

# Coastal Inlets Research Program

US Army Corps of Engineers  
Engineering Research and Development Center



Site of Moriches Inlet  
Nov, 1951

*Julie Dean Rosati  
and  
Nicholas C. Kraus,  
CIRP Program Manager*



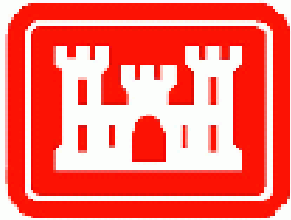
Shinnecock Inlet  
3 days after formation, Sep 1938



Moriches Inlet, NY



Shinnecock Inlet, NY



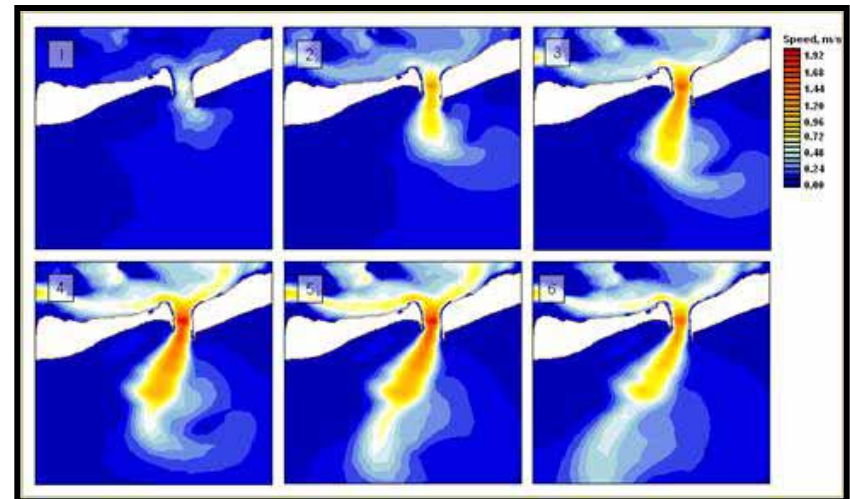
# Coastal Inlets Research Program

US Army Corps of Engineers  
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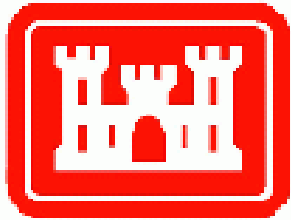
## Objectives

- Develop desk-top tools and models
  - Inlets and adjacent beaches
  - Engineering actions, natural conditions, and storms.
- Reduce Operation and Maintenance (O&M) costs at inlets.
- Transfer knowledge, tools, and models to the public.



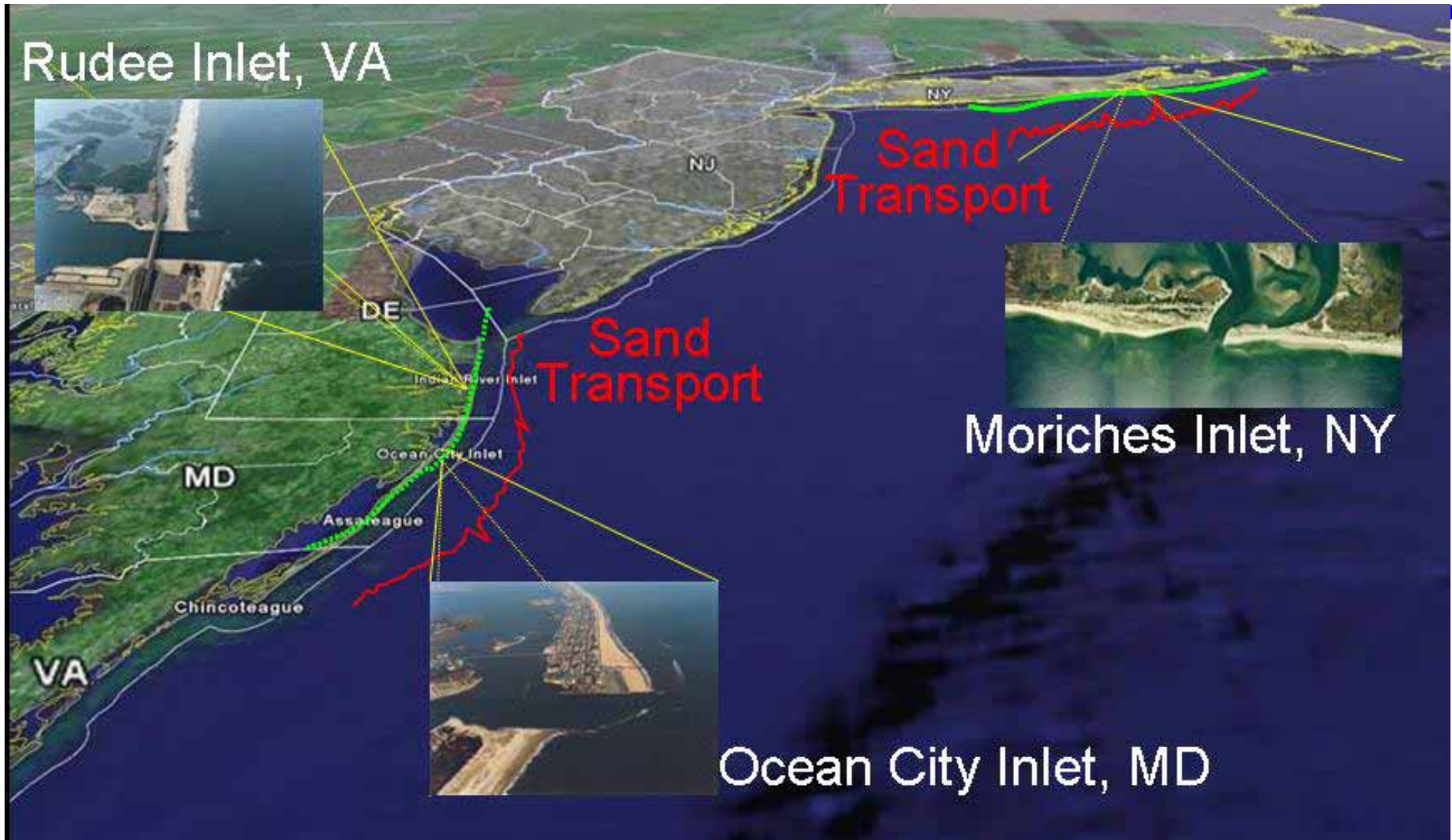
Ebb jet advection and channel migration,  
Shinnecock Inlet, NY

