

US Army Corps of Engineers Lidar and Navigation

Jennifer M. Wozencraft

Director, Joint Airborne Lidar Bathymetry Technical Center of Expertise
Program Manager, USACE National Coastal Mapping Program

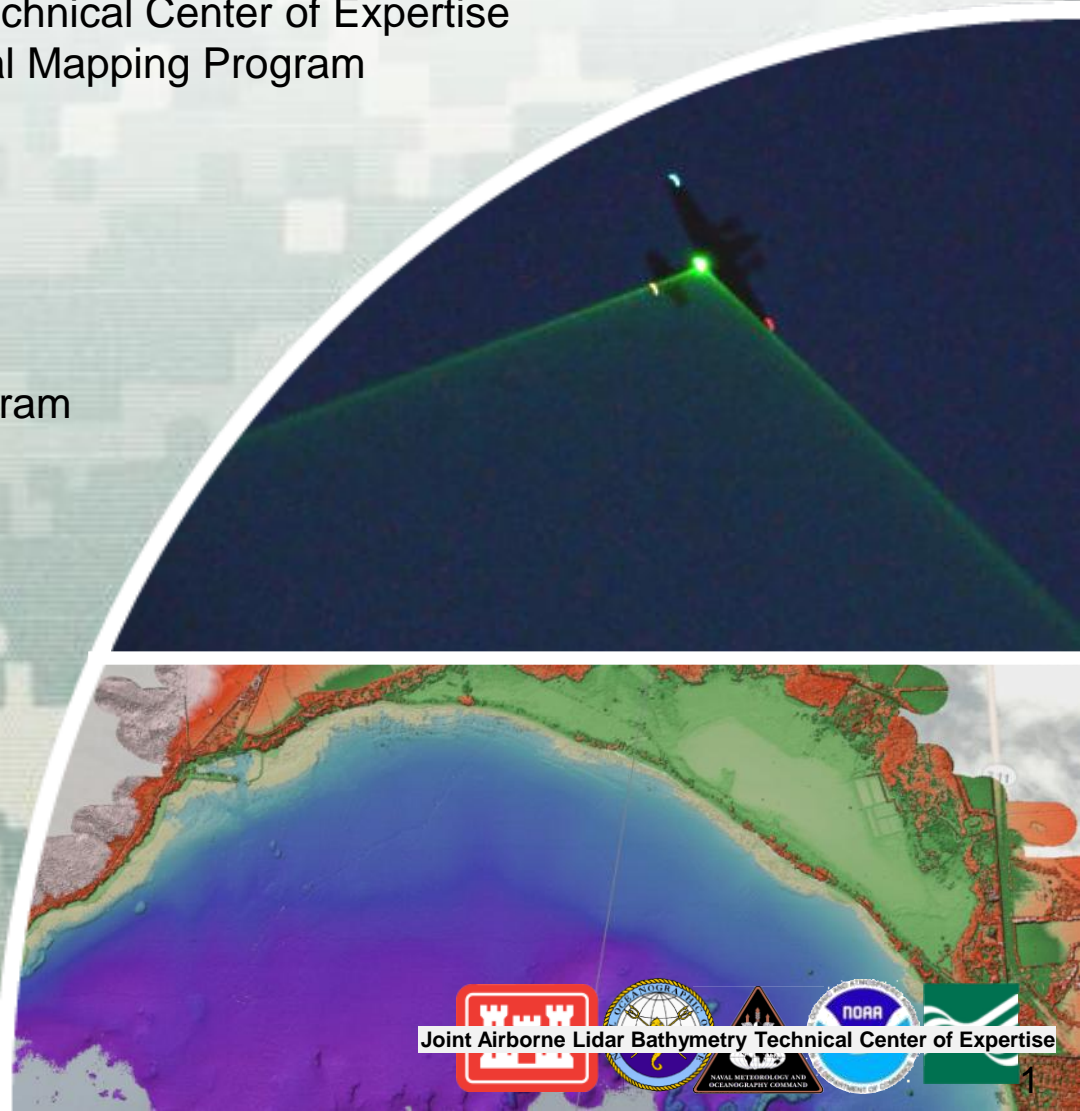
13 February 2014, AAPA H&N meeting

Outline

- Technology
- USACE National Coastal Mapping Program
 - Background
 - Products
 - Applications
- Questions



US Army Corps of Engineers
BUILDING STRONG[®]



Joint Airborne Lidar Bathymetry Technical Center of Expertise



OPERATIONS

Aircraft

Surveys

Procedures

People

Hardware

Software



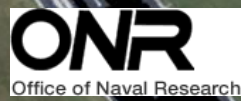
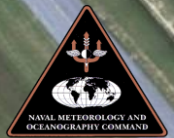
RESEARCH AND DEVELOPMENT

Algorithms

Data
exploitation

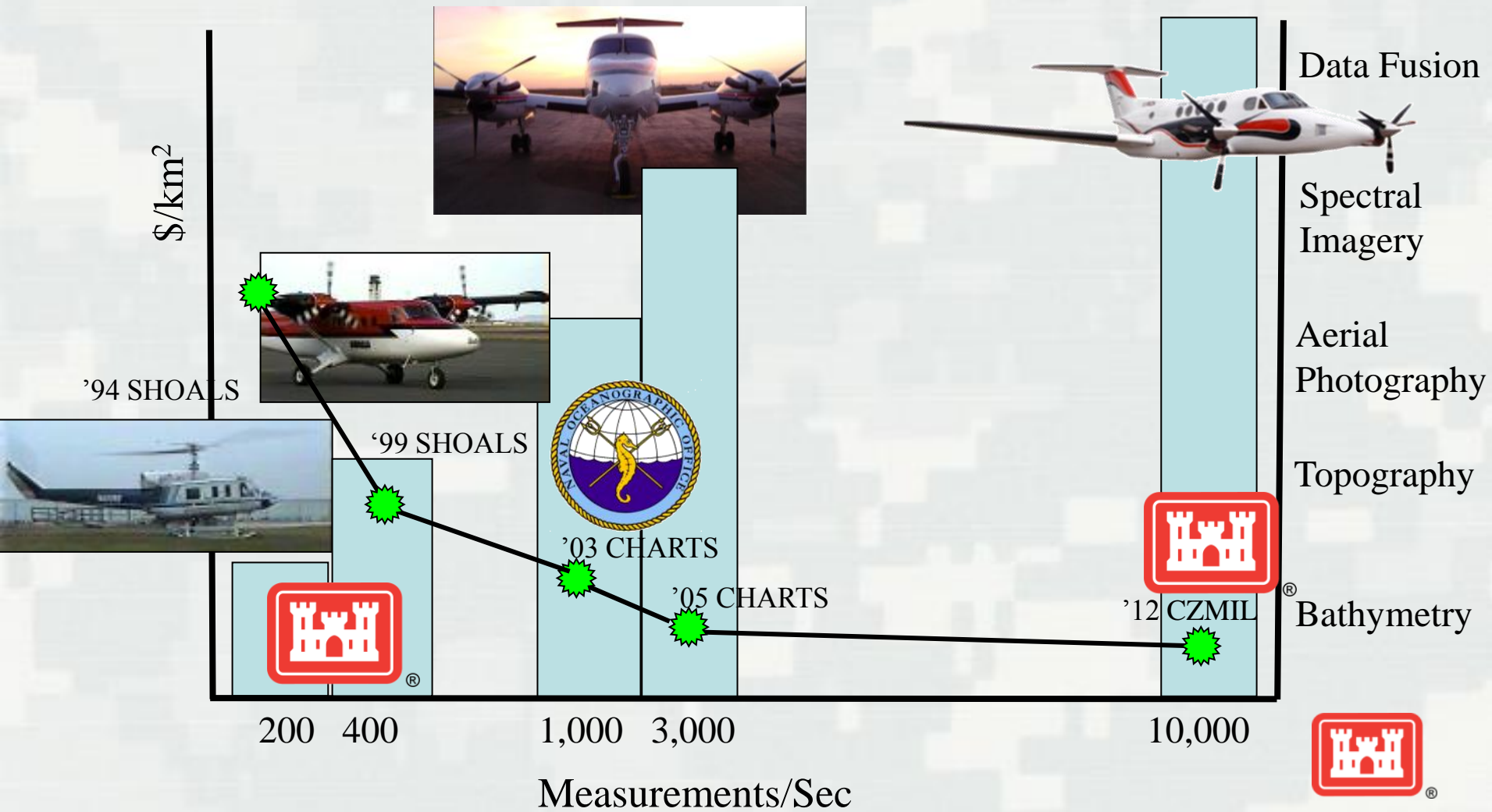


Annual Technical Workshop, 10-11 June 2014, Mobile, AL



Dynamic Aviation

Sensor development history



USACE National Coastal Mapping Program

- Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
- Develop products that build an understanding of how the coastal zone is changing
- Facilitate management of sediment and projects at a regional, or watershed scale



(500 m) Topo

Hydro (1,000 m)

10,000 Hz Pulse Rate (hydro / topo)
0.4 Hz / 25 MP Digital camera (~20 cm pixel)
CASI-1500 Hyperspectral Imager

- 1500 pixels
- 380 – 1050 nm wavelength
- 288 possible bands

15 cm RMSE bathymetry
7.5 cm RMSE topography
Shot spacing:

- 0.7 X 0.7 meter topo / shallow hydro
- 2.0 X 2.0 meter deep hydro
- 300 - 400 m op altitude (hydro)
- 300 - 1200 m op altitude (topo)

400 m

Dia. 290m

• *Shorter laser pulse length and receiver response for increased accuracy, especially in shallow (<2m) water*
 • *Large field-of-view afforded by prism, and more sensitive receivers, increase signal-to-noise ratio.*
 • *Improved depth detection in shallow turbid water*

