



Rhode Island's Coastal Zone Soil Survey

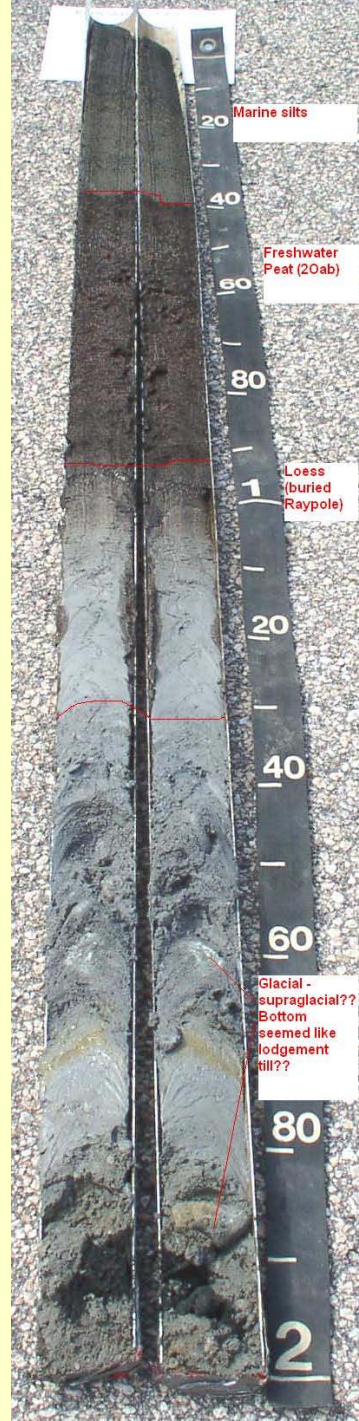
James D. Turenne

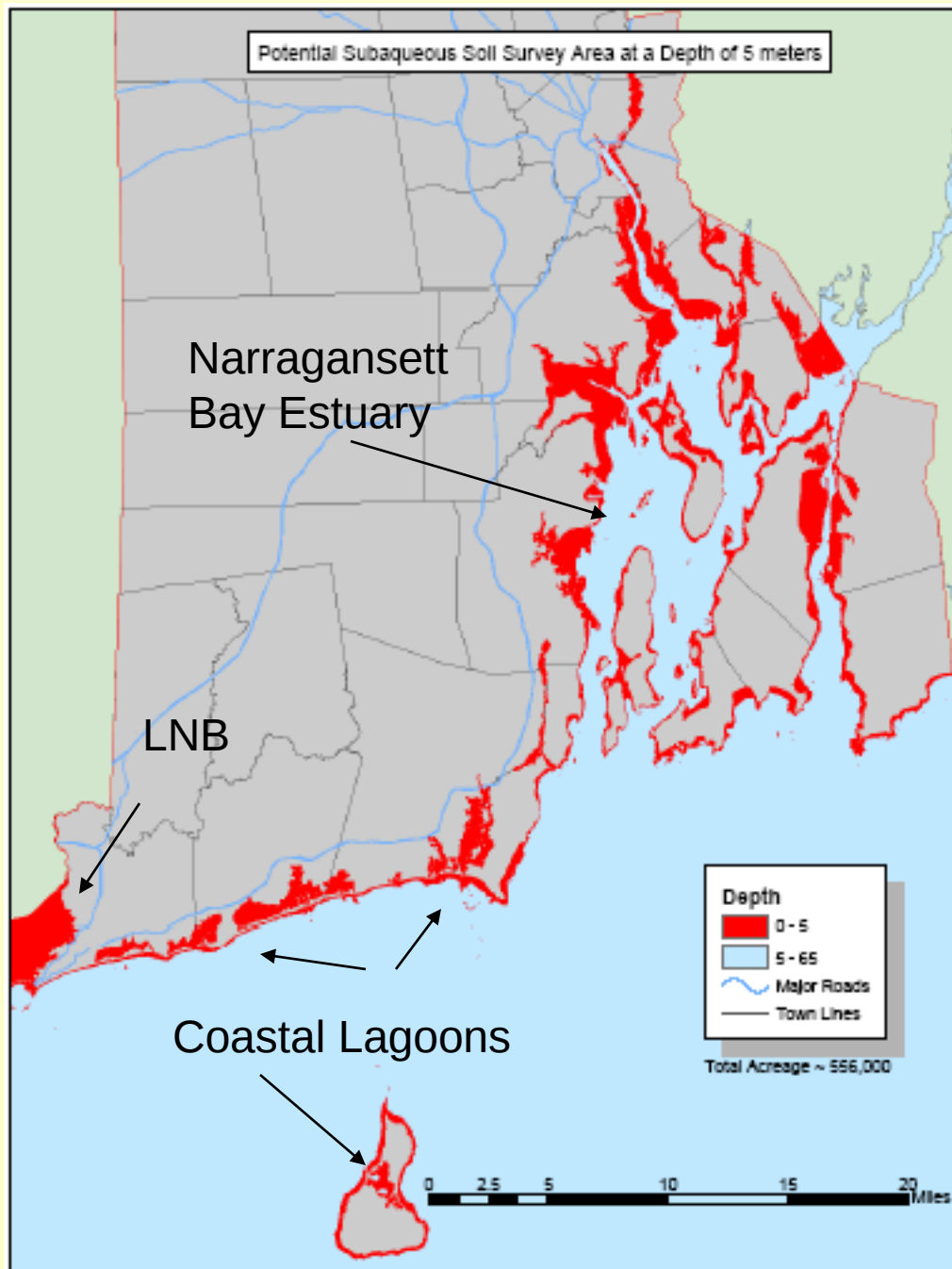
State Soil Scientist

Rhode Island (The Ocean State)

USDA-NRCS

www.mapcoast.org or www.nesoil.com/sas





Rhode Island Stats:

Size = 1,214 sq. miles.

Shoreline = 347 miles.

Relief = 812 feet to sea level.

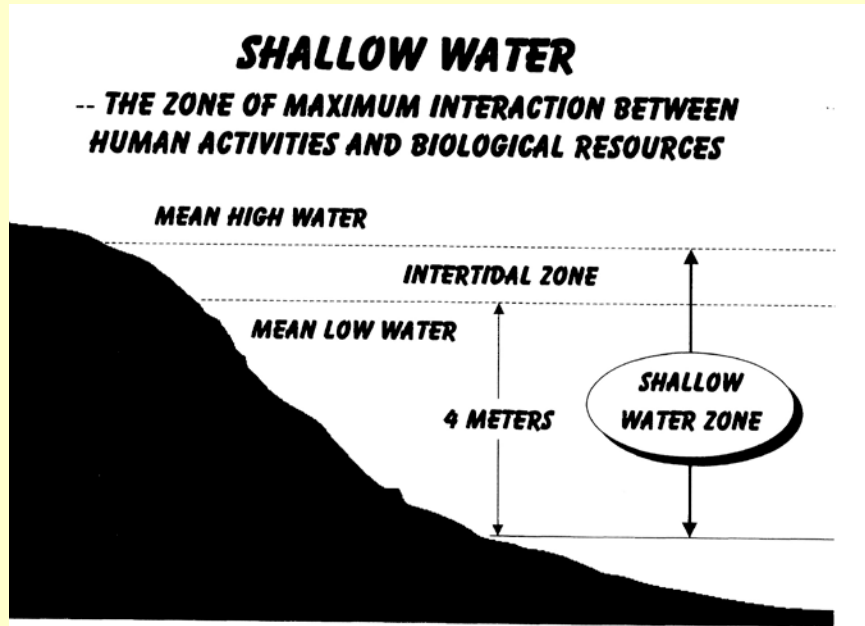
Population = 1 million (mostly along shoreline), 2nd most densely populated .

