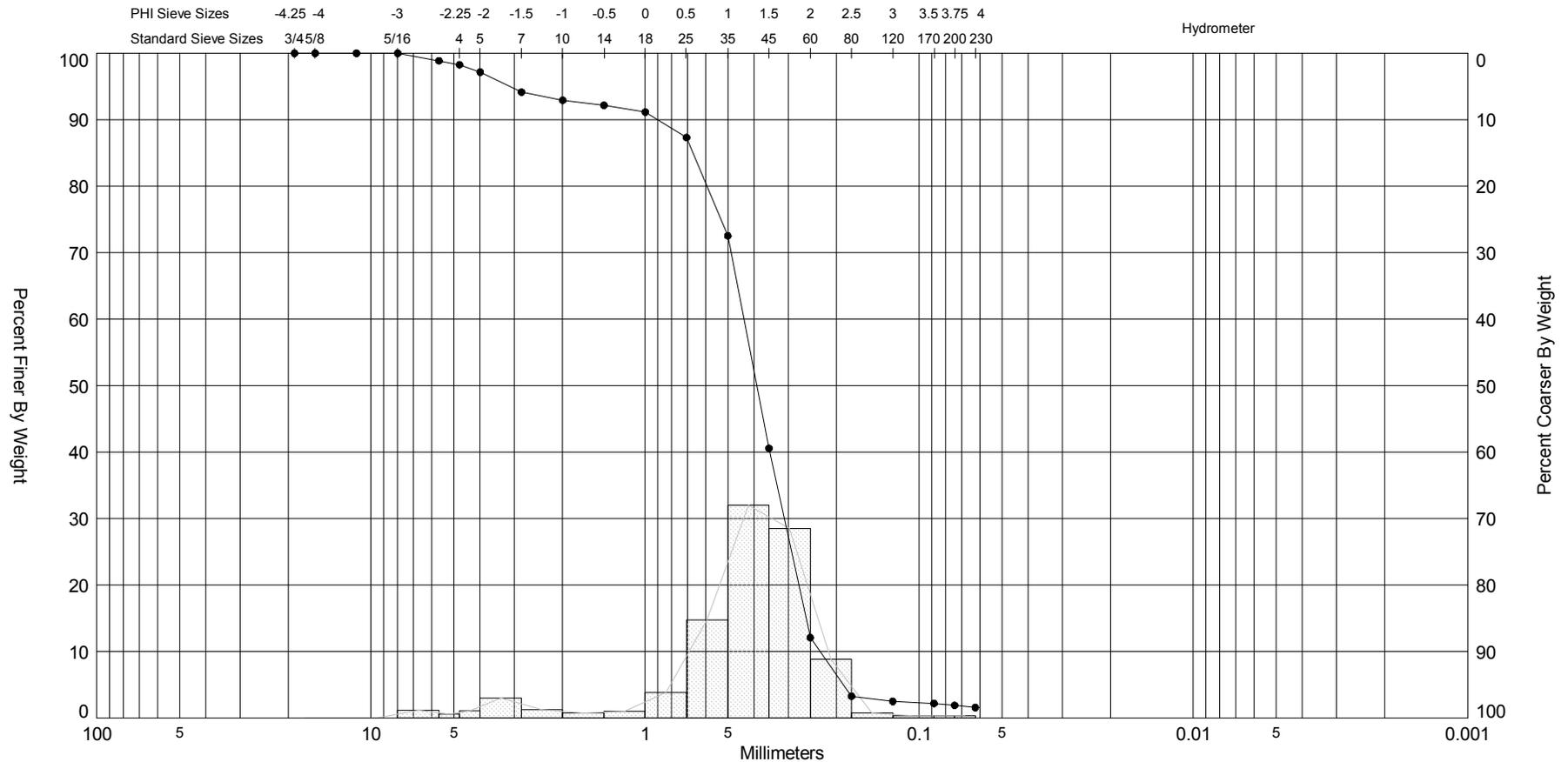
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC18 #2	—●—	-48.7	SP	#200 - 1.01 #230 - 0.97			1.25	1.19	-1.59	9.94	0.79	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-16-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	283,242
												Northing (Y, m):	843,847
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

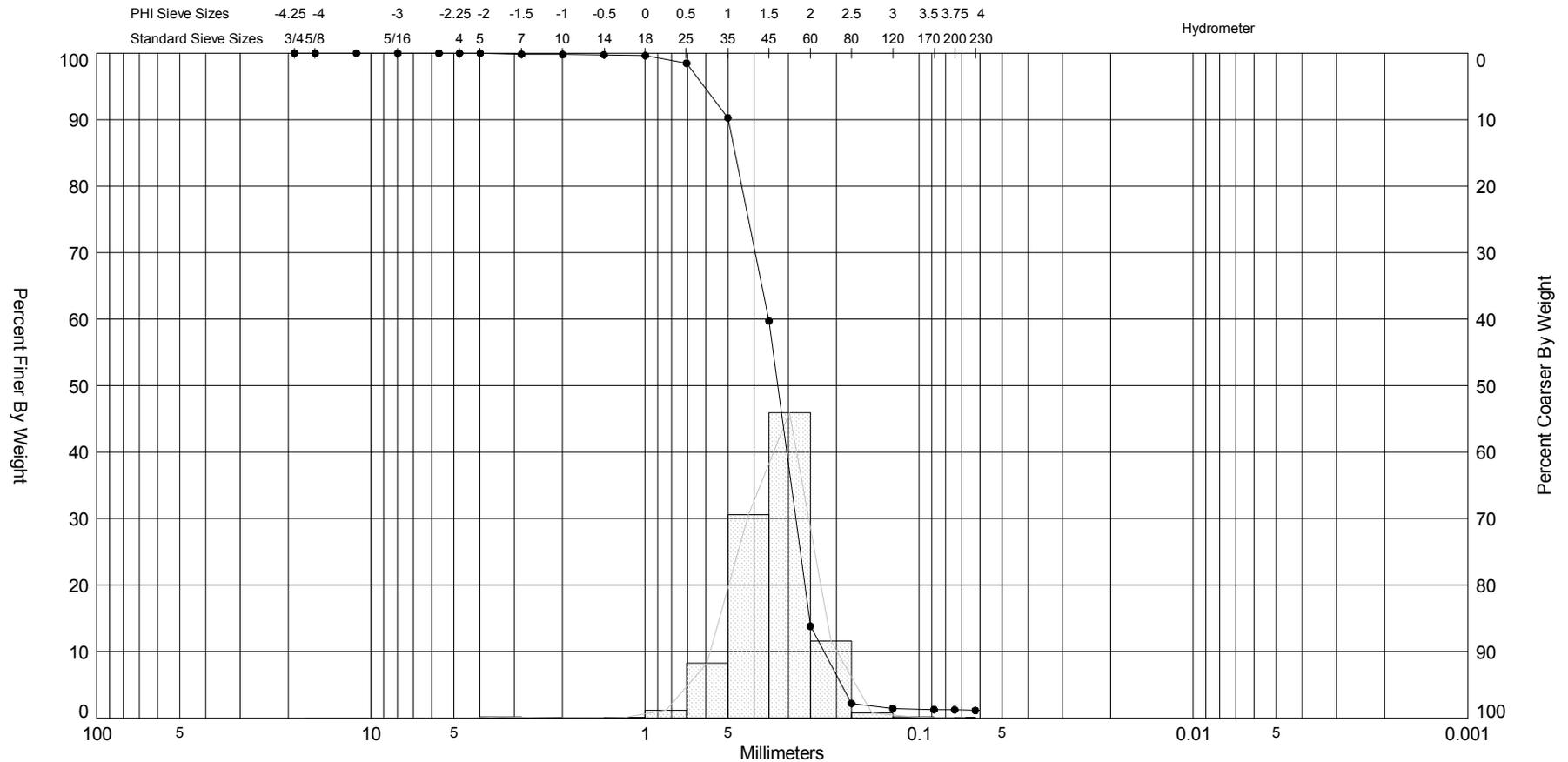
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC18 #3	—●—	-50.3	SW	#200 - 1.90 #230 - 1.59			1.35	1.14	-1.75	6.8	1.05	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-17-17
Depths and elevations based on measured values												Analyzed By:	DA
						APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102						Easting (X, m):	283,242
												Northing (Y, m):	843,847
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

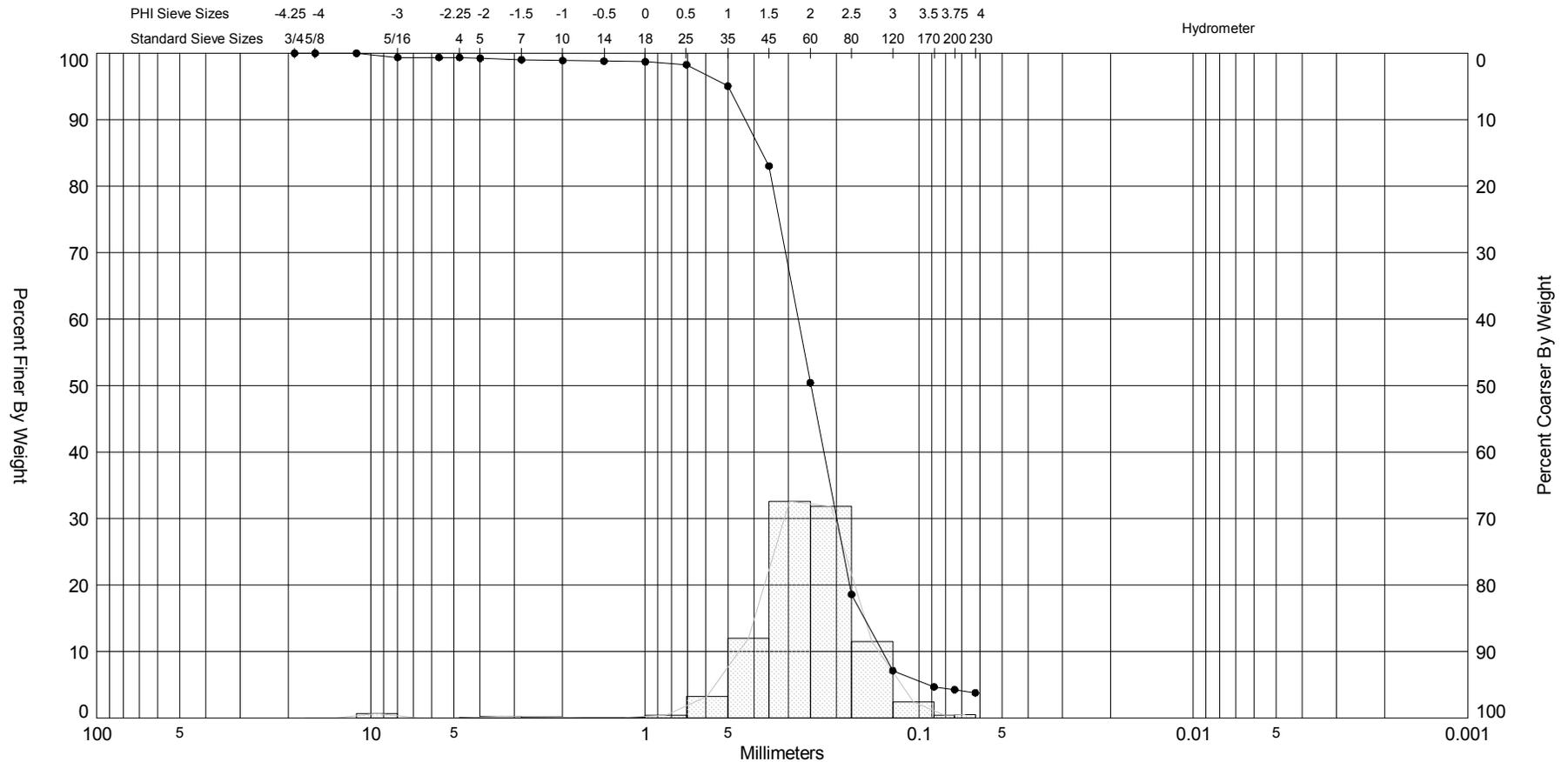
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC18 #4	—●—	-52.0	SP	#200 - 1.24 #230 - 1.13			1.61	1.56	-0.7	7.88	0.48	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-17-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	283,242
												Northing (Y, m):	843,847
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

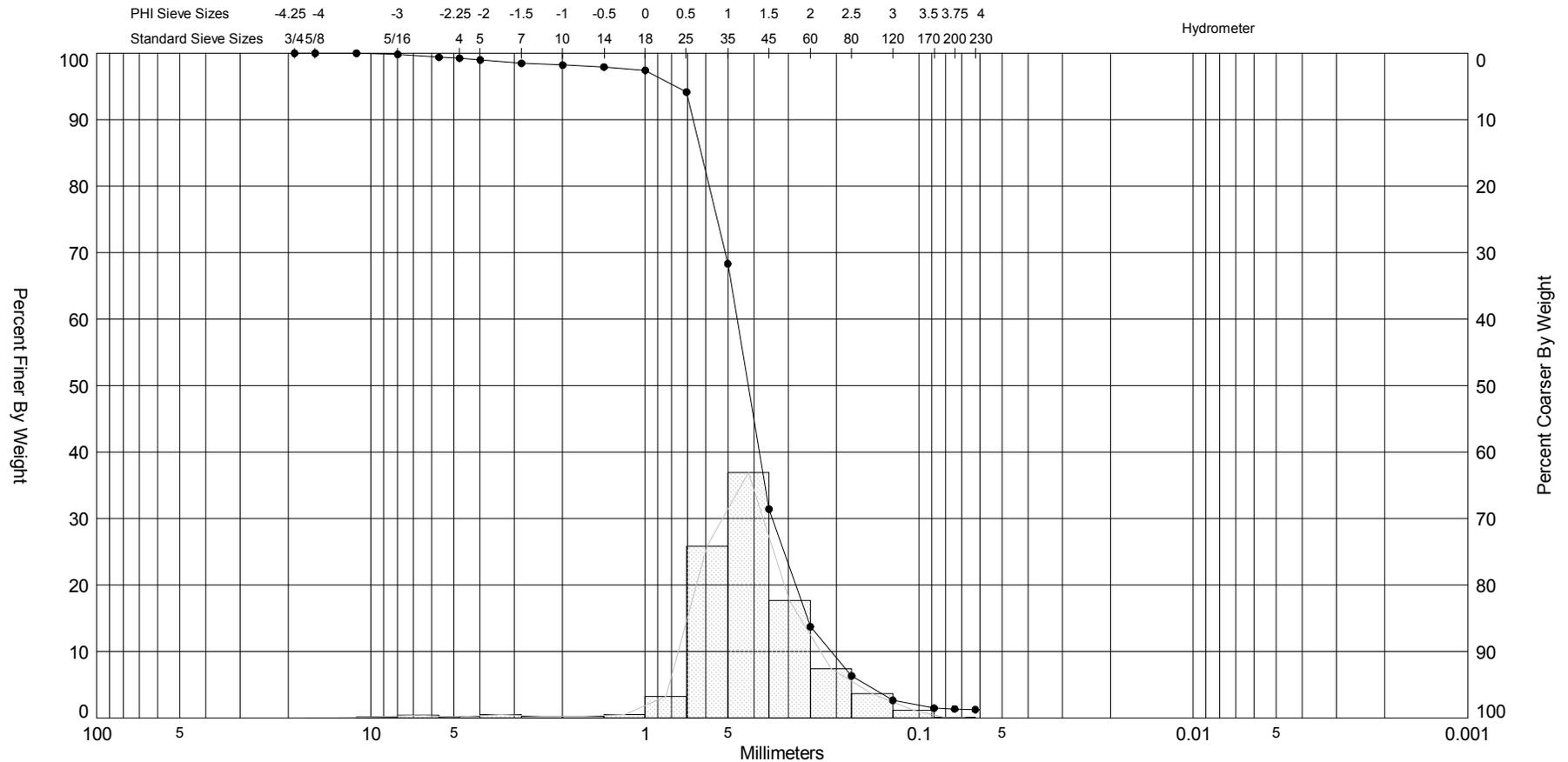
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC19 #1	—●—	-58.1	SP	#200 - 4.26 #230 - 3.79			2.01	1.93	-2.59	18.7	0.76	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-17-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	285,624
												Northing (Y, m):	840,878
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

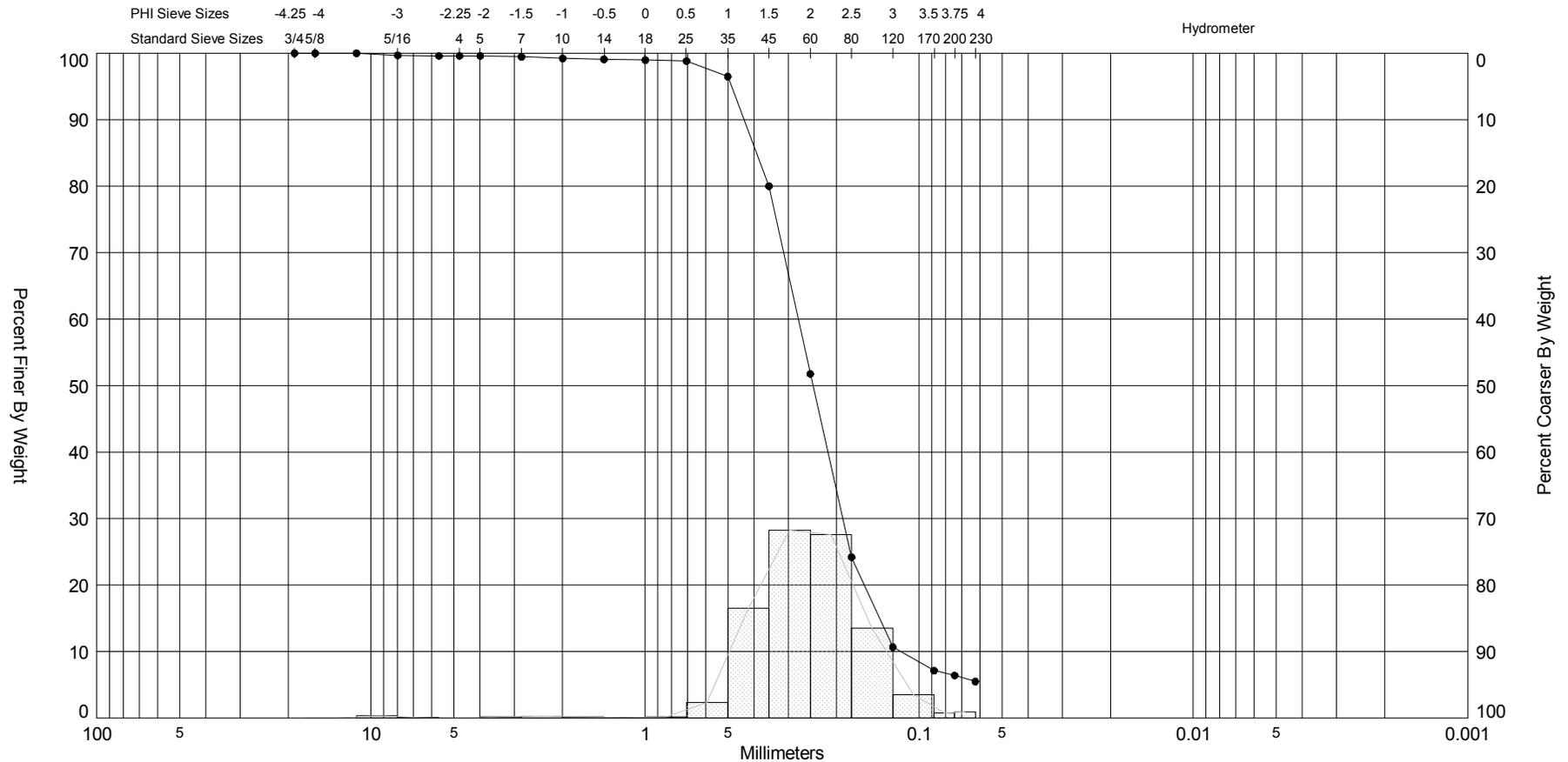
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC19 #2	—●—	-60.8	SP	#200 - 1.37 #230 - 1.27			1.25	1.26	-1.19	9.98	0.78	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-17-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	285,624
												Northing (Y, m):	840,878
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

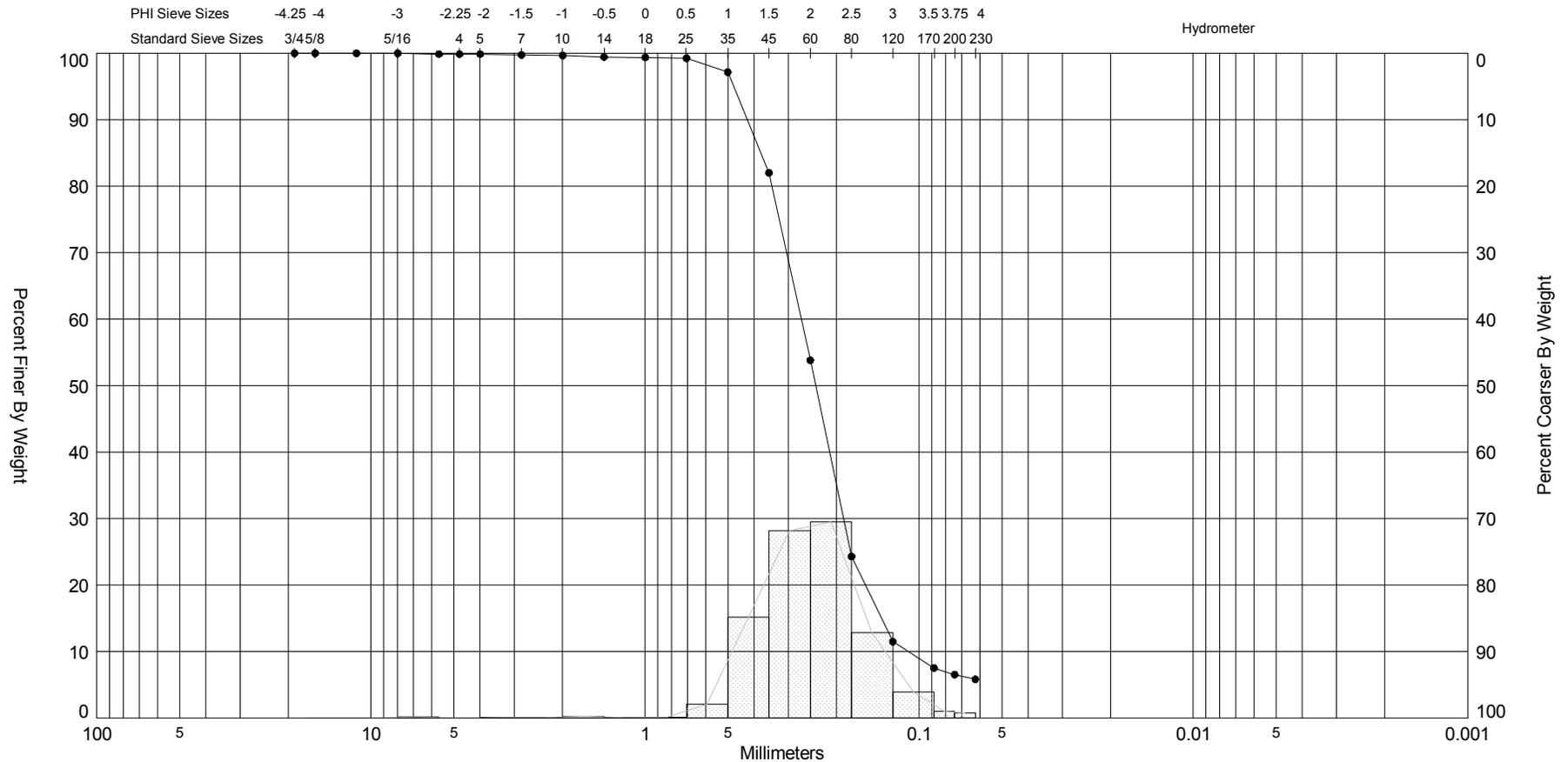
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC19 #3	—●—	-63.1	SP-SM	#200 - 6.40 #230 - 5.49			2.03	1.98	-1.59	13.45	0.74	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	285,624
												Northing (Y, m):	840,878
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

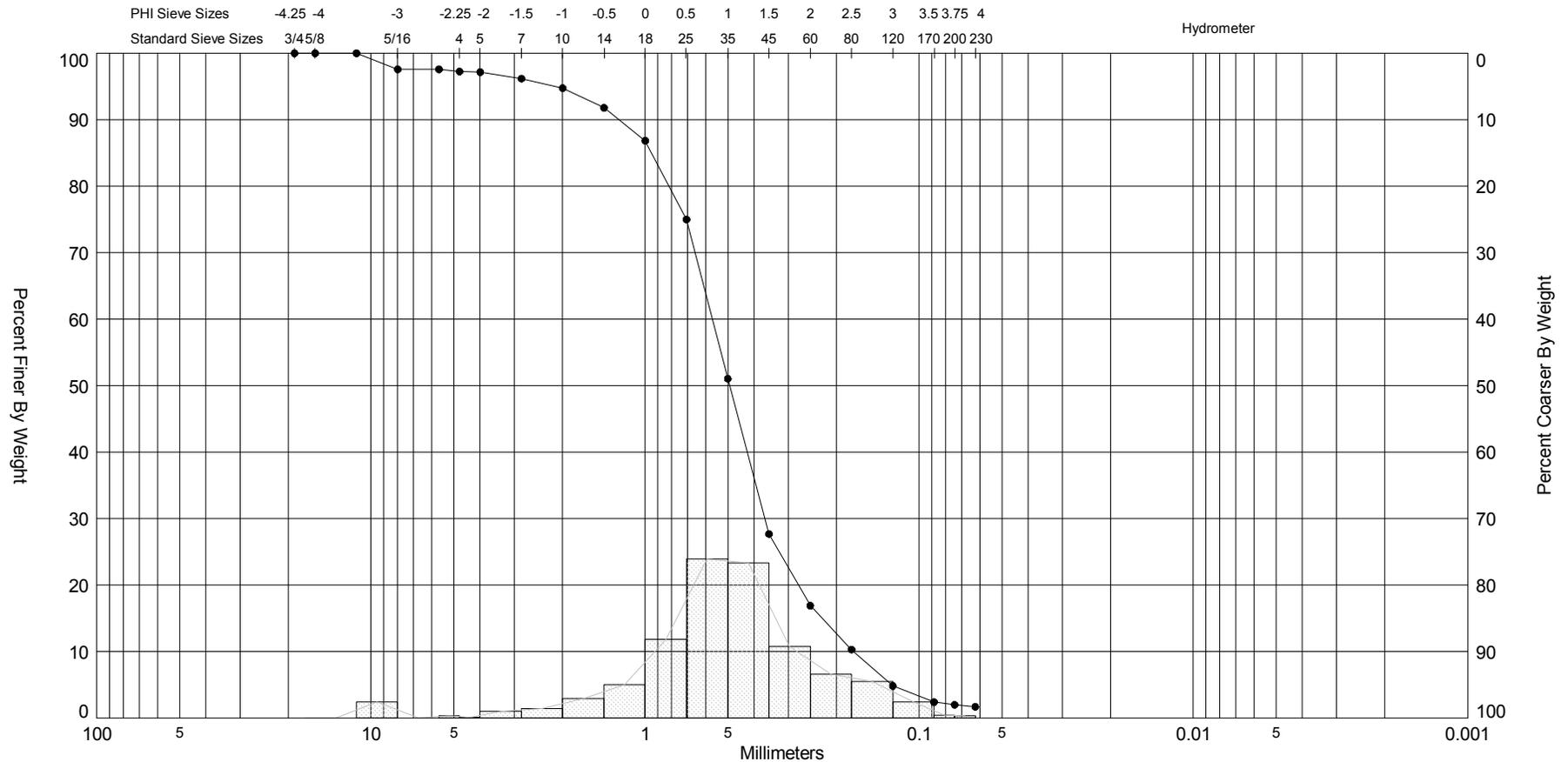
MA-CZM-2017-VC-GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC19 #4	—●—	-66.6	SP-SM	#200 - 6.53 #230 - 5.82			2.06	2.02	-0.71	8.42	0.67	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-17-17
Depths and elevations based on measured values												Analyzed By:	DA
												Easting (X, m):	285,624
												Northing (Y, m):	840,878
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88
												APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102	

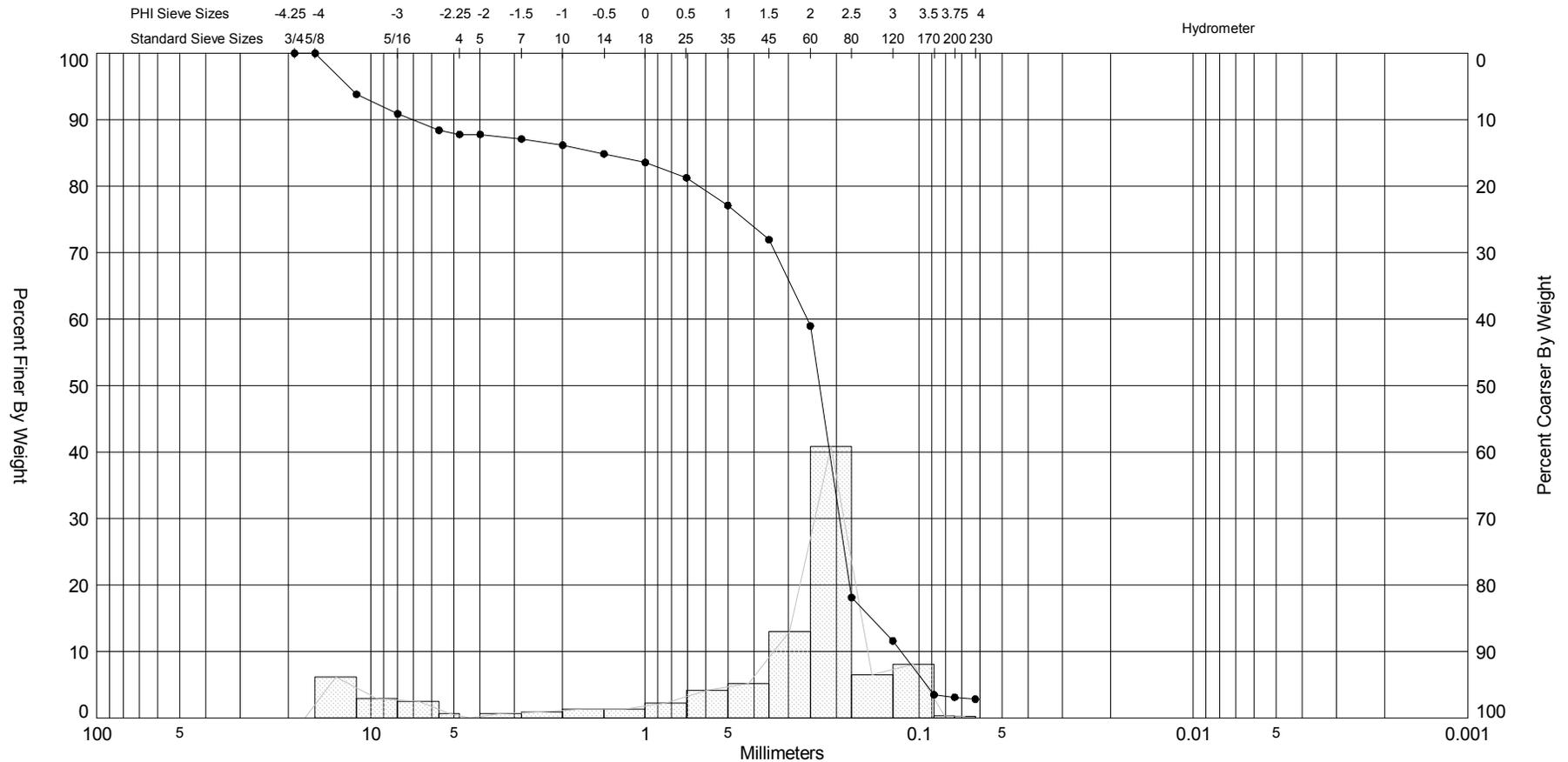
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC20 #1	—●—	-55.7	SW	#200 - 1.99 #230 - 1.69			1.02	0.95	-0.96	5.61	1.19	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
						APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102						Easting (X, m):	284,592
												Northing (Y, m):	838,399
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