National Coastal Mapping Progress

Products

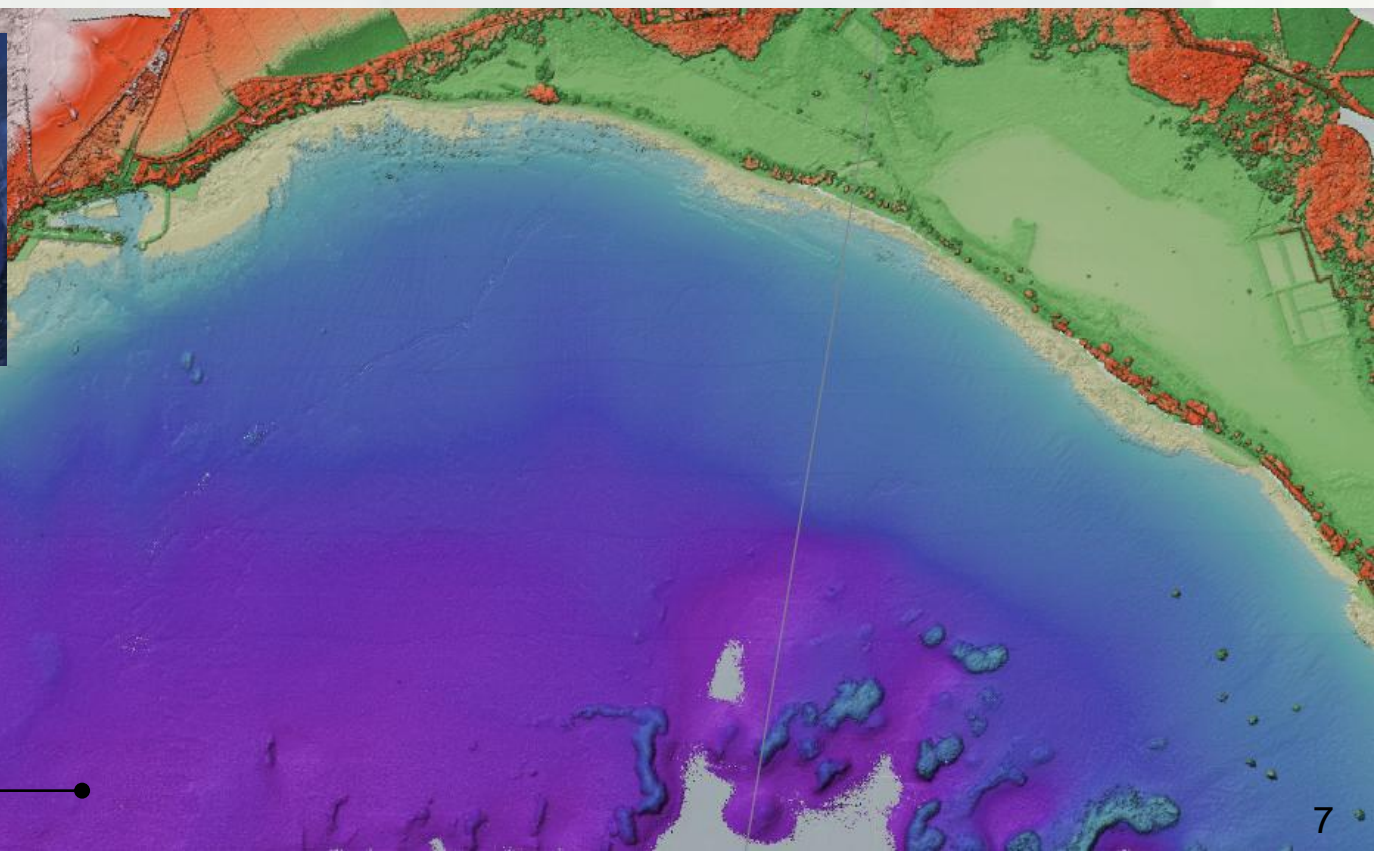
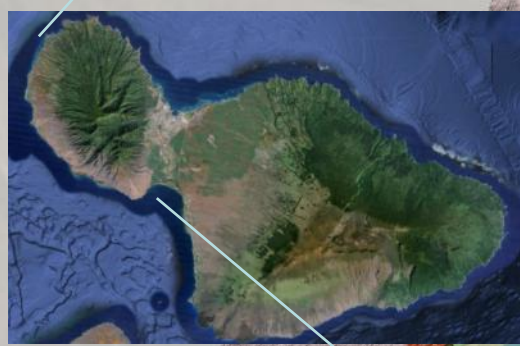
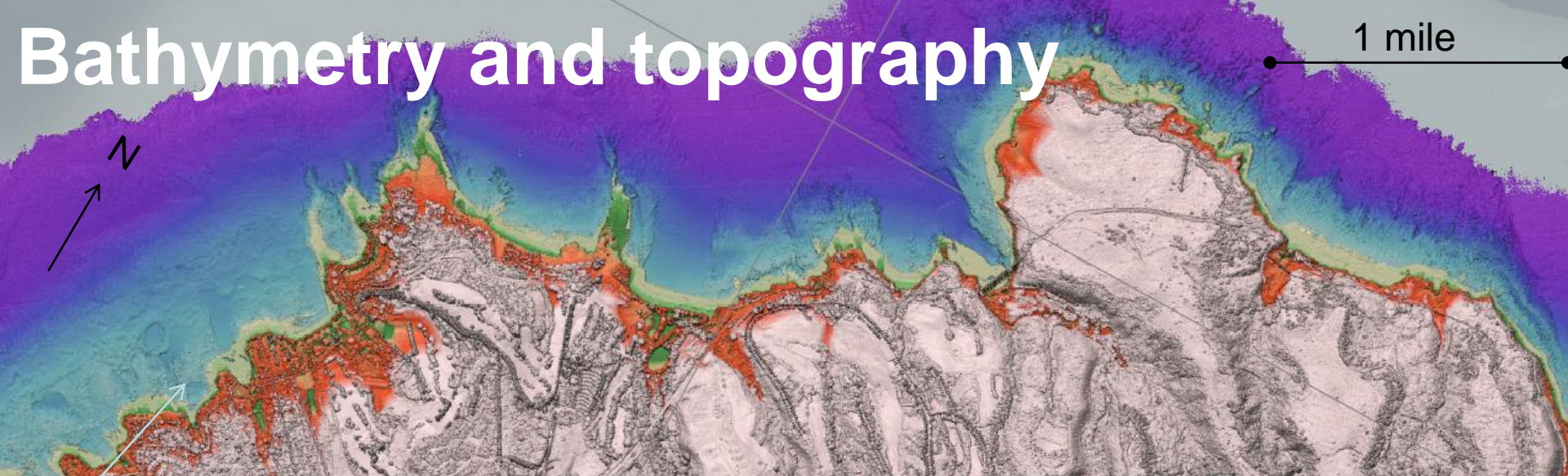
- ASCII XYZ
- Aerial photos
- Zero contour
- Aerial photo mosaics
- 1-meter bathy/topo DEM
- LAS format topo
- 1-meter bathy/topo bare earth DEM
- Hyperspectral image mosaics
- Laser reflectance images
- Basic landcover classification
- Volume change