Geology/Soils: Bedrock is mainly Proterozoic to Paleozoic, late Wisconsinan glacial till/fluvial, soils are mostly Inceptisols, Entisols, and Histosols.

Subaqueous Soils:

Approximately 300,000 acres (areas <5m and coastal soils).

5 meter cutoff



Data Needed	Information Needed	Uses, Benefits, and Other Comments
Data	Bottom imagery	Very useful for management, habitat restoration, public outreach, and aquaculture
	Intertidal zone	
	Invasive species data	Relationship between invasive flora and fauna with sediment and soil
	Microbial data	
	Nutrient conditions over time	Historic trends
	Organic Carbon	Nutrient sinks, global warming studies
	Raw, uninterrupted vector data	
	Relationship between shellfish production, recruitment, sediment, and soil interactions	
	Shoreline change over time	Historic trends
	Soil and sediment	Collect marine coordinates and data to 5-7 meters depth
		Look at other deeper water habitats of need (photic zone) - up to 10 meters
		Soil nomenclature understandable and common to all disciplines
		Taxonomy correlated with the 4 system with other systems to show relationship (will help bring related disciplines together to be able to share information)

Figure 1. Rhode Island's Territorial Sea



The offshore limits of the state's territorial sea are being litigated before the U.S. Supreme Court. This sketch shows the maximum area that the state may claim under existing laws and treaties.

RI NRCS Subaqueous Timeline

- 1996 – Complete SSURGO soils available for terrestrial RI.
- 2000 – 2001 Bradley, Stolt subaqueous soil survey thesis Ninigret Pond, RI.
- 2002 – 2003 RI NRCS Adopts “Working Waters” Strategy – \$1 million eelgrass funds, major emphasis on coastal restoration.
- 2003 – 1st National Workshop.
- 2003 - Gap in RI soil data identified – no subaqueous soil data to incorporate into site selection models or use for working waters – Farm Bill.
- 2004 - Top Priority placed by the STC for the RI soil survey: Establish a Center for Excellence in SAS.

Restoration

Eelgrass Suitability Mapping: Critical Variables

Site Selection Model

Wave Exposure (exposure & current speed)

Soil Characteristics (texture,
sulfide, organic matter)

Bioturbator Abundance

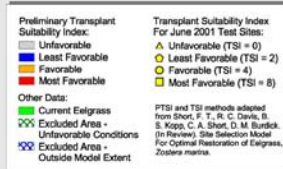
Temperature

Bathymetry (Critical Depth)

Missing!

RI Oyster
Restoration ~1
million

Narragansett Bay Eelgrass Restoration:
Results from Save the Bay's Transplant
Site Selection Model



2004 – Develop Strategy

PROJECT PROPOSAL FOR a COASTAL and SUBAQUEOUS SOIL SURVEY in the Northeast Region MO 12 - May 2004

Introduction:

The northeast hosts 8 of the nation's 28 estuaries in EPA's National Estuary Program. According to EPA's "National Coastal Condition Report", the estuaries in the northeast rank fair to poor in ecological condition. Human activity seriously threatens the vulnerable ecosystems found in the estuaries. Long considered to be wastelands, estuaries have had their channels dredged, marshes and tidal flats filled, waters polluted, and shorelines reconstructed to accommodate our housing, transportation, and agriculture needs. As our population grows and the demands imposed on our natural resources increase, so too does the importance of protecting these resources for their natural and aesthetic values. By 2010, 75 percent of the United States' population is expected to live within 50 miles of the coast.

Soil surveys are produced to provide an important planning tool for resource evaluation and assessment. Resource inventory data is available for terrestrial areas adjacent to coastal shorelines and for deep-water areas. A missing data-set for sound environmental assessment is the soil and sediment type in the subaqueous and coastal area connecting the upland with the deep water environment. Over the past 10 years, this important resource area has been shown to consist of subaqueous soils and can be best inventoried using procedures established by the National Cooperative Soil Survey.

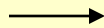
Project Office Proposal:

A. Internal

- Work within the framework of the NCSS to establish an MLRA Coastal Zone Office
- 2004-2005 office plan was written.
- Presented to the MO-12 BOD in 2004 and again in 2005.
- In 2004 all states except 1 voted to approve, in 2005 all states approved the revision.
- Project plan and cover letter was submitted to NHQ and funding.
- Around this time the re-org of the soil survey program kicked in and the Center was never funded.



- B. Externally = work with URI to organize a Soil Survey Work Planning Conference to obtain input from our customers. Needed to obtain input from coastal community about interest and need for a coastal zone soil survey.



MapCoast is Born!

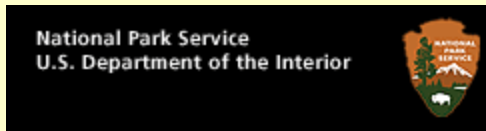
www.mapcoast.org

The MapCoast Partnership - *A timely alignment of people, ideas, needs and goals*

Mapping Partnership for Coastal Soils and Sediment

12 Person
Steering Team

16 Partners have
signed our MOU



MapCoast - Common Ground

MapCoast understands the need to develop a common hierarchal system of coastal soil and sediment classification that encompasses all disciplines including biology, wetlands, geology and pedology.



MapCoast - Common Objectives

- Develop mapping **standards** and **protocols** to produce accurate and useful maps.
- Build multiple **interpretations** of the data to service the coastal resource management community.
- Ensure that data collected will be made **available** to all users.
- Work will be conducted in a **cooperative** manner.
- Partners will **share** resources, technology, and knowledge.
- Provide **training** and **educate** users about the soils and sediment data and maps.

Our Work

- 2004 – User Conference – 70 people, break-out session to develop list of user needs (Synthesis Document).
- Develop Mapping Protocol.
- Use to map Ninigret



Appendix B – Breakout Group Summary

Information Currently Used (paper and electronic maps):

- Bathymetry
- Elevation (topography)
- Ortho-imagery
- GIS data such as soil survey, wetlands, Eelgrass beds, transportations, land use, and habitat maps

Data Needed	Information Needed	Uses, Benefits, and Other Comments
Bathymetry	Dredging information, esp. recently dredged areas	Archaeological uses
	High-resolution digital terrain model	Bathymetric and topographic
	Minimum 2 foot contours	Emergency planning – sea-level rise, FEMA, etc
Chemical and Physical Properties	Chemical and physical analysis of soil and sediment	Grain size distribution, sulfides, salinity throughout cores. Potential turbidity of dredged sediments
	Metals in sediment and bioavailability	Health issues, locating toxins
	Oxic/Anoxic layer	Where does it occur?
	Soil biochemistry, salinity	Salinity drives habitat types
	Water clarity, temperature, nutrients	
Cultural Resources	Drowned village locations	From historic sea level elevation data

MapCoast - 2005

- Field team merge on Ninigret - collect cores, bathy, RTK, side-scan, subbottom, SPI, video, map soil – analyze the data, develop GIS data.
- End season – Feature Segment local news.
- Host 2nd User Conference



2006 – Our Data

- 3rd User Conference – support for MapCoast (Senate, NRCS, State).
- Unveiling of our Ninigret Data.
- Uses of the Data.
- More input from users.
- More Outreach – 2nd News Feature



MAPCOAST
THE MAPPING PARTNERSHIP FOR COASTAL SOILS AND SEDIMENTS

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Google™ Custom Search

JavaScript Required for proper functioning on this site

Welcome to MapCoast.org

Our Partnership

The MapCoast Partnership began during the winter/spring of 2004 when the [Natural Resources Conservation Service \(NRCS\)](#) approached the University of Rhode Island about establishing the institutional framework needed to begin to map, inventory, describe, and classify coastal soils and sediment in Rhode Island and New England.