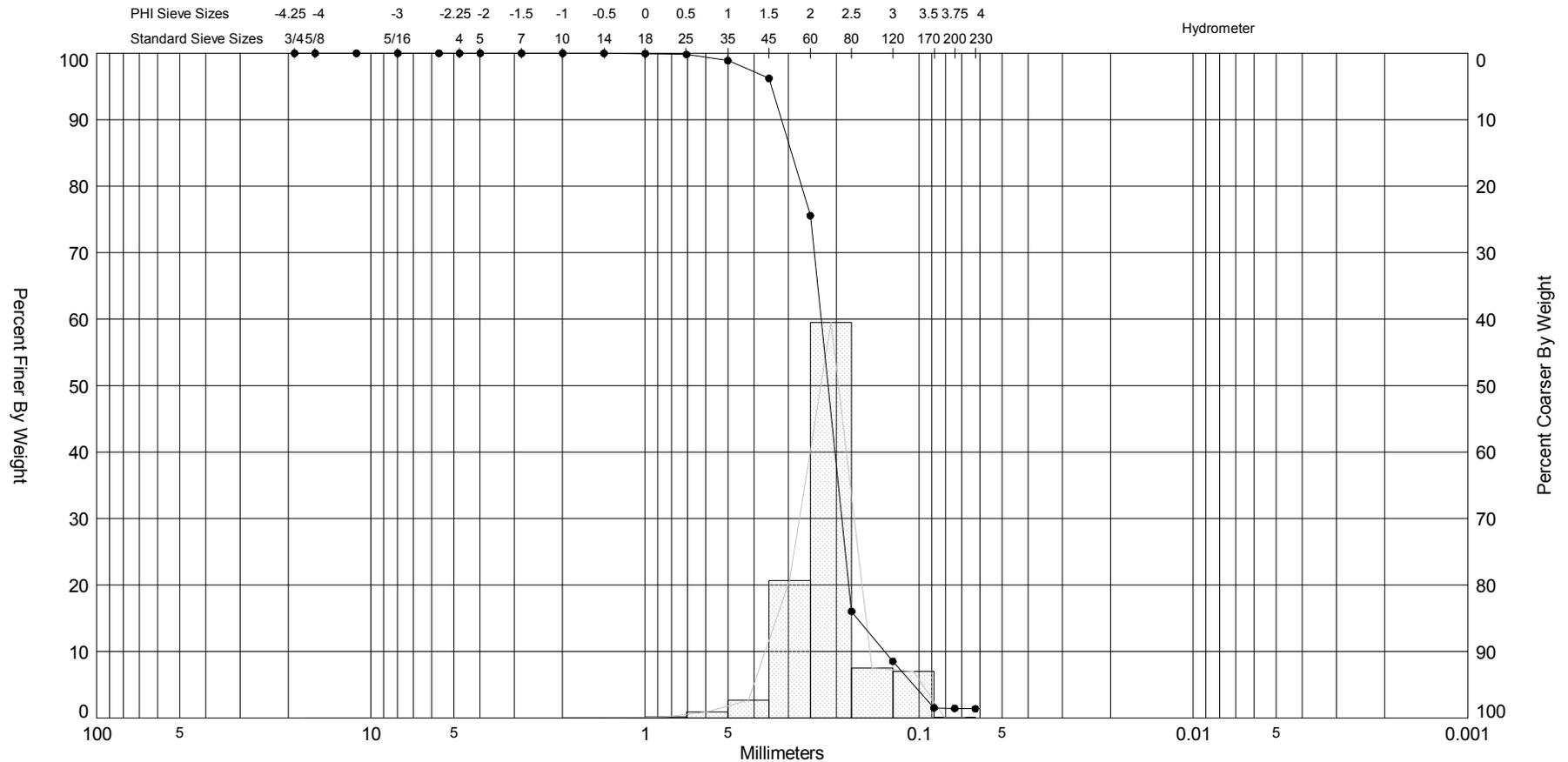
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC20 #2	—●—	-57.2	SW	#200 - 3.12 #230 - 2.83			2.11	1.31	-1.6	4.31	1.98	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	284,592
												Northing (Y, m):	838,399
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

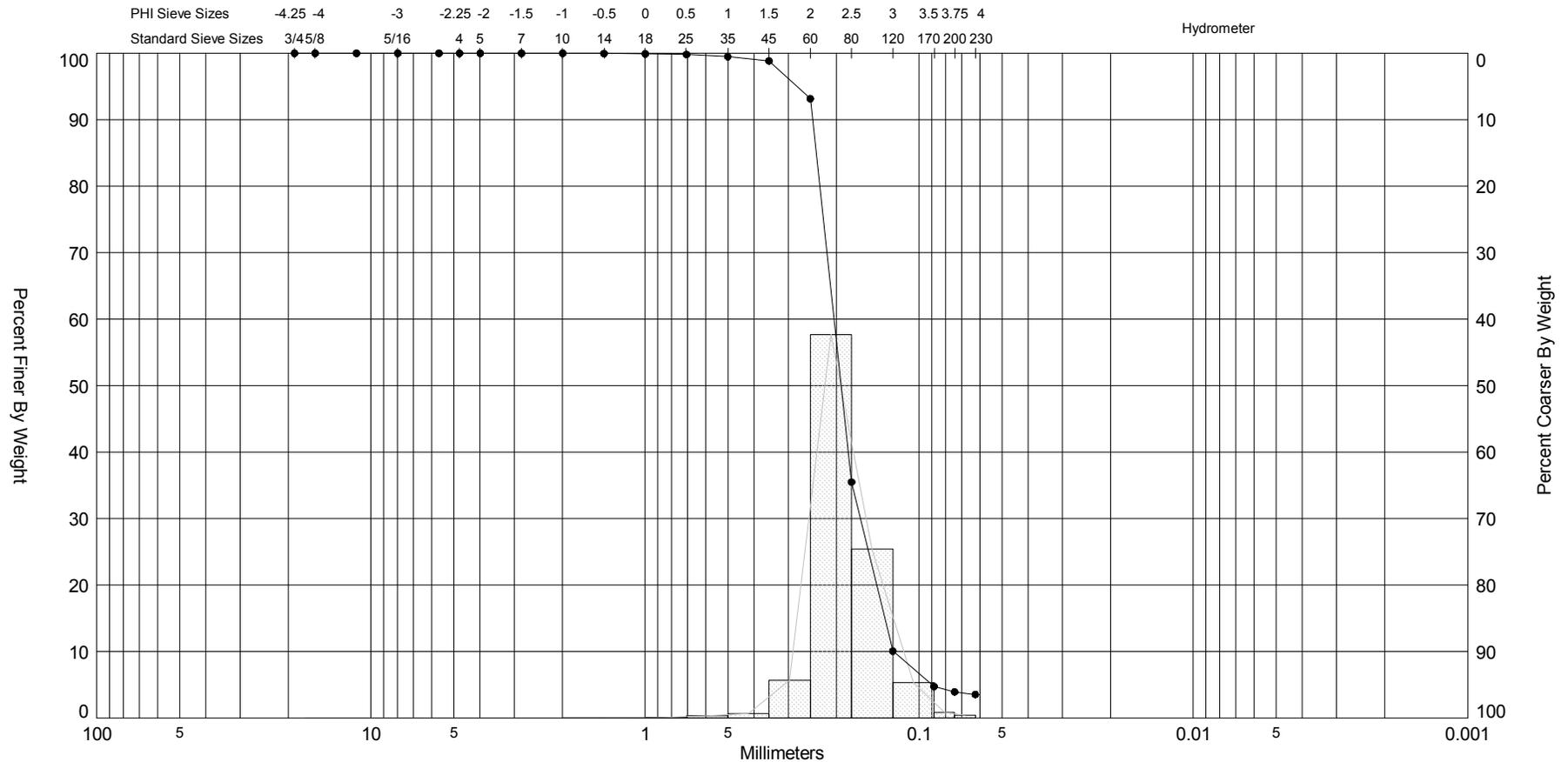
MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC20 #3	—●—	-60.9	SP	#200 - 1.45 #230 - 1.38			2.21	2.21	0.03	5.36	0.45	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	284,592
												Northing (Y, m):	838,399
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC.GPJ 12/8/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MA-CZM-2017-VC20 #4	—●—	-64.7	SP	#200 - 3.93 #230 - 3.54			2.37	2.41	-0.11	7.89	0.4	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments:												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	284,592
												Northing (Y, m):	838,399
												Horizontal Datum:	NAD 1983
												Vertical Datum:	NAVD88

MA_CZM_2017_VC.GPJ 12/8/17

Appendix E

Vibracore Photographs





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
0.0' - 2.0'



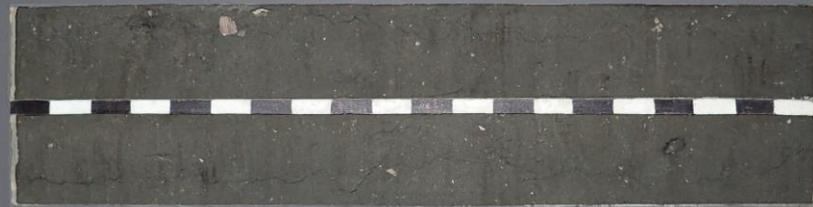
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
4.0' - 6.0'

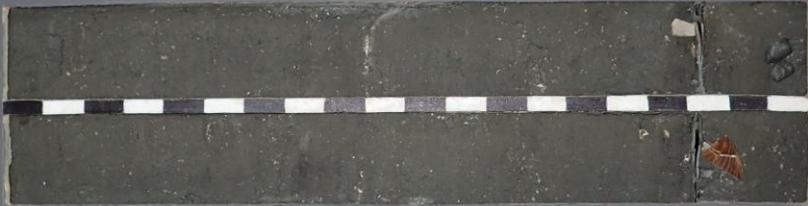


PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
6.0' - 8.0'

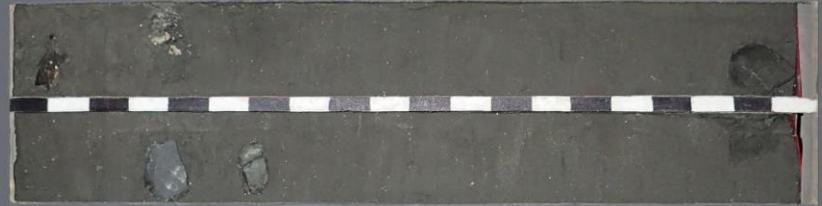




PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC01
10.0'-12.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC02
0.0' - 2.0'



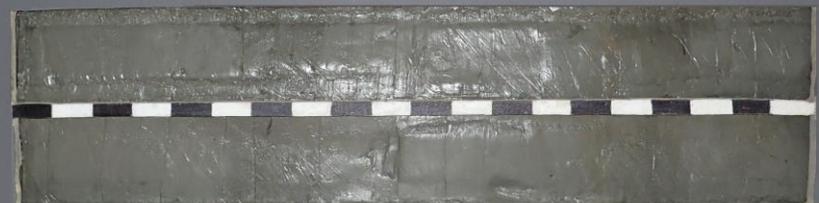
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC02
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC02
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC02
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC02
8.0' - 9.8'





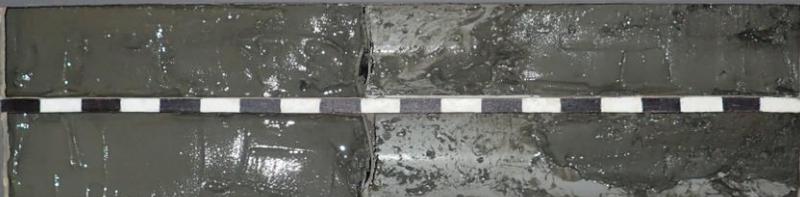
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
10.0'-12.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC03
12.0'-12.3'





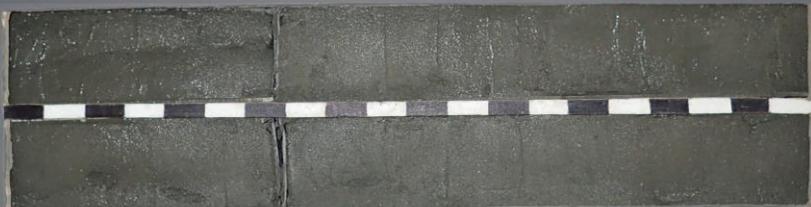
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
6.0' - 8.0'

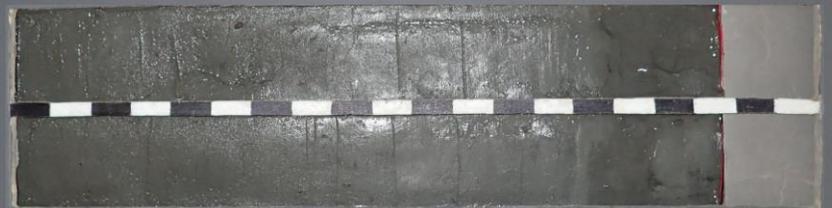




PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC04
10.0'-11.8'







PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC05
8.0' - 8.7'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
10.0'-12.0'

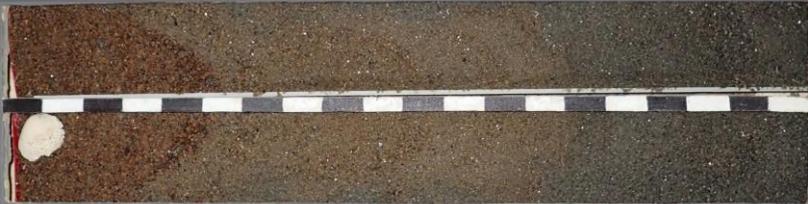


PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC06
12.0'-12.2'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
0.0' - 2.0'



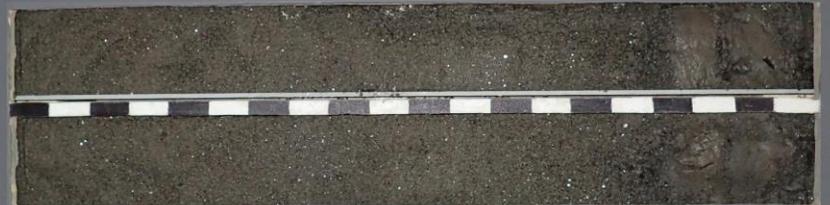
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC07
10.0'-10.8'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
10.0'-12.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC08
12.0'-12.3'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC09
10.0'-12.0'





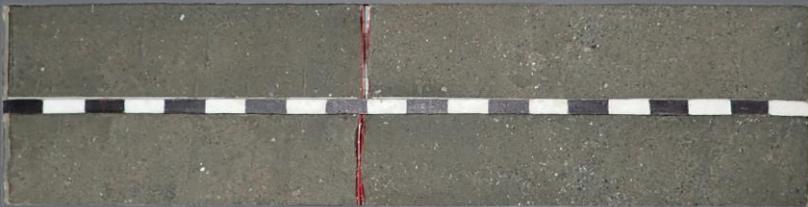
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC10
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC10
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC10
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC10
6.0' - 6.8'





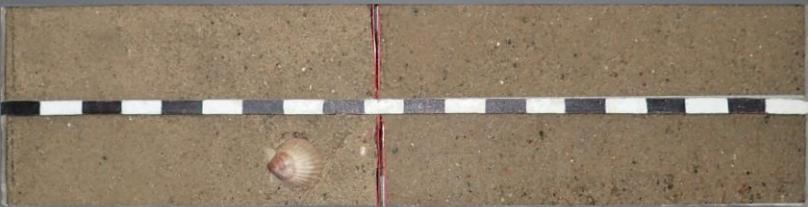
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC11
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC11
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC11
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC11
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC11
8.0' - 9.9'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC12
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC12
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC12
4.0' - 6.0'

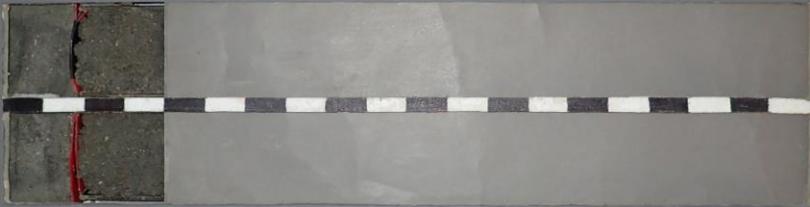


PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC12
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC12
8.0' - 8.4'





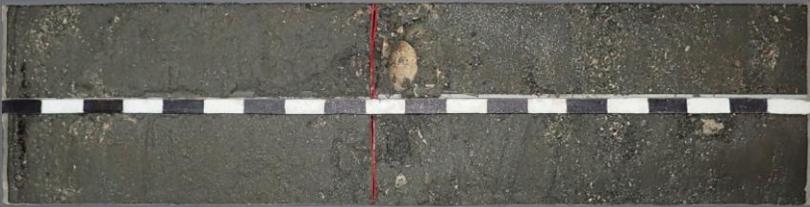
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC13
10.0'-11.5'





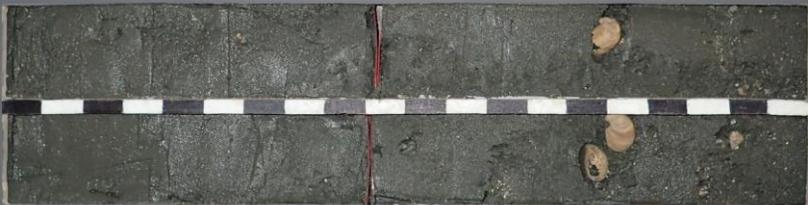
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC14
10.0'-10.5'





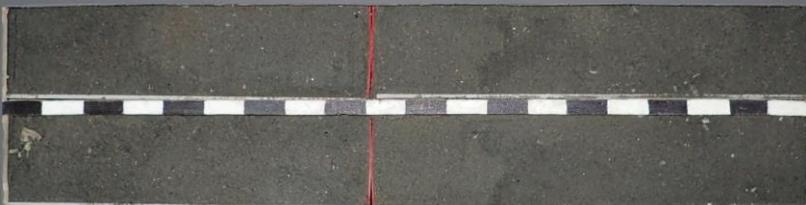
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
6.0' - 8.0'

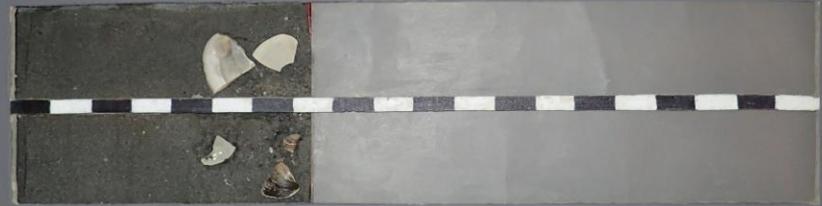




PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC15
10.0'-10.7'





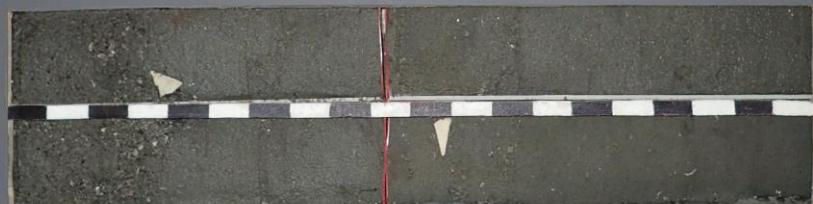
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC16
10.0'-11.2'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC17
10.0'-11.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC18
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC18
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC18
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC18
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC18
8.0'-10.0'





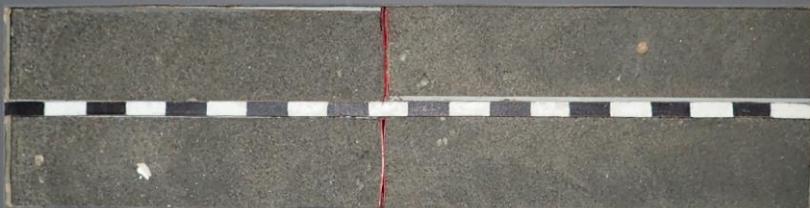
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
0.0' - 2.0'



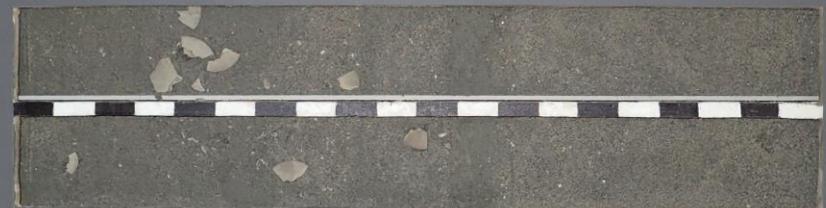
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC19
10.0'-11.5'





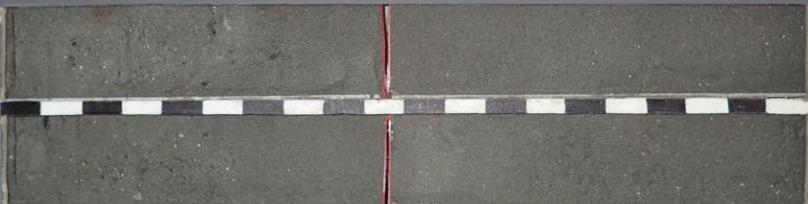
PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
0.0' - 2.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
2.0' - 4.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
4.0' - 6.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
6.0' - 8.0'





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
8.0'-10.0'



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
MA-CZM-2017-VC20
10.0'-10.8'



Appendix F

Grab Sample Logs



GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION BUZ1-G1		LOCATION COORDINATES (m) X = 232,761 Y = 802,637		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1		13. TOTAL NUMBER CORE BOXES N/A
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
6. THICKNESS OF OVERBURDEN N/A		14. ELEVATION GROUND WATER N/A		
7. DEPTH SAMPLED INTO ROCK N/A		15. DATE GRAB STARTED COMPLETED 11-09-17 08:25 11-09-17		16. ELEVATION TOP OF GRAB -57.0 Ft. (uncorrected)
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-57.0	0.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), 0.5" whole shell, olive gray (5Y-4/2), (SP).			Depth = 0.0' Mean (mm): 0.33, Phi Sorting: 0.65 Fines (230): 1.37% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS			
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A				
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>MA State Plane Mainland</td> <td>HORIZONTAL NAD 1983</td> <td>VERTICAL Raw Water</td> </tr> </table>		MA State Plane Mainland	HORIZONTAL NAD 1983	VERTICAL Raw Water
MA State Plane Mainland	HORIZONTAL NAD 1983	VERTICAL Raw Water					
2. GRAB DESIGNATION BUZ2-G2		LOCATION COORDINATES (m) X = 233,048 Y = 801,885		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler			
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED 1</td> <td>UNDISTURBED (UD)</td> </tr> </table>	DISTURBED 1	UNDISTURBED (UD)	
DISTURBED 1	UNDISTURBED (UD)						
4. NAME OF SAMPLER Chip Ryther							
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING				
13. TOTAL NUMBER CORE BOXES N/A							
14. ELEVATION GROUND WATER N/A							
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB <table border="1"> <tr> <td>STARTED 11-09-17 10:24</td> <td>COMPLETED 11-09-17</td> </tr> </table>			STARTED 11-09-17 10:24	COMPLETED 11-09-17	
STARTED 11-09-17 10:24	COMPLETED 11-09-17						
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -66.0 Ft. (uncorrected)					
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A					
18. SIGNATURE AND TITLE OF INSPECTOR KM							

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-66.0	0.0		SAND, fine grained, quartz, trace shell hash, trace silt, 0.25" shell fragment, (0.5" x 0.25") whole shell, dark greenish gray (10Y-4/1), (SP-SM).			Depth = 0.0' Mean (mm): 0.20, Phi Sorting: 0.63 Fines (230): 6.58% (SP-SM)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION BUZ6-G3		LOCATION COORDINATES (m) X = 237,499 Y = 798,970		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER N/A	
7. DEPTH SAMPLED INTO ROCK N/A			15. DATE GRAB STARTED COMPLETED 11-09-17 12:56 11-09-17	
8. TOTAL DEPTH OF GRAB N/A			16. ELEVATION TOP OF GRAB -60.0 Ft. (uncorrected)	
			17. TOTAL RECOVERY FOR GRAB N/A	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-60.0	0.0		SAND, fine grained, quartz, trace clay, trace shell hash, trace whole shell, whole shells up to (0.5" x 0.25"), (0.75" x 0.5") shell fragment, 0.25" rock, dark greenish gray (10Y-4/1), (SP-SC).			Depth = 0.0' Mean (mm): 0.20, Phi Sorting: 0.56 Fines (230): 9.75% (SP-SC)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS				
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A					
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>Raw Water</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	Raw Water
HORIZONTAL	VERTICAL							
MA State Plane Mainland	Raw Water							
2. GRAB DESIGNATION BUZ9-G4		LOCATION COORDINATES (m) X = 240,206 Y = 795,415		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler				
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>1</td> <td></td> </tr> </table>	DISTURBED	UNDISTURBED (UD)	1	
DISTURBED	UNDISTURBED (UD)							
1								
4. NAME OF SAMPLER Chip Ryther								
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A								
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB <table border="1"> <tr> <td>STARTED</td> <td>COMPLETED</td> </tr> <tr> <td>11-09-17 13:48</td> <td>11-09-17</td> </tr> </table>		STARTED	COMPLETED	11-09-17 13:48	11-09-17	16. ELEVATION TOP OF GRAB -65.0 Ft. (uncorrected)
STARTED	COMPLETED							
11-09-17 13:48	11-09-17							
7. DEPTH SAMPLED INTO ROCK N/A		17. TOTAL RECOVERY FOR GRAB N/A						
8. TOTAL DEPTH OF GRAB N/A		18. SIGNATURE AND TITLE OF INSPECTOR KM						

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-65.0	0.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.5" x 0.25"), (0.5" x 0.25") whole shell, olive brown (2.5Y-4/3), (SP).			Depth = 0.0' Mean (mm): 0.27, Phi Sorting: 0.49 Fines (230): 1.72% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

Grab Designation BUZ10-G5

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION BUZ10-G5		LOCATION COORDINATES (m) X = 240,288 Y = 792,641		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 11-09-17 15:39 11-09-17		
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -77.0 Ft. (uncorrected)		
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-77.0	0.0		SAND, fine grained, quartz, trace silt, 0.25" whole shell, dark gray (2.5Y-4/1), (SP).			Depth = 0.0' Mean (mm): 0.19, Phi Sorting: 0.52 Fines (230): 3.90% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS			
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A				
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>MA State Plane Mainland</td> <td>HORIZONTAL NAD 1983</td> <td>VERTICAL Raw Water</td> </tr> </table>		MA State Plane Mainland	HORIZONTAL NAD 1983	VERTICAL Raw Water
MA State Plane Mainland	HORIZONTAL NAD 1983	VERTICAL Raw Water					
2. GRAB DESIGNATION CANAL9-G1		LOCATION COORDINATES (m) X = 285,716 Y = 837,977		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler			
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.					
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED 1</td> <td>UNDISTURBED (UD)</td> </tr> </table>		DISTURBED 1	UNDISTURBED (UD)	
DISTURBED 1	UNDISTURBED (UD)						
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A				
DEG. FROM VERTICAL			14. ELEVATION GROUND WATER N/A				
BEARING			15. DATE GRAB <table border="1"> <tr> <td>STARTED 08-03-17 09:08</td> <td>COMPLETED 08-03-17</td> </tr> </table>		STARTED 08-03-17 09:08	COMPLETED 08-03-17	
STARTED 08-03-17 09:08	COMPLETED 08-03-17						
6. THICKNESS OF OVERBURDEN N/A			16. ELEVATION TOP OF GRAB -52.5 Ft. (uncorrected)				
7. DEPTH SAMPLED INTO ROCK N/A			17. TOTAL RECOVERY FOR GRAB N/A				
8. TOTAL DEPTH OF GRAB N/A			18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-52.5	0.0		SAND, fine grained, quartz, trace shell hash, trace silt, 2 (0.25" x 0.5") shell fragments, 1.75" whole shell, olive gray (5Y-4/2), (SP).			Depth = 0.0' Mean (mm): 0.21, Phi Sorting: 0.48 Fines (230): 3.09% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

Grab Designation CANAL7-G2

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS						
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A							
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>NAD 1983</td> </tr> <tr> <td></td> <td>Raw Water</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	NAD 1983		Raw Water
HORIZONTAL	VERTICAL									
MA State Plane Mainland	NAD 1983									
	Raw Water									
2. GRAB DESIGNATION CANAL7-G2		LOCATION COORDINATES (m) X = 285,206 Y = 840,521		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler						
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>1</td> <td></td> </tr> </table>	DISTURBED	UNDISTURBED (UD)	1			
DISTURBED	UNDISTURBED (UD)									
1										
4. NAME OF SAMPLER Chip Ryther										
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES N/A						
14. ELEVATION GROUND WATER N/A										
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB <table border="1"> <tr> <td>STARTED</td> <td>COMPLETED</td> </tr> <tr> <td>08-03-17 09:26</td> <td>08-03-17</td> </tr> </table>		STARTED	COMPLETED	08-03-17 09:26	08-03-17	16. ELEVATION TOP OF GRAB -62.0 Ft. (uncorrected)		
STARTED	COMPLETED									
08-03-17 09:26	08-03-17									
7. DEPTH SAMPLED INTO ROCK N/A		17. TOTAL RECOVERY FOR GRAB N/A								
8. TOTAL DEPTH OF GRAB N/A		18. SIGNATURE AND TITLE OF INSPECTOR KM								

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-62.0	0.0		SAND, fine to medium grained, quartz, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), rocks up to 0.25", (1.25" x 0.5") shell fragment, grayish brown (2.5Y-5/2), (SP).			Depth = 0.0' Mean (mm): 0.43, Phi Sorting: 0.65 Fines (230): 1.40% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION CANAL2-G3		LOCATION COORDINATES (m) X = 283,004 Y = 844,584		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther				12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED				13. TOTAL NUMBER CORE BOXES N/A
6. THICKNESS OF OVERBURDEN N/A				14. ELEVATION GROUND WATER N/A
7. DEPTH SAMPLED INTO ROCK N/A				15. DATE GRAB STARTED COMPLETED 08-03-17 09:49 08-03-17
8. TOTAL DEPTH OF GRAB N/A				16. ELEVATION TOP OF GRAB -46.0 Ft. (uncorrected)
17. TOTAL RECOVERY FOR GRAB N/A				18. SIGNATURE AND TITLE OF INSPECTOR KM

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-46.0	0.0		SAND, fine to medium grained, quartz, trace coarse grains, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", (1.0" x 0.5") shell fragment, grayish brown (2.5Y-5/2), (SP).			Depth = 0.0' Mean (mm): 0.51, Phi Sorting: 0.51 Fines (230): 1.41% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

Grab Designation CANAL4-G4A

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION CANAL4-G4A		LOCATION COORDINATES (m) X = 283,105 Y = 842,255		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES N/A
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 08-03-17 10:09 08-03-17		16. ELEVATION TOP OF GRAB -46.0 Ft. (uncorrected)
7. DEPTH SAMPLED INTO ROCK N/A		17. TOTAL RECOVERY FOR GRAB N/A		
8. TOTAL DEPTH OF GRAB N/A		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-46.0	0.0		SAND, fine to medium grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5", (2.0" x 0.5") shell fragment, (1.0" x 0.5") shell fragment, olive gray (5Y-4/2), (SW).			Depth = 0.0' Mean (mm): 0.43, Phi Sorting: 0.89 Fines (230): 2.49% (SW)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION CANAL6-G5		LOCATION COORDINATES (m) X = 283,539 Y = 839,631		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
DEG. FROM VERTICAL BEARING			14. ELEVATION GROUND WATER N/A	
6. THICKNESS OF OVERBURDEN N/A			15. DATE GRAB STARTED COMPLETED 08-03-17 10:28 08-03-17	
7. DEPTH SAMPLED INTO ROCK N/A			16. ELEVATION TOP OF GRAB -55.0 Ft. (uncorrected)	
8. TOTAL DEPTH OF GRAB N/A			17. TOTAL RECOVERY FOR GRAB N/A	
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-55.0	0.0		Sandy CLAY, very soft, (0.5" x 0.25") whole shell, very dark greenish gray (10Y-3/1), (CL).			Depth = 0.0' NS