Number of times surveyed since 2004



Bathymetry and topography

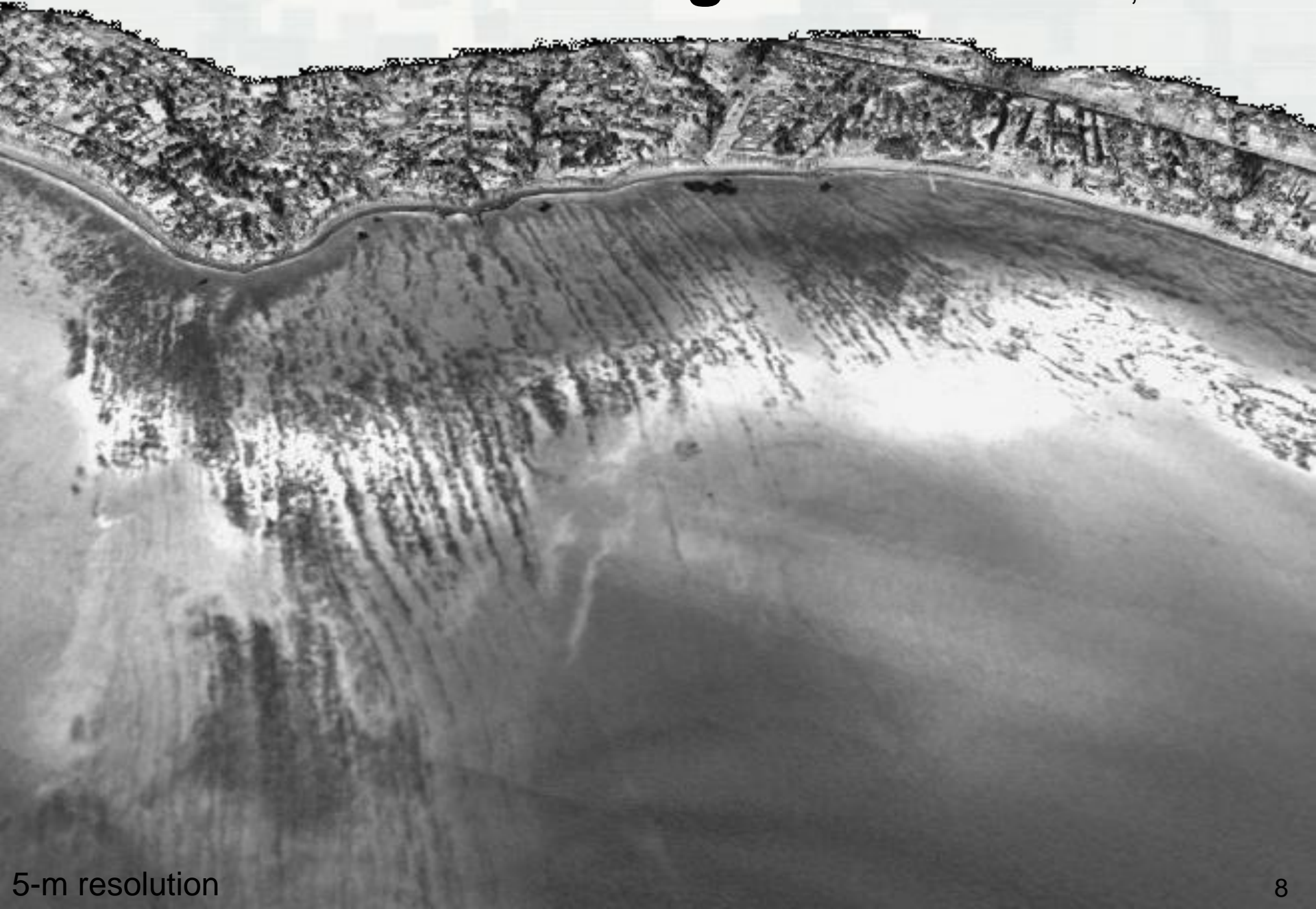
1 mile



1 mile

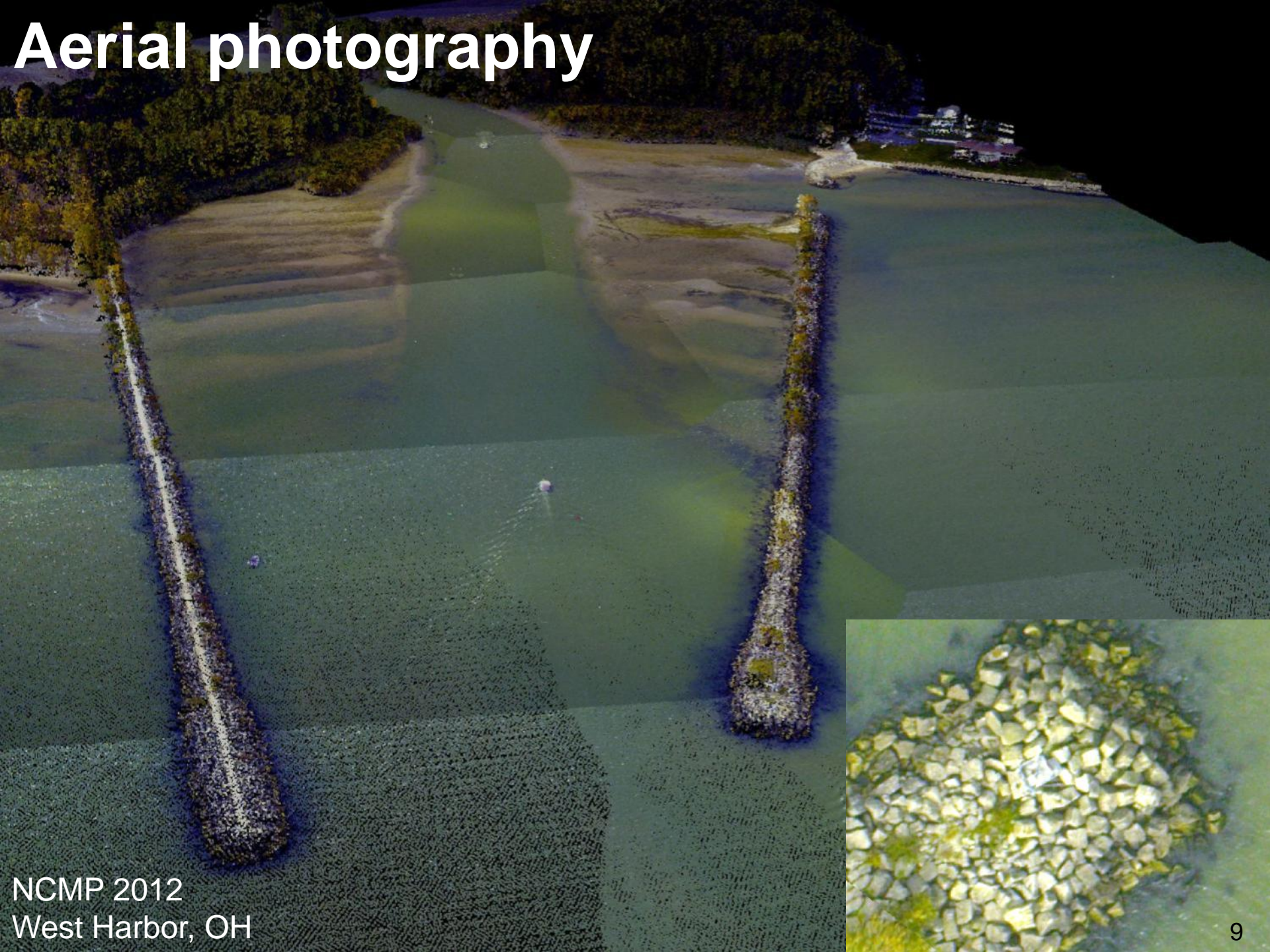
Laser reflectance image

NCMP 2009
Malibu, CA

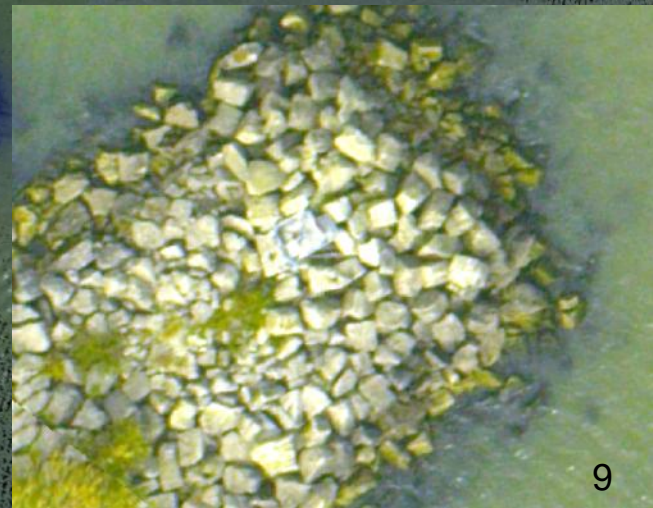


5-m resolution

Aerial photography



NCMP 2012
West Harbor, OH



Hyperspectral imagery

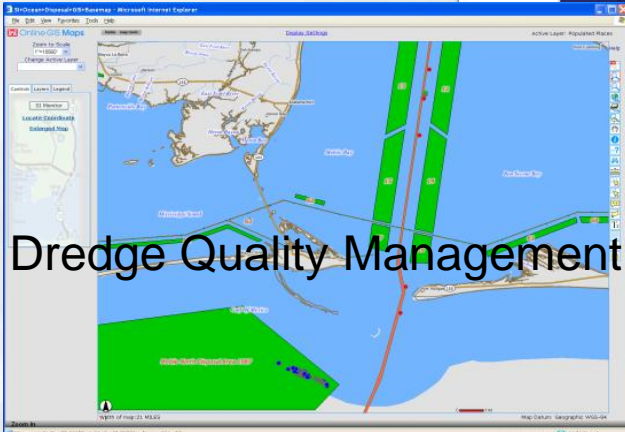
1 m pixel resolution
36 spectral bands
375-1050 nm

Near Laurence Harbor, NJ
Post-Sandy 2012

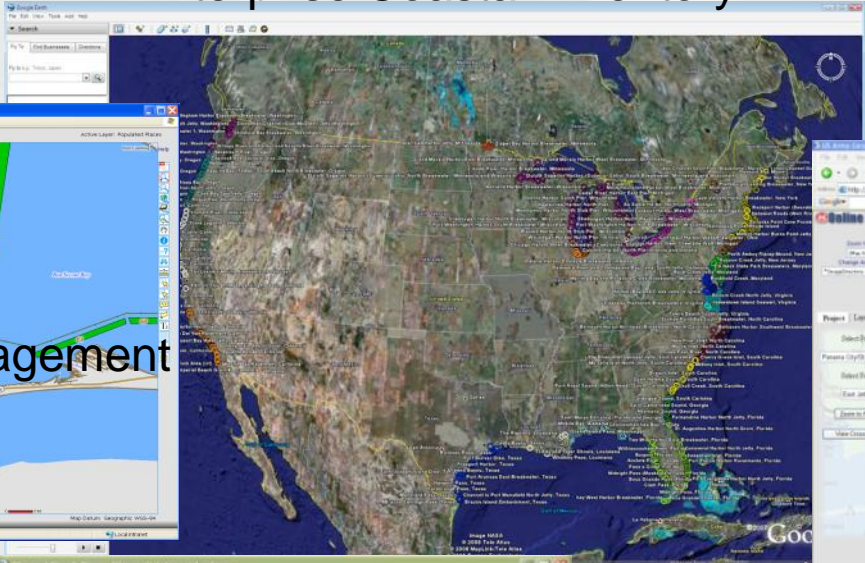


Navigation Data Integration Framework: Navigation and Coastal Data Bank

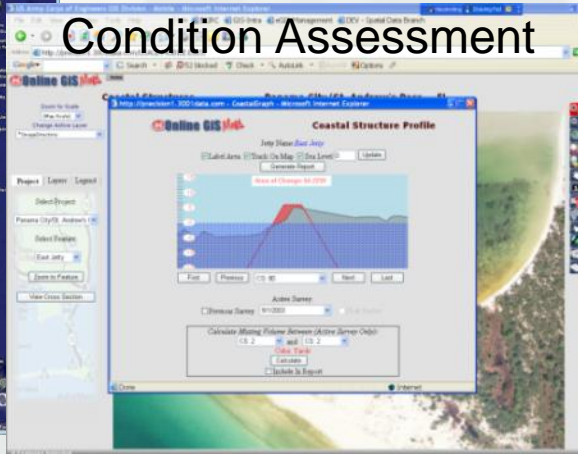
Enterprise Coastal Inventory



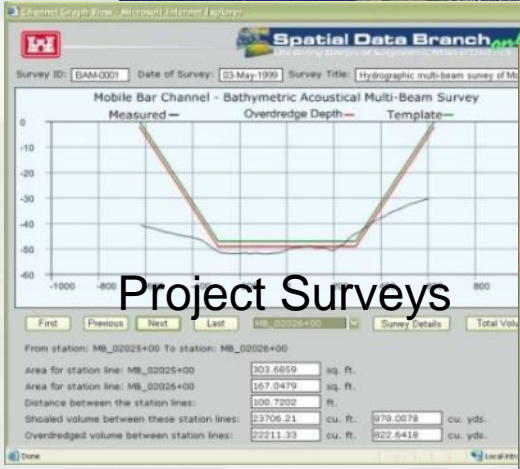
Dredge Quality Management



Coastal Structure
Condition Assessment



- USGS St. Petersburg
- USGS EROS Data Center
- NOAA CSC
- NOAA NGDC
- By Request