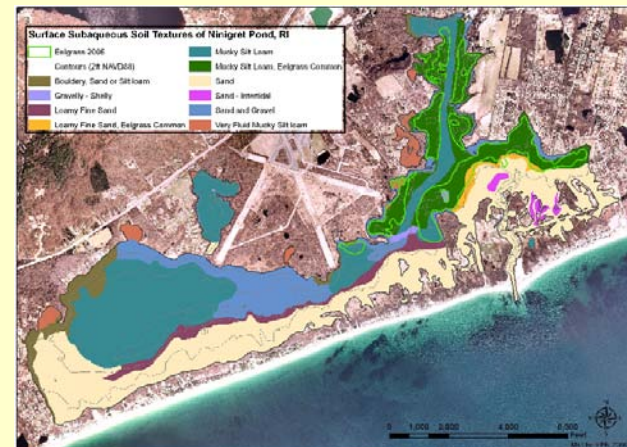
Mission and Goals

The goal of the MapCoast Partnership is to develop a readily accessible database of soils and sediment in coastal Rhode Island that meets the variety of needs of the user community. Soils and sediment map data and attributes are essential for management and protection of coastal ecosystems.

Our initiative strives to create a seamless soils/sediment database of the coastal plain above and ~5 m below the sea surface.

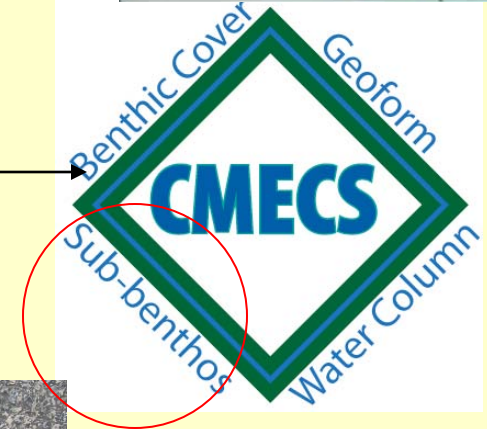
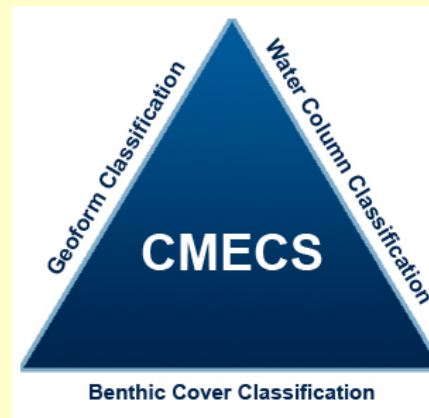
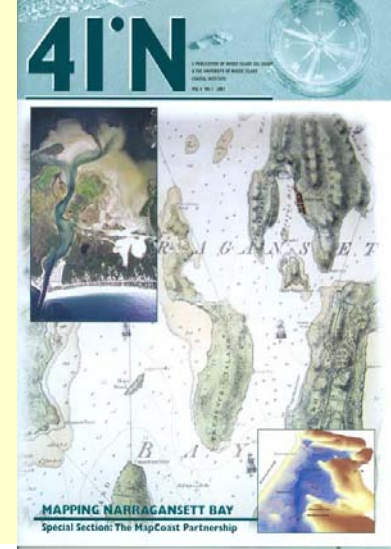
We also strive to create a high resolution, accurate seamless digital terrain model (topography and bathymetry) above and below the sea surface in coastal environments.

The MapCoast partnership was recently featured in 41N. Click [here](#) to read more.



2007-2009

- Outreach/Education (conferences, 41N, 3rd News feature, USGS/NOAA).
- CMECS – sub-benthic component.
- Mapping and Data refinement (NOAA paper).
- Soil amendments (NASIS/Pedon), Interps, taxonomy, freshwater.
- Tech tools, Google Ocean, etc.



Soil taxonomy



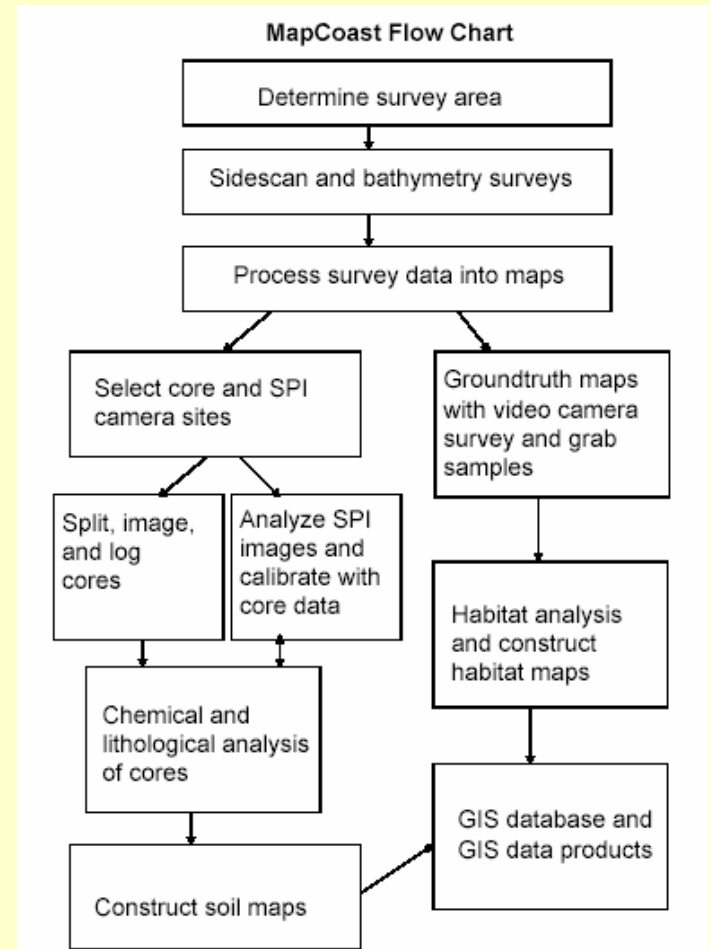
The Future

- Publish a methods manual.
- NOAA paper in Journal of Coastal Research -
Methods and Protocols for Mapping Shallow-subtidal Benthic Habitats
- Continue CMECS Sub-benthic component
- 2010 SAS mapping to SDM/WSS
- Continue outreach.
- Continue mapping RI Coastal Zone – Phase II and III to complete RI600.