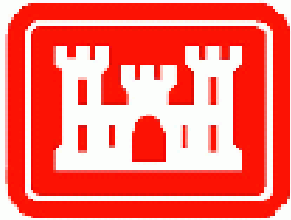




# Cascade

*Regional Coastal Response Model  
System-wide Water Resources Program*





# Connection to Research Programs CIRP & SWWRP



Plovers need unvegetated sand →  
**need to predict new inlet formation (breaching) & overwash**

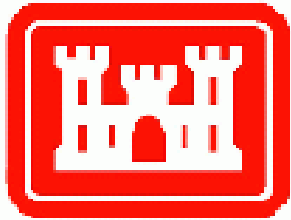


**Coastal Inlets Research Program**  
Inlet breaching models



**System-wide Water Resources Program**

Cascade integrates large-scale shoreline processes, including overwash & breaching



# *Coastal Inlets Research Program Presentation Overview*

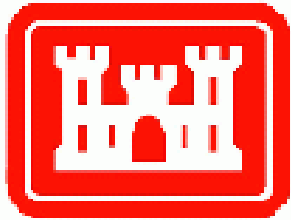


- Overview of inlet and adjacent beach systems
- CIRP tools and models
- SWWRP – Cascade and future plover population module
- Sources of downloads and more information



Photo by C. Perez, USFWS



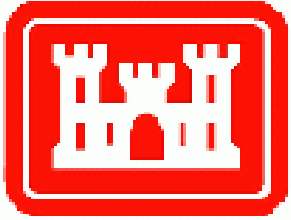


# *I. Inlets and Adjacent Beach Systems*

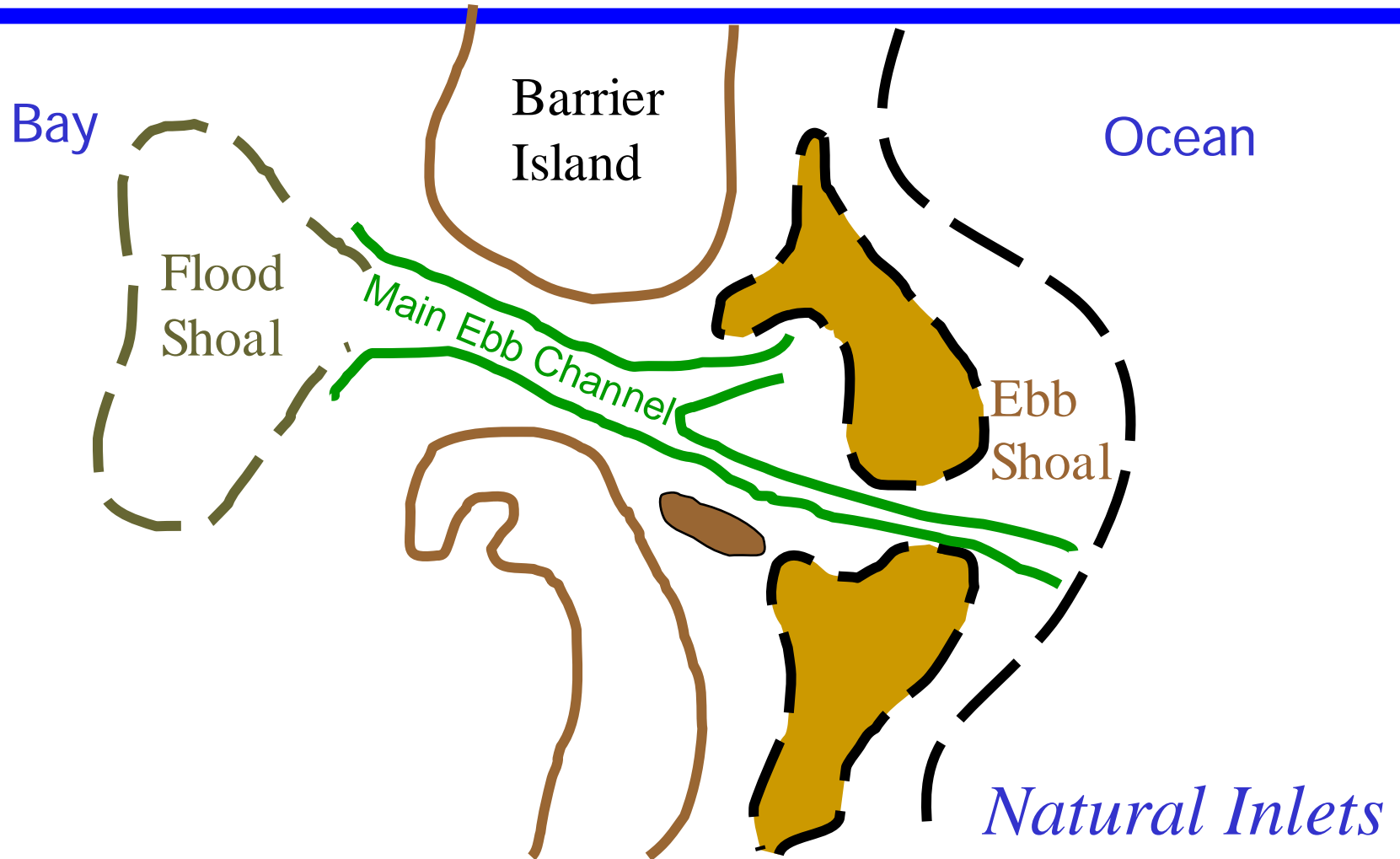


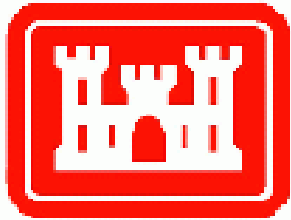
- *How do inlets function?*
- *How does sediment move around inlets?*
- *How do dredging and placement activities seek to replicate natural systems?*