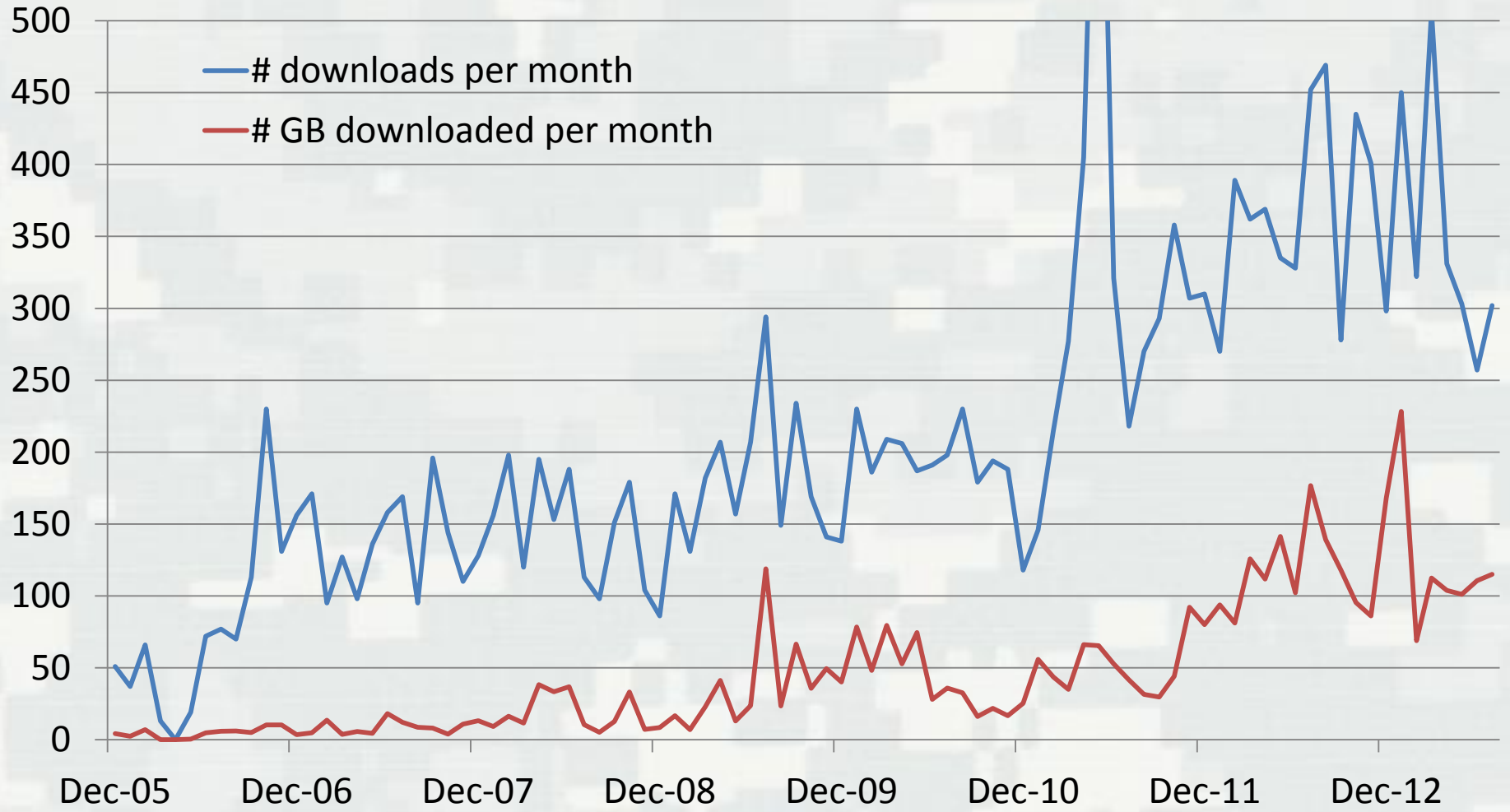


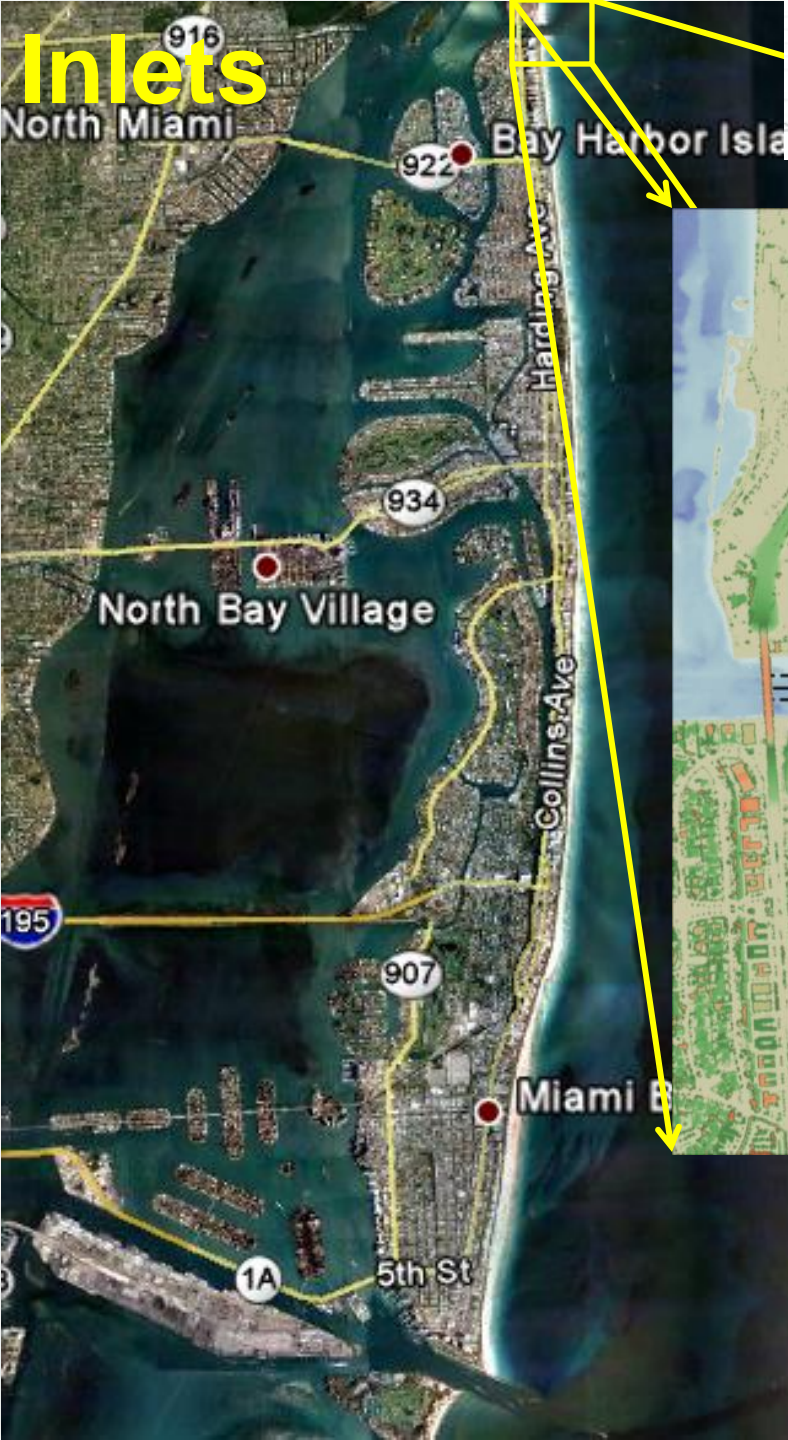
Project Surveys



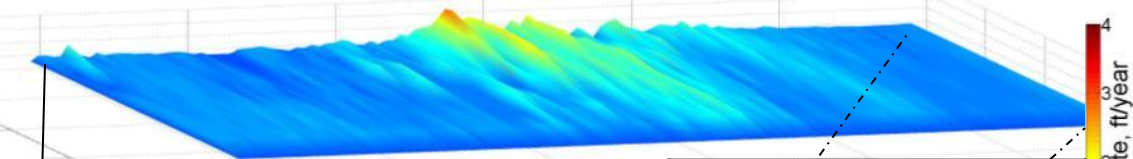
JALBTCX at the DIGITAL COAST

4.2 TB lidar data in more than 19,000 downloads

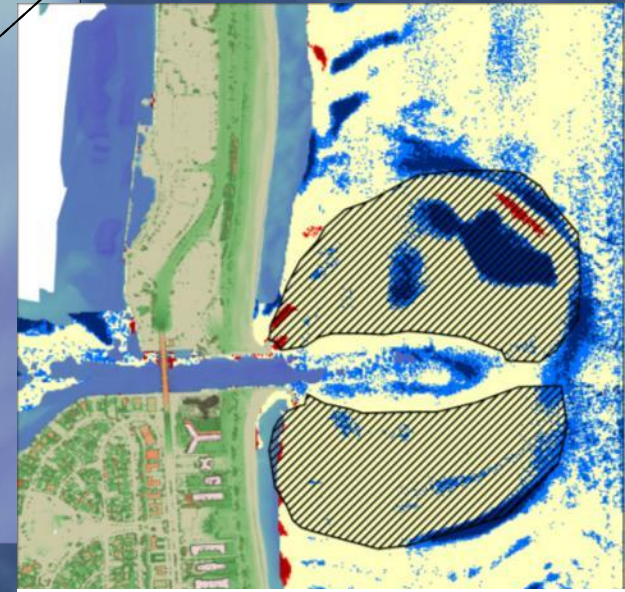
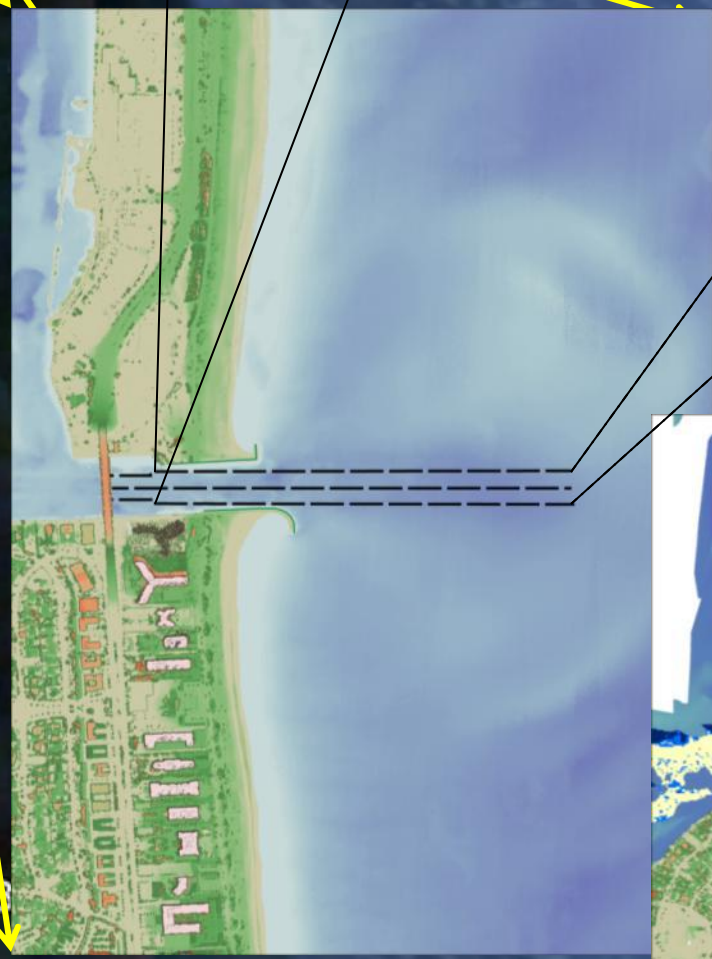




Inlets



Channel Volume CY/yr		
Average	Maximum	Minimum
7,400	12,900	3,900



Volume Change (CY)

Survey	North Shoal	South Shoal	Total
10/2009--6/2004	266,158	174,736	440,894
10/2009--1/2006	232,284	150,703	382,987
1/2006--11/2004	106,561	21,548	128,109
11/2004--6/2004	-81,090	-64,643	-145,733

Asset management coastal structures

The screenshot shows the ArcGIS Explorer Online interface. The browser address bar displays "ArcGIS Explorer Online". The application title is "NCMP Structures". The interface includes a "Mapping" tab and a "Presentation" tab. A search bar at the top right contains the text "Find Places". The main map area shows a coastal region with labels for "San Pedro", "Long Beach Harbor", and "Los Angeles Harbor". A red dashed rectangle highlights a specific structure on the map. A "Query Results" window is open on the right, displaying a table of data for the selected structure.