Mapping Protocol

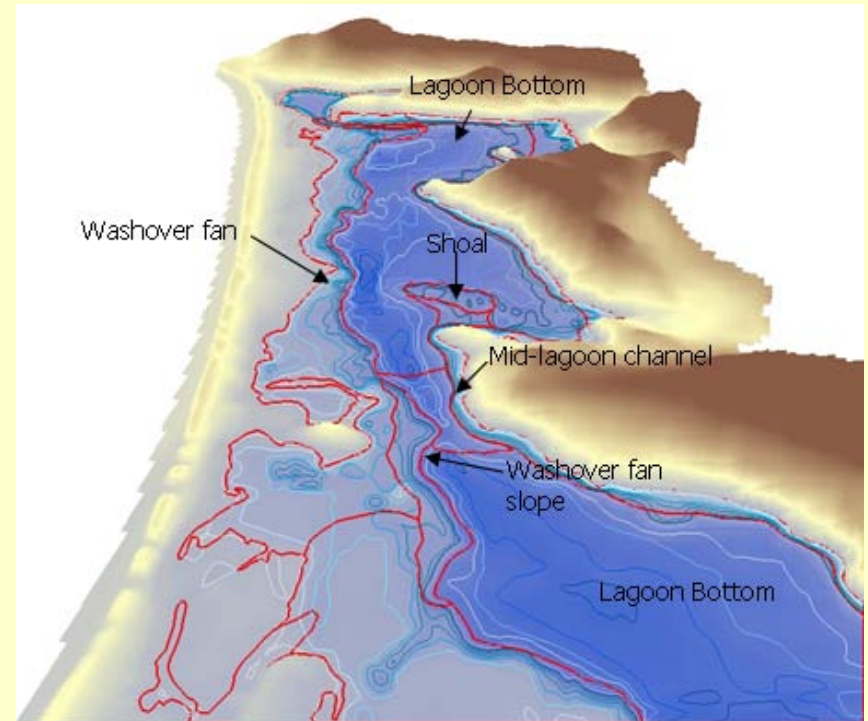
MapCoast developed a flow chart for collecting data in a systematic manner utilizing a variety of remote sensing equipment and field tools.

While this method would be the best protocol to follow rarely do we have all the ducks in line to complete an area this way. Bathymetry is usually the first step and the soil and geologic mapping are done at the same time and the data is shared in a master point file.



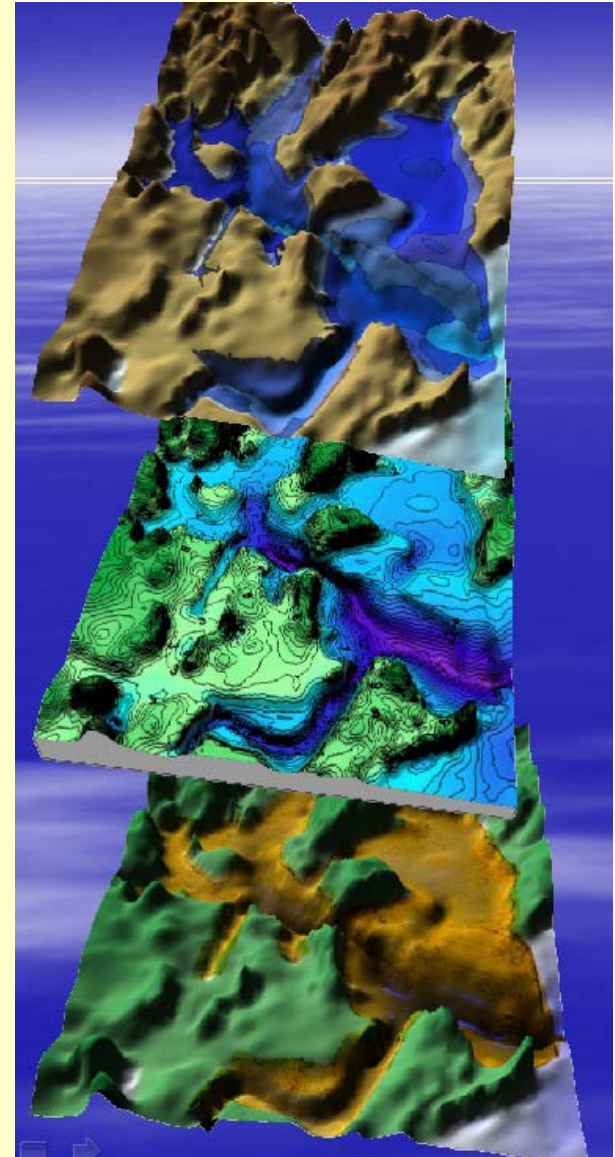
Mapping Procedure

- Need to develop a bathymetric map which is used for subaqueous landform identification.
- Can use existing NOAA charts (order 3 mapping) or create detailed bathymetry using fathometer and RTK GPS.
- Number 1 data need .



Mapping Procedure

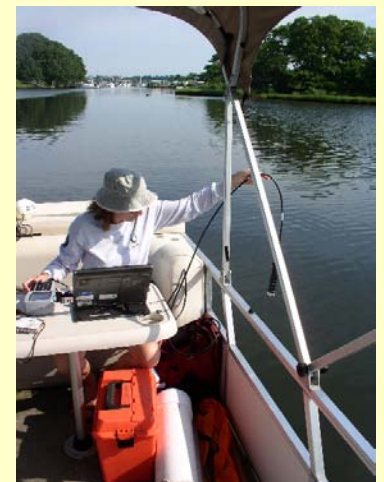
- Develop soil-landscape model using soil formation factors.
- Identify and delineate landforms to determine soil map unit breaks.
- Map the area using standard NCSS procedure. Bucket augers and McCauley peat corers are used to investigate morphology.
- Vibracore techniques are used for deep and detailed observations.
- Describe, sample, classify pedons-series-map units – compile map.





	A	B	C	D	E	F	G	H	I	J	K
1	Site Number:	PJ034		Mapping Unit:	Lbs	Description					
2	Date:	7/31/2007		Location Description:	Bluff Hill Cove					YSI Readings (type in values)	
3	Start Time:	10:38 AM		Water Depth (ft):	6.8	Temp(F)	77	Surface	sal 26.49; do 6.59; pH 7.83		
4	End Time:	11:00 AM		Bottom Type:	soft-bottom			Mid	sal 26.53; do 6.76; pH 7.81		
5	Surveyors:	JT, MB, MP, AS		SAV cover:	none			Bottom	sal 26.76; do 7.68; pH 7.88		
6	Waypoint:	4		Observation Method:	McCauley						
7	UTM Easting:	291387		Site Notes:							
8	UTM Northing:	4585108									
9											
	Horizon	Depth (cm)	Boundary Dist.	Field Texture Class	n-value	Munsell Color (Matrix)	Redox features color/conc	Field Coarse frags (%)	Shell frags (%)	H ₂ S odor	Notes
10	Ag	0-8		fs		1.5Y 2.5/1			common tiny clam shells	slight	EC 15.7; pH 7.2; marine
11	Cg1	8-30		fs		1.5Y 3/1				slight	marine
12	Cg2	30-50		fs		0.7.5Y 3/2				slight	70 cm EC 12.4; pH 7.1; few fine plant frags; marine
13	Cg3	50-70		fs		0.5Y 4/1				slight	common med plant frags; marine
14											

