Final Summary Report

BOEM Cooperative Agreement M14AC00001 to New York State Department of State and Stony Brook University: Assessment of sand needs and resources offshore New York

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NY Lead Agency:

New York State Department of State, Office of Planning and Development, in conjunction with SUNY Stony Brook University, School of Marine and Atmospheric Sciences

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Overview

The technical reports described below and developed pursuant to Cooperative Agreement M14AC00001: *Sand Needs and Resources Offshore New York* are important steps in improving understanding of and linkages between federal and State sand resources offshore New York. These reports are New York State's first attempt to compile and synthesize existing information on sand resources and transport processes, in furtherance of the State's long-standing interest in sand resources. In order to achieve the objectives of the current Cooperative Agreement with the Bureau of Ocean Energy Management (BOEM), the New York State Department of State (DOS) entered into a Cooperative Agreement with BOEM, and a Memorandum of Agreement with the State University of New York (SUNY) at Stony Brook, School of Marine and Atmospheric Sciences. The coordination of effort between these entities, and the data and information that resulted, already have measurably increased New York State's scientific knowledge base and decision-making capacity.

Superstorm Sandy provided clear evidence of the potential suddenness and severity of coastal flooding and erosion, and increased attention to sand management strategies and prioritization of coastal needs. Because the emphasis of this current Cooperative Agreement is on assembling existing data, the below products do not address the desirability of using state or federal sand resources for projects that were previously proposed or that may be under future consideration. Nor do the reports reflect a State-sponsored evaluation or prioritization of existing or potential coastal projects that may require sand resources.

The ultimate goal of the State's Cooperative Agreement efforts is to develop management strategies for offshore sand resources that will preserve the ecological function of offshore systems while helping to achieve resilience for coastal communities. To that end, the State's continued research and coordination activities with the federal government will focus on understanding: sediment transport patterns and the potential effects of removals and placement; the role of sand in natural and ecological system function; the relationships between offshore sand resources and coastal needs; and other related management priorities. In the reporting period, three meetings were arranged with the US Army Corps of Engineers and we participated in webinars with BOEM to discuss BOEM's development of a tool to monitor dredging intensity and the BOEM working group Webinar on Mid-Atlantic Sand management. This information will be critical to the development of sustainable approaches to existing and future activities seeking the use of sand in federal waters offshore New York.

BOEM-NY Cooperative Agreement M14AC00001 Project Deliverables

Technical Reports

Physical Modeling

Wilson, R., H. Bokuniewicz and Y. Huang, 2017. Draft Technical report on physical modeling of effects of potential borrow areas on local wave transformation and beach processes, School of Marine and Atmospheric Sciences, Stony Brook University: 9pp.

Marine sand on the Outer Continental Shelf is a resource available to New York for coastal restoration, and beach nourishment. In order to examine the potential impacts of sand extraction offshore, we have conducted modeling of selected wave climates based on data on wave and wind characteristics, bottom bathymetry, and shoreline orientation. This technical report describes progress on a sensitivity analysis to identify and prioritize the use of sand borrow areas which may result in minimal impacts to the physical system. It focuses specifically on three potential borrow areas identified by BOEM: Fire Island Inlet, Fire Island, and Shinnecock Inlet

Delineation

Flood, R., J. Lashley and H. Bokuniewicz, 2017. Summary Report and Initial Analysis if ASAP 2015 Reconnaissance-Level Data, unpublished report School of Marine and Atmospheric Sciences, Stony Brook University, NY: 25pp +appendices

This summary report of the initial analysis of several portions of the 2015 ASAP reconnaissance-level data confirms that high-quality geophysical data and long sediment cores were collected within Federal waters from 3 to 8 nautical miles offshore Long Island, NY. The analysis of this geophysical data and these cores, supplemented with the data collected during the 2016 ASAP design-level survey, will increase our understanding of sediment deposits in this critical area and allow us to delimit the areas and thicknesses of potential sand resources within this zone where appropriate geophysical data is available.

Flood, R., J. Lashley and H. Bokuniewicz, 2017. Summary Report and Initial Analysis if ASAP 2016 Design-Level Data, unpublished report School of Marine and Atmospheric Sciences, Stony Brook University, NY: 25pp +appendices.