Packery Channel, Corpus Christi, Texas, 7 Mar 05  
A new inlet designed in part with CIRP technology



# Inlets and Adjacent Beaches *Definitions*





# Inlets and Adjacent Beaches

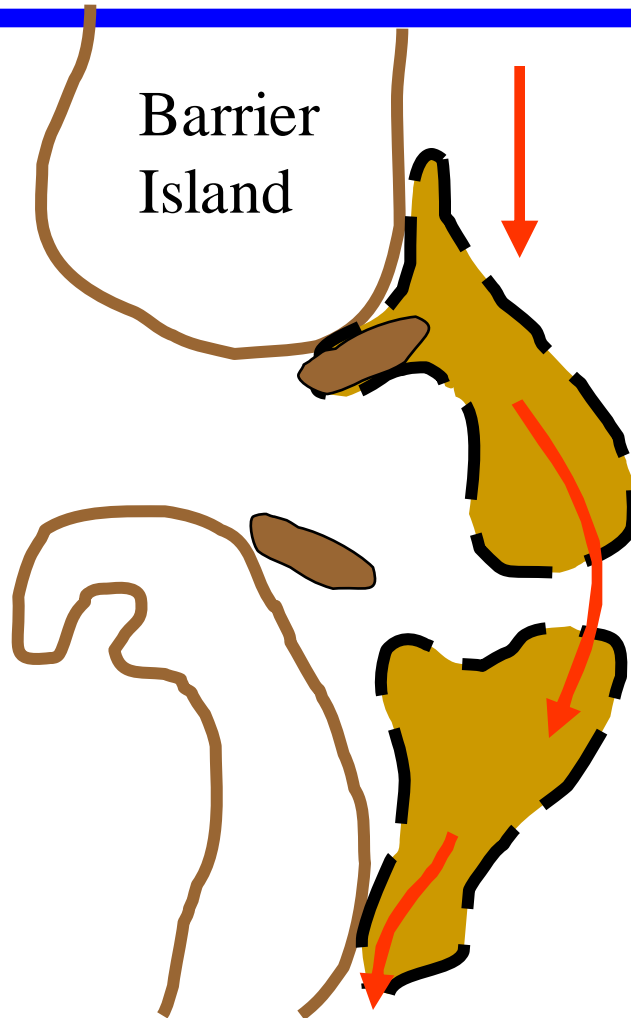
## *Bypassing Sand (1 of 3)*



Bay

Barrier  
Island

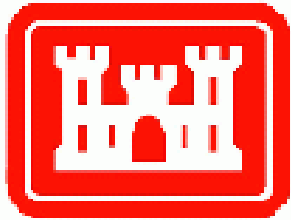
Ocean



1. Wave-Induced  
along Ebb Shoal

*Natural Inlets*





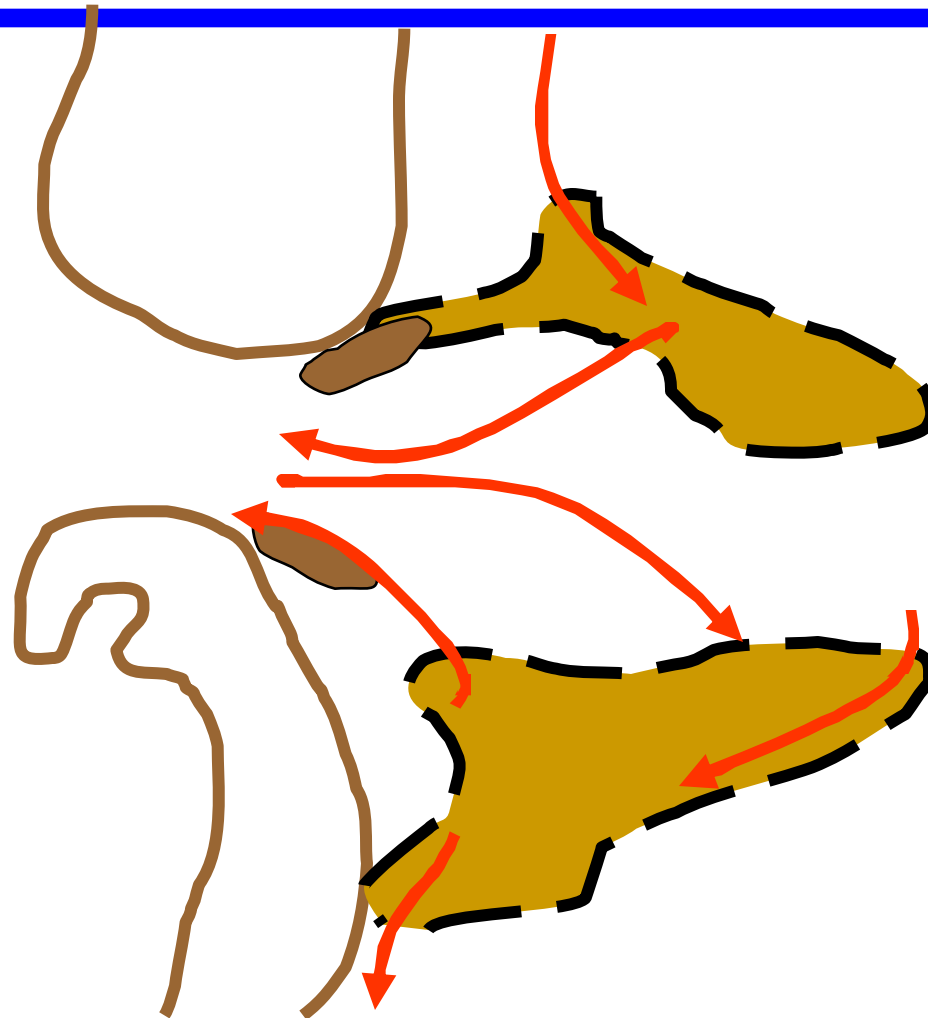
# Inlets and Adjacent Beaches

## *Bypassing Sand* (2 of 3)



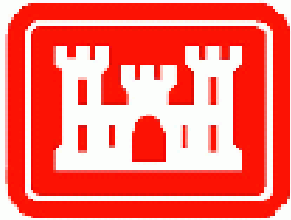