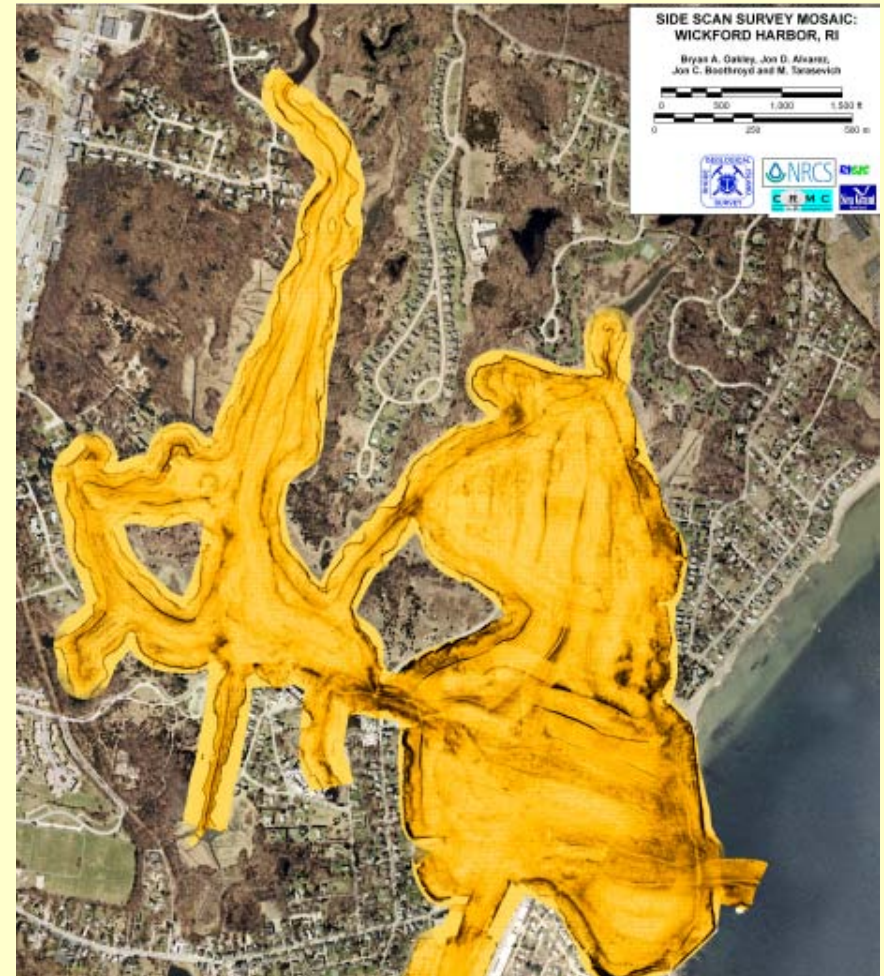
◀ ▶ ◀ ▶ / PJ033 / **PJ034** / PJ035 / PJ036 / PJ037 / PJ038 / PJ039 / PJ040 / PJ041 / Choicelist / ▶ ▶



Remote Sensing Data *used to construct* *Soil, Geology, and Habitat maps.*

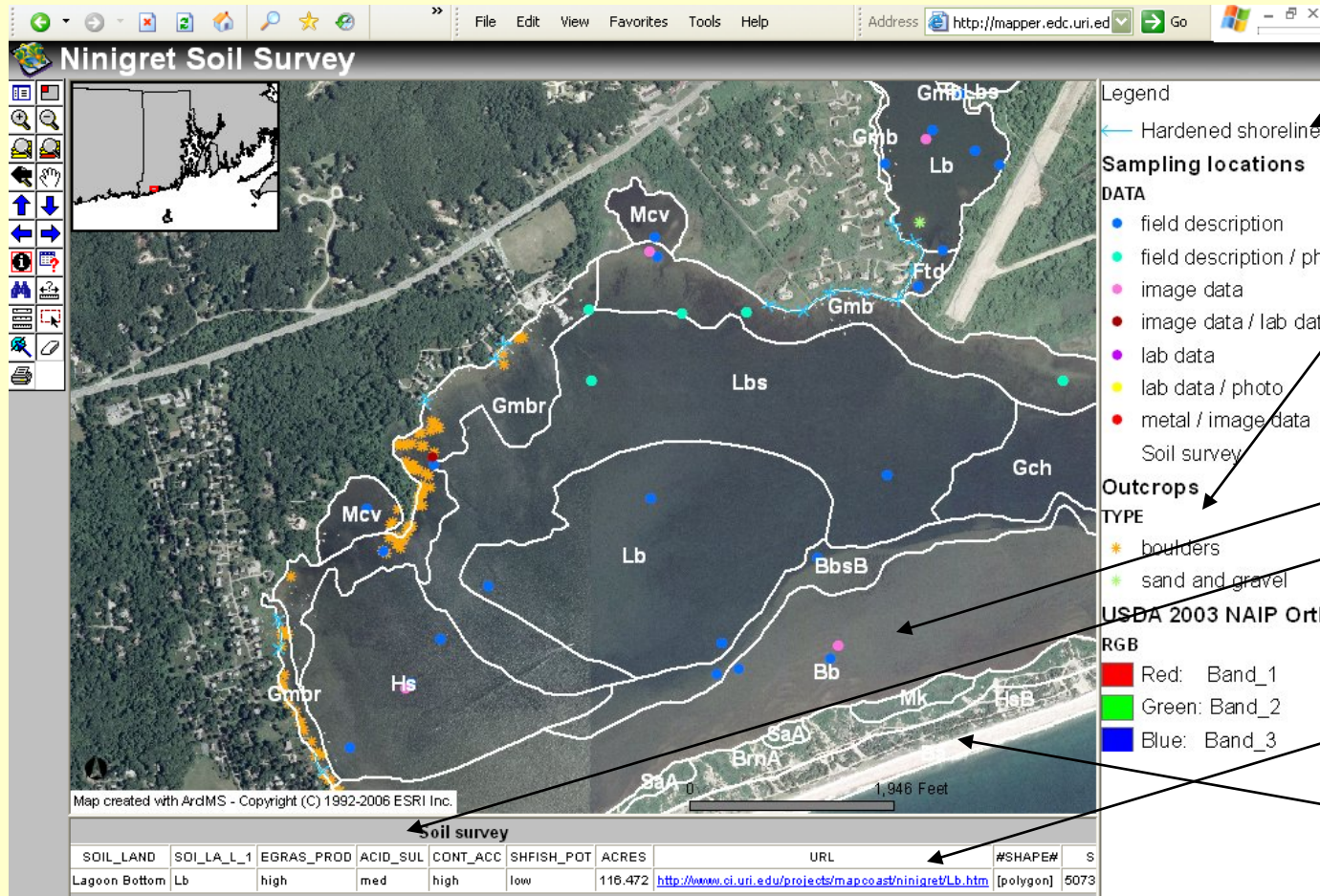
The MapCoast field crew also employs the following technology to map underwater features:

- Side-scan sonar (acoustic map).
- Subbottom – structures down to 70 feet.
- High Resolution Imagery (4") & Pictometry.
- SPI Imagery.
- Still and video images of the bottom.
- GPR and EMI for Coastal Soils.



Side-scan sonar map of Wickford Harbor

IMS Example



Lines – shoreline protection, etc.

Points – AdHoc spot symbols.