MA_CZM_2017_GRABS.GPJ 12/5/17

Grab Designation DUX3-G1

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION DUX3-G1		LOCATION COORDINATES (m) X = 278,992 Y = 871,888		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 11-06-17 08:37 11-06-17		
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -101.0 Ft. (uncorrected)		
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-101.0	0.0		SAND, fine to medium grained, quartz, trace coarse grains, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), 0.25" rock, dark grayish brown (2.5Y-4/2), (SP).			Depth = 0.0' Mean (mm): 0.39, Phi Sorting: 0.61 Fines (230): 0.95% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION DUX4-G2		LOCATION COORDINATES (m) X = 276,756 Y = 871,868		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER N/A	
7. DEPTH SAMPLED INTO ROCK N/A			15. DATE GRAB STARTED COMPLETED 11-06-17 08:54 11-06-17	
8. TOTAL DEPTH OF GRAB N/A			16. ELEVATION TOP OF GRAB -82.0 Ft. (uncorrected)	
			17. TOTAL RECOVERY FOR GRAB N/A	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-82.0	0.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), (2.25" x 2.0") whole shell, dark gray (5Y-4/1), (SP).			Depth = 0.0' Mean (mm): 0.20, Phi Sorting: 0.49 Fines (230): 2.54% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

Grab Designation DUX7-G3A

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION DUX7-G3A		LOCATION COORDINATES (m) X = 274,738 Y = 867,514		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
DEG. FROM VERTICAL BEARING			14. ELEVATION GROUND WATER N/A	
6. THICKNESS OF OVERBURDEN N/A			15. DATE GRAB STARTED COMPLETED 11-06-17 09:25 11-06-17	
7. DEPTH SAMPLED INTO ROCK N/A			16. ELEVATION TOP OF GRAB -66.0 Ft. (uncorrected)	
8. TOTAL DEPTH OF GRAB N/A			17. TOTAL RECOVERY FOR GRAB N/A	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-66.0	0.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to 0.5"; 2 (1.0" x 0.5") shell fragments, 2 (0.25") whole shells, 0.25" rock, olive gray (5Y-4/2), (SP).			Depth = 0.0' Mean (mm): 0.22, Phi Sorting: 0.57 Fines (230): 2.75% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION DUX9-G4		LOCATION COORDINATES (m) X = 276,697 Y = 865,531		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
DEG. FROM VERTICAL BEARING			14. ELEVATION GROUND WATER N/A	
6. THICKNESS OF OVERBURDEN N/A			15. DATE GRAB STARTED COMPLETED 11-06-17 09:41 11-06-17	
7. DEPTH SAMPLED INTO ROCK N/A			16. ELEVATION TOP OF GRAB -88.0 Ft. (uncorrected)	
8. TOTAL DEPTH OF GRAB N/A			17. TOTAL RECOVERY FOR GRAB N/A	
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-88.0	0.0		SAND, fine grained, quartz, little silt, trace rock, trace shell hash, rocks up to 0.5", 2 (0.75" x 0.5") rocks, 0.75" and 1.5" shell fragments, greenish black (10Y-2.5/1), (SM).			Depth = 0.0' Mean (mm): 0.18, Phi Sorting: 1.59 Fines (230): 16.18% (SM)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION DUX6-G5		LOCATION COORDINATES (m) X = 277,206 Y = 863,108		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES N/A
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 11-06-17 09:58 11-06-17		16. ELEVATION TOP OF GRAB -95.0 Ft. (uncorrected)
7. DEPTH SAMPLED INTO ROCK N/A		17. TOTAL RECOVERY FOR GRAB N/A		
8. TOTAL DEPTH OF GRAB N/A		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-95.0	0.0		Clayey SAND, fine grained, quartz, trace rock, trace shell fragments, trace shell hash, shell fragments and rocks up to (0.75" x 0.5"), (2.75" x 1.75") shell fragment, greenish black (10Y-2.5/1), (SC).			Depth = 0.0' NS

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS				
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A					
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>NAD 1983 Raw Water</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	NAD 1983 Raw Water
HORIZONTAL	VERTICAL							
MA State Plane Mainland	NAD 1983 Raw Water							
2. GRAB DESIGNATION HULL4-G1		LOCATION COORDINATES (m) X = 263,324 Y = 897,006		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler				
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>1</td> <td></td> </tr> </table>	DISTURBED	UNDISTURBED (UD)	1	
DISTURBED	UNDISTURBED (UD)							
1								
4. NAME OF SAMPLER Chip Ryther								
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING					
13. TOTAL NUMBER CORE BOXES N/A								
14. ELEVATION GROUND WATER N/A								
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB <table border="1"> <tr> <td>STARTED</td> <td>COMPLETED</td> </tr> <tr> <td>08-17-17 12:03</td> <td>08-17-17</td> </tr> </table>			STARTED	COMPLETED	08-17-17 12:03	08-17-17
STARTED	COMPLETED							
08-17-17 12:03	08-17-17							
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -122.0 Ft. (uncorrected)						
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A						
18. SIGNATURE AND TITLE OF INSPECTOR KM								

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-122.0	0.0		SAND, fine grained, quartz, little silt, trace coarse grains, trace rock, rocks up to (0.75" x 0.5"), 0.25" whole shell, dark gray (2.5Y-4/1), (SW-SM).			Depth = 0.0' Mean (mm): 0.19, Phi Sorting: 1.20 Fines (230): 10.51% (SW-SM)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION HULL5-G2		LOCATION COORDINATES (m) X = 262,609 Y = 898,061		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 08-17-17 12:18 08-17-17		
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -110.0 Ft. (uncorrected)		
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-110.0	0.0		SAND, fine grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments and rocks up to (0.75" x 0.5"), 0.75" and 0.5" whole shells, very dark grayish brown (2.5Y-3/2), (SW-SM).			Depth = 0.0' Mean (mm): 0.34, Phi Sorting: 1.82 Fines (230): 5.19% (SW-SM)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION HULL7-G3A		LOCATION COORDINATES (m) X = 261,231 Y = 898,100		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
6. THICKNESS OF OVERBURDEN N/A			14. ELEVATION GROUND WATER N/A	
7. DEPTH SAMPLED INTO ROCK N/A			15. DATE GRAB STARTED COMPLETED 08-17-17 12:46 08-17-17	
8. TOTAL DEPTH OF GRAB N/A			16. ELEVATION TOP OF GRAB -101.0 Ft. (uncorrected)	
			17. TOTAL RECOVERY FOR GRAB N/A	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-101.0	0.0		SAND, fine grained, quartz, trace coarse grains, trace rock, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.75" x 0.5"), rocks up to (1.25" x 1.0"), (2.0" x 1.25") rock, (2.0" x 1.0") rock, 2 (1.0") whole shells, dark gray (2.5Y-4/1), (SW-SM).			Depth = 0.0' Mean (mm): 0.23, Phi Sorting: 1.39 Fines (230): 4.28% (SW-SM)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS						
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A							
			10. COORDINATE SYSTEM/DATUM <table border="1"> <tr> <td>HORIZONTAL</td> <td>VERTICAL</td> </tr> <tr> <td>MA State Plane Mainland</td> <td>NAD 1983</td> </tr> <tr> <td></td> <td>Raw Water</td> </tr> </table>		HORIZONTAL	VERTICAL	MA State Plane Mainland	NAD 1983		Raw Water
HORIZONTAL	VERTICAL									
MA State Plane Mainland	NAD 1983									
	Raw Water									
2. GRAB DESIGNATION HULL2-G4		LOCATION COORDINATES (m) X = 257,862 Y = 896,014		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler						
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES <table border="1"> <tr> <td>DISTURBED</td> <td>UNDISTURBED (UD)</td> </tr> <tr> <td>1</td> <td></td> </tr> </table>	DISTURBED	UNDISTURBED (UD)	1			
DISTURBED	UNDISTURBED (UD)									
1										
4. NAME OF SAMPLER Chip Ryther										
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING							
13. TOTAL NUMBER CORE BOXES N/A										
14. ELEVATION GROUND WATER N/A										
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB <table border="1"> <tr> <td>STARTED</td> <td>COMPLETED</td> </tr> <tr> <td>08-17-17 13:06</td> <td>08-17-17</td> </tr> </table>			STARTED	COMPLETED	08-17-17 13:06	08-17-17		
STARTED	COMPLETED									
08-17-17 13:06	08-17-17									
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -72.0 Ft. (uncorrected)								
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A								
18. SIGNATURE AND TITLE OF INSPECTOR KM										

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-72.0	0.0		SAND, fine grained, quartz, trace silt, (0.5" x 0.25") shell fragment and rock, 0.25" shell fragment, very dark grayish brown (2.5Y-3/2), (SP).			Depth = 0.0' Mean (mm): 0.24, Phi Sorting: 0.46 Fines (230): 2.36% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION HULL1-G5A		LOCATION COORDINATES (m) X = 257,135 Y = 895,878		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther				12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED				13. TOTAL NUMBER CORE BOXES N/A
6. THICKNESS OF OVERBURDEN N/A				14. ELEVATION GROUND WATER N/A
7. DEPTH SAMPLED INTO ROCK N/A				15. DATE GRAB STARTED COMPLETED 08-17-17 13:24 08-17-17
8. TOTAL DEPTH OF GRAB N/A				16. ELEVATION TOP OF GRAB -69.0 Ft. (uncorrected)
17. TOTAL RECOVERY FOR GRAB N/A				18. SIGNATURE AND TITLE OF INSPECTOR KM

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-69.0	0.0		SAND, fine grained, quartz, trace shell fragments, trace shell hash, trace silt, shell fragments up to (0.5" x 0.25"), 2 (0.5") whole shells, very dark grayish brown (2.5Y-3/2), (SP).			Depth = 0.0' Mean (mm): 0.28, Phi Sorting: 0.58 Fines (230): 2.28% (SP)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION MER10-G1		LOCATION COORDINATES (m) X = 261,287 Y = 946,847		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	13. TOTAL NUMBER CORE BOXES N/A
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 09-13-17 12:45 09-13-17		16. ELEVATION TOP OF GRAB -84.0 Ft. (uncorrected)
7. DEPTH SAMPLED INTO ROCK N/A		17. TOTAL RECOVERY FOR GRAB N/A		
8. TOTAL DEPTH OF GRAB N/A		18. SIGNATURE AND TITLE OF INSPECTOR KM		

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-84.0	0.0		SAND, medium to coarse grained, quartz, trace rock, trace silt, rocks up to 0.5", (1.0" x 0.75") rock, 1.0" whole shell, dark yellowish brown (10YR-3/4), (SW).			Depth = 0.0' Mean (mm): 1.15, Phi Sorting: 1.09 Fines (230): 0.39% (SW)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION MER8-G2		LOCATION COORDINATES (m) X = 260,292 Y = 948,669		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther			12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0	
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES N/A	
DEG. FROM VERTICAL BEARING			14. ELEVATION GROUND WATER N/A	
6. THICKNESS OF OVERBURDEN N/A			15. DATE GRAB STARTED COMPLETED 09-13-17 13:08 09-13-17	
7. DEPTH SAMPLED INTO ROCK N/A			16. ELEVATION TOP OF GRAB -83.0 Ft. (uncorrected)	
8. TOTAL DEPTH OF GRAB N/A			17. TOTAL RECOVERY FOR GRAB N/A	
			18. SIGNATURE AND TITLE OF INSPECTOR KM	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-83.0	0.0		SAND, fine to coarse grained, quartz, trace clay, trace rock, trace shell hash, rocks up to (0.75" x 0.5"), (1.25" x 0.5") shell fragment, very dark grayish brown (10YR-3/2), (SW).			Depth = 0.0' Mean (mm): 1.00, Phi Sorting: 1.12 Fines (230): 1.65% (SW)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION MER7-G3B		LOCATION COORDINATES (m) X = 261,487 Y = 949,990		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 09-13-17 13:30 09-13-17		
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -98.0 Ft. (uncorrected)		
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-98.0	0.0		SAND, medium to coarse grained, quartz, trace rock, trace silt, rocks up to 0.5", 2 (0.75" x 0.5") rocks, dark yellowish brown (10YR-3/4), (SW).			Depth = 0.0' VS: MER10-G1

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION MER4-G4		LOCATION COORDINATES (m) X = 260,341 Y = 953,193		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1
4. NAME OF SAMPLER Chip Ryther				
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG. FROM VERTICAL	BEARING	
13. TOTAL NUMBER CORE BOXES N/A				
14. ELEVATION GROUND WATER N/A				
6. THICKNESS OF OVERBURDEN N/A		15. DATE GRAB STARTED COMPLETED 09-13-17 13:58 09-13-17		
7. DEPTH SAMPLED INTO ROCK N/A		16. ELEVATION TOP OF GRAB -95.0 Ft. (uncorrected)		
8. TOTAL DEPTH OF GRAB N/A		17. TOTAL RECOVERY FOR GRAB N/A		
18. SIGNATURE AND TITLE OF INSPECTOR KM				

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-95.0	0.0		SAND, medium grained, quartz, trace coarse grains, trace rock, trace silt, rocks up to 0.5", 0.25" shell fragment, (0.75" x 0.5") shell fragment, very dark grayish brown (10YR-3/2), (SW).			Depth = 0.0' Mean (mm): 0.93, Phi Sorting: 1.12 Fines (230): 0.92% (SW)

MA_CZM_2017_GRABS.GPJ 12/5/17

GRAB LOG		DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT Preliminary Characterization of Offshore Sand Resources in Selected Study Areas			9. SIZE AND TYPE OF BIT N/A	
			10. COORDINATE SYSTEM/DATUM HORIZONTAL VERTICAL MA State Plane Mainland NAD 1983 Raw Water	
2. GRAB DESIGNATION MER2-G5		LOCATION COORDINATES (m) X = 261,021 Y = 955,438		11. MANUFACTURER'S DESIGNATION OF SAMPLER Ted Young modified van Veen grab sampler
3. SAMPLING AGENCY CR Environmental		CONTRACTOR FILE NO.		
4. NAME OF SAMPLER Chip Ryther				12. TOTAL SAMPLES DISTURBED UNDISTURBED (UD) 1 1 0
5. DIRECTION OF GRAB <input checked="" type="checkbox"/> VERTICAL DEG. FROM VERTICAL BEARING <input type="checkbox"/> INCLINED				13. TOTAL NUMBER CORE BOXES N/A
6. THICKNESS OF OVERBURDEN N/A				14. ELEVATION GROUND WATER N/A
7. DEPTH SAMPLED INTO ROCK N/A				15. DATE GRAB STARTED COMPLETED 09-13-17 14:24 09-13-17
8. TOTAL DEPTH OF GRAB N/A				16. ELEVATION TOP OF GRAB -107.0 Ft. (uncorrected)
17. TOTAL RECOVERY FOR GRAB N/A				18. SIGNATURE AND TITLE OF INSPECTOR KM

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-107.0	0.0		SAND, medium to coarse grained, quartz, trace rock, trace silt, rocks up to 0.75", (0.5" x 0.25") shell fragment, 0.5" whole shell, (1.0" x 0.25") rock, dark brown (10YR-3/3), (SW).			Depth = 0.0' Mean (mm): 1.09, Phi Sorting: 1.23 Fines (230): 0.91% (SW)

MA_CZM_2017_GRABS.GPJ 12/5/17

Appendix G

Grab Sample Granularmetric Reports



Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: BUZ1-G1

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 232,761	Northing (m): 802,637	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -57.0 Raw Water
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USCS: SP	Munsell: Wet - 5Y-4/2 Dry - 5Y-6/2 Washed - 5Y-7/2	Comments:
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Dry Weight (g): 99.75	Wash Weight (g): 98.45	Pan Retained (g): 0.03	Sieve Loss (%): 0.05	Fines (%): #200 - 1.54 #230 - 1.37	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.15	0.15	0.15	0.15
5	-2.00	4.00	0.04	0.04	0.19	0.19
7	-1.50	2.83	0.09	0.09	0.28	0.28
10	-1.00	2.00	0.12	0.12	0.40	0.40
14	-0.50	1.41	0.20	0.20	0.60	0.60
18	0.00	1.00	0.34	0.34	0.94	0.94
25	0.50	0.71	1.30	1.30	2.24	2.24
35	1.00	0.50	10.40	10.43	12.64	12.67
45	1.50	0.35	29.95	30.03	42.59	42.70
60	2.00	0.25	30.17	30.25	72.76	72.95
80	2.50	0.18	17.96	18.01	90.72	90.96
120	3.00	0.13	6.09	6.11	96.81	97.07
170	3.50	0.09	1.22	1.22	98.03	98.29
200	3.75	0.07	0.17	0.17	98.20	98.46
230	4.00	0.06	0.17	0.17	98.37	98.63

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.83	2.31	2.06	1.62	1.21	1.06	0.63
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.62	0.33	0.65	-0.48	6.51	

MA_CZM_2017_GRABS GPJ 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: BUZ2-G2

Analysis Date: 11-30-17; Analyzed By: SMT

Easting (m): 233,048	Northing (m): 801,885	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -66.0 Raw Water
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USCS: SP-SM	Munsell: Wet - 10Y-4/1 Dry - 5Y-5/2 Washed - 5Y-6/3	Comments:
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Dry Weight (g): 98.64	Wash Weight (g): 92.50	Pan Retained (g): 0.30	Sieve Loss (%): 0.05	Fines (%): #200 - 8.04 #230 - 6.58	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.02	0.02	0.02	0.02
14	-0.50	1.41	0.04	0.04	0.06	0.06
18	0.00	1.00	0.06	0.06	0.12	0.12
25	0.50	0.71	0.37	0.38	0.49	0.50
35	1.00	0.50	1.49	1.51	1.98	2.01
45	1.50	0.35	6.02	6.10	8.00	8.11
60	2.00	0.25	19.50	19.77	27.50	27.88
80	2.50	0.18	28.22	28.61	55.72	56.49
120	3.00	0.13	25.46	25.81	81.18	82.30
170	3.50	0.09	8.31	8.42	89.49	90.72
200	3.75	0.07	1.22	1.24	90.71	91.96
230	4.00	0.06	1.44	1.46	92.15	93.42

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.10	2.86	2.39	1.93	1.70	1.25
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.31	0.20	0.63	-0.24	3.62	

MA_CZM_2017_GRABS GP-J 12/5/17

Granulometric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: BUZ6-G3

Analysis Date: 11-30-17; Analyzed By: SMT

Easting (m): 237,499	Northing (m): 798,970	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -60.0 Raw Water
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USCS: SP-SC	Munsell: Wet - 10Y-4/1 Dry - 5Y-5/2 Washed - 2.5Y-6/3	Comments:
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Dry Weight (g): 99.96	Wash Weight (g): 90.42	Pan Retained (g): 0.13	Sieve Loss (%): 0.07	Fines (%): #200 - 10.09 #230 - 9.75	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.04	0.04	0.04	0.04
10	-1.00	2.00	0.02	0.02	0.06	0.06
14	-0.50	1.41	0.04	0.04	0.10	0.10
18	0.00	1.00	0.03	0.03	0.13	0.13
25	0.50	0.71	0.05	0.05	0.18	0.18
35	1.00	0.50	0.40	0.40	0.58	0.58
45	1.50	0.35	4.61	4.61	5.19	5.19
60	2.00	0.25	19.41	19.42	24.60	24.61
80	2.50	0.18	30.19	30.20	54.79	54.81
120	3.00	0.13	26.23	26.24	81.02	81.05
170	3.50	0.09	8.03	8.03	89.05	89.08
200	3.75	0.07	0.83	0.83	89.88	89.91
230	4.00	0.06	0.34	0.34	90.22	90.25

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.18	2.88	2.42	2.01	1.78	1.48
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.33	0.20	0.56	-0.37	4.69	

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: BUZ9-G4

Analysis Date: 11-30-17; Analyzed By: SMT

Easting (m): 240,206	Northing (m): 795,415	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -65.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-4/3 Dry - 2.5Y-6/3 Washed - 2.5Y-7/3	Comments:
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Dry Weight (g): 97.89	Wash Weight (g): 96.25	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 1.79 #230 - 1.72	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.01	0.01	0.01	0.01
10	-1.00	2.00	0.04	0.04	0.05	0.05
14	-0.50	1.41	0.05	0.05	0.10	0.10
18	0.00	1.00	0.04	0.04	0.14	0.14
25	0.50	0.71	0.18	0.18	0.32	0.32
35	1.00	0.50	1.45	1.48	1.77	1.80
45	1.50	0.35	14.71	15.03	16.48	16.83
60	2.00	0.25	42.35	43.26	58.83	60.09
80	2.50	0.18	30.42	31.08	89.25	91.17
120	3.00	0.13	3.81	3.89	93.06	95.06
170	3.50	0.09	3.02	3.09	96.08	98.15
200	3.75	0.07	0.06	0.06	96.14	98.21
230	4.00	0.06	0.07	0.07	96.21	98.28

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.99	2.38	2.24	1.88	1.59	1.47	1.11
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.9	0.27	0.49	0.15	5.35	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: BUZ10-G5

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 240,288	Northing (m): 792,641	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -77.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-4/1 Dry - 5Y-5/2 Washed - 2.5Y-6/3	Comments:
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Dry Weight (g): 101.61	Wash Weight (g): 97.86	Pan Retained (g): 0.14	Sieve Loss (%): 0.07	Fines (%): #200 - 4.62 #230 - 3.90	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.00	0.00	0.00	0.00
14	-0.50	1.41	0.01	0.01	0.01	0.01
18	0.00	1.00	0.13	0.13	0.14	0.14
25	0.50	0.71	0.09	0.09	0.23	0.23
35	1.00	0.50	0.22	0.22	0.45	0.45
45	1.50	0.35	2.35	2.31	2.80	2.76
60	2.00	0.25	14.98	14.74	17.78	17.50
80	2.50	0.18	35.71	35.14	53.49	52.64
120	3.00	0.13	33.06	32.54	86.55	85.18
170	3.50	0.09	9.20	9.05	95.75	94.23
200	3.75	0.07	1.17	1.15	96.92	95.38
230	4.00	0.06	0.73	0.72	97.65	96.10

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.67	2.98	2.84	2.46	2.11	1.95	1.58
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.43	0.19	0.52	-0.25	4.18	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: CANAL9-G1

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 285,716	Northing (m): 837,977	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -52.5 Raw Water
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USCS: SP	Munsell: Wet - 5Y-4/2 Dry - 5Y-6/2 Washed - 5Y-7/2	Comments:
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Dry Weight (g): 95.15	Wash Weight (g): 92.28	Pan Retained (g): 0.07	Sieve Loss (%): 0.01	Fines (%): #200 - 3.47 #230 - 3.09	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.02	0.02	0.02	0.02
14	-0.50	1.41	0.11	0.12	0.13	0.14
18	0.00	1.00	0.24	0.25	0.37	0.39
25	0.50	0.71	0.53	0.56	0.90	0.95
35	1.00	0.50	1.19	1.25	2.09	2.20
45	1.50	0.35	2.49	2.62	4.58	4.82
60	2.00	0.25	13.74	14.44	18.32	19.26
80	2.50	0.18	54.95	57.75	73.27	77.01
120	3.00	0.13	15.82	16.63	89.09	93.64
170	3.50	0.09	2.39	2.51	91.48	96.15
200	3.75	0.07	0.36	0.38	91.84	96.53
230	4.00	0.06	0.36	0.38	92.20	96.91

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.27	2.71	2.48	2.27	2.05	1.89	1.51
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.23	0.21	0.48	-1.16	9.13	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: CANAL7-G2

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 285,206	Northing (m): 840,521	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -62.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-6/2 Washed - 2.5Y-7/2	Comments:
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Dry Weight (g): 100.85	Wash Weight (g): 99.45	Pan Retained (g): 0.01	Sieve Loss (%): 0.02	Fines (%): #200 - 1.48 #230 - 1.40	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.41	0.41	0.41	0.41
5	-2.00	4.00	0.19	0.19	0.60	0.60
7	-1.50	2.83	0.48	0.48	1.08	1.08
10	-1.00	2.00	0.29	0.29	1.37	1.37
14	-0.50	1.41	0.34	0.34	1.71	1.71
18	0.00	1.00	0.85	0.84	2.56	2.55
25	0.50	0.71	3.32	3.29	5.88	5.84
35	1.00	0.50	22.98	22.79	28.86	28.63
45	1.50	0.35	45.85	45.46	74.71	74.09
60	2.00	0.25	16.51	16.37	91.22	90.46
80	2.50	0.18	5.98	5.93	97.20	96.39
120	3.00	0.13	1.74	1.73	98.94	98.12
170	3.50	0.09	0.35	0.35	99.29	98.47
200	3.75	0.07	0.05	0.05	99.34	98.52
230	4.00	0.06	0.08	0.08	99.42	98.60

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.38	1.80	1.53	1.24	0.92	0.72	0.37
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.22	0.43	0.65	-1.21	10.2	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: CANAL2-G3

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 283,004	Northing (m): 844,584	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -46.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-5/2 Dry - 2.5Y-6/3 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 100.27	Wash Weight (g): 98.87	Pan Retained (g): 0.02	Sieve Loss (%): 0.01	Fines (%): #200 - 1.44 #230 - 1.41	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.33	0.33	0.33	0.33
10	-1.00	2.00	0.12	0.12	0.45	0.45
14	-0.50	1.41	0.35	0.35	0.80	0.80
18	0.00	1.00	1.37	1.37	2.17	2.17
25	0.50	0.71	11.59	11.56	13.76	13.73
35	1.00	0.50	35.23	35.14	48.99	48.87
45	1.50	0.35	39.17	39.06	88.16	87.93
60	2.00	0.25	9.13	9.11	97.29	97.04
80	2.50	0.18	1.28	1.28	98.57	98.32
120	3.00	0.13	0.17	0.17	98.74	98.49
170	3.50	0.09	0.05	0.05	98.79	98.54
200	3.75	0.07	0.02	0.02	98.81	98.56
230	4.00	0.06	0.03	0.03	98.84	98.59

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.89	1.45	1.33	1.01	0.66	0.53	0.12

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	0.98	0.51	0.51	-0.53	6.53

MA_CZM_2017_GRABS GPJ 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: CANAL4-G4A

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 283,105	Northing (m): 842,255	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -46.0 Raw Water
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USCS: SW	Munsell: Wet - 5Y-4/2 Dry - 5Y-6/2 Washed - 5Y-6/2	Comments:
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Dry Weight (g): 98.33	Wash Weight (g): 96.02	Pan Retained (g): 0.10	Sieve Loss (%): 0.05	Fines (%): #200 - 2.91 #230 - 2.49	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.98	1.00	0.98	1.00
5/16"	-3.00	8.00	0.43	0.44	1.41	1.44
3.5	-2.50	5.66	0.10	0.10	1.51	1.54
4	-2.25	4.76	0.00	0.00	1.51	1.54
5	-2.00	4.00	0.13	0.13	1.64	1.67
7	-1.50	2.83	0.38	0.39	2.02	2.06
10	-1.00	2.00	0.17	0.17	2.19	2.23
14	-0.50	1.41	0.13	0.13	2.32	2.36
18	0.00	1.00	0.55	0.56	2.87	2.92
25	0.50	0.71	5.05	5.14	7.92	8.06
35	1.00	0.50	19.68	20.01	27.60	28.07
45	1.50	0.35	39.25	39.92	66.85	67.99
60	2.00	0.25	20.51	20.86	87.36	88.85
80	2.50	0.18	5.45	5.54	92.81	94.39
120	3.00	0.13	1.12	1.14	93.93	95.53
170	3.50	0.09	0.98	1.00	94.91	96.53
200	3.75	0.07	0.55	0.56	95.46	97.09
230	4.00	0.06	0.41	0.42	95.87	97.51

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.77	1.88	1.67	1.27	0.92	0.70	0.20

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	1.21	0.43	0.89	-2.3	15.58

MA_CZM_2017_GRABS.GPJ 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: DUX3-G1

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 278,992	Northing (m): 871,888	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -101.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-4/2 Dry - 2.5Y-6/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 103.09	Wash Weight (g): 102.14	Pan Retained (g): 0.00	Sieve Loss (%): 0.04	Fines (%): #200 - 1.00 #230 - 0.95	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.04	0.04	0.04	0.04
10	-1.00	2.00	0.21	0.20	0.25	0.24
14	-0.50	1.41	0.49	0.48	0.74	0.72
18	0.00	1.00	1.38	1.34	2.12	2.06
25	0.50	0.71	4.78	4.64	6.90	6.70
35	1.00	0.50	17.60	17.07	24.50	23.77
45	1.50	0.35	35.03	33.98	59.53	57.75
60	2.00	0.25	30.46	29.55	89.99	87.30
80	2.50	0.18	10.26	9.95	100.25	97.25
120	3.00	0.13	1.50	1.46	101.75	98.71
170	3.50	0.09	0.28	0.27	102.03	98.98
200	3.75	0.07	0.02	0.02	102.05	99.00
230	4.00	0.06	0.05	0.05	102.10	99.05

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.39	1.94	1.79	1.39	1.02	0.77	0.32
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.36	0.39	0.61	-0.43	4.43	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: DUX4-G2

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 276,756	Northing (m): 871,868	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -82.0 Raw Water
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USCS: SP	Munsell: Wet - 5Y-4/1 Dry - 5Y-6/2 Washed - 5Y-7/1	Comments:
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Dry Weight (g): 96.78	Wash Weight (g): 94.36	Pan Retained (g): 0.01	Sieve Loss (%): 0.03	Fines (%): #200 - 2.61 #230 - 2.54	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.00	0.00	0.00	0.00
10	-1.00	2.00	0.01	0.01	0.01	0.01
14	-0.50	1.41	0.01	0.01	0.02	0.02
18	0.00	1.00	0.10	0.10	0.12	0.12
25	0.50	0.71	0.23	0.24	0.35	0.36
35	1.00	0.50	1.14	1.18	1.49	1.54
45	1.50	0.35	4.21	4.35	5.70	5.89
60	2.00	0.25	12.85	13.28	18.55	19.17
80	2.50	0.18	45.39	46.90	63.94	66.07
120	3.00	0.13	26.17	27.04	90.11	93.11
170	3.50	0.09	3.90	4.03	94.01	97.14
200	3.75	0.07	0.24	0.25	94.25	97.39
230	4.00	0.06	0.07	0.07	94.32	97.46

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.23	2.83	2.67	2.33	2.06	1.88	1.40
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.3	0.20	0.49	-0.79	5.32	

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: DUX7-G3A

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 274,738	Northing (m): 867,514	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -66.0 Raw Water
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USCS: SP	Munsell: Wet - 10YR-3/4 Dry - 10YR-5/3 Washed - 10YR-6/3	Comments:
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Dry Weight (g): 98.55	Wash Weight (g): 95.93	Pan Retained (g): 0.05	Sieve Loss (%): 0.04	Fines (%): #200 - 2.98 #230 - 2.75	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.03	0.03	0.03	0.03
7	-1.50	2.83	0.03	0.03	0.06	0.06
10	-1.00	2.00	0.04	0.04	0.10	0.10
14	-0.50	1.41	0.10	0.10	0.20	0.20
18	0.00	1.00	0.11	0.11	0.31	0.31
25	0.50	0.71	0.37	0.38	0.68	0.69
35	1.00	0.50	1.39	1.41	2.07	2.10
45	1.50	0.35	8.83	8.96	10.90	11.06
60	2.00	0.25	15.00	15.22	25.90	26.28
80	2.50	0.18	47.35	48.05	73.25	74.33
120	3.00	0.13	16.92	17.17	90.17	91.50
170	3.50	0.09	4.84	4.91	95.01	96.41
200	3.75	0.07	0.60	0.61	95.61	97.02
230	4.00	0.06	0.23	0.23	95.84	97.25