This summary report of the initial analysis of the 2016 ASAP design-level data confirms that high-quality geophysical data and long sediment cores were collected from three areas within Federal waters from 3 to 8 nautical miles offshore Long Island, NY. The analysis of this geophysical data and these cores, supplemented with the data collected during the 2015 ASAP reconnaissance-level survey, will increase our understanding of sediment deposits in this critical area and allow us to delimit the areas and thicknesses of potential sand resources within this zone

where appropriate geophysical and geological data is available

Flood, R., I. Dwyer, J. Lashley and H. Bokuniewicz, 2018. Technical Report on G&G Data Analysis and Delineation of Potential Sand Borrow Areas, unpublished report, School of Marine and Atmospheric Sciences, Stony Brook University, NY

The Bureau of Ocean and Energy Management (BOEM) conducted three design-level surveys of portions of the New York inner continental shelf extending in Federal waters from 3 to 8 nautical miles (5.6 to 14.8 km) off the south shore of Long Island during 2016 as part of the BOEM Atlantic Sand Assessment Project (ASAP) initiative (Figure 1). The survey collected about 1,112 km of high-resolution subbottom (chirp) profiles, 300 kHz side-scan sonar records, 550 kHz of interferometric bathymetry and side-scan sonar records and magnetometer records. In addition, vibracores up to about 20 ft (6.1 m) long were collected at 59 stations in one of the three study areas. The tracks supplement the reconnaissance-level geophysical tracks and sediment samples that were collected by the BOEM ASAP initiative during 2015 (768 km of geophysical data, vibracores at 31 stations and grab samples at 18 stations). The primary purpose of the ASAP design-level surveys was to provide data needed to identify the nature of, and to quantify the amount of, sand potentially available for beach nourishment projects located in the surveyed Federal waters. Details of ASAP surveys and of data collected during reconnaissance surveys done in 2015 and design-level surveys done in 2016 have been described in prior reports (BOEM, 2016; Flood et al., 2016, 2017a, 2017b). The primary objective of this Technical Report is to use the project geophysical and geological data to identify, delineate, characterize and quantify sand resources in Federal waters south of Long Island.

Sand resources are delineated in four areas based on the design-level geophysical data collected in 2016 and on the vibracores collected in 2015 and 2016. The primary surficial geological features on the inner shelf south of Long Island are large sand ridges with heights of 1 to 5 m (3 to 16 feet) with 1 to 2 km (3,300 to 6,600 feet) spacing. Crests of these sand ridges are generally characterized by sandy deposits up to 3.6 m (12 feet) thick with a flat-lying basal layer observed on seismic profiles. This sandy deposit is likely to be of Holocene age (less than about 10,000 years old). Design-level studies occurred in three areas where sand ridges are present. While the geophysical surveys imaged both sand ridges and areas between sand ridges, vibracores were only collected from a subset of the sand ridges. Since the vibracore data is essential to characterize the nature of sand resources, areas delineated to date are along the crests of sand ridges where vibracores have been taken. Significant sand resources are likely to occur elsewhere on sand ridges and between the sand ridges, but additional vibracores will be needed before any additional areas can be delineated. The basal layer that underlies each of these delineated deposits is an erosional unconformity which occasionally contains fragments of wood and peat. Sediments in and below this basal layer may in places be an avoidance area because they may contain possible cultural resources. Four areas are delineated in this report: Fire Island Design SR1; Fire Island Design SR2, both of which can be classified as "proven" because of the dense seismic coverage and numerous cores, and; Fire Island Inlet Design SR1, and; Moriches

Inlet Design SR1, both of which can be classified as "probable" because of the dense seismic coverage although only one core was collected in each area.

Dredging

Bokuniewicz, H.J. 2018 Framework for the Evaluation of New York's Sand Needs. School of Marine and Atmospheric Sciences, Stony Brook University, Unpublished Report.

This document is a consideration of the sustainability of offshore sand resources needed by coastal communities along New York's ocean shoreline to recover from beach erosion brought on by severe storms. Management of these sand resources is intended to sustain resilient coastal communities as well as to maintain important coastal habitats, both at the shore and offshore on the seafloor.

The sustainability of offshore sand resources depends on three conditions (Hilton 1994): volume removed by dredging should be insignificant compared with the total volume of the resource, or; dredging should occur at a rate that is commensurate to the rate of natural recovery of the resource, and; adverse impacts on habitats should be minimized. These three conditions require adequate knowledge of volume of the resource, total demand, rate of removal, rate of recovery and the area of benthic disturbance. This report makes the following recommendations:

- Develop an active database of dredging projects in a standard format as they are completed;
- Establish a mechanism for improved agency coordination;
- Develop a monitoring program of dredging within designated borrow areas
- Acquire high resolution habitat maps for offshore New York's ocean shoreline.