Polygons – spatial info with attribute data

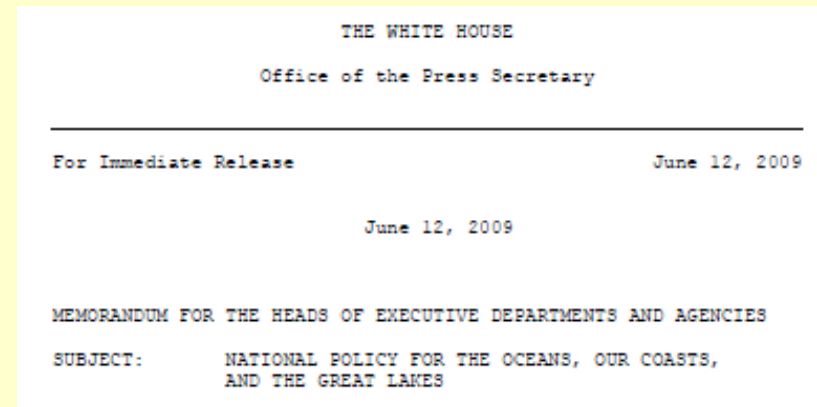
Links

Coastal soils

Why do this – “So What”

“Talking Points”

- The 2004 U.S. Commission on Ocean Policy identified the need for “accurate and seamless living and nonliving marine resource data with bathymetry, and other natural features across the shoreline, coastal zone, near shore areas, and open ocean waters” (Recommendation 25-7)
- By 2010 75% of Population is expected to live w/in 50 miles of the coast.
- None to little mapping currently available for shallow water landscapes.
- **Coastal Soil and Sediment Mapping Helps us Better Manage, Protect, and Restore our States Underwater Marine Landscapes**



The Task Force's recommendations and frameworks should be cost effective and improve coordination across Federal agencies.

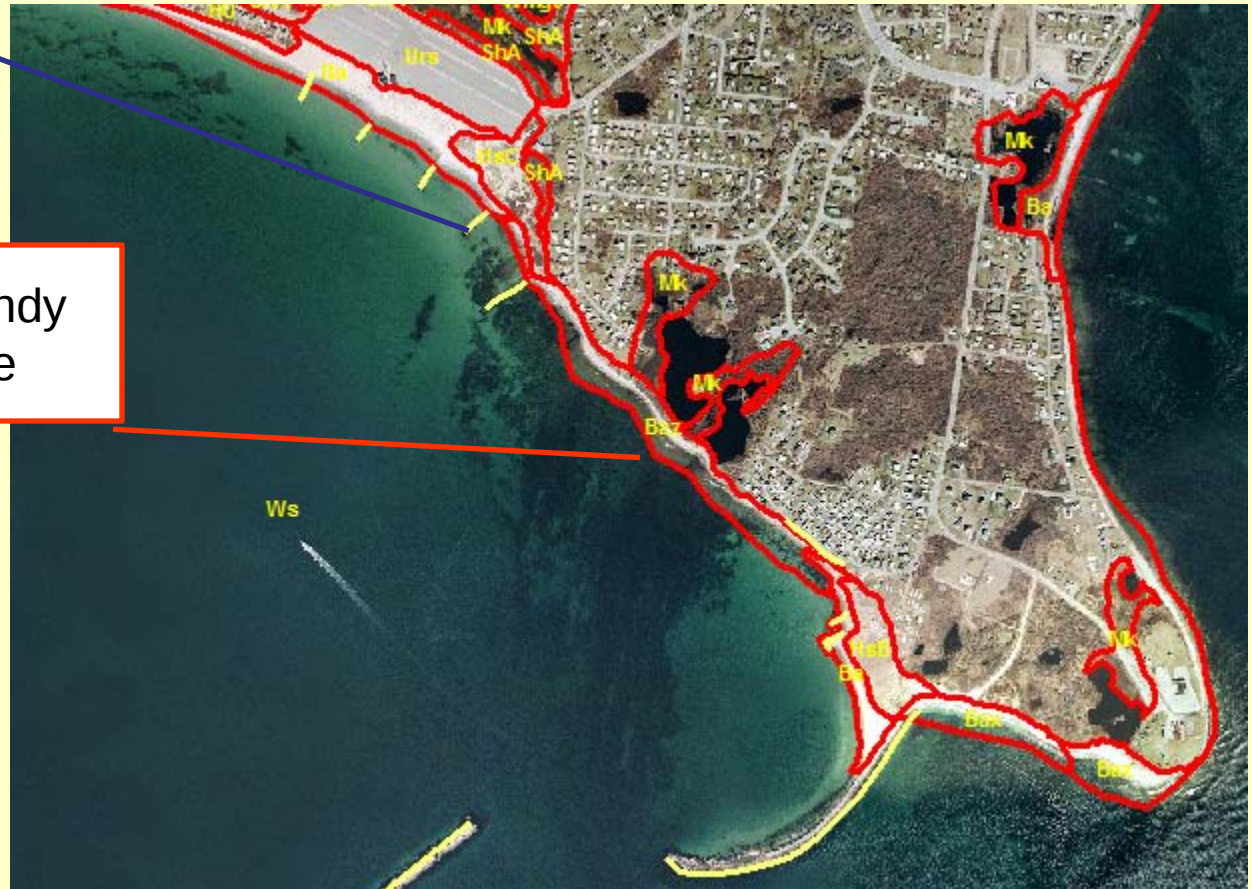
This memorandum covers matters involving the oceans, the Great Lakes, the coasts of the United States, and related seabed, **subsoil**, and living and non-living resources.