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.36	2.78	2.52	2.25	1.96	1.66	1.16
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.19	0.22	0.57	-0.8	6.62	

MA_CZM_2017_GRABS GP-J 12/5/17

Granulometric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: DUX9-G4

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 276,697	Northing (m): 865,531	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -88.0 Raw Water
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USCS: SM	Munsell: Wet - 10Y-2.5/1 Dry - 5Y-5/2 Washed - 5Y-6/2	Comments:
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Dry Weight (g): 96.93	Wash Weight (g): 81.65	Pan Retained (g): 0.39	Sieve Loss (%): 0.00	Fines (%): #200 - 18.32 #230 - 16.18	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	1.96	2.02	1.96	2.02
5/16"	-3.00	8.00	2.52	2.60	4.48	4.62
3.5	-2.50	5.66	0.36	0.37	4.84	4.99
4	-2.25	4.76	0.00	0.00	4.84	4.99
5	-2.00	4.00	0.12	0.12	4.96	5.11
7	-1.50	2.83	0.24	0.25	5.20	5.36
10	-1.00	2.00	0.05	0.05	5.25	5.41
14	-0.50	1.41	0.16	0.17	5.41	5.58
18	0.00	1.00	0.08	0.08	5.49	5.66
25	0.50	0.71	0.31	0.32	5.80	5.98
35	1.00	0.50	0.41	0.42	6.21	6.40
45	1.50	0.35	0.51	0.53	6.72	6.93
60	2.00	0.25	1.06	1.09	7.78	8.02
80	2.50	0.18	9.30	9.59	17.08	17.61
120	3.00	0.13	37.06	38.23	54.14	55.84
170	3.50	0.09	23.09	23.82	77.23	79.66
200	3.75	0.07	1.96	2.02	79.19	81.68
230	4.00	0.06	2.07	2.14	81.26	83.82

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
		3.40	2.92	2.60	2.42	-2.46
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.44	0.18	1.59	-3.06	11.46	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: HULL4-G1

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 263,324	Northing (m): 897,006	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -122.0 Raw Water
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USCS: SW-SM	Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-5/1 Washed - 2.5Y-6/1	Comments:
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Dry Weight (g): 95.64	Wash Weight (g): 85.80	Pan Retained (g): 0.21	Sieve Loss (%): 0.01	Fines (%): #200 - 11.63 #230 - 10.51	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.72	0.75	0.72	0.75
4	-2.25	4.76	1.46	1.53	2.18	2.28
5	-2.00	4.00	0.00	0.00	2.18	2.28
7	-1.50	2.83	0.88	0.92	3.06	3.20
10	-1.00	2.00	0.45	0.47	3.51	3.67
14	-0.50	1.41	0.69	0.72	4.20	4.39
18	0.00	1.00	0.85	0.89	5.05	5.28
25	0.50	0.71	1.13	1.18	6.18	6.46
35	1.00	0.50	1.98	2.07	8.16	8.53
45	1.50	0.35	3.43	3.59	11.59	12.12
60	2.00	0.25	4.31	4.51	15.90	16.63
80	2.50	0.18	8.45	8.84	24.35	25.47
120	3.00	0.13	45.19	47.25	69.54	72.72
170	3.50	0.09	13.02	13.61	82.56	86.33
200	3.75	0.07	1.95	2.04	84.51	88.37
230	4.00	0.06	1.07	1.12	85.58	89.49

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	3.41	3.08	2.76	2.47	1.93	-0.16

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	2.36	0.19	1.2	-2.52	9.64

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: HULL5-G2

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 262,609	Northing (m): 898,061	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -110.0 Raw Water
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USCS: SW-SM	Munsell: Wet - 2.5Y-3/2 Dry - 2.5Y-5/1 Washed - 2.5Y-5/2	Comments:
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Dry Weight (g): 99.88	Wash Weight (g): 94.86	Pan Retained (g): 0.10	Sieve Loss (%): 0.04	Fines (%): #200 - 5.67 #230 - 5.19	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	4.50	4.51	4.50	4.51
3.5	-2.50	5.66	3.67	3.67	8.17	8.18
4	-2.25	4.76	0.72	0.72	8.89	8.90
5	-2.00	4.00	0.95	0.95	9.84	9.85
7	-1.50	2.83	1.76	1.76	11.60	11.61
10	-1.00	2.00	0.98	0.98	12.58	12.59
14	-0.50	1.41	1.32	1.32	13.90	13.91
18	0.00	1.00	1.15	1.15	15.05	15.06
25	0.50	0.71	1.49	1.49	16.54	16.55
35	1.00	0.50	2.66	2.66	19.20	19.21
45	1.50	0.35	5.10	5.11	24.30	24.32
60	2.00	0.25	11.92	11.93	36.22	36.25
80	2.50	0.18	27.95	27.98	64.17	64.23
120	3.00	0.13	20.64	20.66	84.81	84.89
170	3.50	0.09	8.23	8.24	93.04	93.13
200	3.75	0.07	1.20	1.20	94.24	94.33
230	4.00	0.06	0.48	0.48	94.72	94.81

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
	2.98	2.76	2.25	1.53	0.32	-2.93
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.56	0.34	1.82	-1.59	4.36	

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: HULL7-G3A

Analysis Date: 11-20-17; Analyzed By: DA

Easting (m): 261,231	Northing (m): 898,100	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -101.0 Raw Water
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USCS: SW-SM	Munsell: Wet - 2.5Y-4/1 Dry - 2.5Y-6/1 Washed - 2.5Y-6/1	Comments:
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Dry Weight (g): 98.51	Wash Weight (g): 94.52	Pan Retained (g): 0.19	Sieve Loss (%): 0.04	Fines (%): #200 - 5.28 #230 - 4.28	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	2.00	2.03	2.00	2.03
4	-2.25	4.76	1.03	1.05	3.03	3.08
5	-2.00	4.00	0.19	0.19	3.22	3.27
7	-1.50	2.83	2.00	2.03	5.22	5.30
10	-1.00	2.00	1.36	1.38	6.58	6.68
14	-0.50	1.41	0.75	0.76	7.33	7.44
18	0.00	1.00	1.02	1.04	8.35	8.48
25	0.50	0.71	1.21	1.23	9.56	9.71
35	1.00	0.50	2.47	2.51	12.03	12.22
45	1.50	0.35	4.76	4.83	16.79	17.05
60	2.00	0.25	9.90	10.05	26.69	27.10
80	2.50	0.18	23.97	24.33	50.66	51.43
120	3.00	0.13	22.41	22.75	73.07	74.18
170	3.50	0.09	18.98	19.27	92.05	93.45
200	3.75	0.07	1.25	1.27	93.30	94.72
230	4.00	0.06	0.99	1.00	94.29	95.72

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.82	3.25	3.02	2.47	1.90	1.39	-1.57
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.09	0.23	1.39	-1.96	6.6	

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: HULL2-G4

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 257,862	Northing (m): 896,014	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -72.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-3/2 Dry - 2.5Y-4/2 Washed - 2.5Y-5/3	Comments:
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Dry Weight (g): 96.89	Wash Weight (g): 94.71	Pan Retained (g): 0.08	Sieve Loss (%): 0.02	Fines (%): #200 - 2.70 #230 - 2.36	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.12	0.12	0.12	0.12
4	-2.25	4.76	0.00	0.00	0.12	0.12
5	-2.00	4.00	0.00	0.00	0.12	0.12
7	-1.50	2.83	0.07	0.07	0.19	0.19
10	-1.00	2.00	0.00	0.00	0.19	0.19
14	-0.50	1.41	0.01	0.01	0.20	0.20
18	0.00	1.00	0.02	0.02	0.22	0.22
25	0.50	0.71	0.24	0.25	0.46	0.47
35	1.00	0.50	0.85	0.88	1.31	1.35
45	1.50	0.35	3.13	3.23	4.44	4.58
60	2.00	0.25	35.08	36.21	39.52	40.79
80	2.50	0.18	48.01	49.55	87.53	90.34
120	3.00	0.13	4.50	4.64	92.03	94.98
170	3.50	0.09	1.90	1.96	93.93	96.94
200	3.75	0.07	0.35	0.36	94.28	97.30
230	4.00	0.06	0.33	0.34	94.61	97.64

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.01	2.44	2.35	2.09	1.78	1.66	1.51
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	2.06	0.24	0.46	-1.64	22.67	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: HULL1-G5A

Analysis Date: 11-21-17; Analyzed By: DA

Easting (m): 257,135	Northing (m): 895,878	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -69.0 Raw Water
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USCS: SP	Munsell: Wet - 2.5Y-3/2 Dry - 2.5Y-4/2 Washed - 2.5Y-6/2	Comments:
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Dry Weight (g): 99.74	Wash Weight (g): 97.53	Pan Retained (g): 0.04	Sieve Loss (%): 0.03	Fines (%): #200 - 2.54 #230 - 2.28	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	0.00	0.00	0.00	0.00
5	-2.00	4.00	0.00	0.00	0.00	0.00
7	-1.50	2.83	0.03	0.03	0.03	0.03
10	-1.00	2.00	0.00	0.00	0.03	0.03
14	-0.50	1.41	0.00	0.00	0.03	0.03
18	0.00	1.00	0.02	0.02	0.05	0.05
25	0.50	0.71	0.22	0.22	0.27	0.27
35	1.00	0.50	1.38	1.38	1.65	1.65
45	1.50	0.35	21.86	21.92	23.51	23.57
60	2.00	0.25	49.21	49.34	72.72	72.91
80	2.50	0.18	13.58	13.62	86.30	86.53
120	3.00	0.13	3.07	3.08	89.37	89.61
170	3.50	0.09	7.50	7.52	96.87	97.13
200	3.75	0.07	0.33	0.33	97.20	97.46
230	4.00	0.06	0.26	0.26	97.46	97.72

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
3.36	2.41	2.08	1.77	1.51	1.33	1.08
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	1.85	0.28	0.58	1	4.67	

MA_CZM_2017_GRABS GP-J 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MER10-G1

Analysis Date: 11-22-17; Analyzed By: DA

Easting (m): 261,287	Northing (m): 946,847	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -84.0 Raw Water
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USCS: SW	Munsell: Wet - 10YR-3/4 Dry - 10YR-5/3 Washed - 10YR-6/3	Comments:
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Dry Weight (g): 111.45	Wash Weight (g): 111.02	Pan Retained (g): 0.00	Sieve Loss (%): 0.00	Fines (%): #200 - 0.41 #230 - 0.39	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	2.14	1.92	2.14	1.92
3.5	-2.50	5.66	0.79	0.71	2.93	2.63
4	-2.25	4.76	0.80	0.72	3.73	3.35
5	-2.00	4.00	1.89	1.70	5.62	5.05
7	-1.50	2.83	5.07	4.55	10.69	9.60
10	-1.00	2.00	10.19	9.14	20.88	18.74
14	-0.50	1.41	22.93	20.57	43.81	39.31
18	0.00	1.00	22.65	20.32	66.46	59.63
25	0.50	0.71	16.06	14.41	82.52	74.04
35	1.00	0.50	14.09	12.64	96.61	86.68
45	1.50	0.35	7.96	7.14	104.57	93.82
60	2.00	0.25	3.96	3.55	108.53	97.37
80	2.50	0.18	1.79	1.61	110.32	98.98
120	3.00	0.13	0.46	0.41	110.78	99.39
170	3.50	0.09	0.18	0.16	110.96	99.55
200	3.75	0.07	0.04	0.04	111.00	99.59
230	4.00	0.06	0.02	0.02	111.02	99.61

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.67	0.89	0.54	-0.24	-0.85	-1.15	-2.01

Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis
Statistics	-0.2	1.15	1.09	-0.1	3.51

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MER8-G2

Analysis Date: 11-29-17; Analyzed By: SMT

Easting (m): 260,292	Northing (m): 948,669	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -83.0 Raw Water
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USCS: SW	Munsell: Wet - 10YR-3/2 Dry - 2.5Y-5/3 Washed - 2.5Y-6/3	Comments:
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Dry Weight (g): 105.56	Wash Weight (g): 104.16	Pan Retained (g): 0.05	Sieve Loss (%): 0.27	Fines (%): #200 - 1.69 #230 - 1.65	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	0.00	0.00	0.00	0.00
4	-2.25	4.76	1.22	1.16	1.22	1.16
5	-2.00	4.00	0.90	0.85	2.12	2.01
7	-1.50	2.83	6.37	6.03	8.49	8.04
10	-1.00	2.00	12.91	12.23	21.40	20.27
14	-0.50	1.41	15.71	14.88	37.11	35.15
18	0.00	1.00	15.90	15.06	53.01	50.21
25	0.50	0.71	17.26	16.35	70.27	66.56
35	1.00	0.50	13.42	12.71	83.69	79.27
45	1.50	0.35	9.13	8.65	92.82	87.92
60	2.00	0.25	6.81	6.45	99.63	94.37
80	2.50	0.18	2.92	2.77	102.55	97.14
120	3.00	0.13	0.86	0.81	103.41	97.95
170	3.50	0.09	0.30	0.28	103.71	98.23
200	3.75	0.07	0.08	0.08	103.79	98.31
230	4.00	0.06	0.04	0.04	103.83	98.35

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
2.11	1.27	0.83	-0.01	-0.84	-1.17	-1.75
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0	1.00	1.12	0.25	2.59	

MA_CZM_2017_GRABS GPJ 12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MER4-G4

Analysis Date: 11-22-17; Analyzed By: DA

Easting (m): 260,341	Northing (m): 953,193	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -95.0 Raw Water
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USCS: SW	Munsell: Wet - 10YR-3/2 Dry - 2.5Y-5/3 Washed - 2.5Y-6/3	Comments:
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Dry Weight (g): 104.50	Wash Weight (g): 103.58	Pan Retained (g): 0.00	Sieve Loss (%): 0.04	Fines (%): #200 - 0.98 #230 - 0.92	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	0.00	0.00	0.00	0.00
5/16"	-3.00	8.00	0.00	0.00	0.00	0.00
3.5	-2.50	5.66	2.09	2.00	2.09	2.00
4	-2.25	4.76	0.85	0.81	2.94	2.81
5	-2.00	4.00	1.67	1.60	4.61	4.41
7	-1.50	2.83	5.14	4.92	9.75	9.33
10	-1.00	2.00	8.27	7.91	18.02	17.24
14	-0.50	1.41	11.34	10.85	29.36	28.09
18	0.00	1.00	12.19	11.67	41.55	39.76
25	0.50	0.71	19.01	18.19	60.56	57.95
35	1.00	0.50	21.06	20.15	81.62	78.10
45	1.50	0.35	13.75	13.16	95.37	91.26
60	2.00	0.25	5.98	5.72	101.35	96.98
80	2.50	0.18	1.64	1.57	102.99	98.55
120	3.00	0.13	0.31	0.30	103.30	98.85
170	3.50	0.09	0.14	0.13	103.44	98.98
200	3.75	0.07	0.04	0.04	103.48	99.02
230	4.00	0.06	0.06	0.06	103.54	99.08

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.83	1.22	0.92	0.28	-0.64	-1.08	-1.94
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	0.11	0.93	1.12	-0.41	2.87	

MA_CZM_2017_GRABS GPJ_12/5/17

Granularmetric Report

Depths and elevations based on measured values



APTIM
2481 NW Boca Raton Blvd.
Boca Raton, FL 33431
ph (561) 391-8102

Project Name: Preliminary Characterization of Offshore Sand Resources in Selected Study Areas

Sample Name: MER2-G5

Analysis Date: 11-22-17; Analyzed By: DA

Easting (m): 261,021	Northing (m): 955,438	Coordinate System: MA State Plane Mainland	Elevation (ft., uncorrected): -107.0 Raw Water
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USCS: SW	Munsell: Wet - 10YR-3/3 Dry - 2.5Y-5/3 Washed - 2.5Y-6/3	Comments:
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Dry Weight (g): 106.03	Wash Weight (g): 105.08	Pan Retained (g): 0.00	Sieve Loss (%): 0.00	Fines (%): #200 - 0.97 #230 - 0.91	Organics (%):	Carbonates (%):	Shell Hash (%):
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Sieve Number	Sieve Size (Phi)	Sieve Size (Millimeters)	Grams Retained	% Weight Retained	Cum. Grams Retained	C. % Weight Retained
3/4"	-4.25	19.03	0.00	0.00	0.00	0.00
5/8"	-4.00	16.00	0.00	0.00	0.00	0.00
7/16"	-3.50	11.31	2.94	2.77	2.94	2.77
5/16"	-3.00	8.00	0.00	0.00	2.94	2.77
3.5	-2.50	5.66	2.17	2.05	5.11	4.82
4	-2.25	4.76	0.97	0.91	6.08	5.73
5	-2.00	4.00	1.36	1.28	7.44	7.01
7	-1.50	2.83	5.56	5.24	13.00	12.25
10	-1.00	2.00	8.95	8.44	21.95	20.69
14	-0.50	1.41	13.14	12.39	35.09	33.08
18	0.00	1.00	15.06	14.20	50.15	47.28
25	0.50	0.71	21.43	20.21	71.58	67.49
35	1.00	0.50	16.87	15.91	88.45	83.40
45	1.50	0.35	10.45	9.86	98.90	93.26
60	2.00	0.25	4.17	3.93	103.07	97.19
80	2.50	0.18	1.34	1.26	104.41	98.45
120	3.00	0.13	0.37	0.35	104.78	98.80
170	3.50	0.09	0.19	0.18	104.97	98.98
200	3.75	0.07	0.05	0.05	105.02	99.03
230	4.00	0.06	0.06	0.06	105.08	99.09

Phi 5	Phi 16	Phi 25	Phi 50	Phi 75	Phi 84	Phi 95
1.72	1.03	0.74	0.07	-0.83	-1.28	-2.45
Moment	Mean Phi	Mean mm	Sorting	Skewness	Kurtosis	
Statistics	-0.13	1.09	1.23	-0.67	3.81	

MA_CZM_2017_GRABS GPJ_12/5/17

Appendix H (digital only)

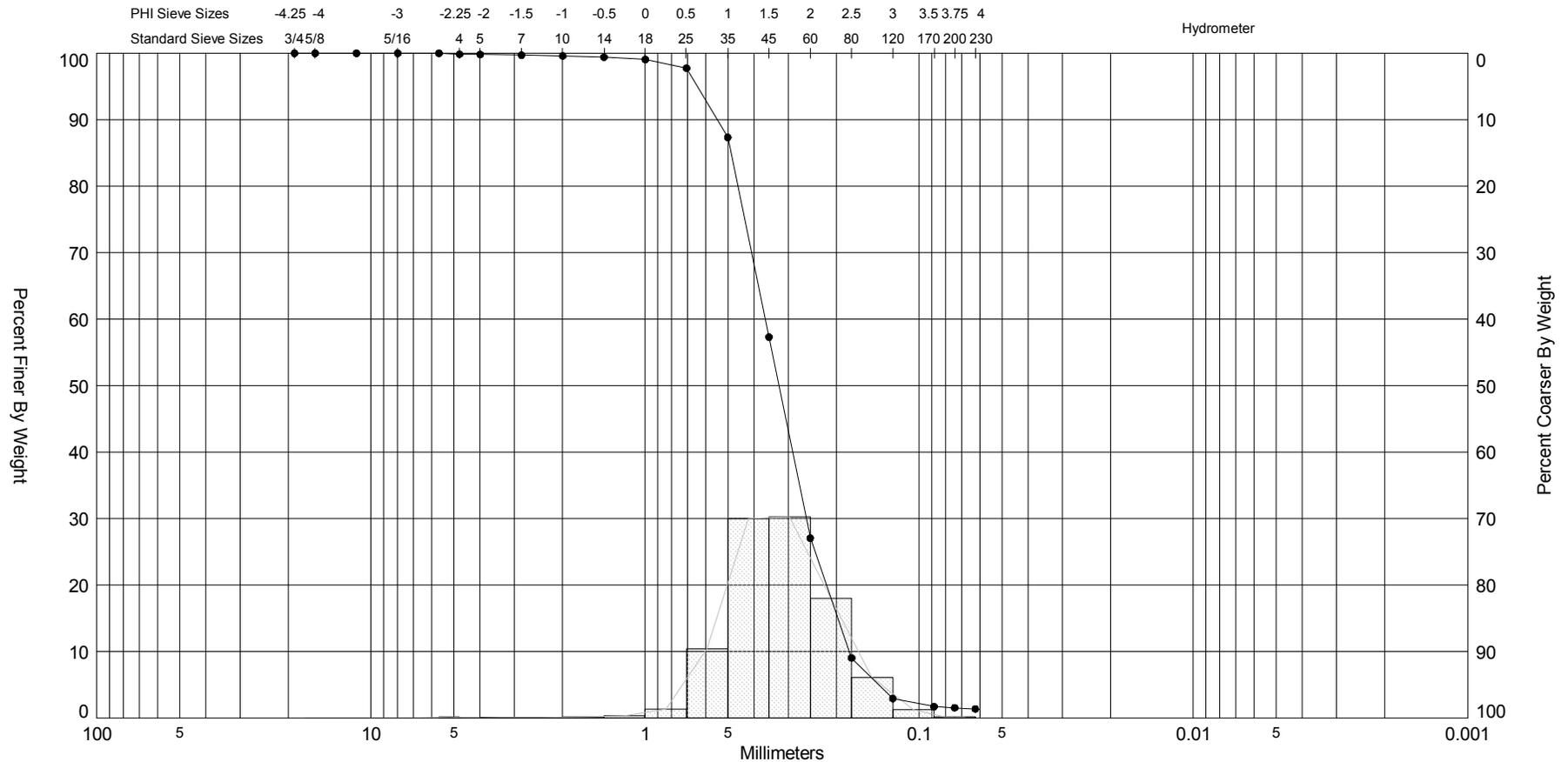
Grab Sample Granularmetric Reports



Appendix I

Grab Sample Granulometric Curves

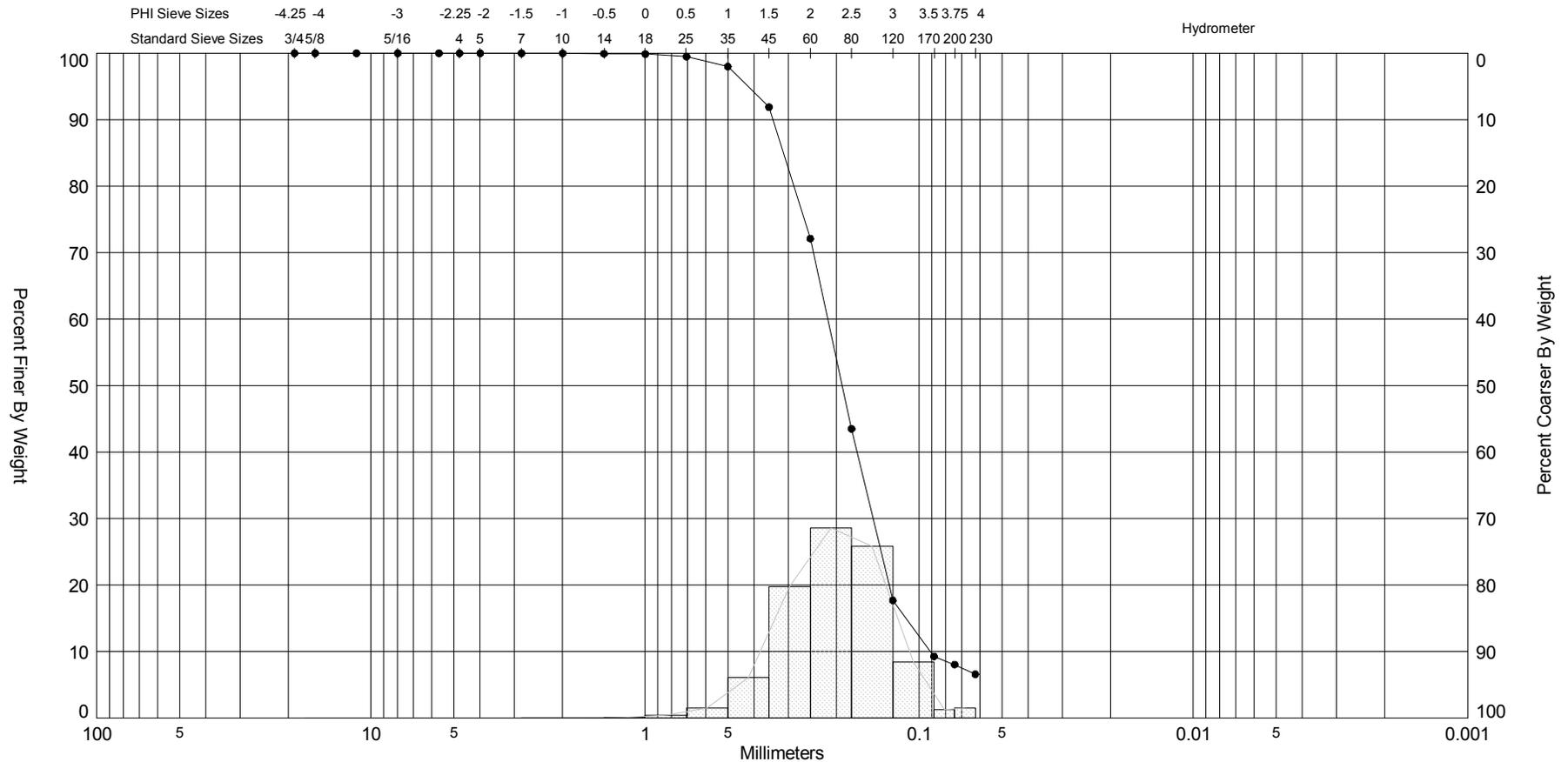




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
BUZ1-G1	—●—	-57.0	SP	#200 - 1.54 #230 - 1.37			1.62	1.62	-0.48	6.51	0.65	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-29-17
Depths and elevations based on measured values												Analyzed By:	SMT
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	232,761
												Northing (Y, m):	802,637
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

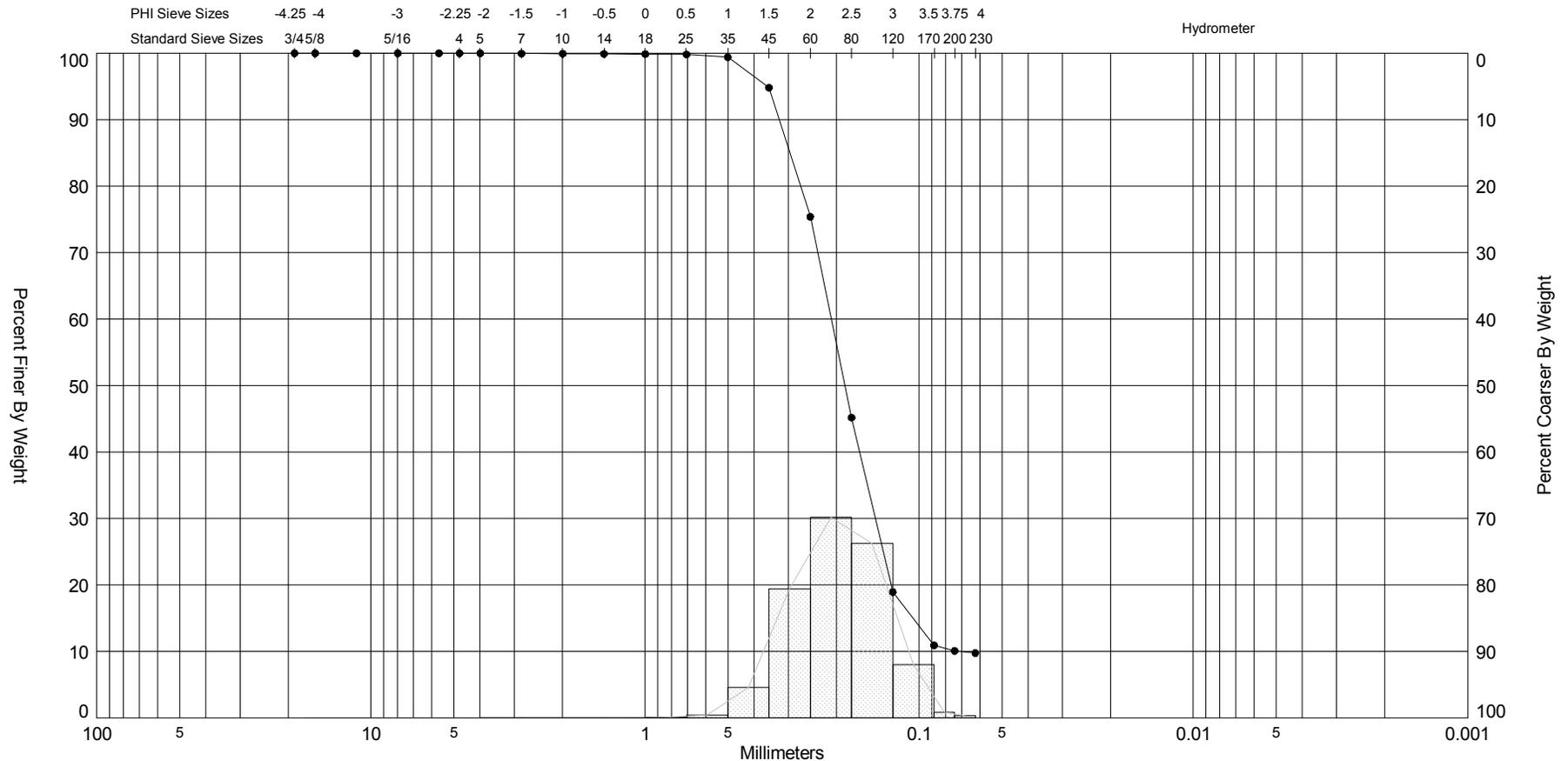
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
BUZ2-G2	—●—	-66.0	SP-SM	#200 - 8.04 #230 - 6.58			2.39	2.31	-0.24	3.62	0.63	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-30-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	233,048
												Northing (Y, m):	801,885
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

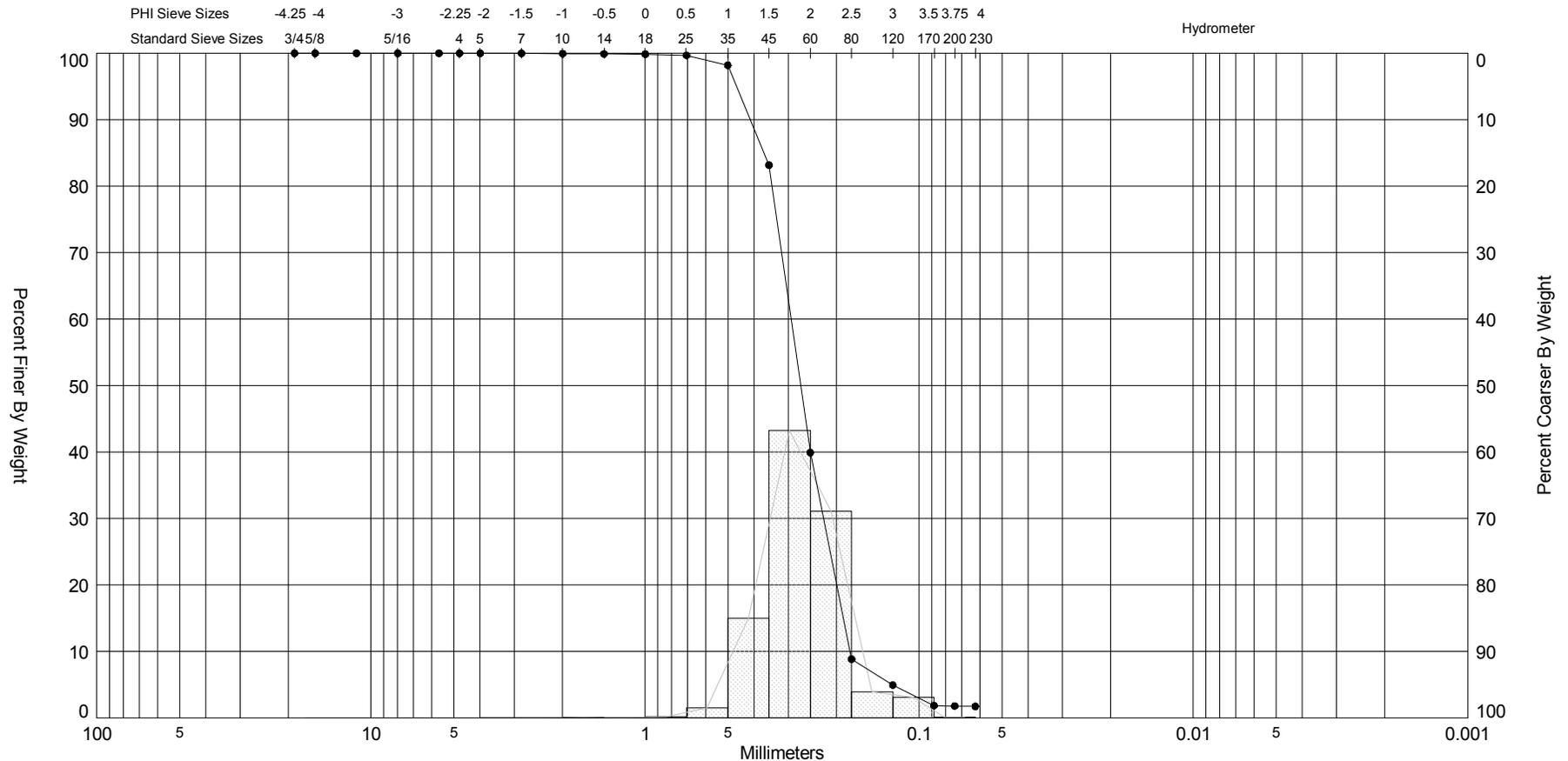
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
BUZ6-G3	—●—	-60.0	SP-SC	#200 - 10.09 #230 - 9.75			2.42	2.33	-0.37	4.69	0.56	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-30-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	237,499
												Northing (Y, m):	798,970
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

