Barnegat Bay (NJ) Subaqueous Soil Survey

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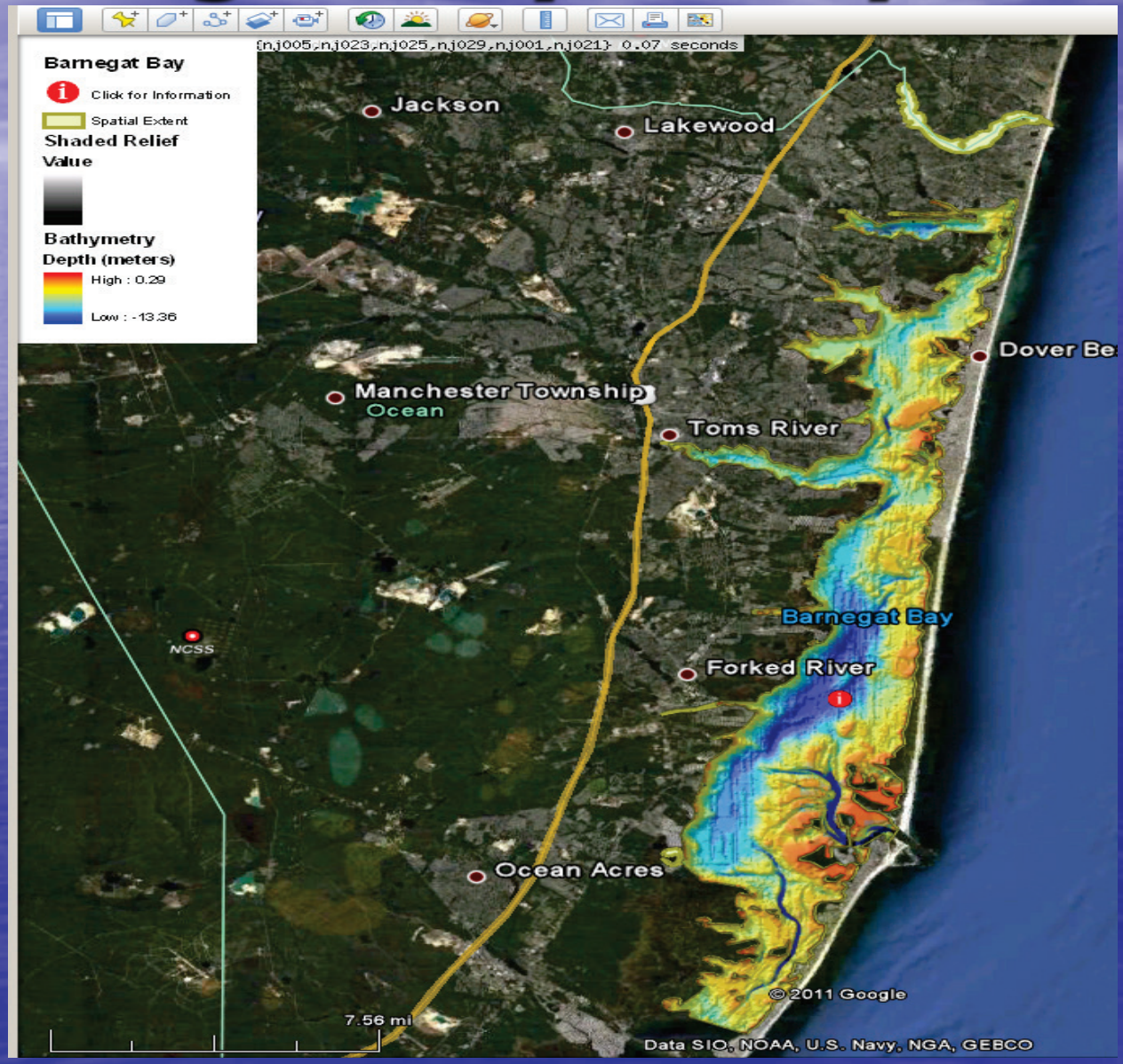
- Cooperation w/ the Barnegat Bay Partnership (BBP)
- Bay is 1 of 28 Congressionally desginated National Estuary Programs (NEP)
- Barnegat is approximately 80,000 acres
- BBP Mission – Restore, protect and enhance the natural resources of the Bay ecosystem
- The state of NJ has prioritized the health of the bay through research projects / partnerships