RI Coastal Zone Soil Survey

Special features: SPS,
fluid/hard, bedforms,
sub

Beach Units: Beaches, sandy
cobbly, bouldery, surface



RI Coastal Zone Soil Survey

HTM soils – Bigapple, Fortress,
Urs,

Tidal Marsh –
Sandyhook, Matunuck,
Pawcatuck, Ipswich

Seamless subaqueous soils

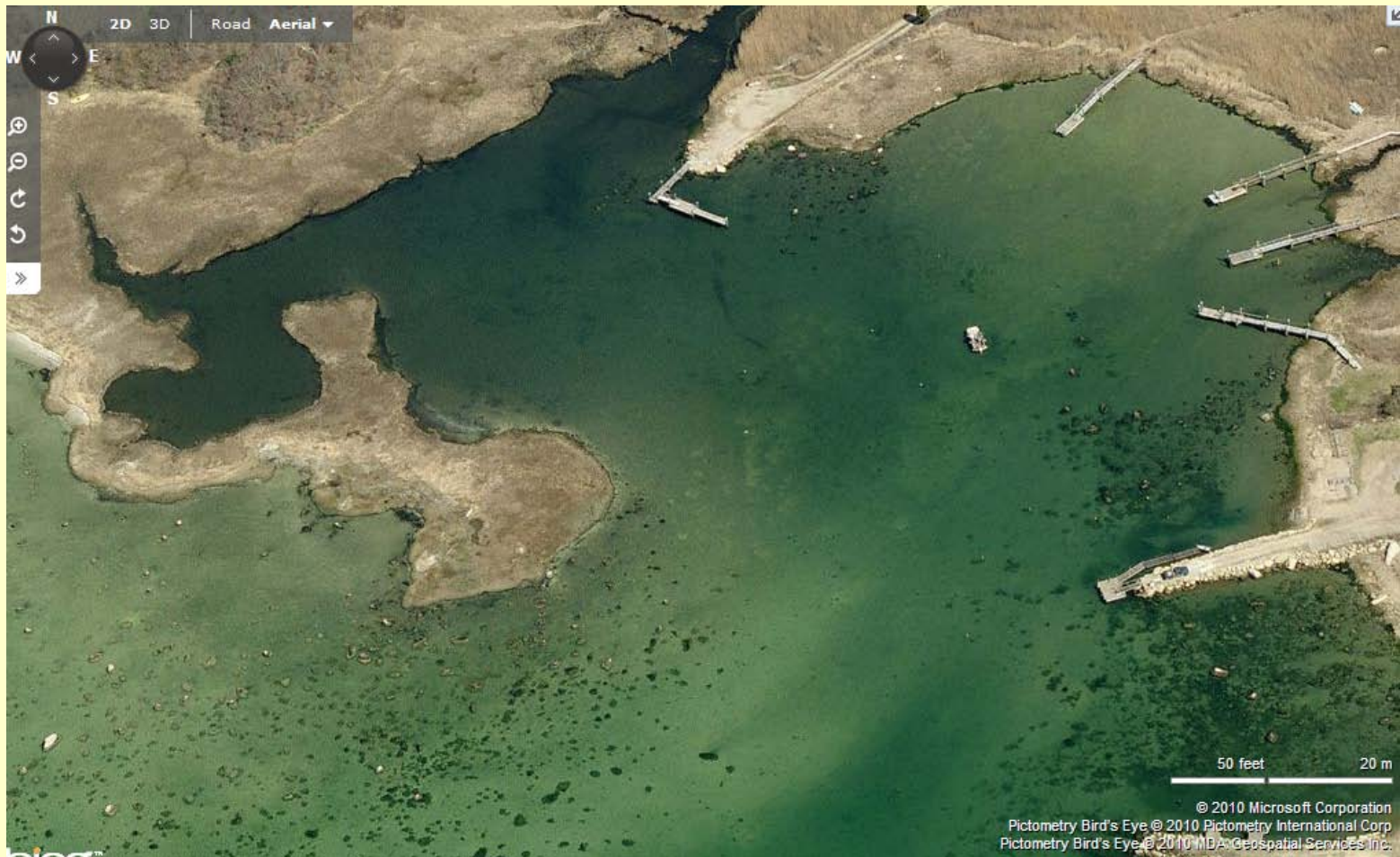


Imagery – past and present

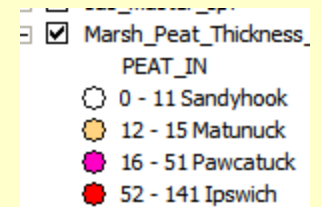


Historic topo, noaa, aerials, pictometry, 4" imagery

Bing Maps “Birds Eye View”



Marsh Mapping

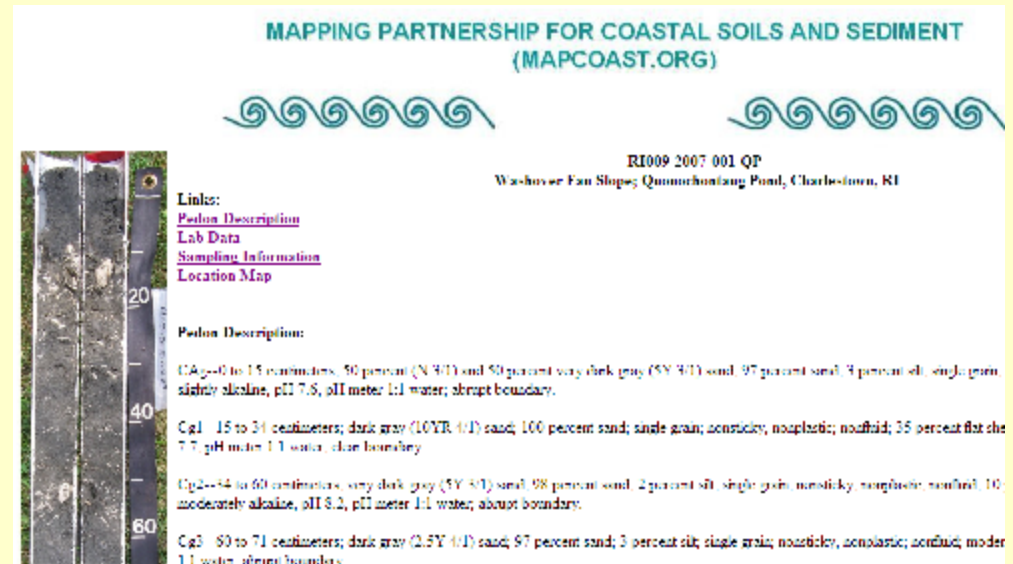


Point Data

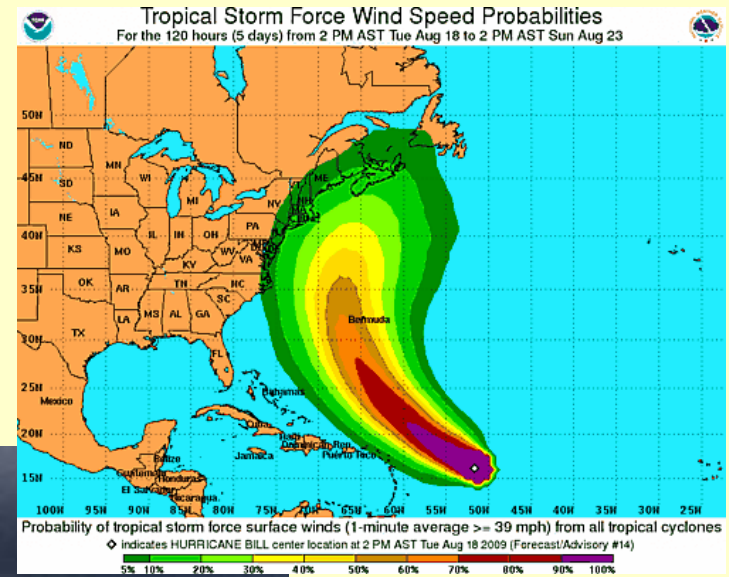


Point/Pedon Data

- 405 Pedons, 62 with lab data.
- Lab analysis includes PSA, OC, AVS/CRS, Incubation pH, metals, etc.
- 12 Series, 20 Map Units
- PedonPC & AnalysisPC used.
- Several Special Features (point/lines).
- All data linked and available (one click), archive core stored at 4C.