LA-LB Harbors Middle...	
66 of 73	
Azimuth	77.9018
jetty_id	SPL_JET_116
meta_id	SPL_jetty_area_1010.xml
coord_id	
feat_name	LA-LB Harbors Middle Breakwater
perim	37936.8875399
perim_u_d	FT
user_flag	
instIn_id	SPL
facil_id	
op_stat_d	UNSPECIFIED
feat_len	18500
length_u_d	FT
crest_hght	14

<http://geoplatform.usace.army.mil>

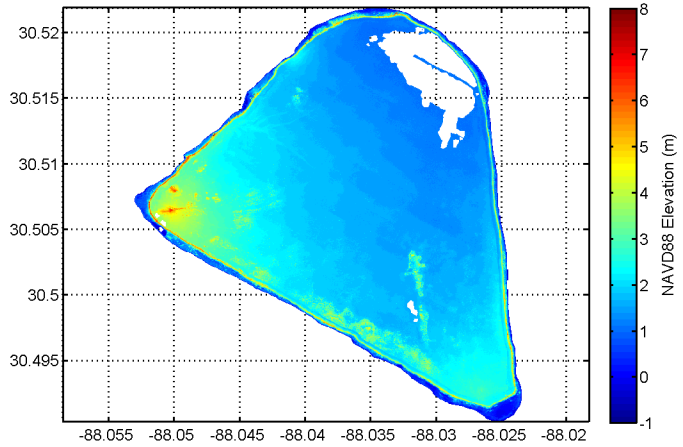
Search NCMP; NCMP Structures

GIRP CSMART, ECID AM

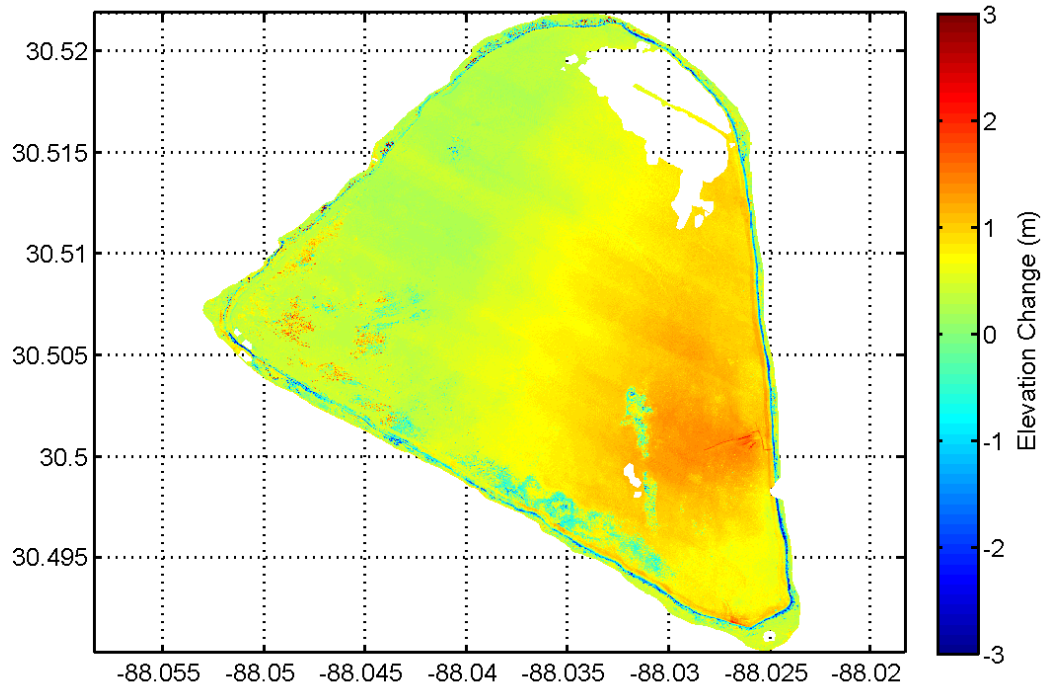
Disposal monitoring



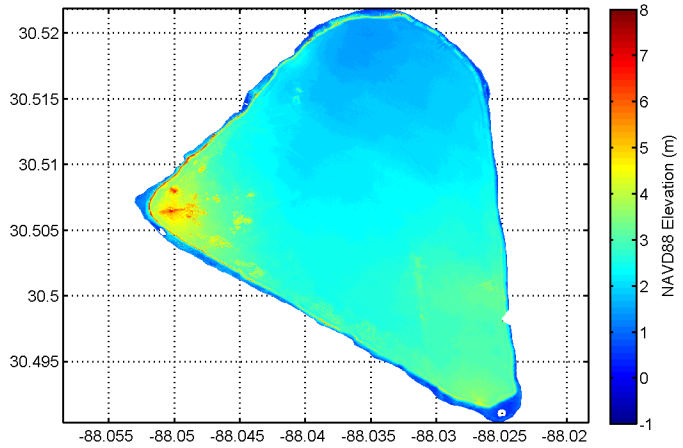
2004 Post-Hurricane Ivan



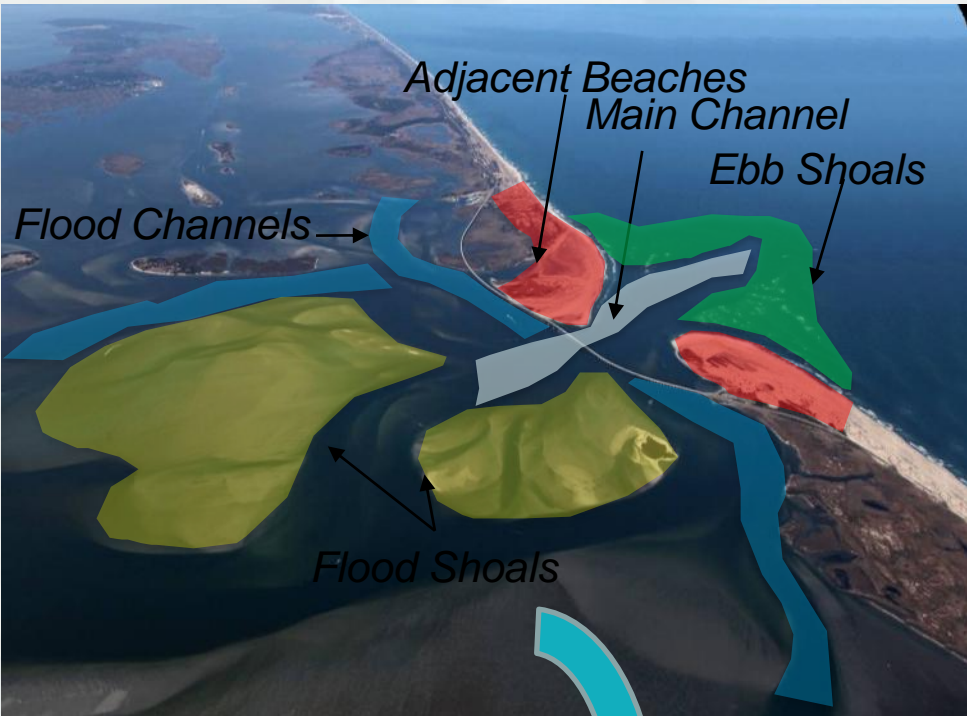
2004 - 2005 Elevation Change



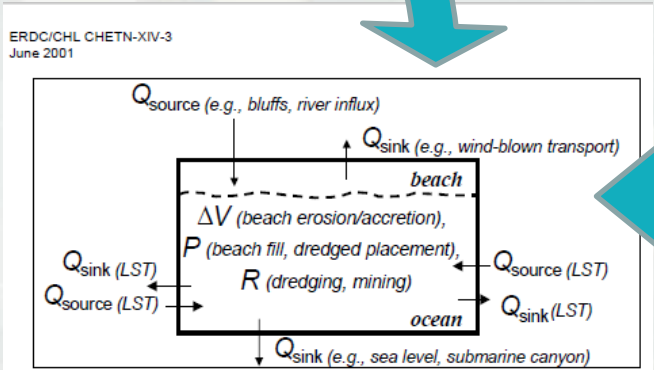
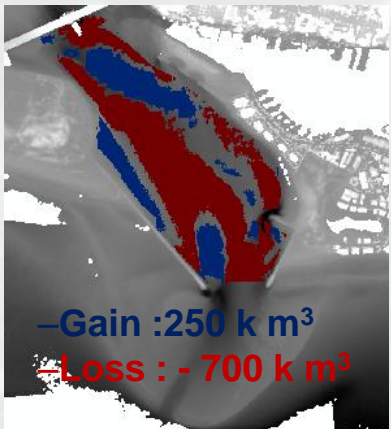
2005 Post-Hurricane Katrina