Partners w/ the Barnegat Bay Partnership

- USEPA
- Ocean County College
- NJ – DEP
- US Geological Survey
- US Fish & Wildlife Service
- NOAA
- USDA-NRCS
- NJ Marine Sciences Consortium
- Ocean County Health Dpt.
- Ocean County Soil District
- Rutgers University
- Rider University
- Montclair State University
- Stockton State University
- American Littoral Society
- US Army Corp of Engineers
- Monmouth University
- NJ Pinelands Commission

Barnegat Bay Bathymetry



US Geological Survey – Seafloor Mapping & Bathy

(lidar to be flown in the fall)

USGS science for a changing world

Overview of USGS Seafloor Mapping in Barnegat Bay - Little Egg Harbor Estuary

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Study Area

In cooperation with the New Jersey Department of Environmental Protection (NJDEP) and the U.S. Geological Survey's (USGS) New Jersey Water Science Center, the USGS Coastal & Marine Geology Science Centers (CMGSC) from Saint Petersburg, Florida and Woods Hole, Massachusetts are conducting comprehensive geophysical surveys, to include laser topobathymetry, of Barnegat Bay, New Jersey during 2011 and 2012. The coastal estuarine waters encompassing Barnegat Bay are of particular interest due to declining water quality over the past half century. The geophysical data will provide an updated bathymetric surface for the Bay that will be utilized in models of estuarine water quality and hydrodynamics.

Figure 1: Overview of coastal marine elevation with historical bathymetry for both estuarine and offshore zones of New Jersey's Atlantic shoreline. (Courtesy of, http://www.state.nj.us/dep/njgs/geodata/)

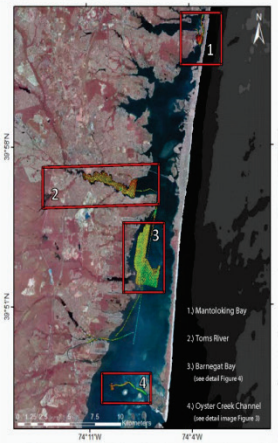


Figure 2: Overview of Barnegat Bay, New Jersey. Color infrared digital orthoquad aerial imagery shown with layers identifying initial survey areas. (Courtesy of, http://www.state.nj.us/dep/njgs/geodata/)

The USGS CMGSC bring a unique perspective to seafloor mapping. In addition to high quality elevation mapping with contemporary instrumentation and techniques, we also provide insight into surficial sediment distribution and stratigraphy. We do this through the simultaneous use of several different geophysical instruments, which characterize the geology of the study area in three dimensions (see geophysical data examples in center frame). This allows for a more thorough understanding of the physical environment and can provide geologic context for parameters such as surface material type and sediment thickness.

Survey Data Types

Geophysical surveying consists of three acoustic ranging (SONAR) component data types:

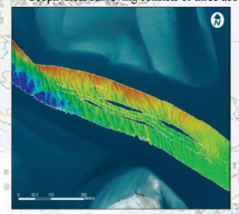


Figure 3: Interferometric bathymetry detail showing sand waves in Oyster Creek Channel (Area 4, Figure 2).

BATHYMETRY

Higher frequency acoustic reflection filtered to indicate depth of water or submerged topography. The interferometric swath system is capable of collecting high-density soundings across a swath that is 7-10 times the water depth, a significant advantage over single-beam fathometers. These data provide the geomorphology of Barnegat Bay and can be used to infer dominant sediment transport processes. Because of the density of soundings, the system is ideal for resolving bedforms, such as sand waves (Figure 3). In addition, for this study, bathymetry will serve as a critical input to hydrodynamic and water quality models.

BACKSCATTER

Higher frequency acoustic reflection intensity of submerged surface material; differentiated by texture, slope, and material distribution in accordance with surficial lithology. Softer seafloors (e.g., grasses, muds) attenuate more sound resulting in a weaker "echo," while harder seafloors (e.g., sands, rock) reflect more sound resulting in a stronger "echo." When these different intensities are put together they create a backscatter mosaic. Mosaics serve as an acoustic image of the seafloor, which can be used to create maps of surficial sediment type (Figure 4; only after ground truthing). These data will help NJDEP and NJWSC better understand habitat distributions in Barnegat Bay.