Bay

Ocean



2. Transport into and out of inlet by tidal currents

*Natural Inlets*



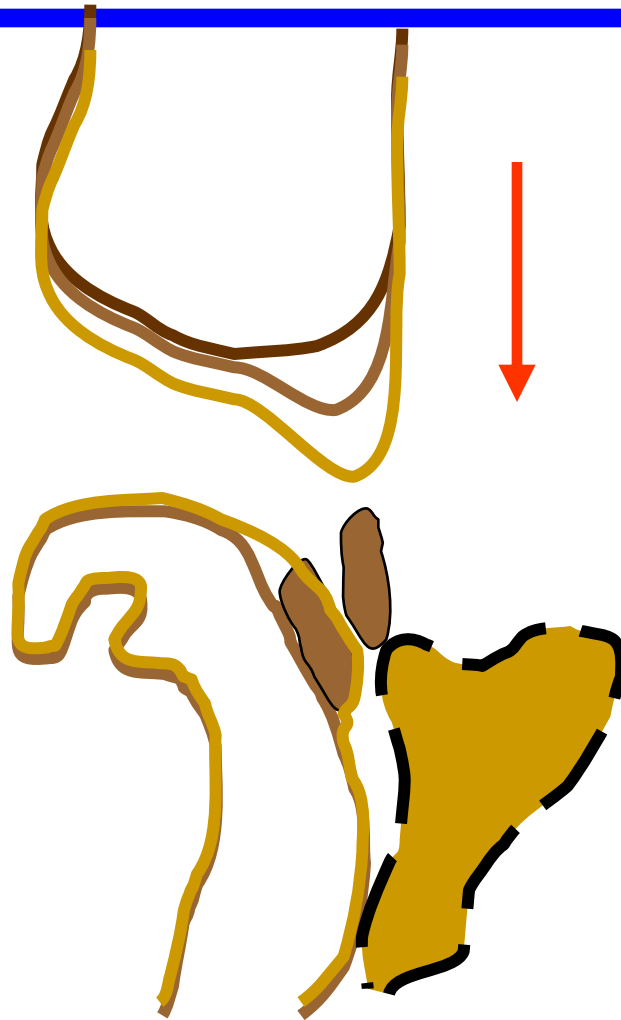
# Inlets and Adjacent Beaches

## *Bypassing Sand* (3 of 3)



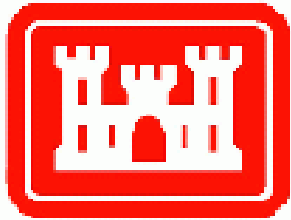
Bay

Ocean



3. Migration of channels and bars

*Natural Inlets*



# Inlets and Adjacent Beaches

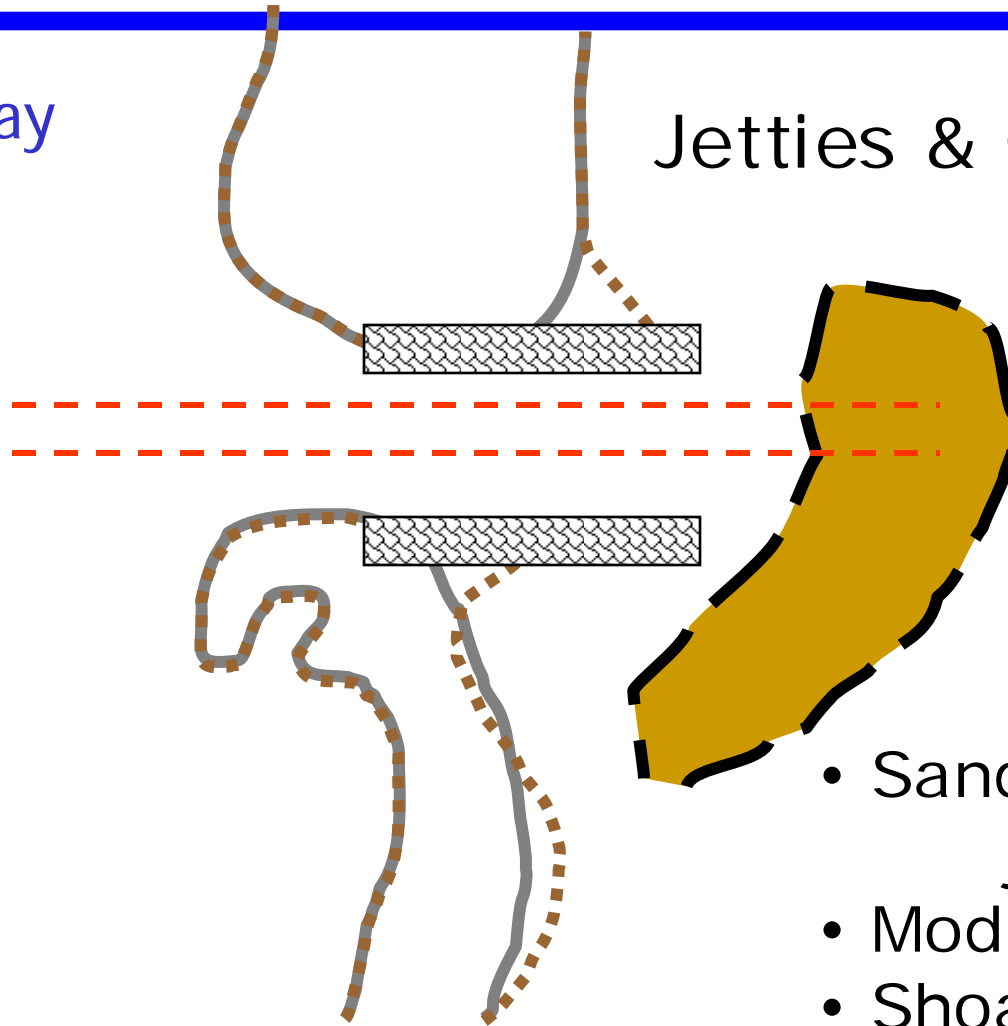
## *Inlet Stabilization*



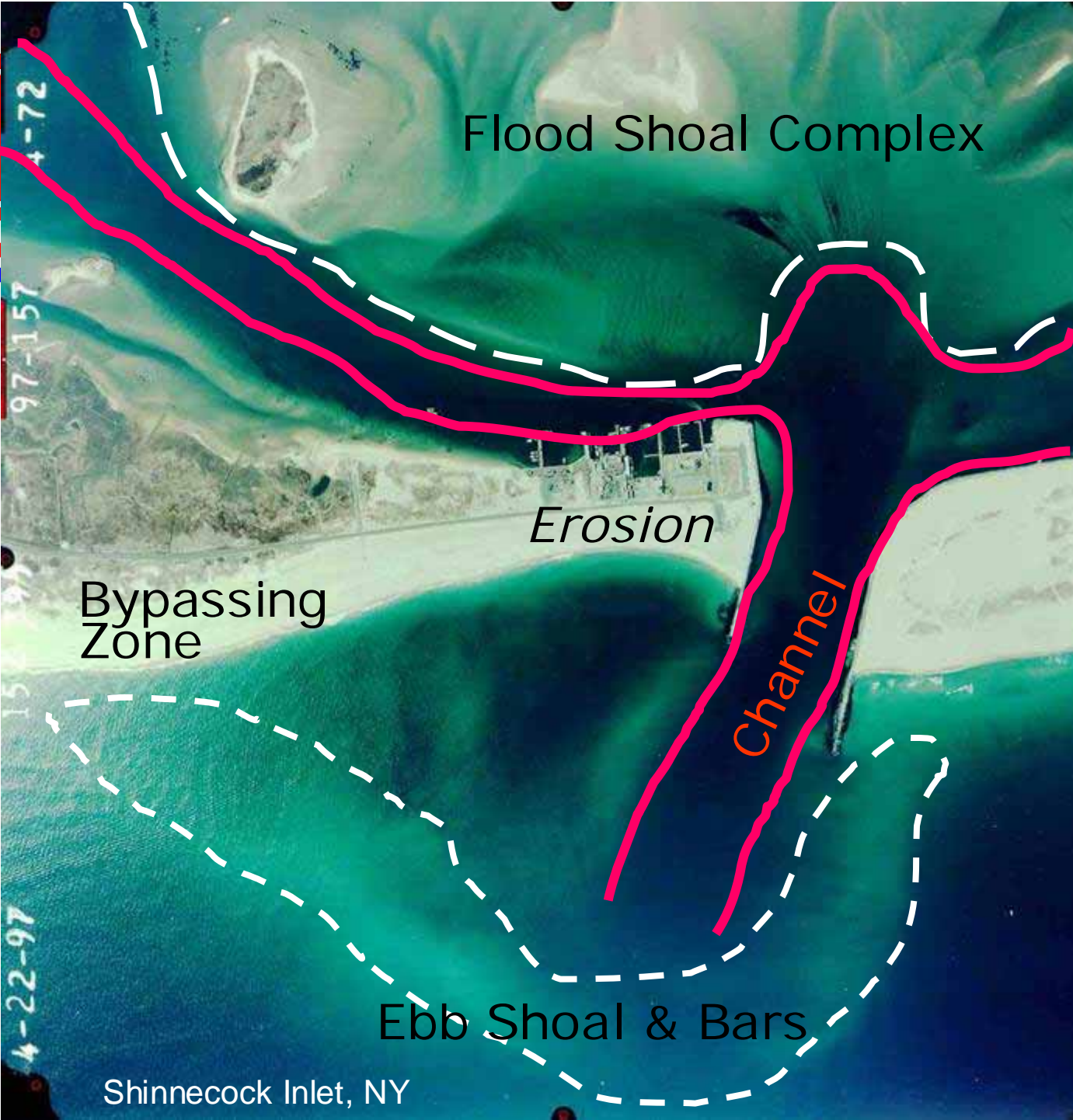
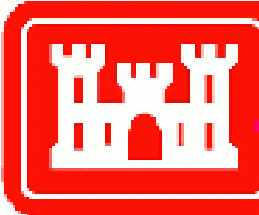
Bay