Questions

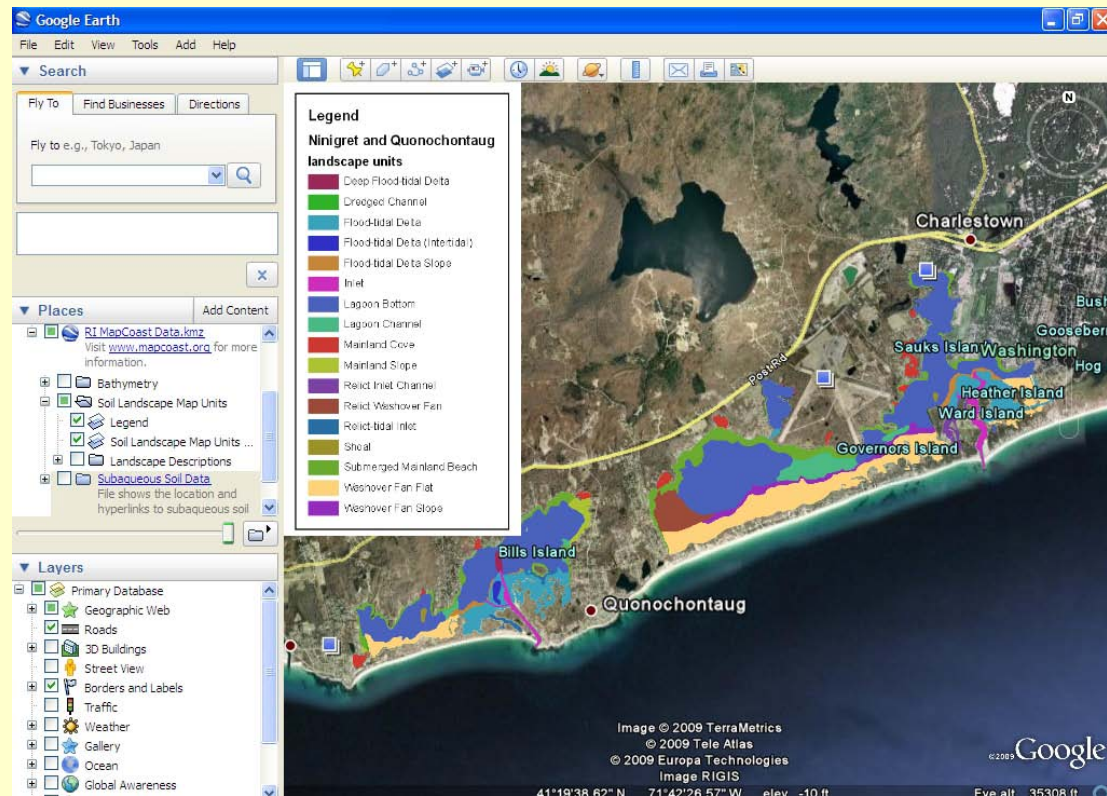


Examples of our Data

<http://maps.edc.uri.edu/arcgis/services>

Google Ocean

Analysis PC



REED SECURED FEDERAL FUNDING FOR RHODE ISLAND FOR FISCAL YEAR 2006

Natural Resources Conservation Service (NRCS) Soil Survey Management Office: \$100,000

The Natural Resources Conservation Service (NRCS) will receive \$100,000 to develop coastal and underwater soil mapping techniques, classification, and soil analysis, as well as provide ongoing training. [\[Click to go back to the top of the page.\]](#)

Pawtuxet Cove Federal Navigation Project Maintenance Dredging: \$1,440,000 Cranston/Warwick

The Army Corps of Engineers will receive \$1,440,000 to remove 90,000 cubic yards of material to restore the 6-foot entrance channel, turning basin and anchorage area in Pawtuxet Cove. The Pawtuxet Cove Federal Navigation Project is an important waterway for vessel traffic serving both the cities of Cranston and Warwick. [\[Click to go back to the top of the page.\]](#)

Narrow River Aquatic Ecosystem Restoration Project: \$150,000 Narragansett/South Kingstown

The Army Corps of Engineers will receive \$150,000 in federal funds to conduct a feasibility study to restore aquatic habitats along the Narrow River in Narragansett and South Kingstown. The Army Corps of Engineers is providing a Preliminary Restoration Study to reduce the pollution between the river and Rhode Island Sound. [\[Click to go back to the top of the page.\]](#)

Roger Williams University Center for Aquaculture Development (CAD): \$1,000,000 Bristol

Roger Williams University (RWU) in Bristol will receive \$1,000,000 to support the establishment of a Center for Aquaculture Development (CAD). The CAD will be established within the University's successful Center for Economic and Environmental Development which has an active aquaculture research program and operates the only shellfish hatchery in Rhode Island. [\[Click to go back to the top of the page.\]](#)

East Providence Waterfront Storm Water Management Analysis: \$250,000

The City of East Providence will receive \$250,000 to analyze and develop an innovative storm water management plan for its newly revitalized waterfront. [\[Click to go back to the top of the page.\]](#)

Bullocks Point Cove Federal Navigation Project Maintenance Dredging: \$630,000 East Providence/Barrington

The Army Corps of Engineers will receive \$630,000 to remove 50,000 cubic yards of dredged material to restore the project's 8-foot entrance channel, the 6-foot inner channel, and the 6-foot mooring and turning basins. [\[Click to go back to the top of the page.\]](#)

Charlestown Breachway navigation study: \$90,000 Charlestown

The Army Corps of Engineers will receive \$90,000 to complete a navigation study and initiate and complete the project design for the Charlestown Breachway and Inlet. There is growing concern for navigation safety through the breachway, which connects Ninigret Pond to Rhode Island Sound. The Army Corps of Engineers is considering a project to remove large boulders on the ocean side of the breachway as well as some dredging of the natural channel farther inland. The Corps will already be dredging in Ninigret Pond for habitat purposes under the South Coast Habitat Restoration Project, minimizing the impact of the project. [\[Click to go back to the top of the page.\]](#)

Boyd's Point Town Salt Marsh Restoration: \$100,000 Portsmouth

The Rhode Island Coastal Resources Management Council will receive \$100,000 to continue construction of Boyd's Point (Town of Portsmouth) salt marsh restoration project. The project will restore 13 acres of salt marsh habitat and wildlife refuge area. The project will also dredge material as well as with the natural navigation project. [\[Click to go back to the top of the page.\]](#)

Brush Neck Wetland Restoration: \$150,000 Warwick

The Army Corps of Engineers and the Rhode Island Coastal Resources Management Council will receive \$150,000 to continue to develop a feasibility study for Brush Neck Cove in Greenwich Bay. [\[Click to go back to the top of the page.\]](#)

Allins Cove Environmental Restoration: \$300,000 Barrington

The Rhode Island Coastal Resources Management Council will receive \$300,000 to continue the restoration of degraded coastal wetlands at Allins Cove in Barrington. This project will restore coastal habitat and salt marsh by improving tidal flushing through removal of dredged material associated with a Federal navigation project. [\[Click to go back to the top of the page.\]](#)

Ten Mile River Fisheries Restoration: \$250,000

The Rhode Island Coastal Resources Management Council will receive \$250,000 to support the restoration of fish runs in the Ten Mile River, which runs in eastern Rhode Island and southeastern Massachusetts. The construction of dams over the last 200 years has prevented fish passage to upstream spawning habitat. Restoring the fish run to the lower Ten Mile River would provide a wide range of benefits to the freshwater and marine fishery and to the surrounding communities. The bill also includes \$14,000 for Inspection of Completed Works by the Army Corps of Engineers, \$360,000 for Project Condition Surveys, and \$25,000 for the Fox Point Hurricane Barrier to upgrade its 40-year old electrical system. [\[Click to go back to the top of the page.\]](#)

New England Lobster Disease Research: \$3 million University Of Rhode Island

The National Sea Grant College Program will receive \$3 million to establish a cooperative research program to study the causes of lobster disease and the decline in the lobster fishery in New England waters. [\[Click to go back to the top of the page.\]](#)

\$9 Million