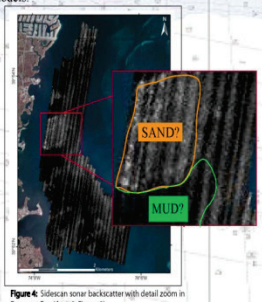


Figure 4: Sidescan sonar backscatter with detail zoom in Barnegat Bay (Area 3, Figure 2).

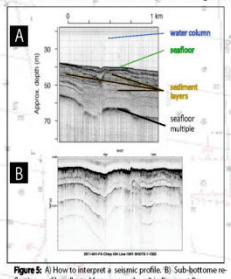


Figure 5: A) How to interpret a seismic profile. B) Sub-bottome reflection profile collected from survey Area 3 in Barnegat Bay.

SEISMIC

Lower frequency acoustic reflection resulting from vertical changes in material density below the seafloor surface. The first reflection is the seafloor and changes in material underlying it are indicated by reflections below the seafloor reflection (Figure 5). Due to the high concentration of organic matter in sediments in estuaries, gas can be produced within the sediments, which can mask any changes in sediment type below them. These data, along with core samples, provide the geologic context for sediment distribution and thickness (i.e., higher concentrations of sandier sediments in paleo tidal inlets).

Geophysical Acoustic Instruments

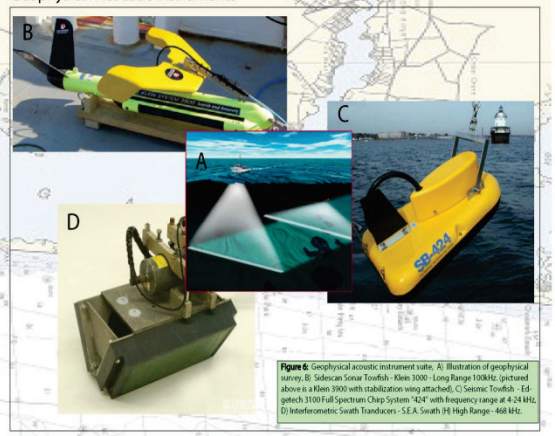


Figure 6: Geophysical acoustic instrument suite. A) Illustration of geophysical survey, B) Sidescan Sonar Towfish - Klein 3000 - Long Range 100kHz (pictured above is a Klein 3900 with stabilization wing attached), C) Seismic Towfish - Edgetech 3100 Full Spectrum Chirp System '424' with frequency range at 4-24 kHz, D) Interferometric Swath Tranducers - S.E.A. Swath (H) High Range - 468 kHz.

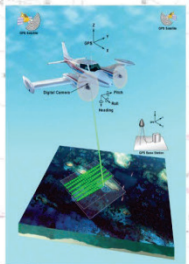


Figure 7: Schematic showing the operation of USGS LiDAR (EAARL). (Courtesy of, http://lidar.cr.usgs.gov/eaarl/)