Jetties & Channel

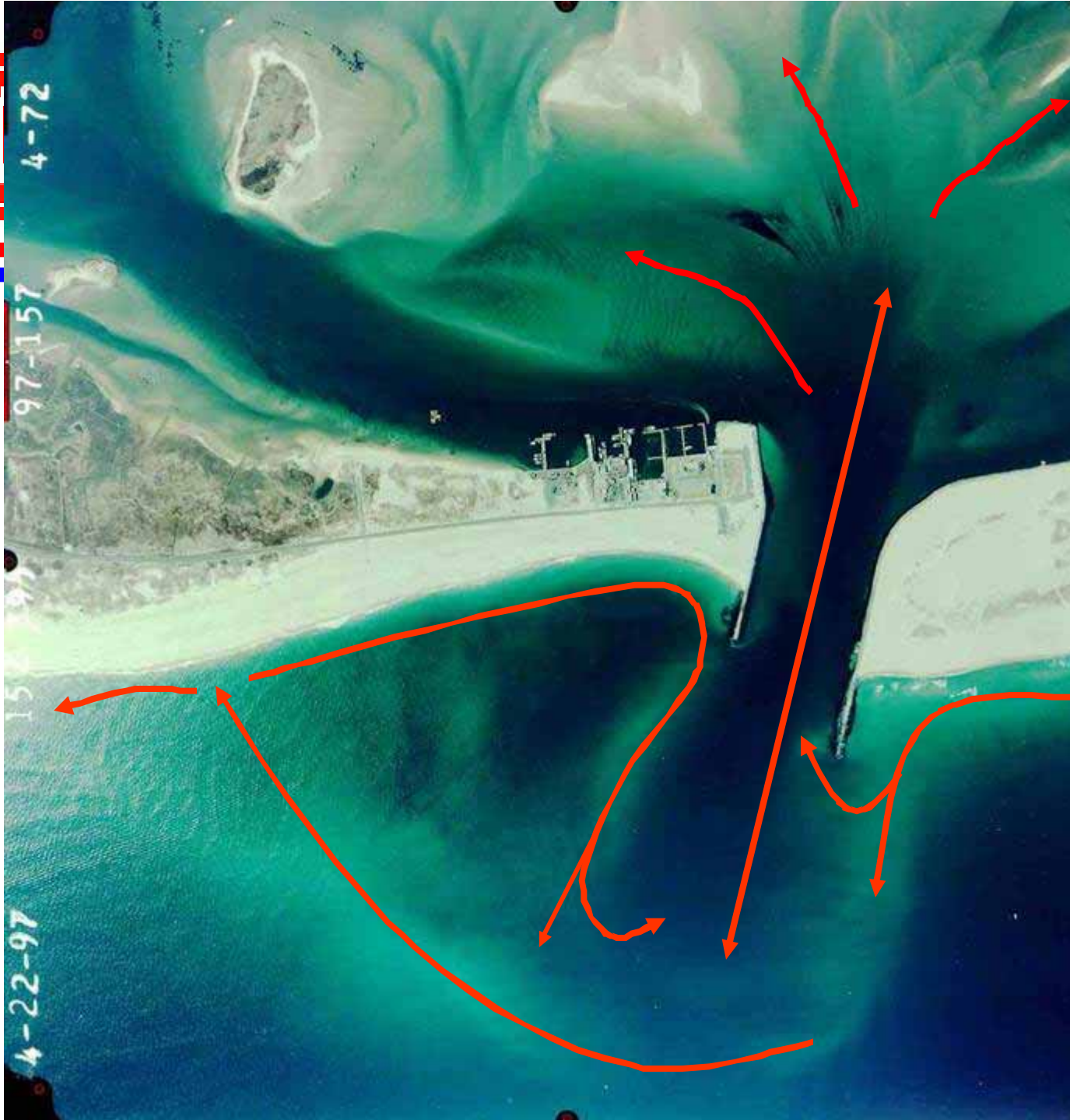
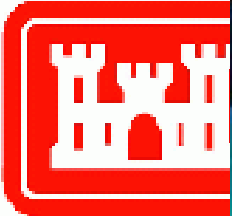
Ocean