Sediment Pathways & Budget

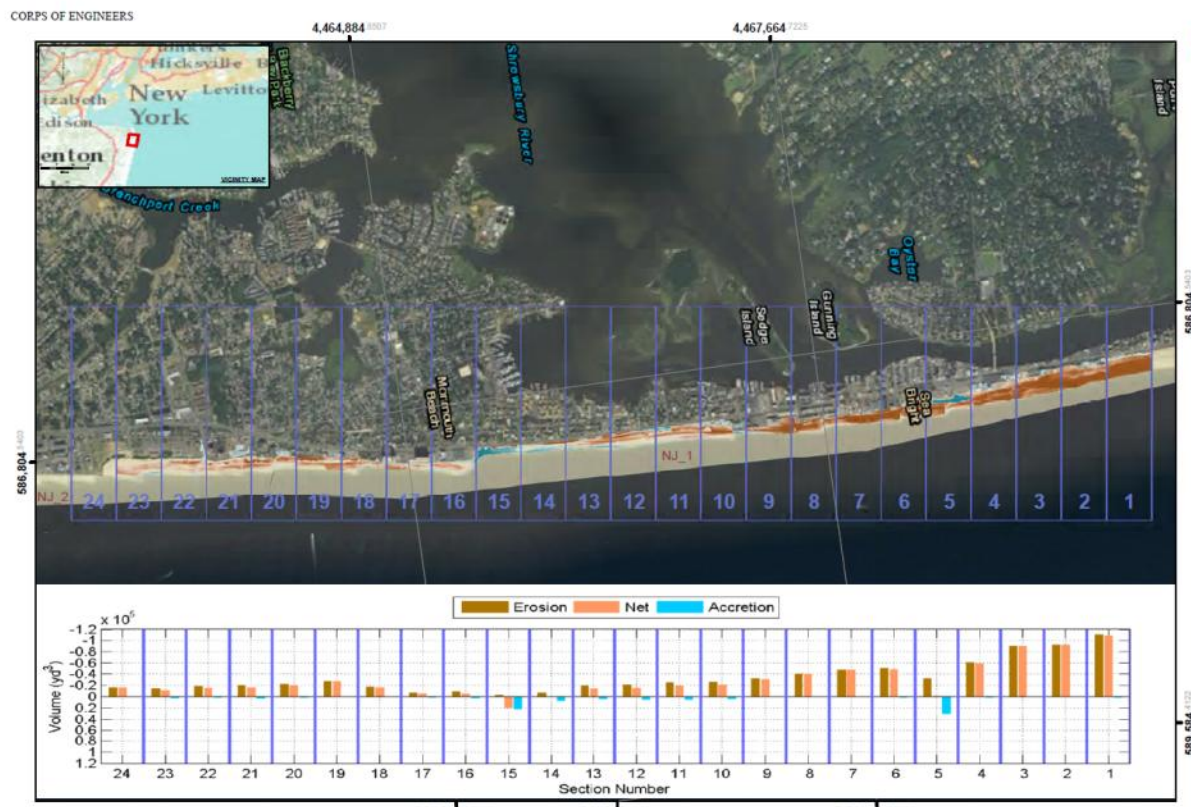
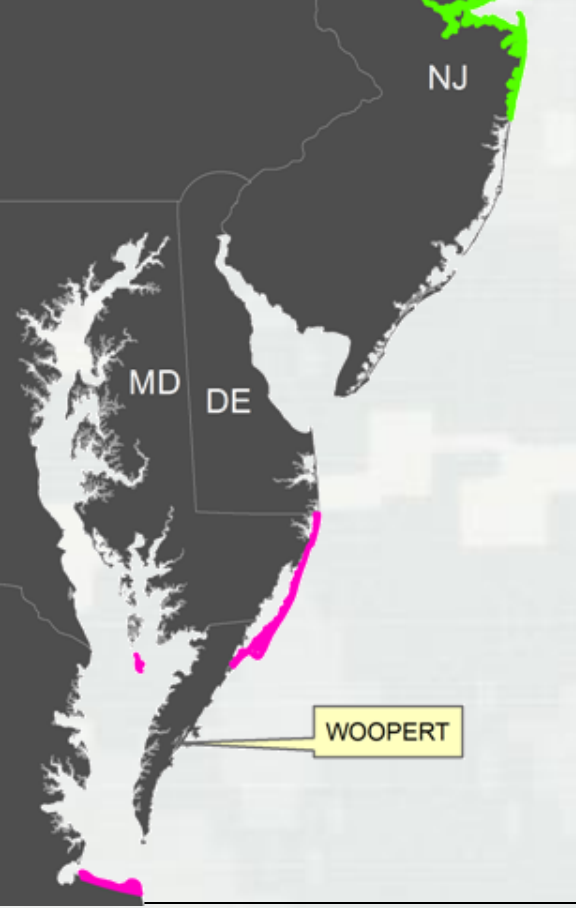
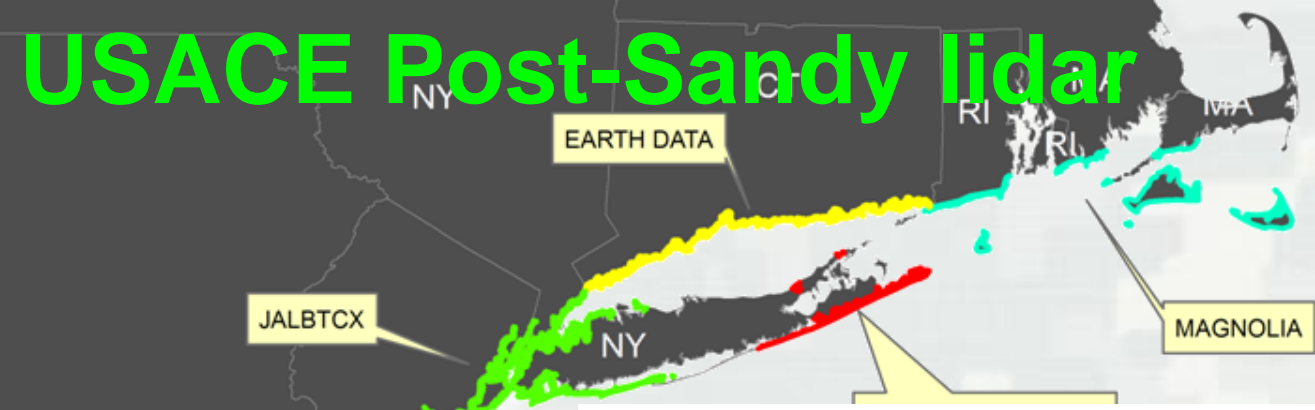


Inlet and ebb shoal

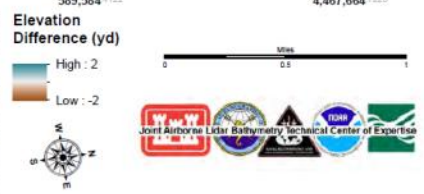


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USACE Post-Sandy lidar



Section	Net (yd³)	Erosion (yd³)	Accretion (yd³)	Section	Net (yd³)	Erosion (yd³)	Accretion (yd³)
1	-10000	-11000	2000	13	-14000	-19000	5000
2	-62000	-62000	1000	14	1000	-7000	8000
3	-60000	-60000	0	15	-20000	-3000	23000
4	-25000	-41000	2000	16	-5000	-2000	3000
5	-1000	-32000	31000	17	-5000	-7000	2000
6	-40000	-51000	2000	18	-16000	-17000	1000
7	-48000	-48000	0	19	-27000	-27000	0
8	-41000	-41000	0	20	-20000	-22000	2000
9	-31000	-32000	1000	21	-16000	-20000	4000
10	-21000	-26000	5000	22	-16000	-16000	2000
11	-19000	-25000	6000	23	-11000	-14000	3000
12	-15000	-31000	6000	24	0	0	0



Horizontal Coordinate System:
NAD 1983 UTM Zone 18N
Datum: North American 1983
Distance Units: Meter
Vertical Datum:
Elevation differences are shown in yards.

The information depicted on this map represents a comparison of survey data collected by JALBTCX after Superstorm Sandy in late October 2012. The data and comparison are preliminary.

Comparison data source: JALBTCX 2010 LIDAR
2012 Aerial Photography data source: NOAA Hurricane Sandy Response Imagery

U.S. ARMY
U.S. Army Corps of Engineers
DAWPC-CEM

DISCLAIMER: The data shown on this map is preliminary and subject to change. The data was collected by JALBTCX after Superstorm Sandy in late October 2012. The data and comparison are preliminary. This map is for informational purposes only and should not be used for navigation or other critical decisions. The data shown on this map is preliminary and subject to change. The data was collected by JALBTCX after Superstorm Sandy in late October 2012. The data and comparison are preliminary. This map is for informational purposes only and should not be used for navigation or other critical decisions.

National Coastal Mapping Program
Post-Superstorm Sandy
Elevation Differences and Volume
New Jersey 03: 00028

Sheet Reference Number 1 of 1

Post-Sandy volume changes

Details |
 Add |
 Basemap |
 Save |
 Share |
 Print |
 Measure |
 Bookmarks

Legend

2012_PostSandy_Volum

Net Volume (cuyd)

- 106000 - -100000
- 99999 - -80000
- 79999 - -60000
- 59999 - -40000
- 39999 - -20000
- 19999 - 0
- 1 - 20000
- 20001 - 40000
- 40001 - 56727
- 56728 - 80000
- 80001 - 100000

NAD Comparison Areas

Polygons

- Coney Island
- FIJI_placement



http://155.82.160.6/arcgis/rest/services/JALBTCX/2012_PostSandy_Volumes/MapServer



2012 Post-Sandy Volume Assessment

[Details](#)
[Add](#)
[Basemap](#)
[Save](#)
[Share](#)
[Print](#)
[Measure](#)
[Bookmarks](#)