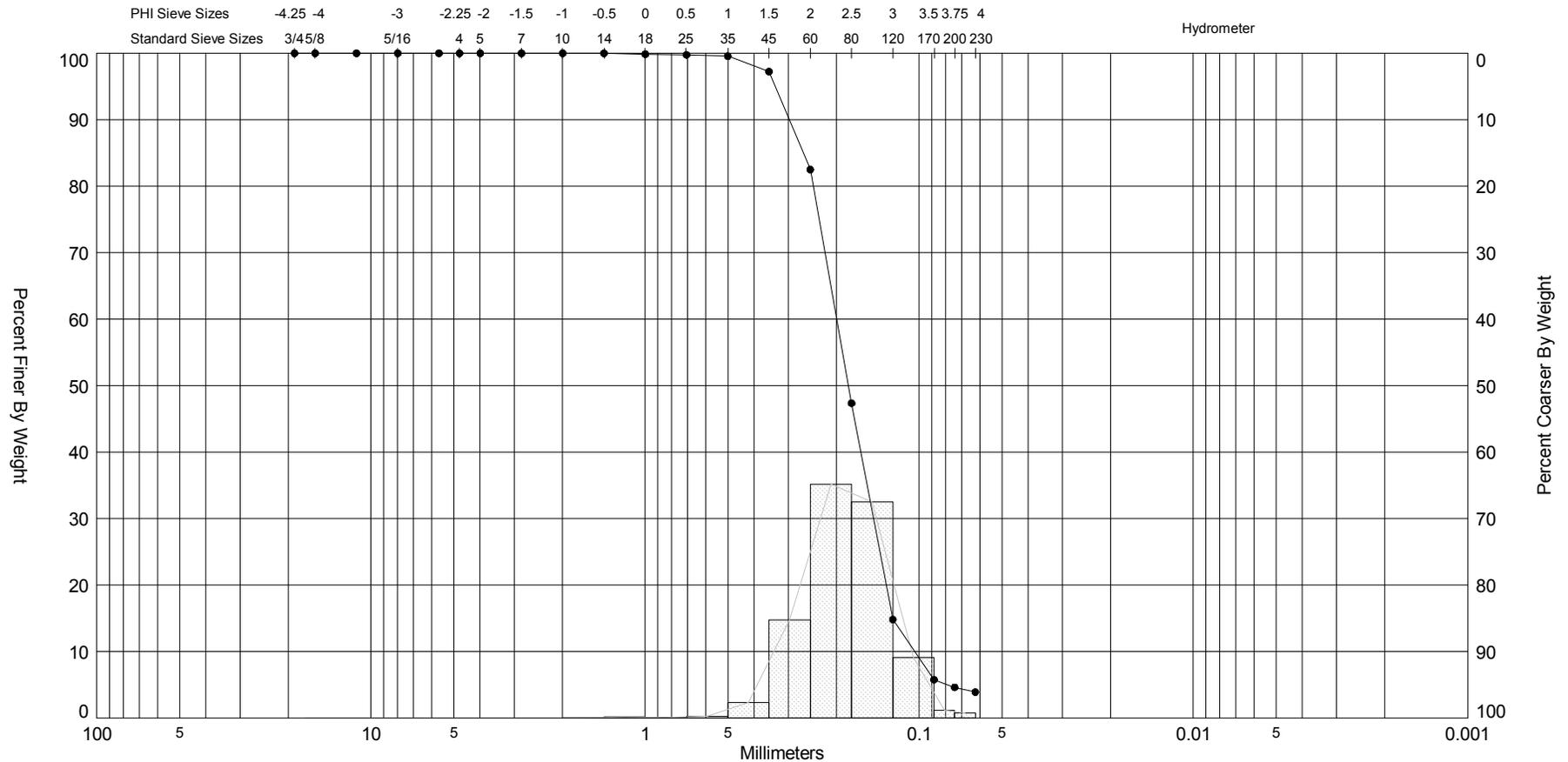
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
BUZ9-G4	—●—	-65.0	SP	#200 - 1.79 #230 - 1.72			1.88	1.9	0.15	5.35	0.49	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-30-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	240,206
												Northing (Y, m):	795,415
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

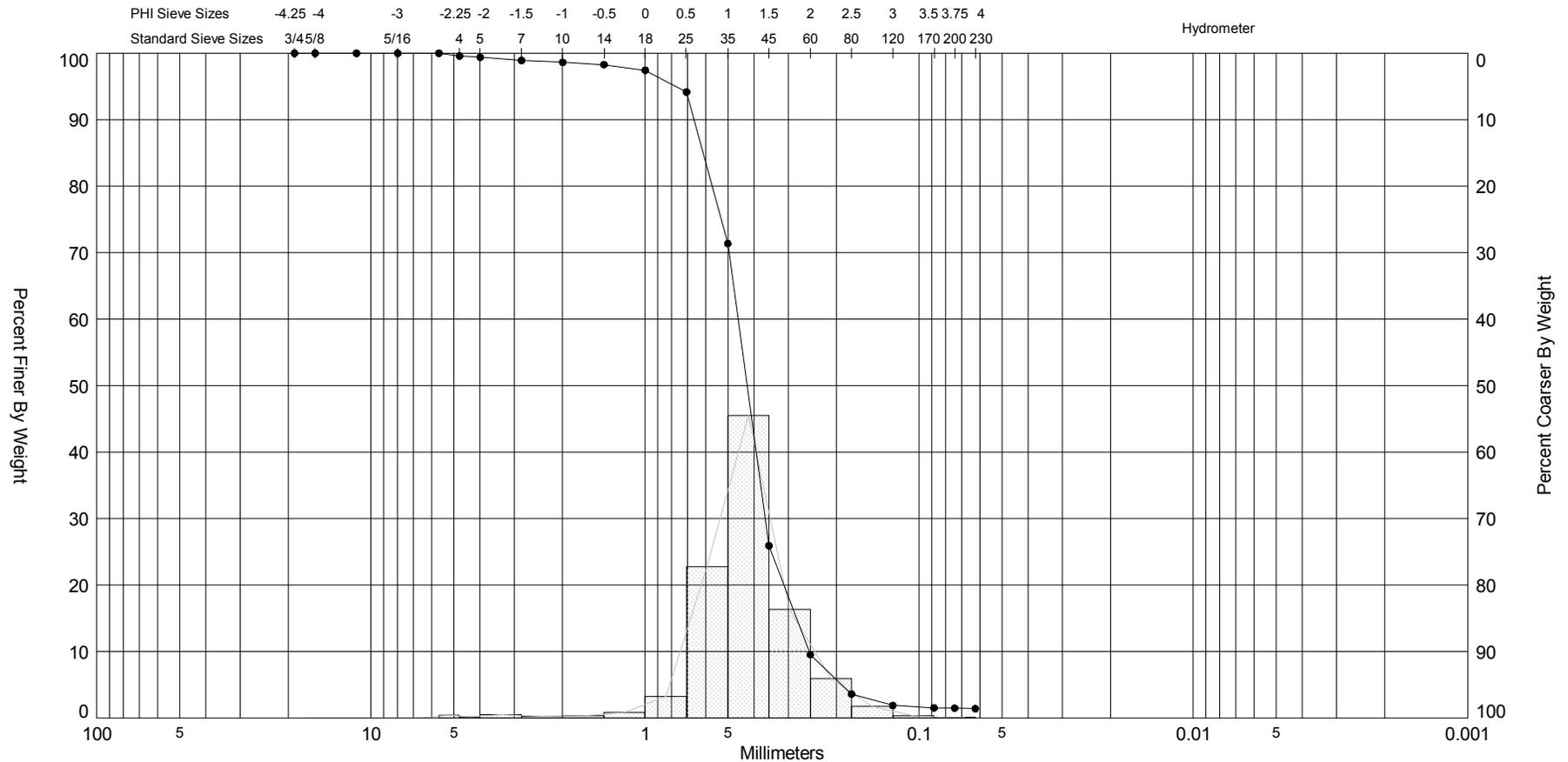
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
BUZ10-G5	—●—	-77.0	SP	#200 - 4.62 #230 - 3.90			2.46	2.43	-0.25	4.18	0.52	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-29-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	240,288
												Northing (Y, m):	792,641
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

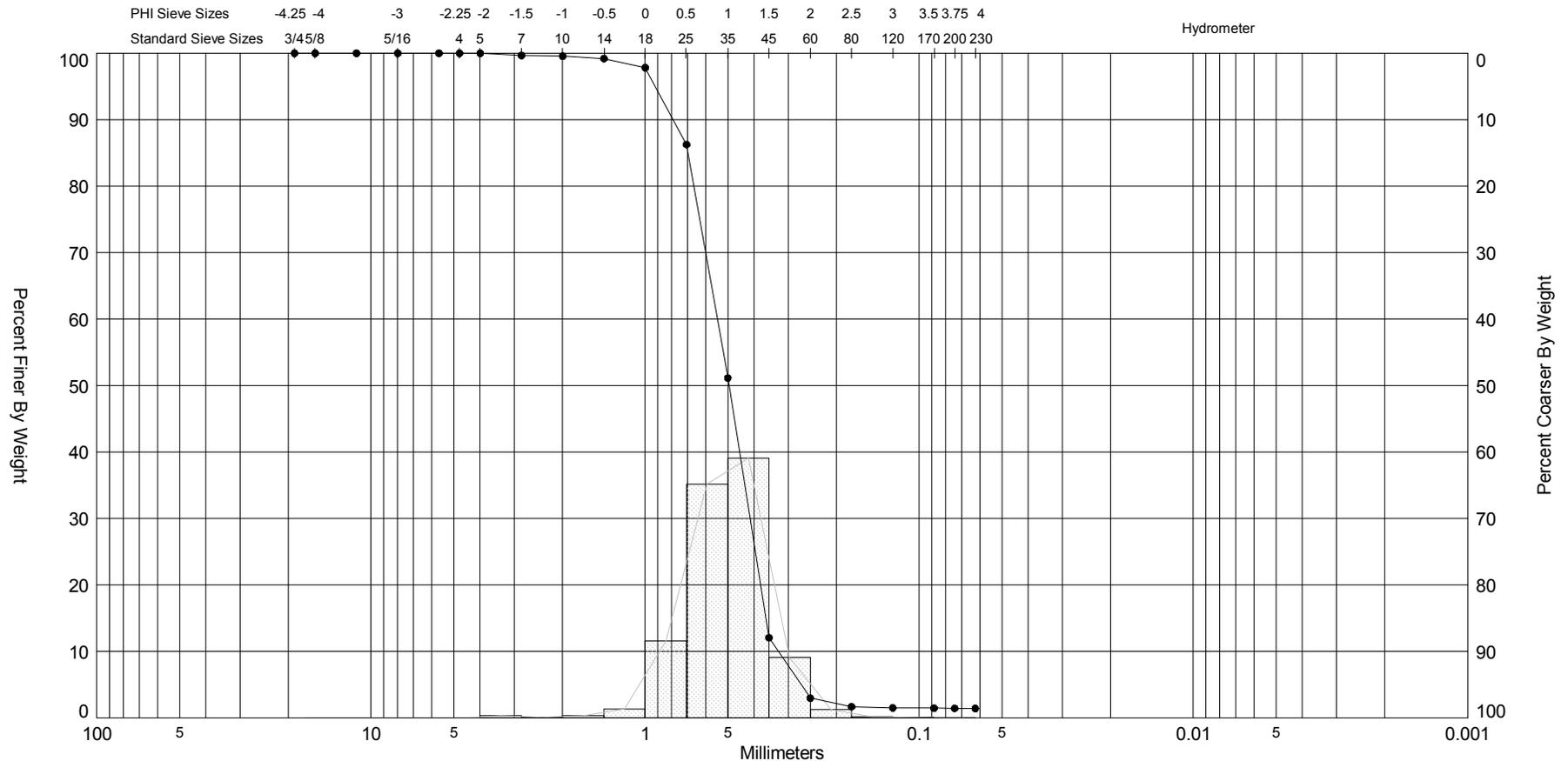
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CANAL7-G2	—●—	-62.0	SP	#200 - 1.48 #230 - 1.40			1.24	1.22	-1.21	10.2	0.65	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	285,206
												Northing (Y, m):	840,521
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												Vertical Datum:	Raw Water

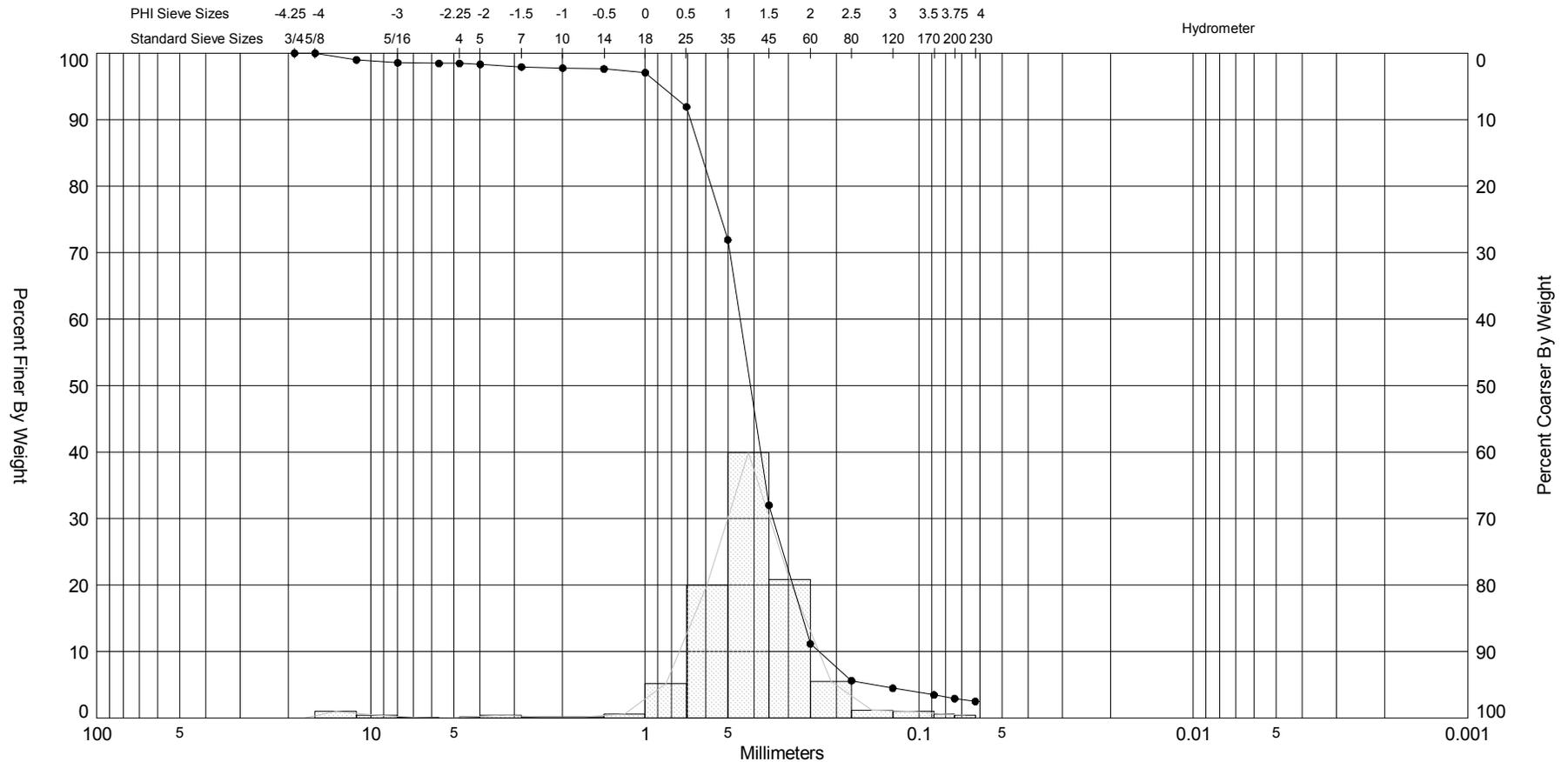
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CANAL2-G3	—●—	-46.0	SP	#200 - 1.44 #230 - 1.41			1.01	0.98	-0.53	6.53	0.51	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-21-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	283,004
												Northing (Y, m):	844,584
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

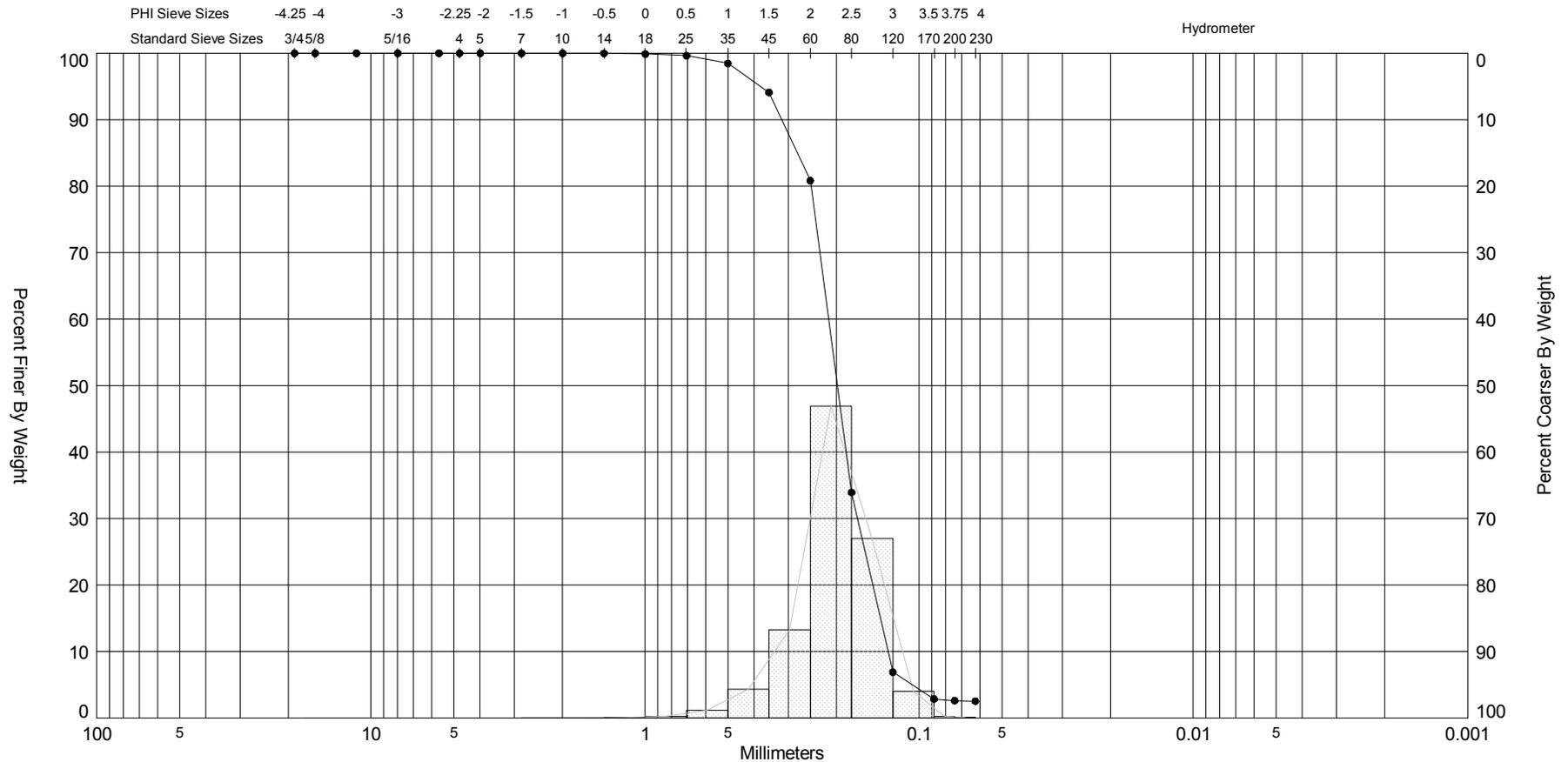
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
CANAL4-G4A	—●—	-46.0	SW	#200 - 2.91 #230 - 2.49			1.27	1.21	-2.3	15.58	0.89	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	283,105
												Northing (Y, m):	842,255
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

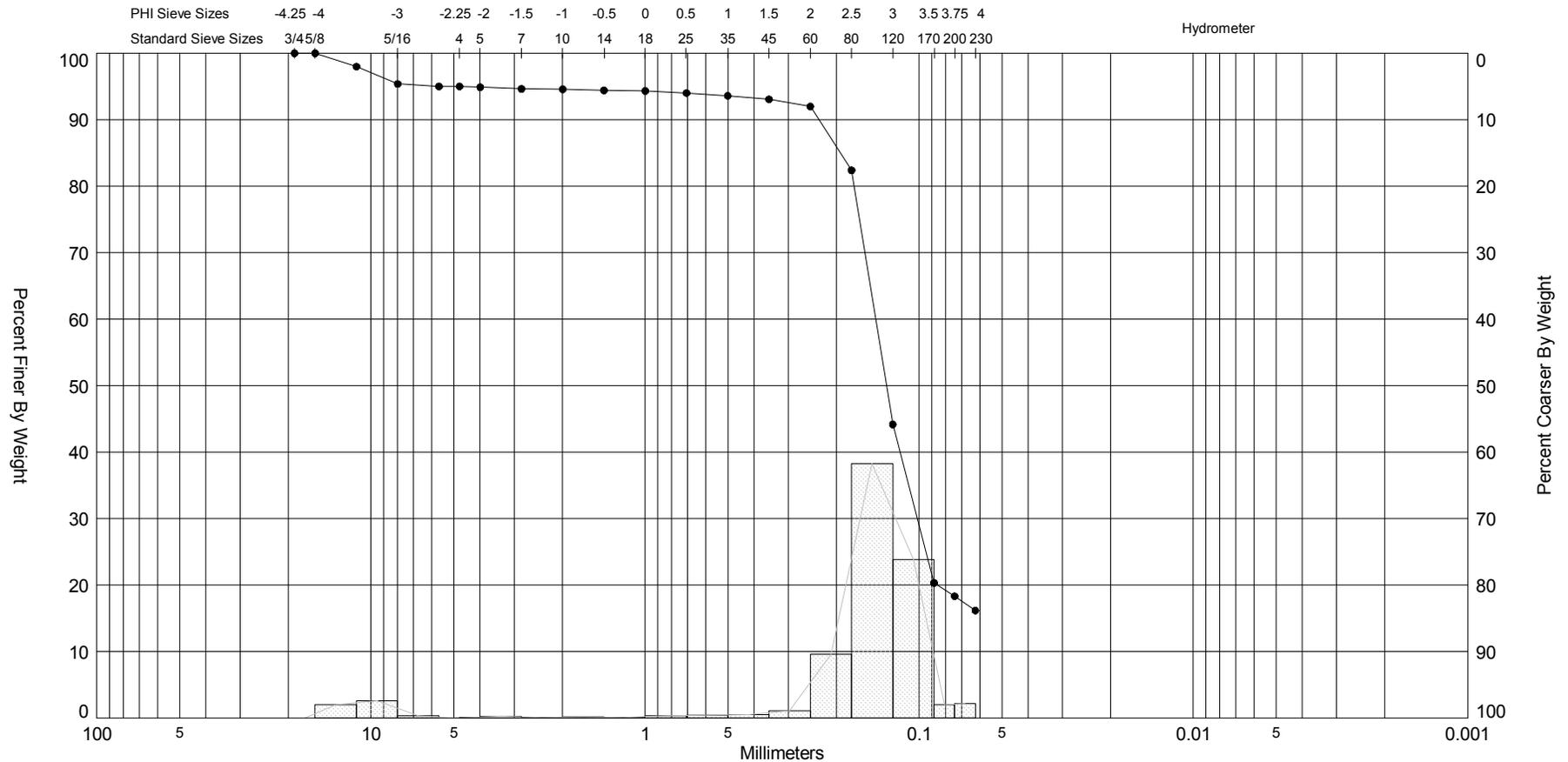
MA_CZM_2017_GRABS.GPJ_12/5/17

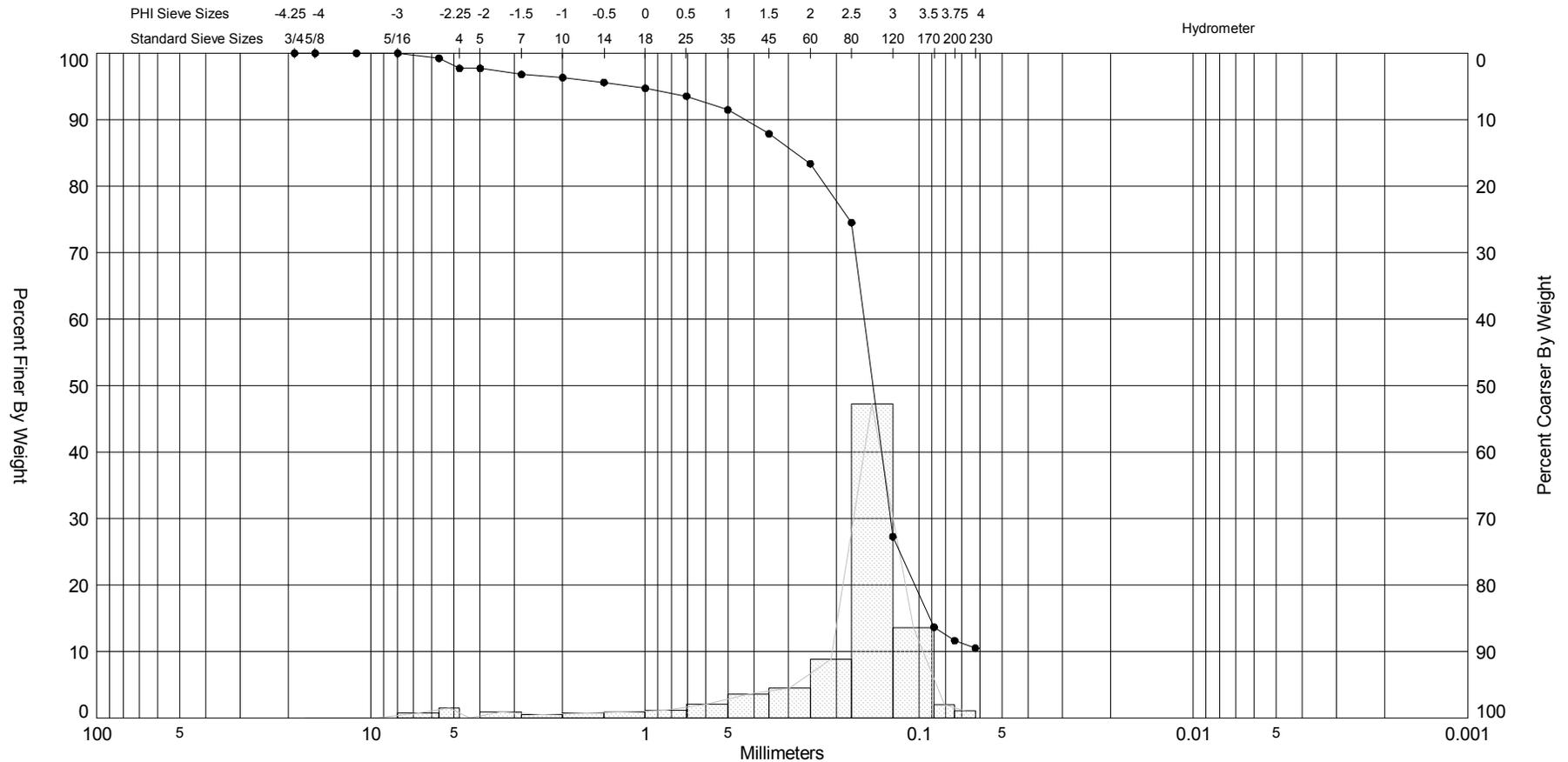


Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
DUX4-G2	—●—	-82.0	SP	#200 - 2.61 #230 - 2.54			2.33	2.3	-0.79	5.32	0.49	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-29-17
Depths and elevations based on measured values												Analyzed By:	SMT
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	276,756
												Northing (Y, m):	871,868
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

MA_CZM_2017_GRABS.GPJ_12/5/17

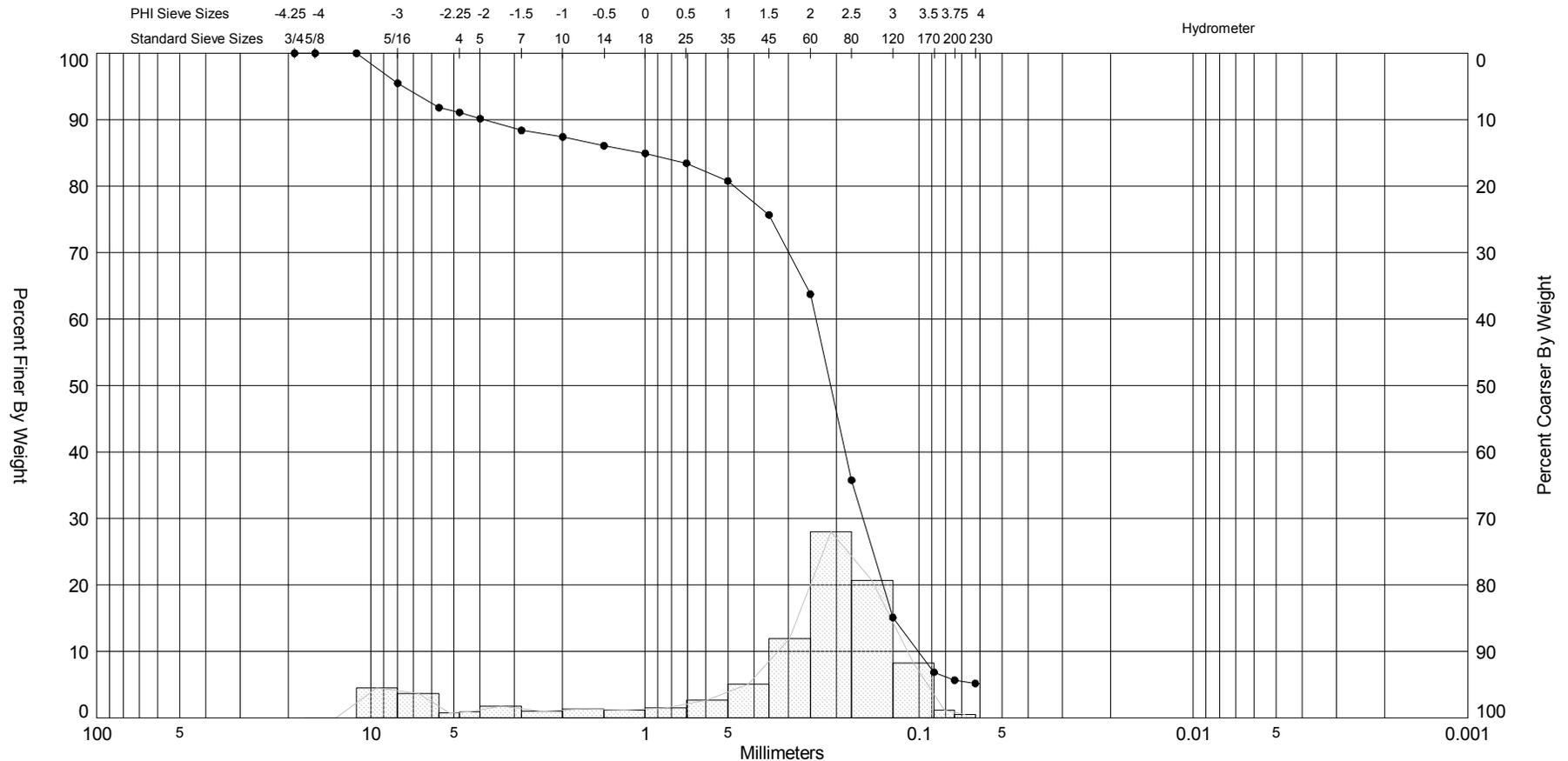




Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
HULL4-G1	—●—	-122.0	SW-SM	#200 - 11.63 #230 - 10.51			2.76	2.36	-2.52	9.64	1.2	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-21-17
Depths and elevations based on measured values												Analyzed By:	DA
												Easting (X, m):	263,324
												Northing (Y, m):	897,006
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water
<p style="text-align: center;">APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p>													