Project Outlook

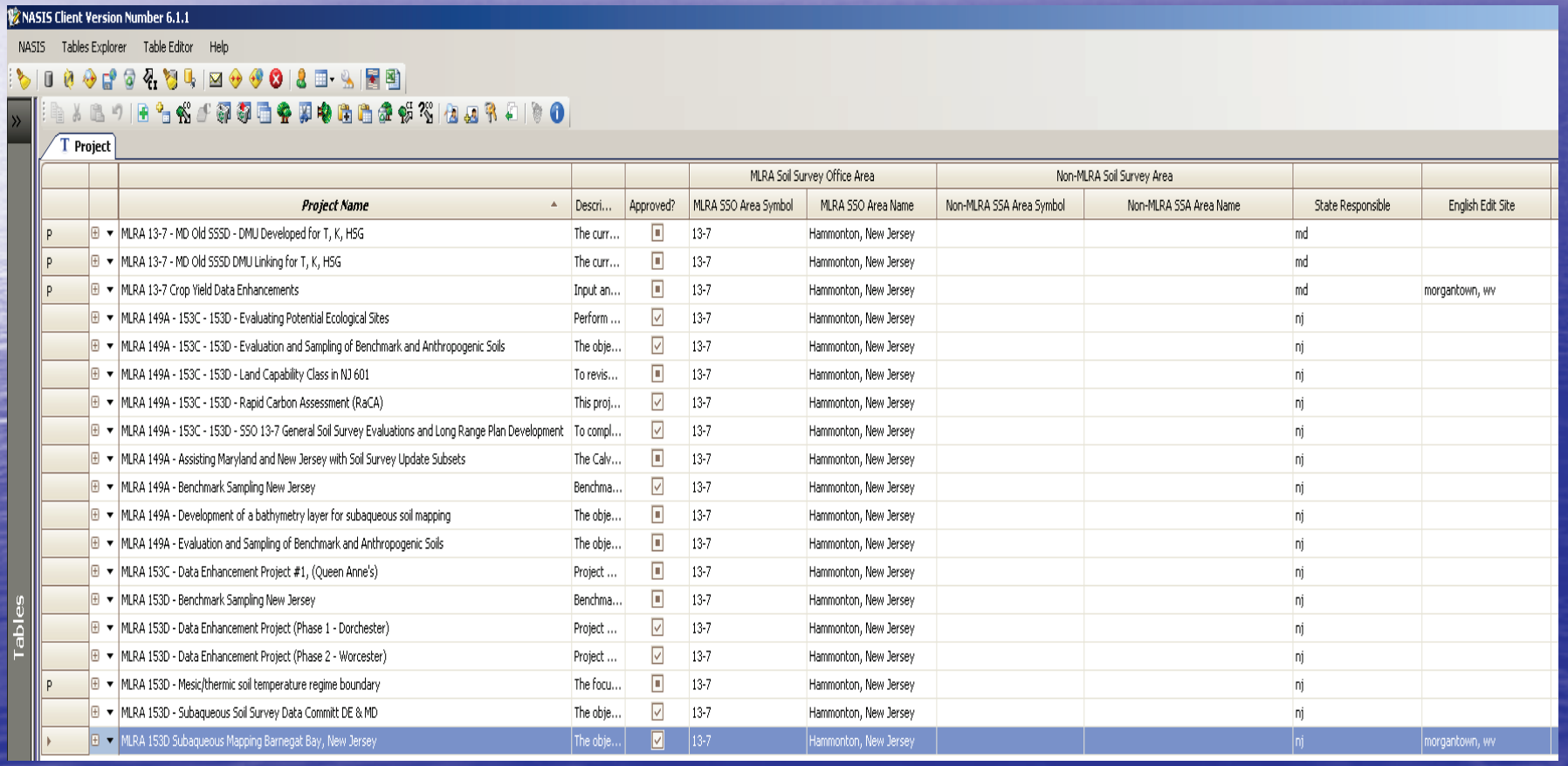
The first leg of geophysical acquisition took place in November 2011. It was a good opportunity for the field crew to familiarize themselves with the geographic area and better understand how the geophysical systems would perform in Barnegat Bay's unique submerged environment. This effort will be followed by a second geophysical survey in March 2012 which will also include sediment sampling and seabed optics for groundtruthing the acoustic data.

To complement the geophysical effort, an airborne lidar mission will also be conducted in an effort to integrate the acoustically derived bathymetry with lidar-derived nearshore soundings and terrestrial topography. This is especially critical in Barnegat Bay where extensive shoals play an important role in steering waves and currents that dictate temporal variability in water quality. Geophysical techniques are only efficient in water depths > 1.5 meters, therefore to improve outputs from numerical models, elevation data is essential in the zone between the 1.5m contour and the shoreline. The USGS lidar system (Figure 7), Experimental Advanced Airborne Research Lidar (EAARL), will not only measure terrestrial topography, but also shallow water elevation based on optical reflection from the seabed. The lidar survey is scheduled for Fall 2012.