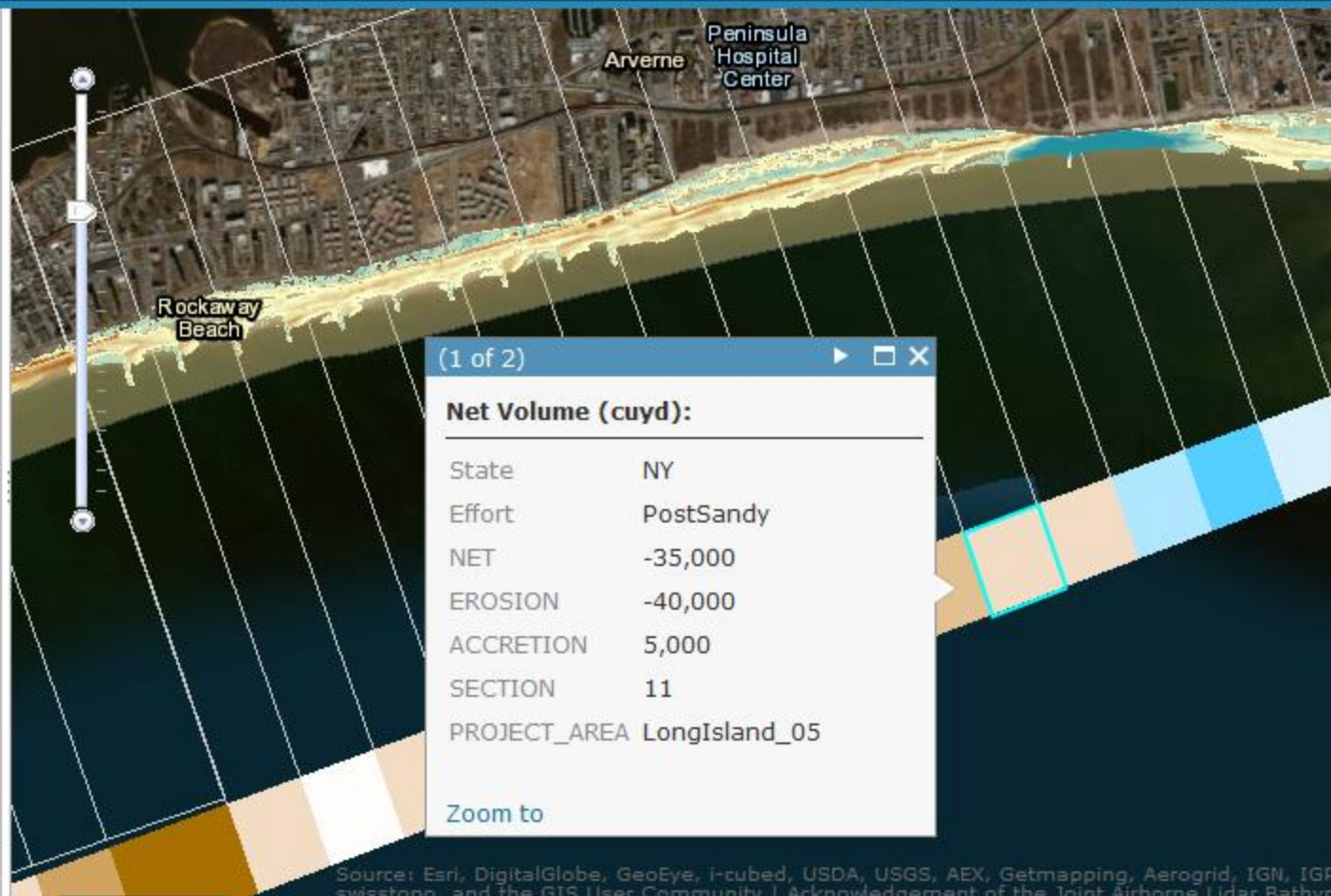
Legend

NAD Comparison Areas

Polygons

- <all other values>
- Coney Island
- FIJI_placement
- Keanesburg
- Lawrence_Hrabor
- NJ_1
- NJ_2
- NJ_4
- Rockaway_placement_area
- WOSI_placement_areas
- Westhampton Placement Area
- nj_3

Alongshore Sections



(1 of 2)

Net Volume (cuyd):

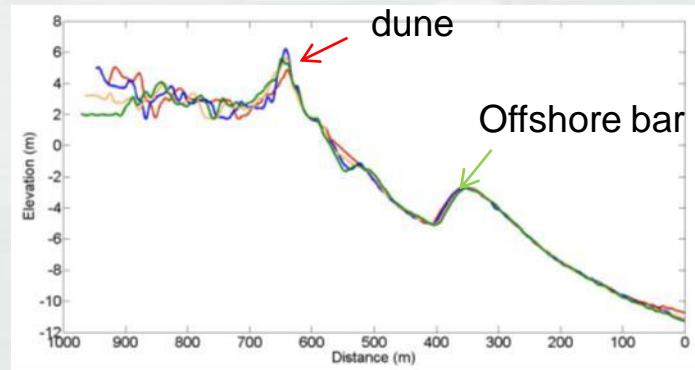
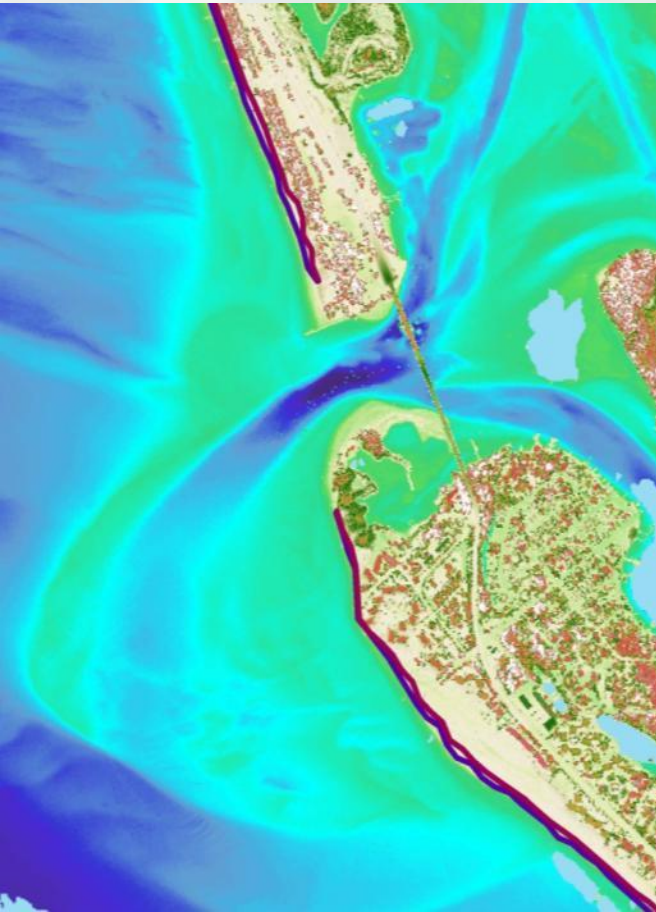
State	NY
Effort	PostSandy
NET	-35,000
EROSION	-40,000
ACCRETION	5,000
SECTION	11
PROJECT_AREA	LongIsland_05

[Zoom to](#)

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community | Acknowledgement of the Joint Airborne Lidar Bathymetry Technical Center of Excellence (JALBTCX) would be appropriate.

Dunes

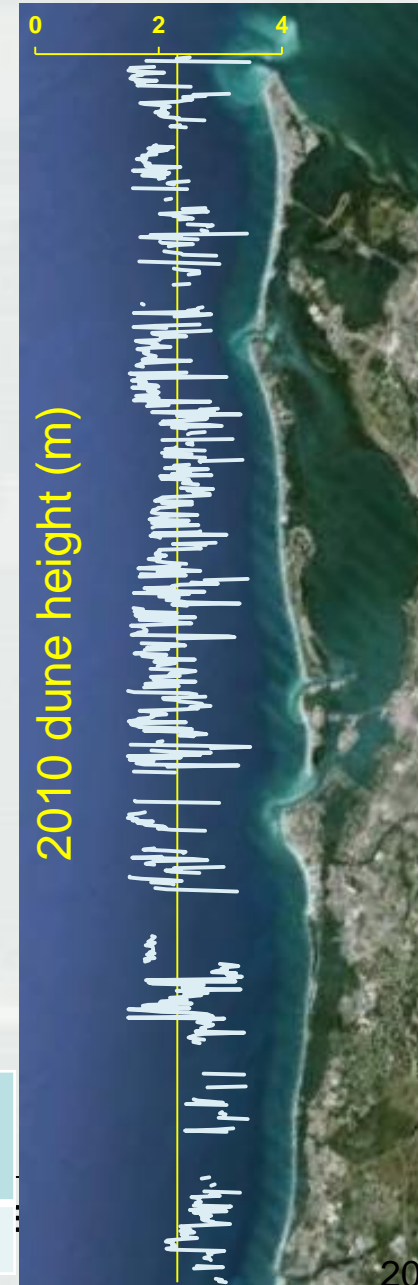
- Provide natural buffer from waves/runup to upland areas
- Volume of sediment available for beach recovery
- Included as part of beach nourishment projects



- Dune height – crest of the first dune
- Dune toe – slope change in dune

2010 Dune Height

2 m



Landscape changes



- Roads/
Bare Ground
- Structures
- Low
Vegetation
- Medium
Vegetation
- Tall
Vegetation



17th Street Canal
New Orleans, LA






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Invasive species detection



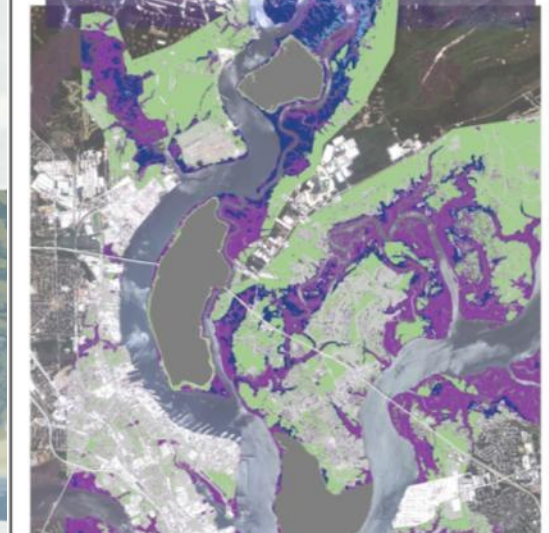
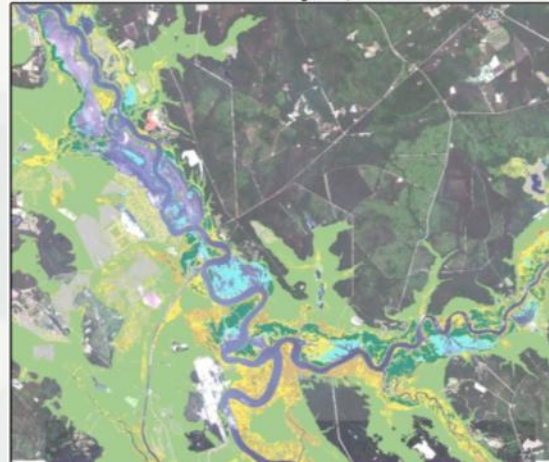
Times Beach, Buffalo NY, 2007
Emergent marsh dominated by *phragmites*



-  Emergent Marsh
-  Forest/Trees
-  Lawn/Field
-  Urban/Developed
-  Water

Wetland Density

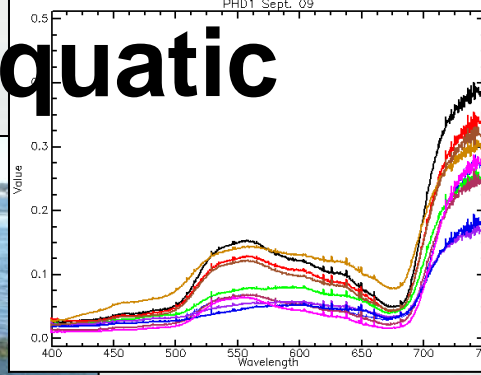
- Detailed wetland habitat mapping may be required for specific projects
- Example: examine potential impacts from a harbor deepening project in SC
 - Identify potential changes in marsh ecosystems as result of salinity changes
 - Combine detailed wetland data with hydro model to examine wetland impacts