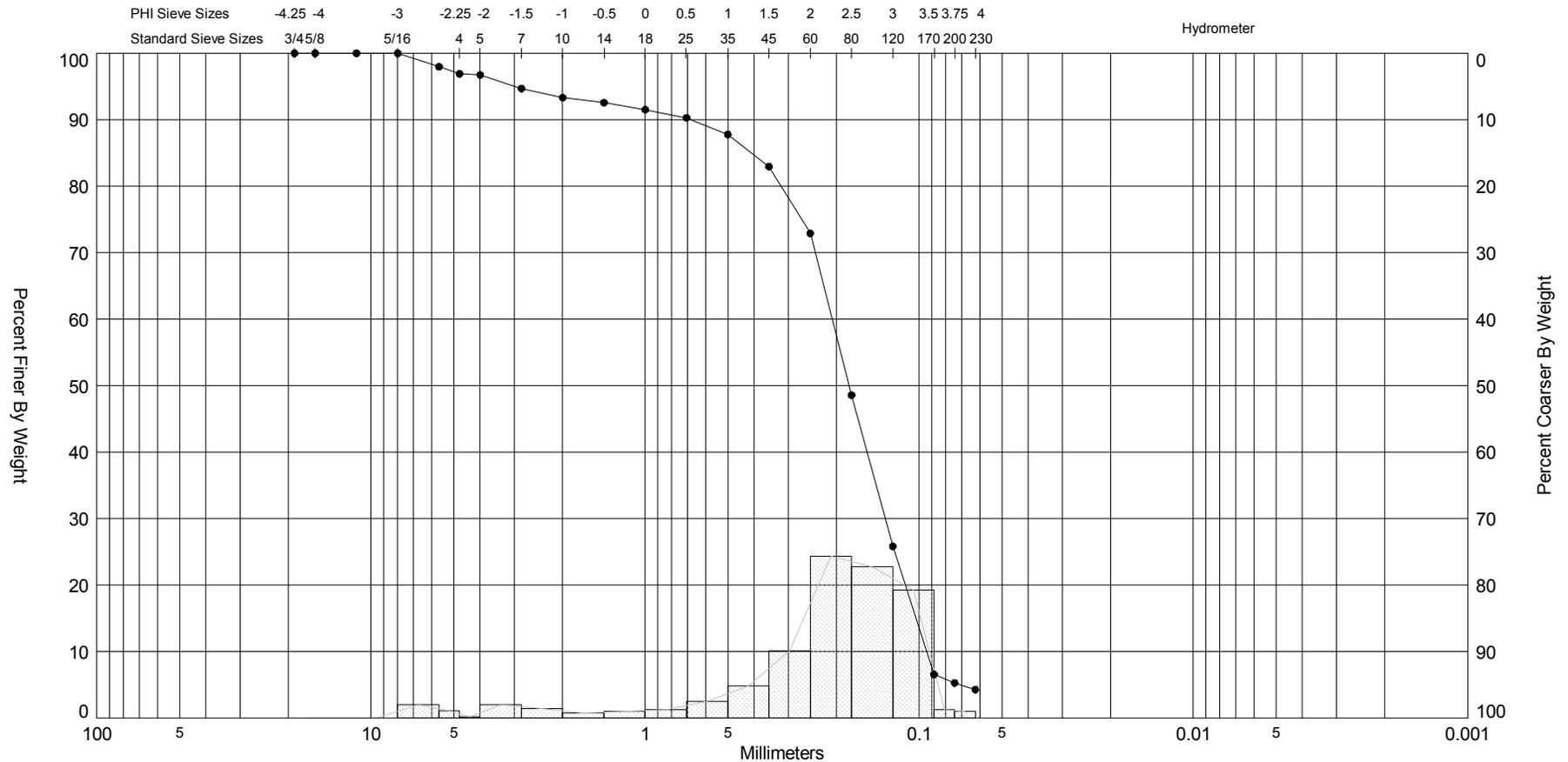
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
HULL5-G2	—●—	-110.0	SW-SM	#200 - 5.67 #230 - 5.19			2.25	1.56	-1.59	4.36	1.82	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-21-17
Depths and elevations based on measured values												Analyzed By:	DA
 <p style="text-align: center;">APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p>												Easting (X, m):	262,609
												Northing (Y, m):	898,061
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

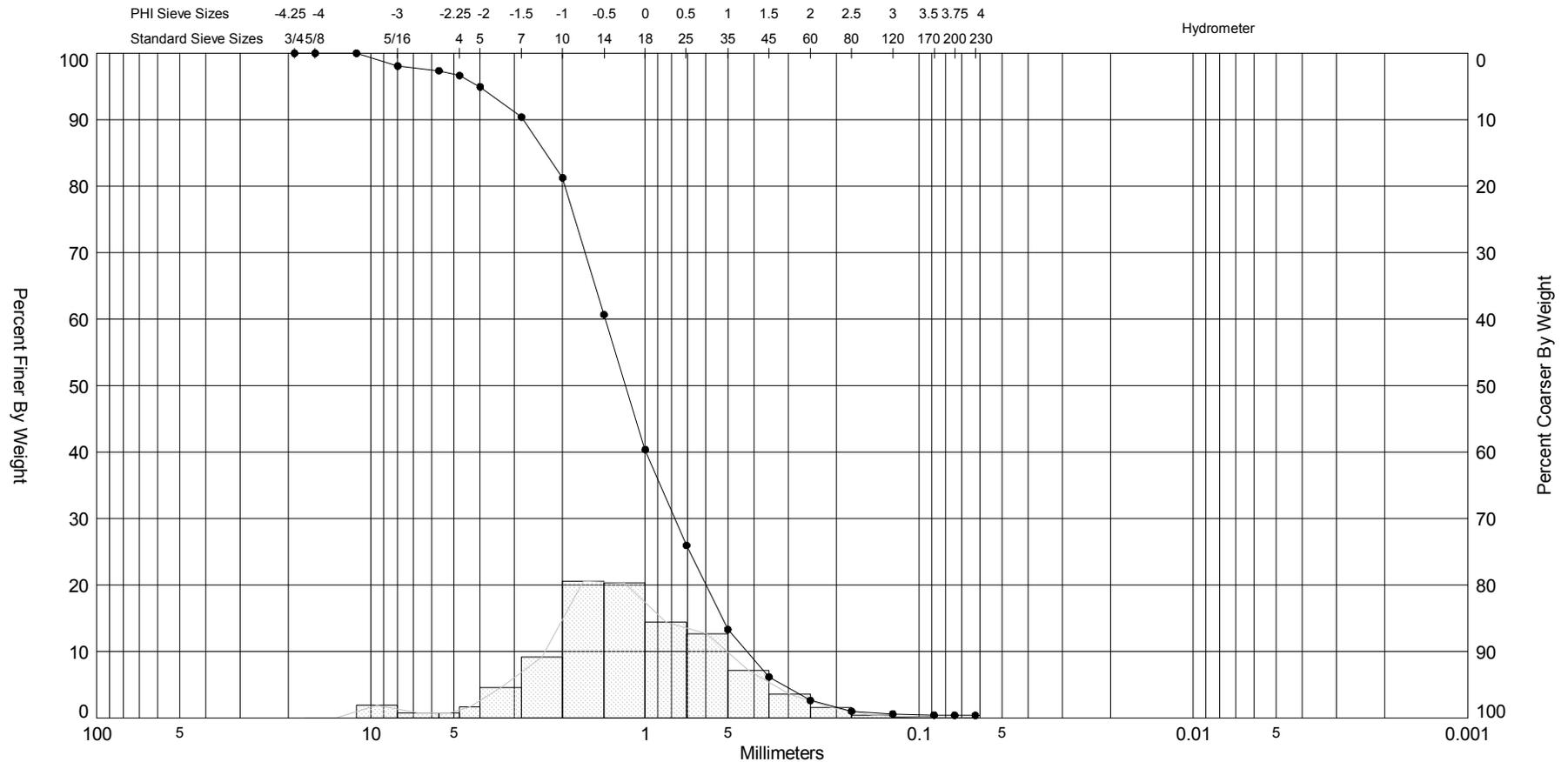
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
HULL7-G3A	—●—	-101.0	SW-SM	#200 - 5.28 #230 - 4.28			2.47	2.09	-1.96	6.6	1.39	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-20-17
Depths and elevations based on measured values												Analyzed By:	DA
							APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102					Easting (X, m):	261,231
												Northing (Y, m):	898,100
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

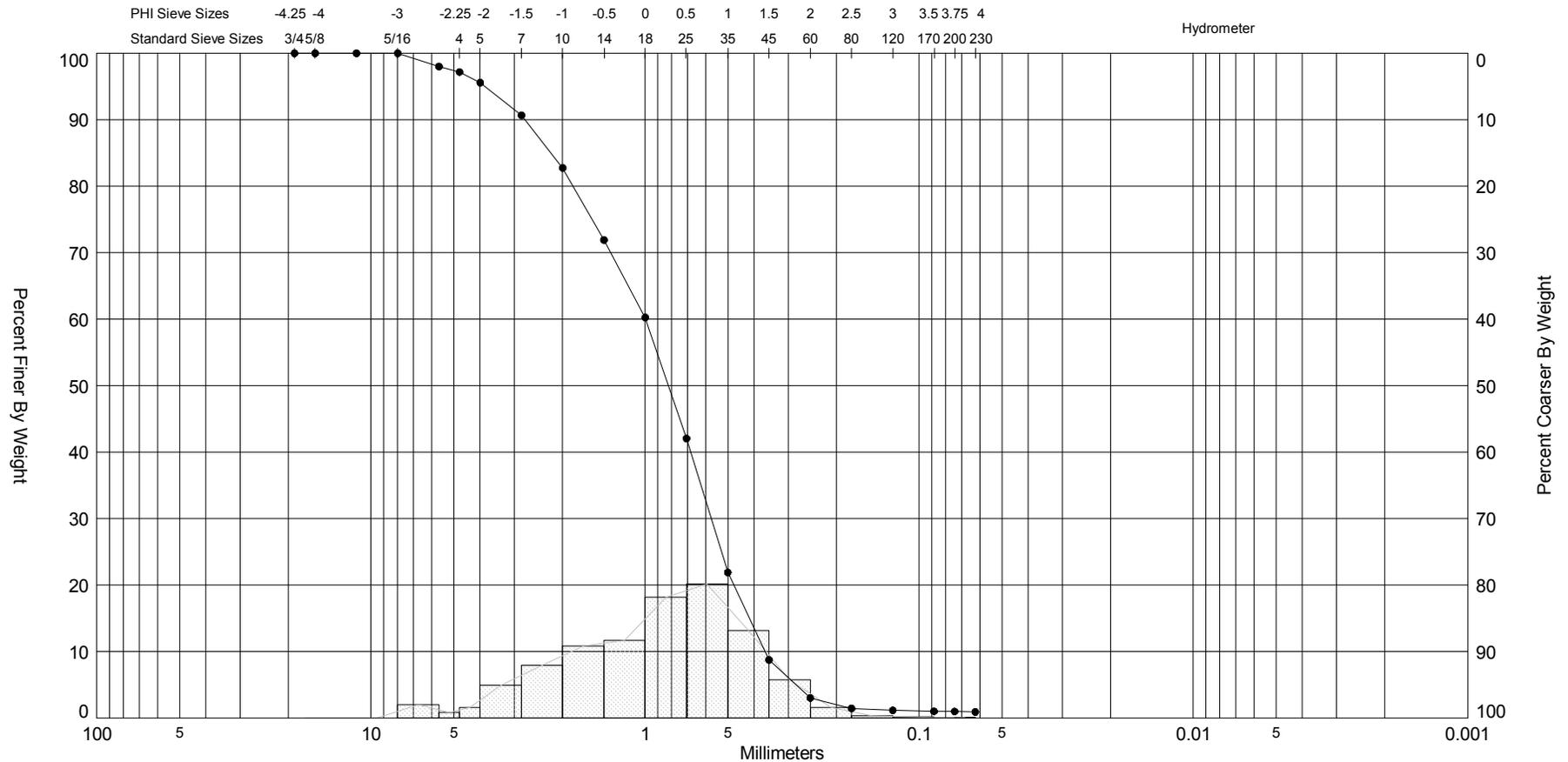
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MER10-G1	—●—	-84.0	SW	#200 - 0.41 #230 - 0.39				-0.2	-0.1	3.51	1.09	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-22-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	261,287
												Northing (Y, m):	946,847
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

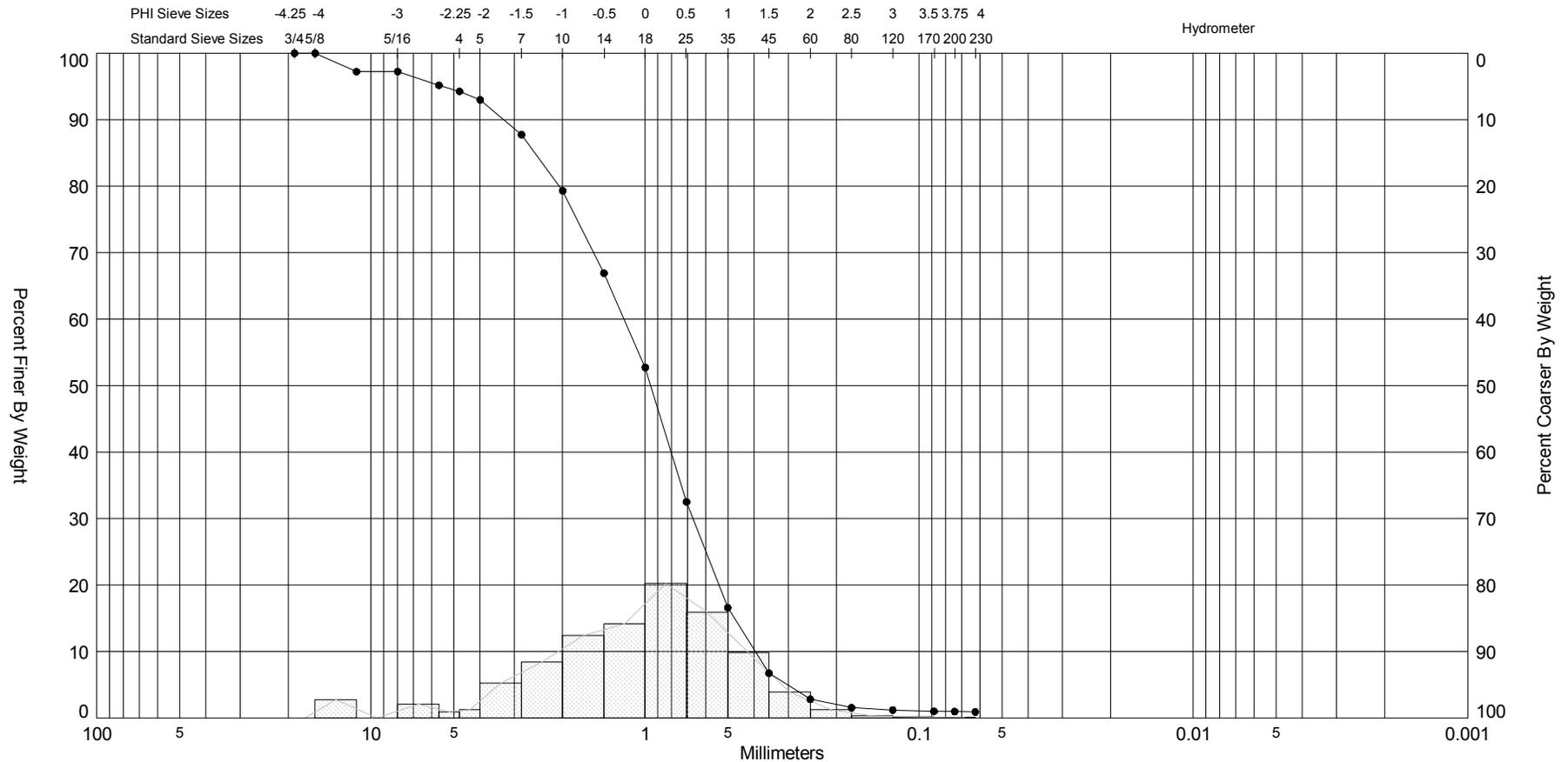
MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MER4-G4	—●—	-95.0	SW	#200 - 0.98 #230 - 0.92			0.28	0.11	-0.41	2.87	1.12	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-22-17
Depths and elevations based on measured values												Analyzed By:	DA
 <p style="text-align: center;">APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p>												Easting (X, m):	260,341
												Northing (Y, m):	953,193
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

MA_CZM_2017_GRABS.GPJ_12/5/17



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

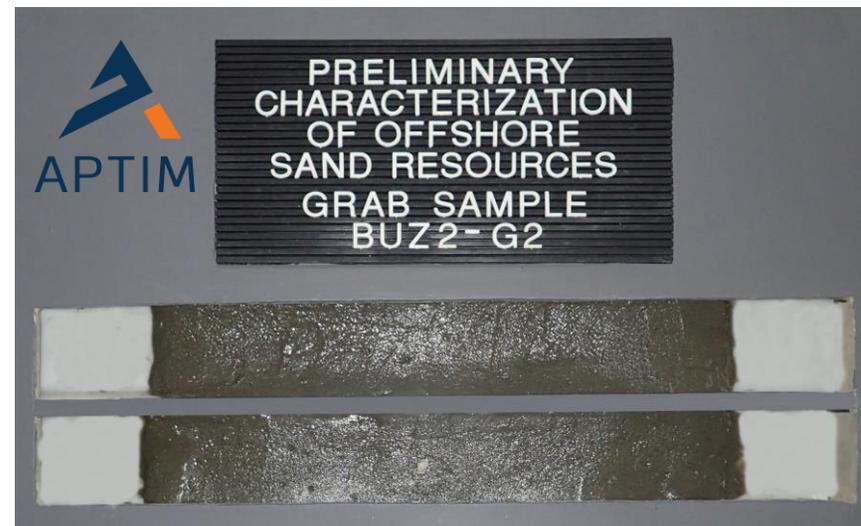
Sample	Symbol	Elev. (ft.)	USCS	% Fines	% Organics	% Carbonates	Median	Mean	Skew	Kurt	Sort	Sample Information	
MER2-G5	—●—	-107.0	SW	#200 - 0.97 #230 - 0.91			0.07	-0.13	-0.67	3.81	1.23	Project Name:	Preliminary Characterization of Offshore Sand Resources in Selected Study Areas
Comments: Elev. (ft.) = uncorrected												Analysis Date:	11-22-17
Depths and elevations based on measured values												Analyzed By:	DA
 <div style="text-align: center;"> <p>APTIM 2481 NW Boca Raton Blvd. Boca Raton, FL 33431 ph (561) 391-8102</p> </div>												Easting (X, m):	261,021
												Northing (Y, m):	955,438
												Horizontal Datum:	NAD 1983
												Vertical Datum:	Raw Water

MA_CZM_2017_GRABS.GPJ_12/5/17

Appendix J

Grab Sample Photographs







PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
BUZ10-G5



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
CANAL9-G1



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
CANAL7-G2



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
CANAL2-G3

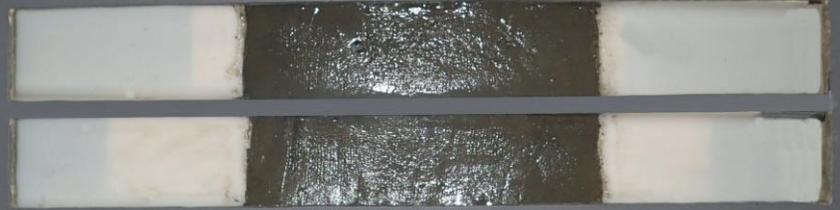




PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
CANAL4-G4A



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
CANAL6-G5



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
DUX3-G1



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
DUX4-G2

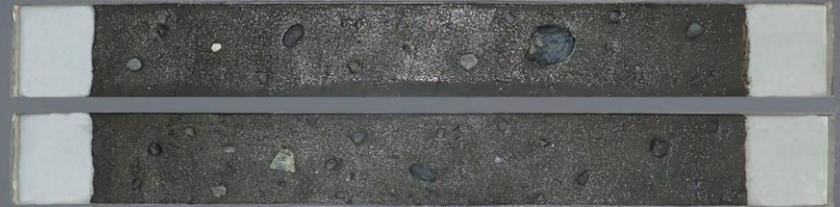




PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
DUX7-G3A



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
DUX9-G4



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
DUX6-G5



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
HULL4-G1





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
HULL5-G2



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
HULL7-G3A



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
HULL2-G4



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
HULL1-G5A





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
MER10-G1



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
MER 8 -G2



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
MER7-G3B



PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
MER4-G4





PRELIMINARY
CHARACTERIZATION
OF OFFSHORE
SAND RESOURCES
GRAB SAMPLE
MER2-G5



Appendix K

Video Transect Plates

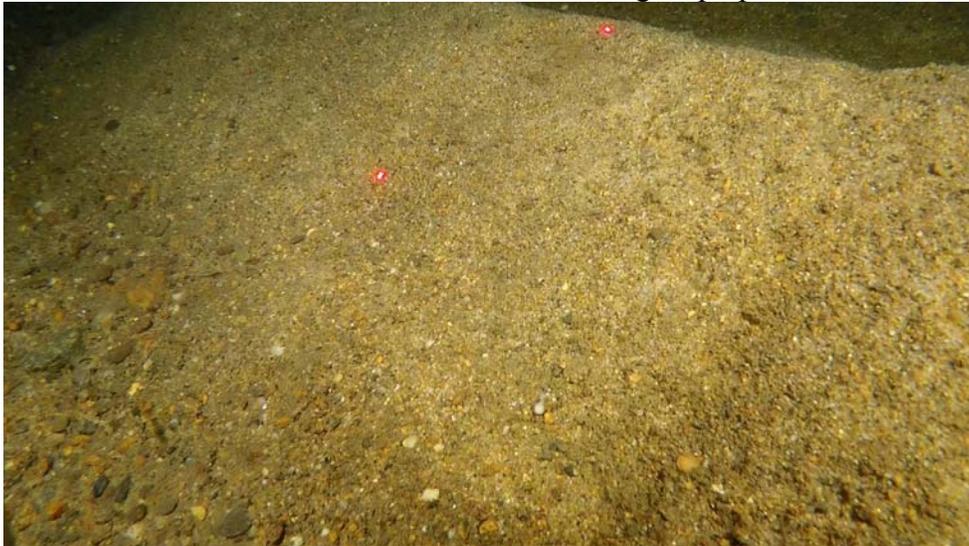




Pebbles in trough of coarse grained sand waves



Peak of low relief sand waves showing amphipod tubes



Sand wave height estimated at one foot provides optimal scallop habitat

Plate 1. Area 1 – Gulf of Maine, Merrimack River - Dominant Sand Wave Substrate



Concealed Goosefish on top of sand wave



Goosefish fleeing from the video sled



Flounder in sand wave bottom

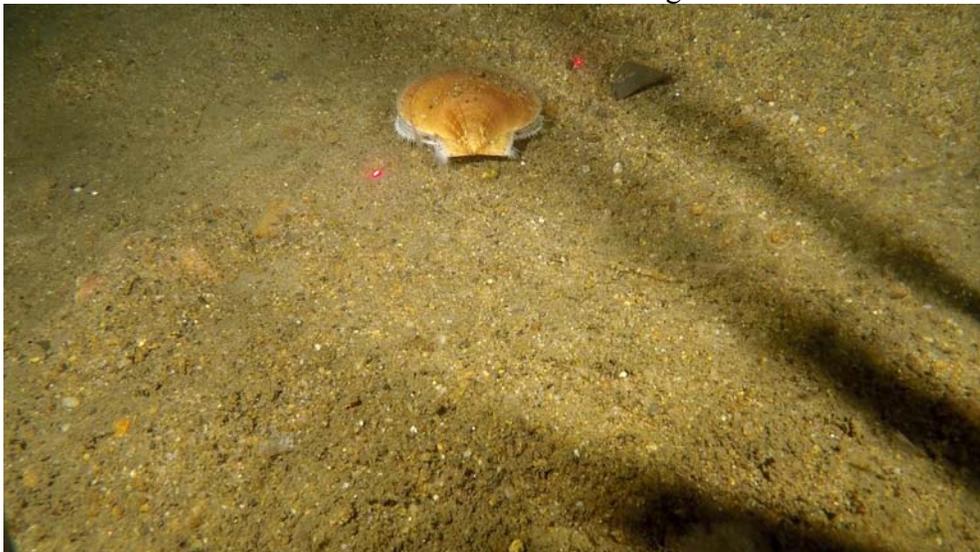
Plate 2. Area 1 – Gulf of Maine, Merrimack River - Representative Fish Species



Lobster defending his territory



Jonah Crab in sand wave trough



Sea scallop in trough of sand waves

Plate 3. Area 1 – Gulf of Maine, Merrimack River - Representative Invertebrates



Polymastia sponge and encrusting red algae in dispersed boulder habitat



Rhodymenia red algae, horse mussels, blood stars in boulders



Northern sea stars in boulder habitat

Plate 4. Area 2 - Mass Bay off Nantasket Beach, Hull - Representative hard bottom habitat



Amphipod tubes in fine grained sand bottom



Montague shrimp in fine grain sand



Sand dollars in fine grained sand

Plate 5. Area 2 – Mass Bay off Nantasket Beach, Hull - Flat Sand, Mud Bottom Habitat



Red hake in depression



Longhorn sculpin in pebble/cobble habitat



Winter flounder in pebble/cobble bottom

Plate 6. Area 2 – Mass Bay off Nantasket Beach, Hull - Representative Fish Species



Adult sea scallop in pebble/cobble habitat



Rock crab in flat/sand mud bottom



Burrowing anemone in pebble/cobble habitat

Plate 7. Area 2 – Mass Bay off Nantasket Beach, Hull - Representative Invertebrates



Amphipod tubes in fine grained sand bottom



Shell aggregate bottom type



Shell hash in flat sand, mud habitat

Plate 8. Area 3 – Cape Cod Bay outside Duxbury Bay - Representative Substrate



Partially buried sea robin in shell aggregate bottom habitat



Juvenile red hake in shell aggregate bottom



Goosefish in flat sand, mud bottom habitat

Plate 9. Area 3 – Cape Cod Bay outside Duxbury Bay - Representative Fish Species



Rock crab in defensive posture in fine grained sand



Live ocean quahog in fine grained sand bottom



Foraging moon snail in flat sand, mud habitat



Silty sand bottom substrate



Rock disposal material with bushy bryozoan at the Cape Cod Canal Disposal Site



Amphipod tubes in flat sand/mud bottom

Plate 11. Area 4 – Cape Cod Bay E-NE of the Canal, Sandwich - Representative Substrate



Red hake in fine sand grained bottom



Scup at rock disposal material at the Cape Cod Canal Disposal Site



Buried sculpin behind shell in flat sand, mud habitat

Plate 12. Area 4 – Cape Cod Bay E-NE of the Canal, Sandwich- Representative Fish



Rock Crab in fine grained sands

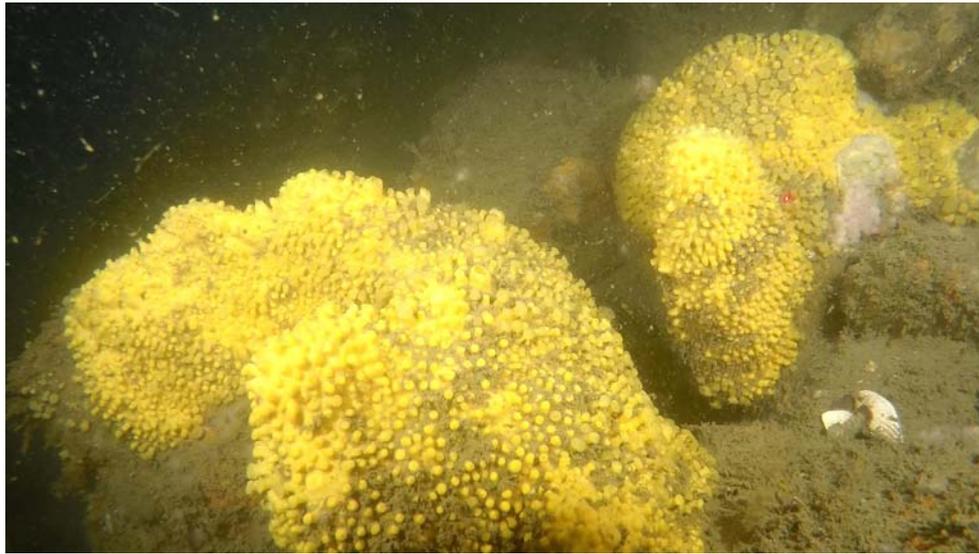


Sand dollars in flat sand, mud bottom



Jonah crab and amphipod tubes in fine grained sands

Plate 13. Area 4 – Cape Cod Bay E-NE of the Canal, Sandwich- Representative Invertebrates



Bread crumb sponge and northern star coral in dispersed boulder bottom



Pebble/cobble bottom habitat



Dispersed boulder bottom with bushy bryozoans

Plate 14. Area 5 – Buzzards Bay off Cuttyhunk Island - Representative Hard Bottom



Fine grained sand ripple bottom at Area 5



Floating branching red algae at sand ripple bottom



Amphipod tubes in fine grain sand bottom

Plate 15. Area 5 – Buzzards Bay off Cuttyhunk Island - Representative Sandy Substrate



Skate on the move in flat sand/mud bottom habitat



Red hake in sand ripple bottom



Sea robin in pebble/cobble bottom



Hermit crab climbing debris in fine grain sand bottom



Plumed worm tubes with shell at flat sand, mud bottom



Squid at flat sand, mud habitat

Plate 17. Area 5 – Buzzards Bay off Cuttyhunk Island - Representative Invertebrates

Appendix L

Video Transect Tables



TABLE 1
CZM SEDIMENT CLASSIFICATION
(Barnhardt, W.A. et al., 1998)

<u>Original</u>	<u>CZM Modified</u>
MUD	
Mud/sand	a FINE
Mud/gravel	
Mud/rock	b Fine with Gravel
SAND	
Sandy/mud	c Fine with Rock
Sand/gravel	d Gravel with Fine
Sand/rock	
	e GRAVEL
GRAVEL	
Gravel/mud	f Gravel with Rock
Gravel/sand	
Gravel/rock	g Rock with Fine
ROCK	
Rock/mud	
Rock/sand	i ROCK
Rock/gravel	

Barnhardt, W.A., J. T. Kelley, S.M. Dickson, and D.F. Belknap. 1998. *Mapping the Gulf of Maine with Side-Scan Sonar: A New Bottom-Type Classification for Complex Seafloors*. Journal of Coastal Research 14(2): 646-659

TABLE 2

BOTTOM HABITAT-SUBSTRATE CLASSIFICATION (Auster, 1998)

Habitat Category	Description	Rationale	Complexity Score
1	Flat sand/mud	Areas with no vertical structure such as depressions, ripples or epifauna	1
2	Sand waves	Troughs provide shelter from current; previous observations indicate that species such as red hake hold position on the down current sides of sand waves and ambush drifting demersal zooplankton and shrimp	2
3	Biogenic structures	Burrows, depressions, cerianthid anemones, hydroid patches; features that are created or used by mobile fauna for shelter	3
4	Shell aggregates	Provide complex interstitial spaces for shelter; also provide a complex, high-contrast background that may confuse visual predators	4
5	Pebble-cobble	Provide small interstitial spaces and may be equivalent in shelter value to shell aggregate, but less ephemeral than shell	5
6	Pebble-cobble with sponge cover	Attached fauna such as sponges provide additional spatial complexity for a wider range of size classes of mobile organisms	10
7	Partially buried or dispersed boulders	Partially buried boulders exhibit high vertical relief; dispersed boulders on cobble pavement provide simple crevices; the shelter value of this type of habitat may be less or greater than previous types based on the size class and behavior of associated species	12
8	Piled boulders	Provide deep interstitial spaces of variable sizes	15

Auster, P.J. 1998. *The conceptual model of the impacts of fishing gear on the integrity of fish habitat.* Conservation Biology V12 (6): 1198-1203.