Conference Presentations

Innes, W., H. Bokuniewicz, R. Flood, R. Wilson and J. Lashley, 2016. Assessment of Sand Resources Offshore New York, American Shore and Beach Preservation Society, 2016 National Coastal Conference 25-28 October, Long Branch, NJ

The New York state Department of State in cooperation with the Bureau of Ocean Energy Management is identifying and assessing marine sand reserves offshore of New York's ocean shoreline. Offshore sand resources are required in order to improve the resiliency of coastal communities and maintain coastal habitats, especially in the wake of "Superstorm" Sandy (October, 2012). Not only is the area one of intense societal attention, but the use of marine

aggregate for coastal resilience must fit into a diverse framework marine spatial planning including not only traditional components, like commercial fishing, but also new factors like the siting of offshore wind-farms. The historical demand for beach nourishment has been about 1.5 million cubic meters per year, but sea level rise and the occurrence of extreme conditions may increase the demand to over 5 million cubic meters annually. Forty-four historical and proposed borrow sites have been delineated and potential borrow areas in Federal waters are being sought. Extensive geophysical and geological data has been compiled and reassessed to support identification, characterization, and delineation of sand resources to meet future demand. Historical borrow areas were apparent in the most recent surveys and it appears that ongoing modification of offshore borrow areas has been occurring, perhaps with a change in substrate. The Bureau of Ocean Energy Management had collected approximately 700 km of new geophysical survey lines located between 3 and 8 nautical miles offshore, and 46 geotechnical samples, comprised of a combination of grab samples and vibracores. The new data will be used to test prior interpretations of sediment distribution and physical processes on the shelf. In addition, wave modeling (SWAN) has been performed over the study area to provide further insight into the oceanographic changes wrought by the removal of sand reserves for use in nourishment projects. For hypothetical borrow areas in Federal waters would be at depths in excess of 15 m. As a result, changes in wave refraction were weak and the impacts on significant wave height were small. Wave breaking was calculated to occur in State waters farther inshore. The result is that there are only minor impacts on longshore sand transport and its divergence.

Flood, R. , J. Lashley, I. Dwyer and H, Bokuniewicz, 2017 Seismic and Core Studies south of Long Island: New Data and New Insights, 24th Conference on the Geology of Long Island and Metropolitan New York, Stony Brook University. 8 April.

The continental shelf immediately south of Long Island can be described as a generally flat area that is characterized by numerous large-scale sand ridges that trend WNW-ESE. The sand ridges can have heights of about 1 to 5 m and spacings of about 1,500 to 2,000 m, and they may prove to be important sources of sand for nourishing the shoreline in a time of rising sea level. Workers at USGS-Woods Hole have been studying the evolution of the near-shore region, but until recently there has been little new data on the shallow structure of the shelf past about 3 to 5 miles offshore. Following Superstorm Sandy, the Federal Bureau of Ocean Energy Management (BOEM) initiated a series of studies along the US East Coast that resulted in the collection of 1,880 line kilometers of new high-resolution seismic profiles and 90 new sediment vibracores up to 20 feet (6.1 m) in length from Federal waters between 3 and 8 nautical miles offshore of Long Island (Figure 1). While the new geological and geophysical data is being used to identify potential offshore sand resources, it also is providing some new insights into the depositional history of the inner shelf. One sequence of particular interest includes the erosional surface that apparently formed during the post-glacial sea-level rise and the units above and below that surface. The erosional surface can have local relief of a meter or more and some cores that

penetrate the erosional surface contain peats, muds, wood fragments and rocks. The irregular nature of the erosional surface may be due to the rapid post-glacial sea-level at this time. Cores suggest that sandy shelf sediments from an earlier time of high sea level underlie the erosional surface in other areas. However, the sediments underlying the unconformity can also contain truncated depressions that are apparently filled with finer-grained sediments. Such depressions might be remnants of channels that cross the shelf, but at least one of the depressions has a limited length and is oriented parallel to the shoreline. Perhaps this depression resulted from deformation related to a moving ice sheet during an earlier ice age such Marine Isotope Stage 2 or 4. Thickness variations of the surficial (Holocene) sands in the sand ridges appear to be independent of the underlying topography, and erosion also occurs along the flanks and in the troughs of the sand ridges, suggesting a dynamic origin of the sand ridges we observe today.

Bibliography

Bokuniewicz, H., Lashley, J., and Innes, W. 2018. Preliminary annotated bibliography for sand needs and resources offshore New York. School of Marine and Atmospheric Sciences, Stony Brook University. Unpublished Report.