U.S. Department of the Interior
U.S. Geological Survey

February 2012

Approved Project in NASIS



		Project Name	Descri...	Approved?	MLRA Soil Survey Office Area: MLRA SSO Area Symbol	MLRA SSO Area Name	Non-MLRA Soil Survey Area: Non-MLRA SSA Area Symbol	Non-MLRA SSA Area Name	State Responsible	English Edit Site
P		MLRA 13-7 - MD Old SSSD - DMU Developed for T, K, HSG	The curr...	☐	13-7	Hammonton, New Jersey			md	
P		MLRA 13-7 - MD Old SSSD DMU Linking for T, K, HSG	The curr...	☐	13-7	Hammonton, New Jersey			md	
P		MLRA 13-7 Crop Yield Data Enhancements	Input an...	☐	13-7	Hammonton, New Jersey			md	morgantown, wv
		MLRA 149A - 153C - 153D - Evaluating Potential Ecological Sites	Perform ...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - 153C - 153D - Evaluation and Sampling of Benchmark and Anthropogenic Soils	The obje...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - 153C - 153D - Land Capability Class in NJ 601	To revis...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - 153C - 153D - Rapid Carbon Assessment (RaCA)	This proj...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - 153C - 153D - SSO 13-7 General Soil Survey Evaluations and Long Range Plan Development	To compl...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - Assisting Maryland and New Jersey with Soil Survey Update Subsets	The Calv...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - Benchmark Sampling New Jersey	Benchma...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - Development of a bathymetry layer for subaqueous soil mapping	The obje...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 149A - Evaluation and Sampling of Benchmark and Anthropogenic Soils	The obje...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 153C - Data Enhancement Project #1, (Queen Anne's)	Project ...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 153D - Benchmark Sampling New Jersey	Benchma...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 153D - Data Enhancement Project (Phase 1 - Dorchester)	Project ...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 153D - Data Enhancement Project (Phase 2 - Worcester)	Project ...	☑	13-7	Hammonton, New Jersey			nj	
P		MLRA 153D - Mesic/thermic soil temperature regime boundary	The focu...	☐	13-7	Hammonton, New Jersey			nj	
		MLRA 153D - Subaqueous Soil Survey Data Committ DE & MD	The obje...	☑	13-7	Hammonton, New Jersey			nj	
		MLRA 153D Subaqueous Mapping Barnegat Bay, New Jersey	The obje...	☑	13-7	Hammonton, New Jersey			nj	morgantown, wv

Barnegat Bay Project Plan

PROJECT PLAN
Subaqueous Soil Mapping Barnegat Bay

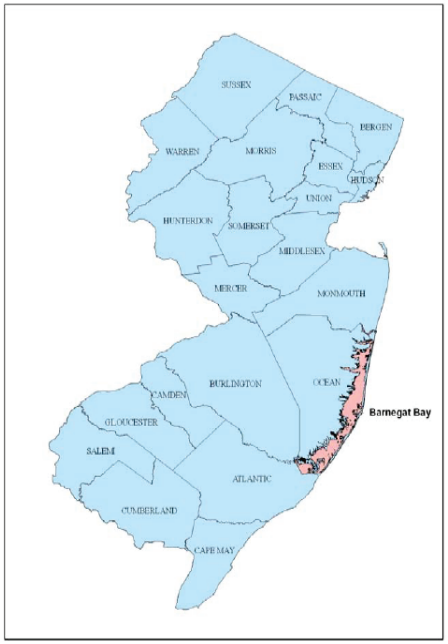
Objective

The objective is to generate a subaqueous soil map for the Barnegat Bay estuary following National Soil Survey standards and to make the soil survey available to the public through Web Soil Survey.

Background

Barnegat Bay is located along the shoreline of the east coast of Ocean County, New Jersey and consists of an approximate area of 80,777 acres. The purpose of the project is to provide soils information following National Soil Survey standards, based, in this case, on depths, position, and physical and chemical properties of the sediments. The soil survey can and will provide information that is vital for planning, recreation, aquatic vegetation restoration, commercial and recreational fishing operations, and disposal and management of dredge material. The ever growing human population in and around Barnegat Bay has contributed to many diverse problems with the estuary.

Figure 1. Barnegat Bay Location.



- https://nrcs.sc.egov.usda.gov/ssra/mo-13/hammonton/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2fssra%2fmo%2d13%2fhammonton%2fShared%20Documents%2fMLRA%20Business%20Plans%202012%2fApproved%20Project%20Plans&FolderCTID=&View=%7bF5D57348%2dDF60%2d4059%2d9794%2d692B32AE08B9%7d

Barnegat Bay (NJ) Subaqueous Soil Survey

- Year 1 (2012) – Acquire bathymetry and determine / generate basic soil and landform map (reimbursable for product)
- Year 2 (2013) – Map, sample, transect, progressively correlate, and begin NASIS build for entire bay
- Year 3 (2014) – Complete NASIS, final correlation, and publish / commit survey to Soil Data Mart / Web Soil Survey