TABLE 3
OBSERVED SPECIES LIST AND CODES FOR FIELD DATA SHEETS

FAUNA

PORIFERA

BCS	Bread crumb sponge	<i>Halichondria panicea</i>
POL	Polymastia Sponge	<i>Polymastia robusta</i>

CNIDARIA

CER	Burrowing anemone	<i>Cerianthus borealis</i>
AN	Clonal Plumose Anemone	<i>Metritium senile</i>
NSC	Northern star coral	<i>Astrangia poculata</i>
HYD	Hydroids	Hydrozoa
HYDST	Solitary hydroids	<i>Hybocodon pendula</i>
HYDTB	Tubularian hydroids	<i>Tubularia crocea</i>

BRYOZOA

BRY	Bushy bryozoan	<i>Bugula</i> sp.
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MOLLUSCA

CW	Channeled Whelk	<i>Busycotypus canaliculatus</i>
OYS	Common Oyster	<i>Crassostrea virginica</i>
EMS	Eastern Mudsnaill	<i>Ilyanassa obsoleta</i>
SQ	Long-Finned Squid	<i>Loligo pealei</i>
HM	Northern Horse Mussel	<i>Modiolus modiolus</i>
MS	Northern moon snail	<i>Lunatia heros</i>
OQ	Ocean quahog	<i>Artica islandica</i>
SS	Sea Scallop	<i>Placopecten magellanicus</i>
SL	Slipper limpet	<i>Crepidula fornicata</i>

ANNELIDA

Polychaeta

LW	Lug worm	<i>Arenicola</i> sp.
PW	Parchment worm	<i>Chaetopterus variopedatus</i>
PLW	Plumed worm	<i>Diopatra cuprea</i>
WH	Sedentary polychaetes	Polychaeta

ARTHROPODA

Crustacea

LOB	American Lobster	<i>Homarus americanus</i>
BAR	Barnacle	<i>Balanus</i> sp.
AMP	Four-eyed amphipod	<i>Ampelisca</i> sp.
HC	Flat claw hermit crab	<i>Pagurus pollicaris</i>
HC	Long-wrist hermit crab	<i>Pagurus longicarpus</i>
RC	Jonah crab	<i>Cancer borealis</i>
LC	Lady crab	<i>Ovalipes ocellatus</i>

TABLE 3
OBSERVED SPECIES LIST AND CODES FOR FIELD DATA SHEETS

	ARTHROPODA (cont.)	
SH	Montague's Shrimp	<i>Pandalus montagui</i>
MYS	Opossum shrimp	<i>Mysis</i> sp.
RC	Rock crab	<i>Cancer irroratus</i>
SC	Spider crab	<i>Lubinia emarginata</i>
	ECHINODERMATA	
HEN	Blood Star	<i>Henricia sanguinolenta</i>
NSS	Northern sea star	<i>Asteria vulgaris</i>
SD	Sand dollar	<i>Echinarachnius parma</i>
PSO	Scarlet Psolus	<i>Psolus fabricii</i>
	VERTEBRATA	
	<u>Elasmobranchiomorphi</u>	
SK	Little Skate	<i>Raja erinacea</i>
	<u>Osteichthyes</u>	
CU	Cunner	<i>Tautoglabrus adspersus</i>
GF	Goosefish	<i>Lophius americanus</i>
SCP	Longhorn sculpin	<i>Myoxocephalus octodecimspinosus</i>
SR	Northern sea robin	<i>Prionotus carolinus</i>
RH	Red Hake	<i>Urophycis chuss</i>
RG	Rock Gunnel	<i>Pholis gunnellus</i>
SP	Scup	<i>Stenotomus chrysops</i>
SFLD	Summer Flounder	<i>Paralichthys dentatus</i>
WFLD	Windowpane Flounder	<i>Scophthalmus aquosus</i>
FLD	Winter Flounder	<i>Pseudopleuronectes americanus</i>
	CHORDATA	
DID	White invasive tunicate	<i>Didemnum candidum</i>
	<u>FLORA</u>	
	CHLOROPHYTA	
ULVA	Sea Lettuce	<i>Ulva lactuca</i>
	RHODOPHYTA	
BRALG	Branching red alga	Rhodophyta
RALG	Dulse	<i>Rhodymenia palmata</i>
ERALG	Encrusting red algae	<i>Lithothamnium</i> sp.
CH	Irish Moss	<i>Chondrus crispus</i>

TABLE 3
OBSERVED SPECIES LIST AND CODES FOR FIELD DATA SHEETS

Relative abundance biota

- R** rare - 3 or less observed during segment
- O** occasional - >3 but infrequent
- C** common - frequently observed during segment
- A** abundant - consistently and/or continuously seen throughout segment

TABLE 4
VIDEO FIELD DATA GULF OF MAINE EAST OF THE MOUTH OF THE MERRIMACK RIVER

BENTHIC SURVEY FIELD SHEET

JR,BM,VL

DATE: 9/12/2017-9/13/2017

WEATHER: sunny, w wind 10 mph, seas 1-2 ft

AREA: 1-Merrimack River					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
9/12/2017											
mer-1a											
0-250m	001_0924	9:24:00	81	125	a	2	sd	o	rc ¹ , sd-13, mys-3, sh, sfld, gf (juv.)		
250-500m		9:39:00	85	125	a	2	mys	a	sd-15, mys-4 (obs.) ² , amp-2, rc, fld, rh, ss, scp-2, lob-2, sfld		
500-750m		9:52:00	87	125	a	2	mys	a	sd-12, mys-6, amp-2, fld-2, sh, rc, ss, lob, hc	10:06:00	88.3
mer-2											
0-250m	002_1022	10:22:00	97	150	a	2	ss	c	ss-28, rc-2, sd, mys-6, scp-3, sh, lob-3, fld, hc ⁵ , rh-2		
250m		10:36:00	100	150	a	2			ss-3 (hooked lobster pot ended transect)	10:39:00	100
mer-2a											
0-250m	004_1054	10:54:00	100	150	a	2	mys/ss	a	lob-2,ss-24, rh-4, mys-4 (gravel in sand wave trough), fld, fld (juv.), sh, scp-5, rc, (gravel in sand wave trough), rh (juv.)		
250-500m		11:13:00	103	150	a	2	mys/ss	a	ss-17, mys 5, amp-2, fld-2, scp (gravel in sand wave troughs), hc, wfld, rc, rh	11:33:00	105
mer-3											
0-250m	005_1206	12:06:00	78	125	a	2	amp	a	rc-2 , hc, amp-4, mys-4, lob, scp (juv.), rh-2, fld		
250-500m		12:22:00	82	125	a	2	mys/lob	a/c	amp-3, mys-3, lob-4, rh-2, fld-2, hc, scp		
500-710m		12:37:00	85	125 then 150 (at 12:41:00)	a	2	mys/lob	a/c	amp-5, mys-6 , lob-4, sh, fld-2, rh, hc, scp, sd-3, rc, sd (ended 40m early due to lobster pot, go pro was off when camera came up)	12:50:00	87
mer-4											
0-250m	004_1311	13:11:00	91	150	a	2	mys	a	rh, ss-10, mys-3, amp-4, sk, lob, cu, (13:20:00 moving from lobster pot), (back on the bottom 13:22:00)	13:25:00	95
mer-4a											
0-360m	006_1335	13:35:00	95	150	a	2	mys	a	lob-4, ss-13 , scp-4, mys-4, sk, amp-2, rc (moving from lobster pot 13:49:00)		
360-500m		13:53:00	99	150	a	2	mys	a	mys-6, ss-21, amp-4, scp-3, fld-4, scp-2, rh (gravel in sand wave troughs)	14:07:00	101

TABLE 4
VIDEO FIELD DATA GULF OF MAINE EAST OF THE MOUTH OF THE MERRIMACK RIVER

AREA: 1-Merrimack River					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
mer-5											
0-165m	005_1430	14:30:00	65	100	a	2	amp/lob	c	mys, rc-2, lob-3, amp-3, bralg (moving from lobster pot)	14:40:00	70
165-500m		14:42:00	74	125	a	2	amp/lob	c	amp-8, fld, mys-2, rh (juv.), rc-4, lob-3, hc-2, scp, sh,		
500-750m		14:57:00	80	125	a	2	amp	a	amp-7, rc-2, mys-3, lob, hc	15:12:00	84
mer-6											
0-250m	006_1523	15:23:00	90	125	a	2	mys	a	rc-3, hc, ss-8, amp-5, mys-6, lob, scp-2, rc-2, fld (ended transect at 250m, at edge of shape file)	15:37:00	92
mer-6a											
0-250m	006_1548	15:48:00	95	150	a	2	mys	a	amp-3, mys-4, rc, fld, ss, sd, (small boulder; gravel in sand wave troughs)		
250-500m		16:03:00	97	150	a	2	mys	a	amp-3, mys-6, rh-2, ss-8, fld-2, rc-3, scp, rh (juv.) sh		
500-750m		16:22:00	98	150	a	2	mys	a	ss-21, amp-3, mys-4, rh-3, ss-20, sh-3, hc, rc, rh	16:39:00	98.1
9/13/2017											
mer-7											
0-250m	007_0835	8:35:00	95	150	a	1 and 2 ⁴	mys/ss	a	mys-5, hc, fld-5, amp-3, ss-13, (small sand ripples), rc-2, rh, fish (08:44:00)		
250-500m		8:47:00	96	150	a	1 and 2	mys/ss	a	rc, mys-8, ss-29, scp, lob, amp-2, hc, fld,		
500-750m		8:59:00	98	150	a	1 and 2	ss	c	ss-54, mys-7, lob, hc, scp-2, amp-3, fld-2, (gravel in sand wave troughs)	9:12:00	98
mer-8											
0-250m	008_0929	9:29:00	77	115/125 (09:34)	a	2	mys	a	amp-5, mys-5, ss-3, hc, rc, (ocean quahog shells), scp-2, lob, sd		
250-500m		9:44:00	79	125	a	2	amp/ss	a	rh, amp-7, mys-3, hc-2, ss-21, scp, rc-2, hc, sk, lob		
500-750m		9:59:00	81	125	a	2	amp/ss	a	ss-34, amp-8, mys-5, sk, rc-3, lob, (ocean quahog shells)	10:15:00	82
mer-9											
0-250m	009_1039	10:39:00	75	125	a	2	amp	a	hc-4, amp-6, mys-3, ss-12, hc, amp-4, fld-2, rh, rc		
250-500m		10:53:00	77	125	a	2	mys	a	amp-2, ss-21, mys-4, rc-2, hc, fld		
500-750m		11:05:00	78	125	a	2	mys	a	amp-4, mys-8, rc-3, lob-4, (gravel in sand wave the troughs), hc-2, rh-2, fld-2, sh	11:18:00	81

TABLE 4
VIDEO FIELD DATA GULF OF MAINE EAST OF THE MOUTH OF THE MERRIMACK RIVER

AREA: 1-Merrimack River					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
mer-10											
0-250m	010_1130	11:30:00	83	125	a	2	mys	a	scp-4, fld, ss-35, sh, mys-7, amp-4, (gravel in sand wave troughs), rh-3, rc		
250-500m		11:43:00	86	125	a	2	mys	a	ss-32, mys-12, amp-6, rh-2, rh, hc, fld		
500-750m		11:57:00	89	125	a	2	mys	a	scp-3, mys-4, amp-4, ss-30, hc-3, sk, rc-4, fld, (gravel in sand wave troughs;ocean quahog shells)	12:12:00	87

Notes:

¹ Jonah and rock crabs were difficult to differentiate all were identified as rc

² Mysid shrimp (mys) numbers are the number of observations not counts of individuals - numerous individuals were present for each observation

³ (1) - Auster code in parentheses is a secondary Habitat-Substrate type that is estimated to cover about 10-15% of the bottom

⁴ 1 and 5 - Auster code is an example of a combination bottom Habitat-Substrate type having areas of flat sand/mud and pebble cobble in approximately equal proportions

⁵ hc - Hermit crab includes both the long-wrist hermit crab (*Pagarus longicarpus*) and the flatclaw hermit crab (*P. pollicaris*)

TABLE 5
VIDEO FIELD DATA MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL

BENTHIC SURVEY FIELD SHEET JR,BM,SM **DATE:** 8/16/2107 and 8/17/17 **WEATHER:** sunny, nw wind 10 mph, seas 1 ft

AREA: 2-Nantasket Beach, Hull				CZM	Auster						
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
8/16/2017											
hull-10											
0-250m	010_829	8:30:01	98	150	d	5	rc	c	rc ¹ -10, ss-14, cu-5 ,school of cu, fish 8:36:00, (occasional boulders), scp-2, lob-2, did-2, hen, nss		
250-500m		8:45:00	100	150	d	5	rc	c	scp-2, fish 8:46:00, ss-12, did-2, (boulder), rc-7, fish 8:49:00, (transition to sand patch 8:50:00), fld-2, rg-2, fish 8:54:00, (lobster pot forced to surface 8:55:35 then deployed again), cu, hyd, scp, pso		
500-750m		8:59:39	94	150	d	5	ss	c	lob-2, nss, ss-54, did (patch), hyd-3, rc-4, (lobster pot with lob), rg-2, cu, hen-4, eralg, hydtb	9:13:45	84
hull-9											
0-250m	009_924	9:24:32	88	150	d	5	ss	c	sq, nss, ss-46, (lobster pot), cu, rc, hyd, sponge-2, rh-3, occasional scp, did, eralg		
250-500m		9:37:20	90	150	d	2 and 5 ⁴	ss	c	ss-59, nss, rh-6, eralg-2, scp-4, sponge-2, hyd, hen-3, rh-4, cu-3, rg, (sand waves with gravel on top 9:42:00; sand patch 9:44:00), rc, scp-2, did-2, hydst		
500-750m		9:53:53	91	150	c and d	2 and 5	ss	c	ss-35, fld-2, rc-3, sponge-4, rh-7, hen-2, scp, rh-5, cu-5, eralg, did (couple of sand patches)	10:08:00	92
hull-8											
0-250m	008_1020	10:20:00	101	150	c and d	2 and 5	ss	c	rc-3, ss-14, rh, rc-4, (sand patches 10:28:00; fine sand with occasional pebble 10:29:00), scp, scp (juv.), (fine sand with shell 10:33:00), sk		
250-500m		10:34:50	103	155	d	1 and 4	ss	o	scp-2, rc-8, (shells) (boulder 10:37:30), (lobster pot gear surfaced-10:38, on bottom 10:38:40), ss-16, (back into sand shell 10:42:00), fld-3, rh, hen, (fine sand 10:46:00), (back into rocks 10:48:00), hc		
500-750m		10:50:00	105	155	b and d	1 and 5, (4) ³	ss	o	(fine sand, shells) ss-9, rc-4, scp, (patches of rock and pebbles), did, hyd, (rocks and pebbles, back into fines 10:56, slight sand ripples 10:57, some shell), rh, cu, (occasional small boulder, rocks 11:00:00, sand 11:02), scp (juv.),rg, (small boulder, boulder, gravel cobble 11 :07)	11:07:00	106
hull-7											
0-250m	007_1131	11:31:00	103	150	b and c	5 (1)	ss	c	cu-7, cu school-2, ss-44, rc-5, (rocky), hen-3, lob-2, hyd-2, (few boulders), fld, (patch of sand 11:41:00, fine sand 11:45:00-11:46:00)		
250-500m		11:47:40	98	150	b and c	5 (1)	ss	c	ss-39, oys, nss-2, hyd-2, (patch of sand 11:49, small boulder 11:50), cu-8, cu school, hen-2, lob, scp-2, ast, (sand 11:52 patchy), fld-3, rc-3, (sandy patches 11:55), rg, (sand 11:57), (boulder)		
500-750m		12:04:30	100	150	b and c	5	ss	c	ss-26+, an, lob, rc-4,(large boulder), fld-2, (boulders, sand patch 12:07 some shell), scp, (back into pebble cobble 12:14), rg,cu-2, (sand 12:16), wh, (pebble cobble 12:17), hc ⁵	12:20:25	101

TABLE 5
VIDEO FIELD DATA MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL

AREA: 2-Nantasket Beach, Hull					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
hull-6											
0-250m	006_1234	12:34:00	121	175	d	1 and 5	ss	a	cer-8, ss-38+, scp (juv.), scp-3,rc-4, (some sand 12:42), (shell cobble bottom), (bottom H-S 5), sh-3, (sand 12:44), hyd-2, (rocky), hyd		
250-500m		12:49:30	120	175	d	5 and 7	ss	c	rc-3,ss-49, sh-2, cer-6,scp-3, sk		
500-750		13:03:50	109	175	d, h and i	5 and 7	ss	a	rc, cer-2, ss-44+, cu-10,cunner school-3, scp-4, (boulders), lob-2, nss, hm (boulders (H-S 7-8)	13:17:45	96
hull-5											
0-250m	005_13:42	13:42:00	110	175	a	2 (4)	rc	o	rc-5, ss-2, rh, sh,(avoiding lobster pot gear on surface-13:50 back on bottom 13:50:50, lobster pot on surface-13:54-55),(shell hash bottom), (caught up with a lobster pot had to pull gear and restart)	13:59:00	110
hull-5a											
0-250m	005_14:06	14:06:00	112	175	a	1 (4)	rc	o	sh-3, rc-5, fld, (burrow), rh		
250-500m		14:19:00	118	175	a	1 (5)	fld in sand; cu in hard bottom	o	fld-4, rc-2, rh, (pebbles starting to get hard bottom 14:26), hyd, cu-5, cu school, hen-3, sponge-3, pol-sponge, (cobbles to boulders), hyd, nss, bcs	14:33:00	106
hull-4											
0-250m	004_1454	14:54:00	126	175	b	1 and 5	ss	o	ss-5+, scp (juv.), sh, fld-2, (fine sand (1,a) 14:58), mys, cer, rh-3, burrow-2, rc,amp tubes, (cobble), number of ss 15:04		
250-500m		15:07:50	125	175	a	1 (5)	ss	c	rc-5, fld-2, 1509:44 gf, rg-2,ss-18,(pebble patches 1,5 combo15:14), hyd, cu-2, (more rocky bottom), cer-2,(sand 15:17(1-a)), scp (juv.), rh, mys ²		
500-750m		15:21:40	125	175	a	1	ss	c	mys, ss-25, rh-7, burrow, scp-2,scp (juv.),rg-2, ss-24, fld-3, rc-2, hc	15:36:55	128
8/17/2017											
hull-1											
0-250m	001_846	8:46:00	80	110	a	1	rc	a	rc-26, rc in burrow-2, (burrows), fld, rg-2,unknown fish 9:00		
250-500m		9:00:38	77	110	a	1	sd	a	ss, rc-11, sd-4+, (sd dominant at 9:04), fld-3		
500-750m		9:16:10	76	110	a	1	rc	a	rc-48, (burrows),rc in burrow-3, (almost sand ripples 9:20), rh, rg-2	9:34:00	76

TABLE 5
VIDEO FIELD DATA MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL

AREA: 2-Nantasket Beach, Hull					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
hull-2											
0-250m	002_943	9:43:00	82	125	a and b	1 and 5	sd	a and b	scp-2, scp (juv.),ss-2 (some fine sand but pebble cobble dominant), rc-3, gf (9:47), (110 ft cable out at 9:49), fld-2, (less gravel more fine 9:50 (1-a)), sd-5 dominant 9:55, sh, (burrows)		
250-500m		10:04:00	76	110	a	1	sd	a	sd-5+, rh-2, rc-5, ss-4, fld, (boulder harder bottom 10:18 (5,b)), sponge-2, did		
500-600m		10:19:00	67	110	b and f	5 and 7	cu	c	cu-4, school of cu, rc-2,eralg, (occasional boulder, shell), ss-5, rc-2, hen-2, (more boulders), sponge, ralg ,lob, ch (ended early at ~600m gear caught up on boulder)	10:30:00	62
hull-3											
0-250m	003_1046	10:46:00	104	150	d	5	ss	a	lob, ss-14++, cu-10, eralg, did-2, cu, hyd, 10:51:48 unknown fish, hen, sponge, rc		
250-500m		10:59:39	107	150	c and d	5	ss	a	ss-4++ ,did,cu-6, an-7, sponge, hc, rc-4, (a little sandier 1/5), cer-2, rg		
500-750m		11:13:00	110	150	c and d	1 and 5	ss	a	fld-2, ss-11, an-6, sponge, hyd, cer-10, rc-4, scp	11:28:00	120

Notes:

¹ Jonah and rock crabs were difficult to differentiate all were identified as rc

² Mysid shrimp (mys) numbers are the number of observations not counts of individuals - numerous individuals were present for each observation

³ (1) - Auster code in parentheses is a secondary Habitat-Substrate type that is estimated to cover about 10-15% of the bottom

⁴ 1 and 5 - Auster code is an example of a combination bottom Habitat-Substrate type having areas of flat sand/mud and pebble cobble in approximately equal proportions

⁵ hc - Hermit crab includes both the long-wrist hermit crab (*Pagurus longicarpus*) and the flatclaw hermit crab (*P. pollicaris*)

TABLE 6
VIDEO FIELD DATA CAPE COD BAY OUTSIDE DUXBURY BAY

BENTHIC SURVEY FIELD SHEET

JR,BM,LP

DATE:

11/3/2017

WEATHER: sunny, w wind 10 mph, seas 1-2 ft

AREA: 3 - Outside Duxbury Bay, Cape Cod Bay					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
dux-1											
0-250m	001_0904	9:04:00	123	220	a	1	mys	o	fld-2, sh, (shell hash),rg (juv.)-3, sk, rc ¹⁻⁴ , oq (shell hash), mys ²⁻² , scp-2, lob		
250-500m		9:19:00	122	220	a	1	mys	o	mys-2,(shell hash), scp-2, rc	9:32:00	124
dux-2											
	002_1027	10:27:00							video no good, sled got tangled	10:29:00	
dux-2a											
0-250m	002_1037	10:37:00	131	225	a	1	mys	c	rc-4, (shell hash), fld-5, rg (juv.), (shell common), scp		
250-500m		10:47:00	123	225	a	1	mys	c	rh (juv.)-5, rh, rc, (shell hash), rc-2, fld-5, mys-3, sk, oq shell, scp, lob	10:57:00	128
dux-3											
0-250m	003_1127	11:27:00	104	200	a	1	sd	a	sd-9, mys-3, rh (juv.)-4, (shell hash), lob, rc, ms		
250-500m		11:35:00	104	200	a	1	sd	c	sd-12, mys-4, (shell hash), rh (juv.)-3, rc-2	11:43:00	105
dux-4											
0-250m	004_1202	12:02:00	77	150	a	1	mys	c	rc-3, rh (juv.)-3, sh, mys-3, sd-8, rc-2, sd-6		
250-500m		12:09:00	82	150	a	1	mys	c	sd-3, mys-2, (shell hash), rc-5, (ms sand collar), (shell hash), oq shell, lob-2	12:18:00	87
dux-7											
0-250m	007_1252	12:52:00	68	150	a	1	sd	c	lob, mys-3, sd-10, sh, rc-2, (sand ripples)		
250-500m		12:59:00	67	150	a	1	sd	c	sh, mys-5, sd-14, rc-3, fld	13:08:00	66
dux-8											
0-250m	008_1323	13:23:00	90	200	a	1	mys	c	rc, lob, mys-5, sd-6, sh-2, (oq shell), rh (juv.),sk		
250-500m		13:32:00	94	200	a	1 and 4 ⁴	mys	c	mys-4, sd-3, (shell hash), sh-2, sd, (oq shell), rc-6, sh-2, rh (juv.)-3, (shell hash), scp (juv.)-3,scp	13:43:00	95
dux-9											
0-250m	009_1400	14:00:00	88	175	a	1	mys	a	mys-3, rc, lob, rh (juv.)-2		
250-500m		14:09:00	86	175	a	1	mys	a	my-4s,rc-4, rh (juv.)	14:17:00	87
dux-5											

TABLE 6
VIDEO FIELD DATA CAPE COD BAY OUTSIDE DUXBURY BAY

AREA: 3 - Outside Duxbury Bay, Cape Cod Bay					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
0-230m	005_1437	14:37:00	109	200	a	1	mys	a	mys-3, rh (juv.)-3, rh, lob, (gear caught lobster pot - transect ended)	14:45:00	106
dux-5a											
0-300m	005_1455	14:55:00	94	200/180(15:02)	a and b	1 and 5	mys	a	mys-6, (shell hash), (oq shell), rh (juv.)-3, (shell hash), scp (juv.), rc-2	15:06:00	91
dux-6											
0-250m	006_1523_0	15:23:00	86	175	a	1	mys	c	mys-2, rh (juv.)-2, (shell hash), scp, rc-3, sk, fld		
250-500m		15:30:00	89	175	a and b	1 and 5	mys	c	rh (juv.)-4, (burrows common), mys, rh, rc-7, mys-2, (pebble cobble bottom 13:37)	15:37:00	91
dux-10											
0-250m	010_1550	15:50:00	58	125	a and b	1 and 5	mys	c	mys-3, (floating eel grass strands), sd-4, sk-3, rc, sh-4, rh (juv.), scp, (oq shell)		
250-550m	250m	16:02:00	62	125	a	1	mys	c	rc-7, hc, fld, mys-5, sk (juv.), rc-5, (floating eel grass strands),sh, (went off bottom,back on bottom(16:11) (shell hash), sd-4	16:15:00	62

Notes:

¹ Jonah and rock crabs were difficult to differentiate all were identified as rc

² Mysid shrimp (mys) numbers are the number of observations not counts of individuals - numerous individuals were present for each observation

³ (1) - Auster code in parentheses is a secondary Habitat-Substrate type that is estimated to cover about 10-15% of the bottom

⁴ 1 and 5 - Auster code is an example of a combination bottom Habitat-Substrate type having areas of flat sand/mud and pebble cobble in approximately equal proportions

⁵ hc - Hermit crab includes both the long-wrist hermit crab (*Pagurus longicarpus*) and the flatclaw hermit crab (*P. pollicaris*)

TABLE 7
VIDEO FIELD DATA CAPE COD BAY EAST OF THE CAPE COD CANAL, SANDWICH

BENTHIC SURVEY FIELD SHEET

JR,BM,SM

DATE:

8/2/2107

WEATHER: sunny, sw wind 10 mph, seas 1 ft

AREA: 4 - Cape Cod Bay, E-NE of Canal, Sandwich					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
canal-9											
0-250m	009_0855	8:55:00	47	100	b	2	sd	a	sd numerous, fld, lob, (some cobbles), rc ¹ , (sand ripples), sh,		
250-500m		9:04:00	49	100	b	2	sd	a	sd numerous, ghost trap and unidentified fish, hc ⁵ , rc, scp, ms,		
500-750m		9:13:00	51	100	b	1	sd	a	sd numerous, ms-2, (lobster pot gear to the surface), hc, sk, rc, bralg, cu-2, (rock, lobster gear)		
750-1000m		9:21:00	56	100	b	2	sd	a	sd numerous, sh-3	9:29:00	58
canal-8											
canal-8	008_953	9:52:00	62.5	125					Branching ralg, (lost Outland camera connection, line no good)		
canal-8a											
0-250m	008_1023	10:23:00	57	125	a	1	sd	a	sd numerous, fld, hc, (surf clam shell),		
250-500m		10:32:00	58	125	a	1	sd	a	sd numerous, hc, rc-2		
500-750m		10:41:00	58	125	a	1	sd	a	sd numerous, unknown fish (10:43),		
750-1000m		10:49:00	59	125	a	1	sd	a	sd numerous, rc-3, hc-4, unknown fish(10:55:10), wh-3	10:58:10	59
canal-7											
0-250m	007_1112	11:12:00	58	125	a	1	sd	a	sd numerous (laser out of focus), rc, fld(11:13), lob, rc, (surf clam shell-2)		
250-500m		11:20:17	57	125	a	1	sd	a	sd numerous, rc, (surf clam shell)		
500-750m		11:29:12	59	125	a	1	sd	a	sd numerous, hc-4, (surf clam shell-5), fld		
750-1000m		11:37:36	58	125	a	1	sd	a	sd numerous, (surf clam shell-2), sk-2, hc-4, hl, sh-2, lob	11:47:00	56.5
canal-10											
0-250m	010_1214	12:14:00	53	110	a	1 and 3 ⁴	sd	a	sd numerous, hc, fld-2, sfld, lob-2, rc, (surf clam shell), hl		
250-500m		12:20:40	52	110	a	1 and 3	sd	a	sd numerous, hl-3, (surf clam shell), (lobster pot gear to the surface), hc-2, rc-2 (lobster borrows), ms		
500-750m		12:27:43	53	110	a	1 and 3	sd	c	sd common, lob, rc, sk		
750-1000m		12:33:39	55	110	a	1 and 3	sd	c	sd common, (lobster pot gear to the surface), (oq shell),(burrows) ,rc, hl, fld, hc, (go pro data coverage not complete)	12:41:38	56