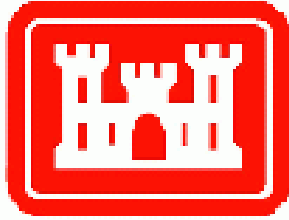


- Sand impoundment at jetties
- Modified bypassing
- Shoaling in channel









# Inlet Navigation Channel Operation and Maintenance (O&M)

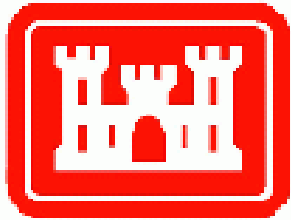


The Corps moves  
250-350 Million cu yd of sediment annually

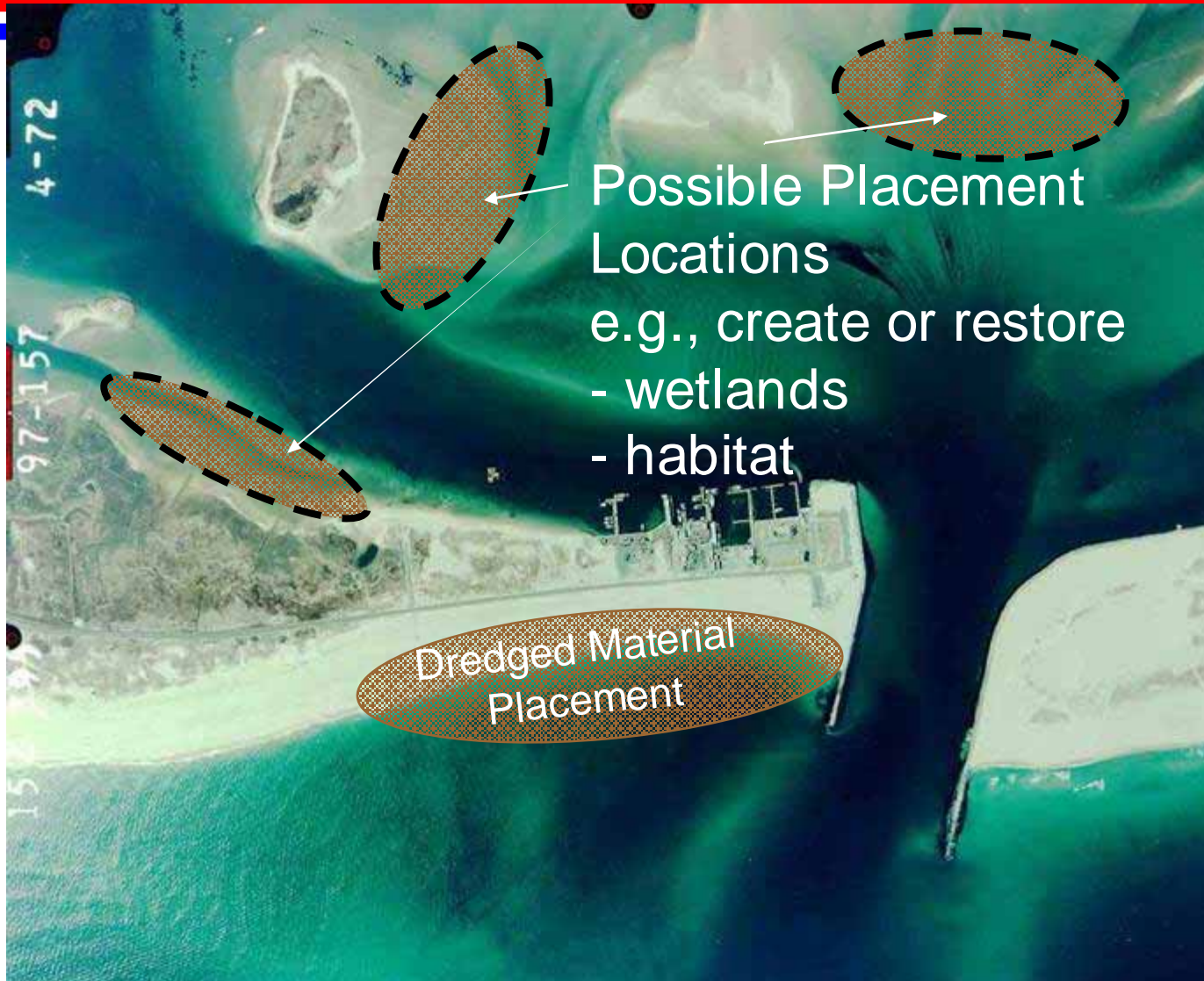


**Costing > \$700 Million per year**



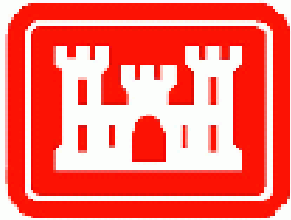


# Inlets and Adjacent Beaches *Dredging and Placement for Beneficial Use*



Possible Placement Locations  
e.g., create or restore  
- wetlands  
- habitat

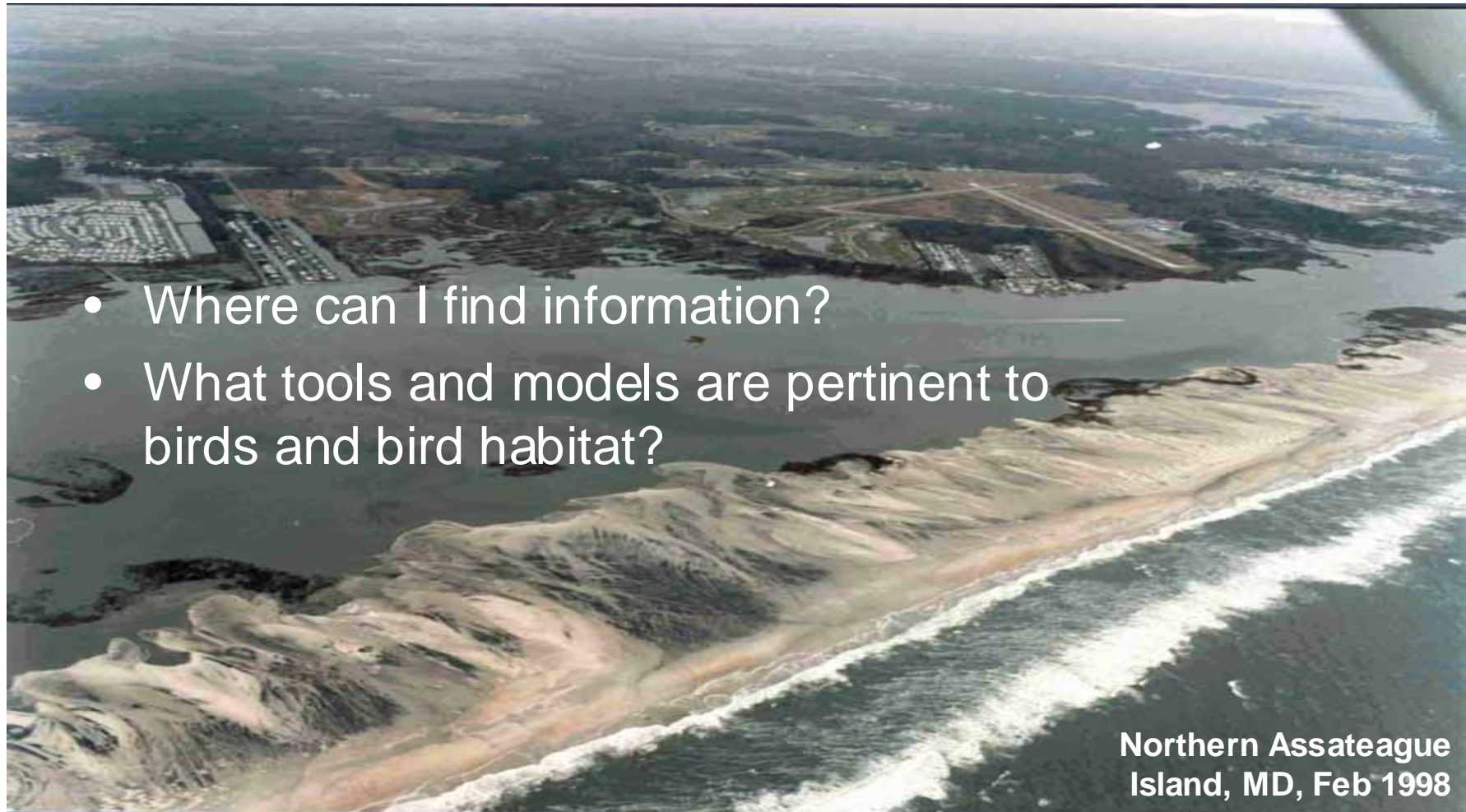
Dredged Material Placement



## II. CIRP Tools and Models

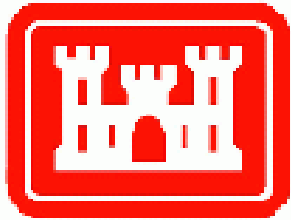


- Where can I find information?
- What tools and models are pertinent to birds and bird habitat?



Northern Assateague  
Island, MD, Feb 1998





# CIRP Tools and Models

## All available via CIRP Website

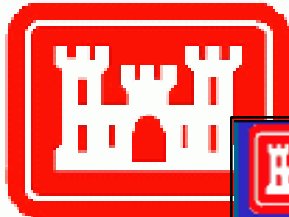


<http://cirp.wes.army.mil/cirp/cirp.html>

The screenshot shows the CIRP website homepage. At the top left is the US Army Corps of Engineers logo. To its right is a navigation menu with links: Home, Photo Collections, Channel Resource Center (INCRC), Inlets Database, Federal Inlets Database, Inlets Online, Products & Tools, What's New, News & Events, Work Units, Technical Notes, Publications, Online Presentations, Data Summaries, Case Studies, Technical Staff, and Related Sites. A 'Site Search' button is also present. The main heading is 'CIRP Coastal Inlets Research Program'. Below this is a '!! Warning !!' section. A visitor counter shows '022531' visitors since 18 January 1999. A 'Guestbook' link is in a blue oval. The 'Featured Links' section includes: 'Overview of the CIRP (PDF file)' with a description of a conference paper; 'Photo Collections' with a 'NEW' tag and a request for images; and 'Database of Federal Inlets and Entrances' with a description of an online database. A photograph of Redfish Pass, Florida, USA is shown on the left side of the featured links.