Data Deliverables

A DVD had been provided on September 16, 2017 containing the project files to that date. The DVD contained not only the reports and presentations but also results of the physical oceanographic modeling project in ARCMAP format and the results of the Geology and geophysics analysis of ASAP data in ARCMAP and EXCEL formats.

Complementary State Efforts to Identify Needs Areas

With ninety percent of New York State's population residing in waterfront communities, management of flooding and erosion hazards is a critical concern. During Superstorm Sandy alone, the Governor's Office estimates that 305,000 homes were destroyed primarily by storm surges; over 400,000 people were evacuated; and 53 New Yorkers lost their lives.

DOS Coastal Risk Areas and Community Resilience Planning

While several products exist to help people identify flood risk, such as FEMA floodplains maps, no single product characterizes the cumulative flood risks facing coastal communities. DOS partnered with the National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA) to combine different pieces of information (see list below) to identify New York's most vulnerable coastal areas. The result was the "DOS Coastal

Risk Areas" which classify areas of extreme, high, and moderate risk for use in future resilience planning.

To identify Coastal Risk Areas, DOS staff gathered information on the following elements of coastal risk:

- elevation
- floodplain
- sea, lake, and overland surges from hurricanes (slosh)
- sea level rise scenario
- shallow coastal flooding
- susceptible natural shoreline features

Maps that used relevant data to classify each of these elements were overlaid on top of one another using GIS. The results of this overlay analysis were used to classify New York's coastal areas into three risk categories: extreme, high, and moderate. The Extreme Risk Areas are the most vulnerable areas, which are currently at risk from frequent flooding. High Risk Areas face less risks from flooding than extreme, but more so than the Moderate Risk Area. All three areas will continue to increase in vulnerability as sea level rises.

The DOS Coastal Risk Areas help identify vulnerable community assets and areas where development is most vulnerable. Risk assessment and resilience planning is a means of evaluating risk in advance of storm events. Through resilience planning, communities have time to identify risks to social, economic, cultural and natural resources that support their quality of life. The risk area maps can be used to compile an inventory of vulnerable assets that support community functions. Once the location of vulnerable functions is known, the risk maps can help assign a general level of risk to each assets to help communities determine which are most vulnerable to prioritize resilience planning efforts and strategies.

As an immediate follow-up to Superstorm Sandy, and in recognition that communities are the most knowledgeable resources on past events and what is most at risk, New York initiated a new community resiliency planning initiative called the "New York Rising Community Reconstruction" program (NYRCR). One goal of the NYRCR Plans was to increase the future resilience of the places and/or services providing critical social, economic, and natural functions within a community (i.e., assets).

Through the NYRCR planning process, each community identified critical assets and then overlaid those assets with the DOS coastal Risk Areas in order to assign a level of risk in relation to future storm events and sea level rise. This asset risk assessment helped communities strategically plan for and identify future investments that would expedite recovery and improve future resiliency. Examples of assets include public facilities such as schools, medical facilities; emergency and public safety services including fire and police protection; as well as natural,

cultural, and recreational resources such as wetlands, beaches, and parks. Assets also include critical infrastructure such as transportation roadways, utility networks, and storm water systems required to support those essential public facilities.

Other Holdings

In addition to community-wide assets, governments at various levels also own or maintain assets that may also be vulnerable. The National Park Service partnered with the Program for the Study of Developed Shorelines (PSDS) at Western Carolina University (WCU) to begin an assessment of the level of exposure that park owned assets will face during a period of rising sea level. The first phase of this collaborative project between WCU and NPS has focused on identifying NPS assets that may be threatened by a future 1 m rise in sea level within 40 coastal units. A 1 m rise in sea level can be expected to occur in the next 100 to 150 years. Many of the assets identified are already vulnerable to existing coastal hazards (erosion and storms). Holdings identified within or adjacent to New York State include:

- Castle Clinton National Monument
- Fire Island National Seashore
- Gateway National Recreation Area
- Governors Island National Monument
- Sagamore Hill National Historic Site
- Statue of Liberty National Monument

Similarly, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) is undergoing an effort to determine the impacts of climate change on their facilities. Specifically, OPRHP is using GIS to identify where the potential impact of storms and sea level rise will be in order to develop management plans that improve resilience and expedite recovery after storms. The DOS Coastal Risk Areas have been a key resource in this analysis, helping OPRHP assess the relative vulnerability of valuable coastal park resources, including infrastructure and natural resources.