TABLE 7
VIDEO FIELD DATA CAPE COD BAY EAST OF THE CAPE COD CANAL, SANDWICH

AREA: 4 - Cape Cod Bay, E-NE of Canal, Sandwich					CZM	Auster				End Time	Raw Water Depth (ft)
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
canal-6											
0-250m	006_1302	13:02:00	45	100	a	1 and 3	sd	c	sd common, sk-2, rc, (burrow, mounds), hc, (lobster pots gear to the surface)		
250-500m		13:08:48	49.5	100	a	1 and 3	sd	c	sd common, (burrows),(lobster pot gear to the surface), (surf clam shell), unknown(13:10), (lobster pot on bottom), patches of ralg, (soft bottom)		
500-750m		13:15:19	52	150	a	3	sd	o	sd common, number of wh, rc-2, unknown (13:16), (burrows), patches bralg, lob, sfld, sk, outside of study area's shapefile (13:20)		
750-1000m		13:23:00	55.5	150	a	3	sd	o	occasional sd, unknown (13:24), rc-2, (burrows), fld	13:31:19	56.5
canal-5											
0-250m	005_1343	13:43:00	43	100	b	1	sd	a	numerous sd, lob-2, rc-2, hc, bralg, diatoms on top of sand, fld, (unknown 13:51)		
250-500m		13:51:30	47	100	b	1	sd	a	numerous sd, hc, bralg, ulva, green alg, scp, hc, unknown(13:57),		
500-750m		14:00:00	49	100	b	1 and 3	sd	a	numerous sd, diatoms on sediment surface,(burrows),(lobster pot gear to the surface 14:02), hc, bralg, hl, (let out 20 ft of line)		
750-1000m		14:07:00	51	120	a	1 and 3	sd	c	sd common, burrows, unknown (14:09), diatoms on sediment surface common, (wind increase 10-15 knots, seas 2 ft), unknown 14:15	14:16:45	53
canal-4											
0-250m	004_1427	14:27:00	39	100	b	1	sd	a	sd numerous, lob, hc, diatoms covering sediment surface, (lobster pot gear to the surface),bralg, hc,		
250-500m		14:35:10	39	100	b	1	sd	a	sd numerous, hc-2, bcs, sk, diatoms on the sediment surface		
500-750m		14:42:57	39	100	b	1	sd	a	sd numerous, hc-3, diatoms on the sediment surface, lob, bralg		
750-1000m		14:50:00	48	100	b	1	sd	c	sd common, rc-3, bralg, diatoms on the sediment surface, unknown (14:51:44), (burrows), sk-, hc, unknown fish (14:56)	14:57:20	53
canal-3											
0-250m	003_1515	15:15:00	40	100	b	1	sd	a	sd numerous, fld, diatoms on sediment surface , hc-5, fld, sk, (hit lobster pot)		
250-500m		15:20:00	42	100	b	1	sd	a	sd numerous, hc-3, diatoms on sediment surface, lob		
500-750m		15:31:00	41.5	100	b	1	sd	a	sd numerous, diatoms on sediment surface, fld, hc-5, lob-3, (lobster pot gear to the surface), sh		
750-1000m		15:38:00	42	100	b	1	sd	a	sd numerous, diatoms on the sediment surface, rc, hc-2, lob, fld	15:45:00	43

TABLE 7
VIDEO FIELD DATA CAPE COD BAY EAST OF THE CAPE COD CANAL, SANDWICH

AREA: 4 - Cape Cod Bay, E-NE of Canal, Sandwich					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
canal-2											
0-250m	002_1557	15:57:00	36	90	b	1	sd	a	sd numerous, sk-2, hc-6, diatoms on the sediment surface, rc-6 (trace of pebbles)		
250-500m		16:04:00	40	90	b	1 and 5	sd	a	sd numerous, hc-3, diatoms on sediment surface, bralg, ms, (pebbles in trough), fld, lob-2, unknown (16:10:50) rc		
500-750m		16:13:00	42	90	b	1 and 5	sd	a	sd numerous, lob-3, rc-4, (shell), fld-2, (some sand waves)		
750-1000m		16:20:00	42	90	b	1	sd	a	sd numerous, (lobster pot gear to the surf), lob-2, hc-4, (sand waves), rc-2, sk-2, hc-2, ms	16:27:28	43
canal-1											
0-270m	004_17:01	17:07:00	78	200	a	1	mys	a	mys ² abundant, sp, (patch of rock), fld-3, rc-2, (harder material)		
270-500m		17:16:00	79.5	200	a	1	mys	a	mys abundant (cobble, events of rock disposal), (burrows H-S of 1 and 3), rc-2, (lobster pot gear to the surface), fld-2, (turn boat to get around lobster pots), unknown fish 12:23		
500-750m		17:24:00	80.5	200	a	1 (3)	mys	a	mys abundant, fld, (burrows H-S of 1 and 3, really fine silty bottom), unknown fish 17:33:08,		
750-1000m		17:34:00	81	200	a	1 (3)	mys	a	mys abundant, (burrow) rh-2, (silty bottom), rc, fld, (rocks, dredged material) (burrow)		
1000-1250m		17:44:00	81	200	a	1 (3)	mys	a	mys abundant (silty bottom, fines), rc-8, fld, (burrows), sponge, rh-2	17:53:45	81.5

Notes:

¹ Jonah and rock crabs were difficult to differentiate all were identified as rc

² Mysid shrimp (mys) numbers are the number of observations not counts of individuals - numerous individuals were present for each observation

³ (1) - Auster code in parentheses is a secondary Habitat-Substrate type that is estimated to cover about 10-15% of the bottom

⁴ 1 and 5 - Auster code is an example of a combination bottom Habitat-Substrate type having areas of flat sand/mud and pebble cobble in approximately equal proportions

⁵ hc - Hermit crab includes both the long-wrist hermit crab (*Pagurus longicarpus*) and the flatclaw hermit crab (*P. pollicaris*)

TABLE 8
VIDEO FIELD DATA BUZZARDS BAY OFF CUTTYHUNK ISLAND

BENTHIC SURVEY FIELD SHEET					JR,BM,JD	DATE:	11/9/2017	WEATHER: sunny, w wind 10 mph, seas 1-2 ft			
AREA: 5 - Buzzards Bay off Cuttyhunk Island					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
buz-1											
0-250m	001_0740	7:40:00	55	80	a and b	1 and 5	hc ⁵	c	hc-17, (shell hash), cw egg case, (occasional pebble/cobble bottom), (small boulder),cw, rh,cer, bar (barnacles),pw		
250-500m		7:59:00	57	80, 90 (08:08)	a	1	hc	c	hc-18, cw-3, sd, plw (floating eelgrass strand-2 observations)	8:19:00	60
buz-5											
0-250m	005_0836	8:36:00	54	90	a (g)	1 (7) ³	hc	c	(hard bottom at start of transect), hyd and bry in hard bottom, nsc, bar, hc-26, sd-7, (floating eelgrass strand)		
250-500m		9:02:00	53	85	a and b	1 and 5 ⁴ at (9:16) then 1 at (9:23)	sl	c	hc-20, sd, (pebble cobble 9:15), (floating aglae), sl- 5, spc-5, cw, oys	9:25:00	53
buz-2											
0-250m	002_0946	9:46:00	66	110	a	1	hc	c	hc-20, lc, cw-3, (floating eelgrass strand)		
250-500m		10:06:00	65	110	a	1	hc	o	hc-2, hc-12, hc, sq, rh, sr-2	10:20:00	66
buz-4											
0-250m	001_1046	10:46:00	55	100	a	1 and 2	hc	c	hc-14, (sand ripples with pebbles in trough), sd-2, rh		
250-500m	250m	11:02:00	53	100	a	1	hc	c	hc-14, (sand ripples), sd-4	11:19:00	52
buz-3											
0-250m	003_1129	11:29:00	65	110	a	1	hc	c	hc-18, cw, sd-2, cer, sr, sq, od, fld, rh-2		
250-500m		11:47:00	65	110	a	1	hc	c	hc-21, sd-3, rh	12:04:00	65
buz-6											
0-250m	006_1221	12:21:00	61	110	a	1	hc	c	hc-21, (sand ripples), cw, od, rh, (floating eelgrass strands)		
250-500m		12:37:00	61	110	a	1	hc	o	hc-11, bcs, nsc (boulder)	12:50:00	61
buz-7											
0-250m	007_1304	13:04:00	67	110	a, b and g	1, 2 and 7	bcs	r	sr, sd, cer, (boulders), bcs, nsc-2 (boulder), cu-2, hyd-2		

**TABLE 8
VIDEO FIELD DATA BUZZARDS BAY OFF CUTTYHUNK ISLAND**

AREA: 5 - Buzzards Bay off Cuttyhunk Island					CZM	Auster					
Transect ID and segment	File Name	Start Time	Raw Water Depth (ft)	Line Out - Layback (ft)	Sed type	Habitat-Substrate type	Dom. fauna	Rel. Abund.	Notes/Comments	End Time	Raw Water Depth (ft)
250-500m		13:20:00	67	110	a, b and g	1, 2 and 7	bcs	o	nsc-6, hyd-2, bcs-9, (boulder), (boulder) cu-4,(boulder), (boulders), hen, sp-2	13:33:00	69
buz-8											
0-250m	008_13:59	13:59:00	62	110	a	1	hc	o	(sand ripples), hc-4, lob		
250-500m	250m	14:11:00	63	110	a	1	hc	o	(sand ripples), hc-5	14:23:00	63
buz-9											
0-250m	009_1433	14:33:00	65	110	a	1	hc	r	(floating eelgrass strands), (sand ripples), hc-3, rh-3, fld, lw egg sack		
250-500m	250m	14:45:00	64	110	a	1	hc	c	hc-10, sp-2, ms, rh	14:56:00	65
buz-10											
0-250m	010_1506	15:07:00	75	115	a	1	hc	o	hc-5, rh-4, cw		
250-500m	250m	15:20:00	75	115	a	1	hc	o	ems, rh-7, hc-5, (floating eelgrass strand), sk	15:35:00	77

Notes:

¹ Jonah and rock crabs were difficult to differentiate all were identified as rc

² Mysid shrimp (mys) numbers are the number of observations not counts of individuals - numerous individuals were present for each observation

³ (1) - Auster code in parentheses is a secondary Habitat-Substrate type that is estimated to cover about 10-15% of the bottom

⁴ 1 and 5 - Auster code is an example of a combination bottom Habitat-Substrate type having areas of flat sand/mud and pebble cobble in approximately equal proportions

⁵ hc - Hermit crab includes both the long-wrist hermit crab (*Pagurus longicarpus*) and the flatclaw hermit crab (*P. pollicaris*)

TABLE 9
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 1 - GULF OF MAINE EAST OF THE MERRIMACK RIVER
September 12-13, 2017

Transect ID	Dominant_Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	CZM - Barnhardt et. al (1998)	Raw Water Depth (ft)	
					start	end
mer-1a						
0-250m	Sand dollar	Occasional	Sand waves	Fine	81	85
250-500m	Mysid shrimp	Abundant	Sand waves	Fine	85	87
500-750m	Mysid shrimp	Abundant	Sand waves	Fine	87	88
mer-2						
0-250m	Sea scallop	Common	Sand waves	Fine	97	100
mer-2a						
0-250m	Mysid shrimp/Sea scallop	Abundant	Sand waves	Fine	100	103
250-500m	Mysid shrimp/Sea scallop	Abundant	Sand waves	Fine	103	105
mer-3						
0-250m	Amphipod	Abundant	Sand waves	Fine	78	82
250-500m	Mysid shrimp/Lobster	Abundant/Common	Sand waves	Fine	82	85
500-710m	Mysid shrimp/Lobster	Abundant/Common	Sand waves	Fine	85	87
mer-4						
0-250m	Mysid shrimp	Abundant	Sand waves	Fine	91	95
mer-4a						
0-360m	Mysid shrimp	Abundant	Sand waves	Fine	95	99
360-500m	Mysid shrimp	Abundant	Sand waves	Fine	99	101
mer-5						
0-165m	Amphipod/Lobster	Common	Sand waves	Fine	65	70
165-500m	Amphipod/Lobster	Common	Sand waves	Fine	70	80
500-750m	Amphipod	Abundant	Sand waves	Fine	80	84
mer-6						
0-250m	Mysid shrimp	Abundant	Sand waves	Fine	90	92
mer-6a						
0-250m	Mysid shrimp	Abundant	Sand waves	Fine	95	97
250-500m	Mysid shrimp	Abundant	Sand waves	Fine	97	98
500-750m	Mysid shrimp	Abundant	Sand waves	Fine	98	98

TABLE 9
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 1 - GULF OF MAINE EAST OF THE MERRIMACK RIVER
September 12-13, 2017

Transect ID	Dominant Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	CZM - Barnhardt et. al (1998)	Raw Water Depth (ft)	
					start	end
mer-7						
0-250m	Mysid shrimp/Sea scallop	Abundant	Fine sand, Mud/Sand Waves	Fine	95	96
250-500m	Mysid shrimp/Sea scallop	Abundant	Fine sand, Mud/Sand Waves	Fine	96	98
500-750m	Sea scallop	Common	Fine sand, Mud/Sand Waves	Fine	98	98
mer-8						
0-250m	Mysid shrimp	Abundant	Sand waves	Fine	77	79
250-500m	Amphipod/Sea scallop	Abundant	Sand waves	Fine	79	81
500-750m	Amphipod/Sea scallop	Abundant	Sand waves	Fine	81	82
mer-9						
0-250m	Amphipod	Abundant	Sand waves	Fine	75	77
250-500m	Mysid shrimp	Abundant	Sand waves	Fine	77	78
500-750m	Mysid shrimp	Abundant	Sand waves	Fine	78	81
mer-10						
0-250m	Mysid shrimp	Abundant	Sand waves	Fine	83	86
250-500m	Mysid shrimp	Abundant	Sand waves	Fine	86	89
500-750m	Mysid shrimp	Abundant	Sand waves	Fine	89	87

TABLE 10
SUMMARY FOR POTENTIAL SAND RESOURCE SITE
AREA 2 - MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL
August 16-17, 2017

Transect ID	Dominant Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water Depth (ft)	
						start	end
hull-1							
0-250m	Rock Crab ¹	Abundant	Flat Sand, Mud		Fine	80	77
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	77	76
500-600m	Rock Crab	Abundant	Flat Sand, Mud		Fine	76	76
hull-2							
0-250m	Sand Dollar	Abundant	Flat Sand,Mud/Pebble, Cobble		Fine/Fine with gravel	82	76
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	76	67
500-600m	Cunner	Common	Pebble, Cobble/Partially Buried or Dispersed Boulders		Fine with gravel/Gravel with rock	67	62
hull-3							
0-250m	Sea Scallop	Abundant	Pebble, Cobble		Gravel with fine	104	107
250-500m	Sea Scallop	Abundant	Pebble, Cobble		Fine with rock/Gravel with fine	107	110
500-750m	Sea Scallop	Abundant	Flat Sand,Mud/Pebble, Cobble		Fine with rock/Gravel with fine	110	120
hull-4							
0-250m	Sea Scallop	Occasional	Flat Sand,Mud/Pebble, Cobble		Fine with gravel	126	125
250-500m	Sea Scallop	Common	Flat Sand, Mud	Pebble, Cobble	Fine	125	125
500-750m	Sea Scallop	Common	Flat Sand, Mud		Fine	125	128
hull-5							
0-250m	Rock Crab	Occasional	Sand waves	Shell Aggregate	Fine	110	110
hull-5a							
0-250m	Rock Crab	Occasional	Flat Sand, Mud	Shell Aggregate	Fine	112	118
250-500m	Winter Flounder/Cunner	Occasional	Flat Sand, Mud	Pebble, Cobble	Fine	118	106

TABLE 10
SUMMARY FOR POTENTIAL SAND RESOURCE SITE
AREA 2 - MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL
August 16-17, 2017

Transect ID	Dominant Fauna	Abundance of Dominant Spp.	Auster (1998) -		CZM - Barnhardt et. al (1998)	Raw Water Depth (ft)	
			primary	secondary ²		start	end
hull-6							
0-250m	Sea Scallop	Abundant	Flat Sand, Mud/Pebble, Cobble		Gravel with fine	121	120
250-500m	Sea Scallop	Common	Pebble, Cobble/Partially Buried or Dispersed Boulders		Gravel with fine	120	109
500-750m	Sea Scallop	Abundant	Pebble, Cobble/Partially Buried or Dispersed Boulders		Gravel with fine/Rock with gravel/Rock	109	96
hull-7							
0-250m	Sea Scallop	Common	Pebble, Cobble	Flat Sand, Mud	Fine with gravel/Fine with rock	103	98
250-500m	Sea Scallop	Common	Pebble, Cobble	Flat Sand, Mud	Fine with gravel/Fine with rock	98	100
500-750m	Sea Scallop	Common	Pebble, Cobble		Fine with gravel/Fine with rock	100	101
hull-8							
0-250m	Sea Scallop	Common	Sand Waves/Pebble, Cobble		Fine with rock/Gravel with fine	101	103
250-500m	Sea Scallop	Occasional	Flat Sand, Mud/Shell Aggregate		Gravel with fine	103	105
500-750m	Sea Scallop	Occasional	Flat Sand, Mud/Pebble, Cobble	Shell Aggregate	Fine with gravel/Gravel with fine	105	106
hull-9							
0-250m	Sea Scallop	Common	Pebble, Cobble		Gravel with fine	88	90
250-500m	Sea Scallop	Common	Sand Waves/Pebble, Cobble		Gravel with fine	90	91
500-750m	Sea Scallop	Common	Sand Waves/Pebble, Cobble		Gravel with fine/Fine with rock	91	92

TABLE 10
SUMMARY FOR POTENTIAL SAND RESOURCE SITE
AREA 2 - MASSACHUSETTS BAY OFF NANTASKET BEACH, HULL
August 16-17, 2017

Transect ID	Dominant_Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water Depth (ft)	
						start	end
hull-10							
0-250m	Rock Crab	Common	Pebble, Cobble		Gravel with fine	98	100
250-500m	Rock Crab	Common	Pebble, Cobble		Gravel with fine	100	94
500-750m	Sea Scallop	Common	Pebble, Cobble		Gravel with fine	94	84

Notes:

¹ Rock crabs and Jonah crabs could not be differentiated in the field when viewing video

² A secondary Habitat-Substrate type is estimated to cover about 10-15% of the bottom

TABLE 11
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 3 - CAPE COD BAY OUTSIDE DUXBURY BAY

November 3, 2017

Transect ID	Dominant_Fauna	Abundance of		Raw Water		
		Dominant Spp.	Auster (1998) - primary	CZM - Barnhardt et. al (1998)	Depth (ft) start	end
dux-1						
0-250m	Mysid Shrimp	Occasional	Flat Sand, Mud	Fine	123	122
250-500m	Mysid Shrimp	Occasional	Flat Sand, Mud	Fine	122	124
dux-2						
0-250m	video no good			Fine		
dux-2a						
0-250m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	131	123
250-500m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	123	128
dux-3						
0-250m	Sand Dollar	Abundant	Flat Sand, Mud	Fine	104	104
250-500m	Sand Dollar	Common	Flat Sand, Mud	Fine	104	105
dux-4						
0-250m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	77	82
250-500m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	82	87
dux-5						
0-230m	Mysid Shrimp	Abundant	Flat Sand, Mud	Fine	109	106
dux-5a						
0-300m	Mysid Shrimp	Abundant	Flat Sand, Mud/Pebble, Cobble	Fine/Fine with gravel	94	91
dux-6						
0-250m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	86	89
250-500m	Mysid Shrimp	Common	Flat Sand, Mud/Pebble, Cobble	Fine/Fine with gravel	89	91
dux-7						
0-250m	Sand Dollar	Common	Flat Sand, Mud	Fine	68	67
250-500m	Sand Dollar	Common	Flat Sand, Mud	Fine	67	66
dux-8						
0-250m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	90	94
250-500m	Mysid Shrimp	Common	Flat Sand, Mud/Shell Aggregate	Fine	94	95
dux-9						
0-250m	Mysid Shrimp	Abundant	Flat Sand, Mud	Fine	88	86
250-500m	Mysid Shrimp	Abundant	Flat Sand, Mud	Fine	86	87

TABLE 11
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 3 - CAPE COD BAY OUTSIDE DUXBURY BAY
November 3, 2017

Transect ID	Dominant_Fauna	Abundance of Dominant Spp.	Raw Water		Depth (ft) start	end
			Auster (1998) - primary	CZM - Barnhardt et. al (1998)		
dux-10						
0-250m	Mysid Shrimp	Common	Flat Sand, Mud/Pebble, Cobble	Fine/Fine with gravel	58	62
250-500m	Mysid Shrimp	Common	Flat Sand, Mud	Fine	62	62

TABLE 12
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 4 - CAPE COD BAY EAST AND NORTH OF THE CAPE COD CANAL, SANDWICH
August 22, 2017

Transect ID	Dominant Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water	
						Depth (ft) start	end
canal-1							
0-270m	Mysid Shrimp	Abundant	Flat Sand, Mud		Fine	78	79.5
270-500m	Mysid Shrimp	Abundant	Flat Sand, Mud		Fine	79.5	80.5
500-750m	Mysid Shrimp	Abundant	Flat Sand, Mud	Biogenic Structures	Fine	80.5	81
750-1000m	Mysid Shrimp	Abundant	Flat Sand, Mud	Biogenic Structures	Fine	81	81
1000-1250m	Mysid Shrimp/Rock Crab ¹	Abundant/Common	Flat Sand, Mud	Biogenic Structures	Fine	81	81.5
canal-2							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	36	40
250-500m	Sand Dollar	Abundant	Flat Sand, Mud/ Pebble, Cobble		Fine with gravel	40	42
500-750m	Sand Dollar	Abundant	Flat Sand, Mud/ Pebble, Cobble		Fine with gravel	42	42
750-1000m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	42	43
canal-3							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	40	42
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	42	41.5
500-750m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	41.5	42
750-1000m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	42	43
canal-4							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	39	39
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	39	39
500-750m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	39	48
750-1000m	Sand Dollar	Common	Flat Sand, Mud		Fine with gravel	48	53
canal-5							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	43	47
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	47	49
500-750m	Sand Dollar	Abundant	Flat Sand, Mud/ Biogenic Structures		Fine with gravel	49	51
750-1000m	Sand Dollar	Common	Flat Sand, Mud/ Biogenic Structures		Fine	51	53
canal-6							
0-250m	Sand Dollar	Common	Flat Sand, Mud/ Biogenic Structures		Fine	45	49.5
250-500m	Sand Dollar	Common	Flat Sand, Mud/ Biogenic Structures		Fine	49.5	52
500-750m	Sand Dollar	Occasional	Biogenic Structures		Fine	52	55.5
750-1000m	Sand Dollar	Occasional	Biogenic Structures		Fine	55.5	56.5

TABLE 12
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 4 - CAPE COD BAY EAST AND NORTH OF THE CAPE COD CANAL, SANDWICH
August 22, 2017

Transect ID	Dominant_Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water	
						Depth (ft) start	end
canal-7							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	58	57
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	57	59
500-750m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	59	58
750-1000m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	58	56.5
canal-8							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	57	58
250-500m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	58	58
500-750m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	58	59
750-1000m	Sand Dollar	Abundant	Flat Sand, Mud		Fine	59	59
canal-9							
0-250m	Sand Dollar	Abundant	Sand Waves		Fine with gravel	47	49
250-500m	Sand Dollar	Abundant	Sand Waves		Fine with gravel	49	51
500-750m	Sand Dollar	Abundant	Flat Sand, Mud		Fine with gravel	51	56
750-1000m	Sand Dollar	Abundant	Sand Waves		Fine with gravel	56	58
canal-10							
0-250m	Sand Dollar	Abundant	Flat Sand, Mud/Biogenic Structures		Fine	53	52
250-500m	Sand Dollar	Abundant	Flat Sand, Mud/Biogenic Structures		Fine	52	53
500-750m	Sand Dollar	Common	Flat Sand, Mud/Biogenic Structures		Fine	53	55
750-1000m	Sand Dollar	Common	Flat Sand, Mud/Biogenic Structures		Fine	55	56

Notes:

¹ Rock crabs and Jonah crabs could not be differentiated in the field when viewing video

² A secondary Habitat-Substrate type is estimated to cover about 10-15% of the bottom

TABLE 13
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 5 - BUZZARDS BAY OFF CUTTYHUNK ISLAND
November 9, 2017

Transect ID	Dominant_Fauna	Abundance of		Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water Depth	
		Dominant Spp.	Auster (1998) - primary			(ft) start	end
buz-1							
0-250m	Hermit Crab	Common	Flat Sand, Mud/Pebble, Cobble		Fine/ Fine with gravel	55	57
250-500m	Hermit Crab	Common	Flat Sand, Mud		Fine	57	60
buz-2							
0-250m	Hermit Crab	Common	Flat Sand, Mud		Fine	54	53
250-500m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	53	53
buz-3							
0-250m	Hermit Crab	Common	Flat Sand, Mud		Fine	65	65
250-500m	Hermit Crab	Common	Flat Sand, Mud		Fine	65	65
buz-4							
0-250m	Hermit Crab	Common	Flat Sand, Mud/ Sand Waves		Fine	55	53
250-500m	Hermit Crab	Common	Flat Sand, Mud		Fine	53	52
buz-5							
0-250m	Hermit Crab	Common	Flat Sand, Mud	Partially buried or dispersed boulders	Fine	66	65
250-500m	Slipper Limpet	Common	Flat Sand, Mud/Pebble, Cobble		Fine/ Fine with gravel	65	66
buz-6							
0-250m	Hermit Crab	Common	Flat Sand, Mud		Fine	61	61
250-500m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	61	61
buz-7							
0-250m	Bread crumb sponge	Rare	Flat Sand, Mud/Sand Waves/ Partially Buried or Dispersed Boulders		Fine/ Fine with gravel/ Rock with fine	67	67
250-500m	Bread crumb sponge	Occasional	Flat Sand, Mud/Sand Waves/ Partially Buried or Dispersed Boulders		Fine/ Fine with gravel/ Rock with fine	67	69
buz-8							
0-250m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	62	63

TABLE 13
SUMMARY FOR POTENTIAL OFFSHORE SAND RESOURCES SITE
AREA 5 - BUZZARDS BAY OFF CUTTYHUNK ISLAND
November 9, 2017

Transect ID	Dominant_Fauna	Abundance of Dominant Spp.	Auster (1998) - primary	Auster (1998) - secondary ²	CZM - Barnhardt et. al (1998)	Raw Water Depth (ft) start	end
250-500m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	63	63
buz-9							
0-250m	Hermit Crab	Rare	Flat Sand, Mud		Fine	65	64
250-500m	Hermit Crab	Common	Flat Sand, Mud		Fine	64	65
buz-10							
0-250m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	75	75
250-500m	Hermit Crab	Occasional	Flat Sand, Mud		Fine	75	77

TABLE 14
SPECIES OBSERVED AT OFFSHORE SAND RESOURCE STUDY AREAS DURING VIDEO FIELD OPERATIONS

		AREA 1 - Gulf of ME off Mouth Merrimack River	AREA 2 - Mass Bay off Nantasket Beach, Hull	AREA 3 - Cape Cod Bay outside Duxbury Bay	AREA 4 - Cape Cod Bay, N-E of Canal, Sandwich	AREA 5 - Buzzards Bay off Cuttyhunk Island
<u>FAUNA</u>	Sampling Date	9/12-13/2017	8/16-17/2017	11/3,6/2017	8/2-3/2017	11/8-9/2017
PORIFERA						
Bread crumb sponge	<i>Halichondria panicea</i>		X		X	X
Polymastia sponge	<i>Polymastia robusta</i>		X			
CNIDARIA						
Burrowing anemone	<i>Cerianthus borealis</i>	X	X		X	X
Clonal plumose anemone	<i>Metritium senile</i>		X			
Hydroids	Hydrozoa		X	X		X
Northern star coral	<i>Astrangia poculata</i>					X
Solitary hydroids	<i>Hybocodon pendula</i>		X			
Tubularian hydroids	<i>Tubularia crocea</i>		X			X
BRYOZOA						
Bushy bryozoa	<i>Bugula sp.</i>					X
MOLLUSCA						
Channeled whelk	<i>Busycotypus canaliculatus</i>				X	X
Common oyster	<i>Crassostrea virginica</i>	X				X
Eastern mudsnail	<i>Ilyanassa obsoleta</i>					X
Long-finned squid	<i>Loligo pealei</i>		X			X
Northern horse mussel	<i>Modiolus modiolus</i>		X			
Northern moon snail	<i>Lunatia heros</i>			X	X	X
Ocean quahog	<i>Artica islandica</i>	X		X		X
Sea scallop	<i>Placopecten magellanicus</i>	X	X			
Slipper limpet	<i>Crepidula fornicata</i>					X
ANNELIDA						
Polychaeta						
Lug worm	<i>Arenicola sp.</i>					X
Parchment worm	<i>Chaetopterus variopedatus</i>					X
Plumed worm	<i>Diopatra cuprea</i>					X
Sedentary polychaetes	Polychaeta		X	X	X	X

TABLE 14
SPECIES OBSERVED AT OFFSHORE SAND RESOURCE STUDY AREAS DURING VIDEO FIELD OPERATIONS

		AREA 1 - Gulf of ME off Mouth Merrimack River	AREA 2 - Mass Bay off Nantasket Beach, Hull	AREA 3 - Cape Cod Bay outside Duxbury Bay	AREA 4 - Cape Cod Bay, N-E of Canal, Sandwich	AREA 5 - Buzzards Bay off Cuttyhunk Island
ARTHROPODA						
Crustacea						
American lobster	<i>Homarus americanus</i>	X	X	X	X	X
Barnacle	<i>Balanus</i> sp.					X
Four-eyed amphipod	<i>Ampelisca</i> sp.	X	X	X	X	X
Flat claw hermit crab	<i>Pagurus pollicaris</i>	X	X	X	X	X
Long-wrist hermit crab	<i>Pagurus longicarpus</i>					
Jonah crab ¹	<i>Cancer borealis</i>	X	X	X	X	
Lady crab	<i>Ovalipes ocellatus</i>					X
Montague's shrimp	<i>Pandalus montagui</i>	X	X	X	X	
Opossum shrimp	<i>Mysis</i> sp.	X	X	X	X	
Rock crab ¹	<i>Cancer irroratus</i>	X	X	X	X	
Spider crab	<i>Lubinia emarginata</i>					X
ECHINODERMATA						
Blood Star	<i>Henricia sanguinolenta</i>	X	X			X
Northern sea star	<i>Asteria vulgaris</i>		X			
Sand dollar	<i>Echinarachnius parma</i>	X	X	X	X	X
Scarlet psolus	<i>Psolus fabricii</i>		X			
TOTAL NUMBER OF INVERTEBRATES		13	22	12	13	25

TABLE 14
SPECIES OBSERVED AT OFFSHORE SAND RESOURCE STUDY AREAS DURING VIDEO FIELD OPERATIONS

		AREA 1 - Gulf of ME off Mouth Merrimack River	AREA 2 - Mass Bay off Nantasket Beach, Hull	AREA 3 - Cape Cod Bay outside Duxbury Bay	AREA 4 - Cape Cod Bay, N-E of Canal, Sandwich	AREA 5 - Buzzards Bay off Cuttyhunk Island
VERTEBRATA						
<u>Elasmobranchiomorphi</u>						
Little skate	<i>Raja erinacea</i>	X	X	X	X	X
<u>Osteichthyes</u>						
Cunner	<i>Tautoglabrus adspersus</i>	X	X			
Goosefish	<i>Lophius americanus</i>	X	X	X		
Longhorn sculpin	<i>Myoxocephalus octodecimspinosus</i>	X	X	X	X	
Northern sea robin	<i>Prionotus carolinus</i>			X		X
Red hake	<i>Urophycis chuss</i>	X	X	X	X	X
Rock gunnel	<i>Pholis gunnellus</i>		X	X		
Scup	<i>Stenotomus chrysops</i>		X	X	X	
Summer flounder	<i>Paralichthys dentatus</i>	X			X	
Windowpane flounder	<i>Scophthalmus aquosus</i>	X				
Winter flounder	<i>Pseudopleuronectes americanus</i>	X	X	X	X	X
UROCHORDATA						
White invasive tunicate	<i>Didemnum candidum</i>		X			
TOTAL NUMBER OF CHORDATA		8	9	8	6	4
SPECIES RICHNESS FAUNA		22	32	21	20	30
<u>FLORA</u>						
CHLOROPHYTA						
Sea lettuce	<i>Ulva lactuca</i>				X	
RHODOPHYTA						
Branching red alga	Rhodophyta	X	X	X	X	
Dulse	<i>Rhodymenia palmata</i>		X			
Encrusting red algae	<i>Lithothamamnium</i> sp.		X			
Irish moss	<i>Chondrus crispus</i>		X			
SPECIES RICHNESS FLORA		1	4	1	2	0

Notes: ¹ Rock crabs and Jonah crabs could not be differentiated when viewing video in the field.

Appendix M (digital only)

OTI Video Transect Files



Appendix N (digital only)

GoPro HD Video Transect Videos and Photos



Appendix O (digital only)

Select Towed HD Video Transect Screen Captures



Appendix P (digital only)

Video Transect Navigation Table



Appendix Q (digital only)

GoPro HD Video Transect Videos with Timestamp