Discrimination of submerged aquatic vegetation species

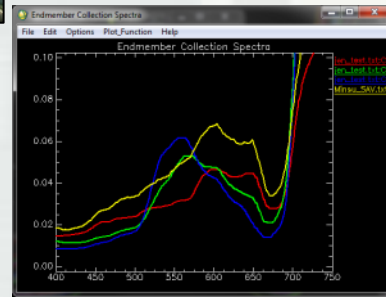
Background: Dredging impacts to SAV vary by species; CWA lists SAV as a Special Aquatic Site Mapping species is important for:

- Planning dredging operations
- Mitigating ecological damage
- Monitoring SAV

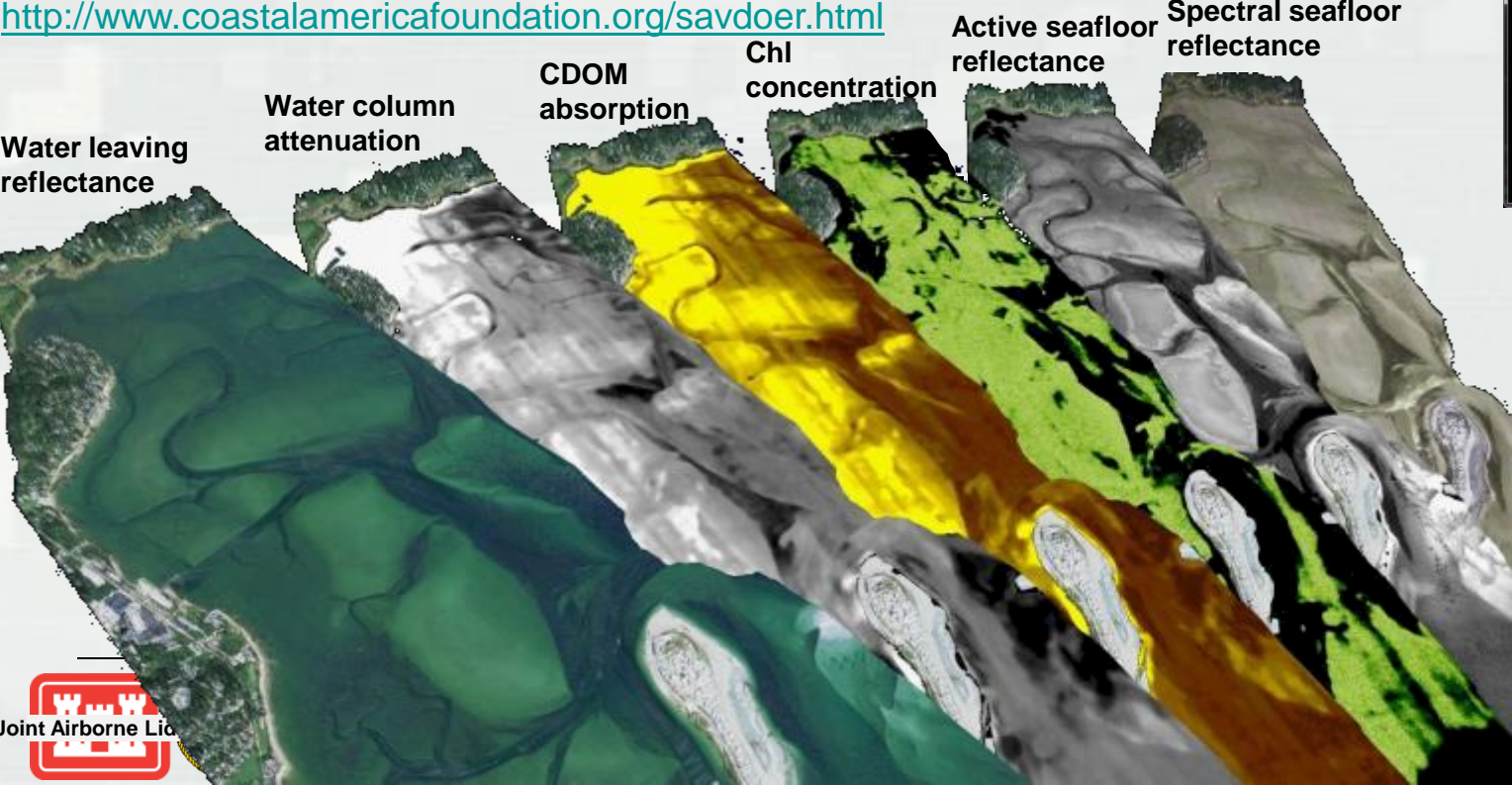
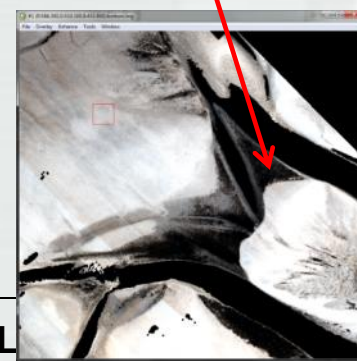


Submersed Eelgrass spectra, Plymouth Harbor, MA

<http://www.coastalamericafoundation.org/savdoer.html>



Seagrass



Coastal engineering indices

combined coastal engineering geomorphology index



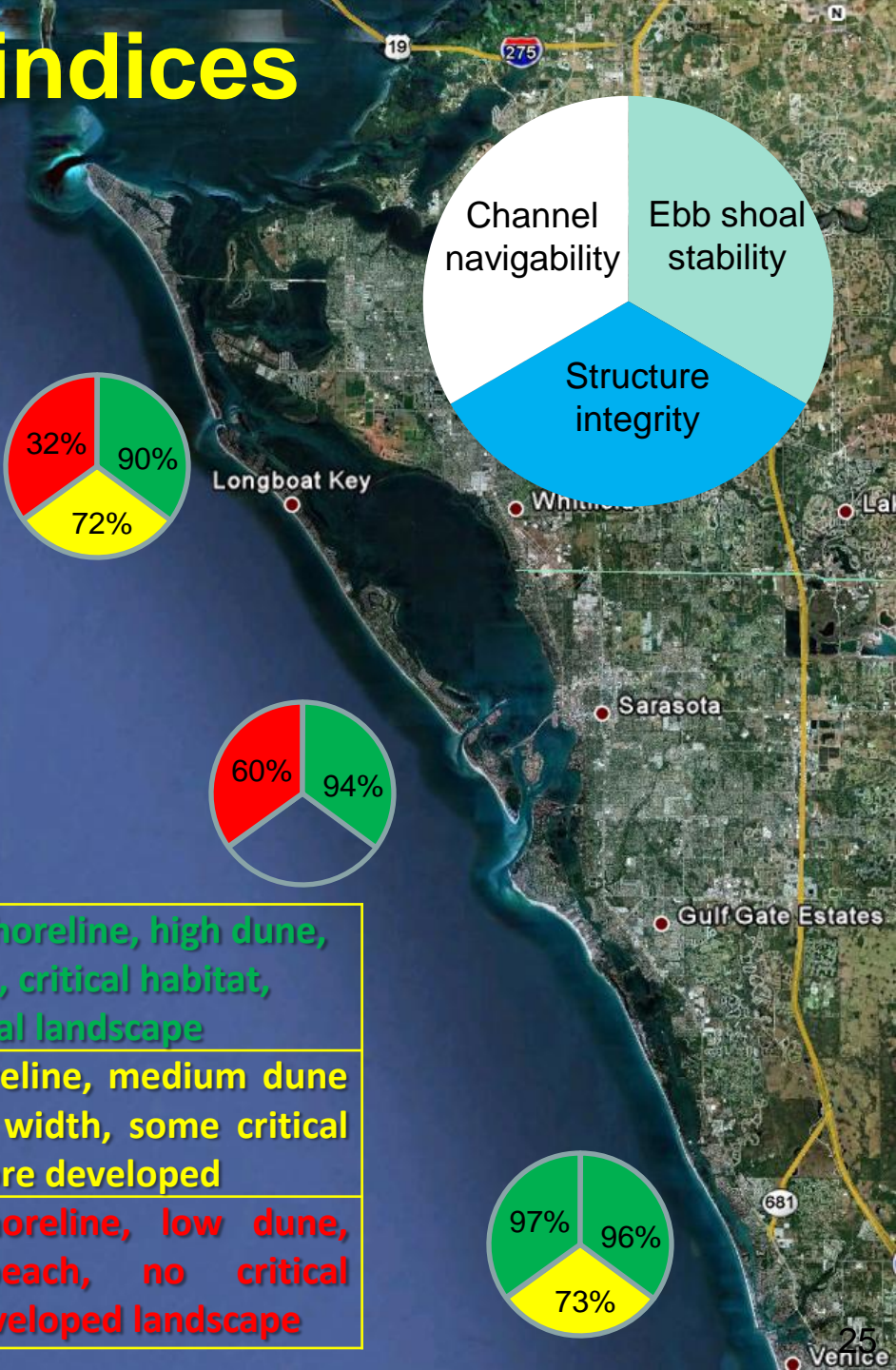
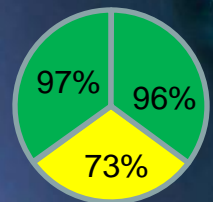
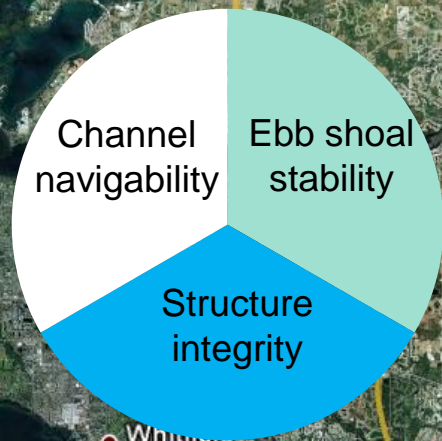
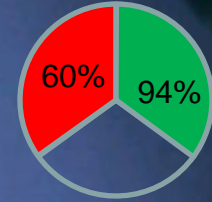
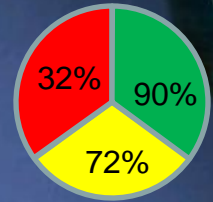
combined environmental index



human use index



Green	Accreting shoreline, high dune, wide beach, critical habitat, more natural landscape
Yellow	Stable shoreline, medium dune and beach width, some critical habitat, more developed
Red	Eroding shoreline, low dune, narrow beach, no critical habitat, developed landscape



Questions?

jennifer.m.wozencraft@usace.army.mil

228-806-6044