- Inlets Online
- Inlets Database
- Download Tools & Reports
- Workshop Presentations

# Inlets Online



US Army Corps  
of Engineers

US Army Engineer Research and Development Center



## Inlets Online



INLET/BEACH  
PROCESSES



INLET/BEACH  
MORPHOLOGY



ENGINEERING  
ACTIVITIES



GLOSSARY  
OF TERMS



SELECT  
A SITE

### Inlets Online

Inlets Online is an information and analysis resource on tidal inlets, navigation channels, and the adjacent beaches. It is intended to serve as a tutorial for non-specialists as well as an information center for specialists in the areas of coastal engineering, geology, oceanography, and coastal zone management.



ANALYSIS  
METHODS



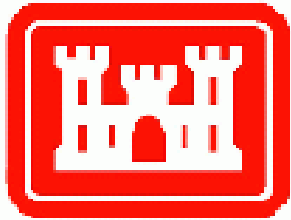
ANALYTICAL  
TOOLBOX



**CIRP** Coastal Inlets Research Program

**CHL** Coastal and Hydraulics Laboratory

We hope your browsing experience is informative and productive. Our goal is to continually update the site with new data on Federal inlets, navigation channels, and adjacent beaches to provide useful information for coastal engineers and scientists, coastal zone managers, and non-specialists. Continued development and use of this site will benefit directly from suggestions and comments provided by its users. Please take a moment to register your comments regarding the site and its contents by providing [Feedback](#).



# Inlets Online Illustrating Inlet & Beach Processes



- Inlet and Beach Processes
- Inlet and Beach Morphology
- Engineering Activities

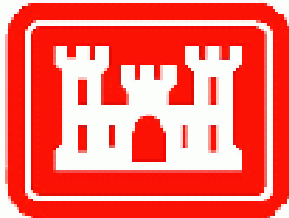


*Tutorial*  
*Illustrate processes*  
*History*

**Inlet/Beach Morphology**

**Please Pick a Topic:**

Storm Response	Washover	Example 1: Shinnecock Inlet, New York - 1938
Shoals	Breach	Example 2: East Pass Inlet, Destin, Florida - 1938
Hard Bottom		Example 3: Ocean City Inlet, Maryland - 1998
Channel Orientation		



# Inlets Online Glossary of Terms



Please click on the letters to view the index:

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

You can also perform a full content search by keywords. Separate multiple words by spaces:

Any of the words  All words

[Gabion](#)  
[Gale](#)  
[Generating Area](#)  
[Geographical Information System \(GIS\)](#)  
[Geometric Grade Scale](#)  
[Geometric Mean](#)  
[Geometric Mean Diameter](#)  
[Geometric Shadow](#)  
[Geomorphology](#)  
[Geophysics](#)  
[Geotextile](#)  
[Glacier](#)  
[Glacio-Eustasy](#)  
[Glacio-Isostasy](#)  
[Global Positioning System \(GPS\)](#)  
[Gorge](#)  
[Gradation](#)

[Graded](#)  
[Graded Bedding](#)  
[Graded Shoreline](#)  
[Grade Scale](#)  
[Gradient](#)  
[Grading](#)  
[Gravel](#)  
[Gravity Wave](#)  
[Groin](#)  
[Groin Bay](#)  
[Groin System](#)  
[Gulf](#)  
[Gulf Coast Low](#)  
[Water Datum](#)  
[Gut](#)

## GRADIENT (gra'-di-ent)

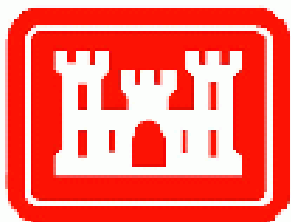
(1) A degree of inclination, or a rate of ascent or descent, of an inclined part of the Earth's surface with respect to the horizontal; the steepness of a slope. It is expressed as a ratio (vertical to horizontal), a fraction (such as m/km or ft/mi), a percentage (of horizontal distance), or an angle (in degrees). The synonymous term grade is used in engineering. (2) More general, a change of a value per unit of distance (e.g., the gradient in longshore transport causes erosion or accretion). (3) With reference to winds or currents, the rate of increase or decrease in speed, usually in the vertical; or the curve that represents this rate.

PDF files for printing and downloading:

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)







# Inlets Online

## Download photographs



**Federal Inlet Aerial Photo Database**



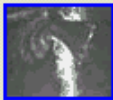


Choose a Coastal Region

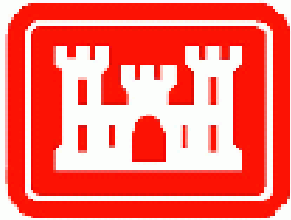
**Federal Inlet Aerial Photos - East Coast**

You can also search  
Step 1: Select Division  
North Atlantic Division

**Ocean City Inlet, Maryland**

[Topographic Site Map](#) | [Construction and Rehabilitation History](#)  
[Corps Project Report](#) | [Link to Baltimore District Web Site](#)

Date yyyy-mm-dd	Image	High Resolution Download	Details
1933-09-18	 <a href="#">View Image</a>	<a href="#">zip file (1.2 MB)</a>	<a href="#">Details</a>
1933-10-00	 <a href="#">View Image</a>	<a href="#">zip file (0.8 MB)</a>	<a href="#">Details</a>
1934-10-09	 <a href="#">View Image</a>	<a href="#">zip file (0.6 MB)</a>	<a href="#">Details</a>
1935-11-05	 <a href="#">View Image</a>	<a href="#">zip file (1.7 MB)</a>	<a href="#">Details</a>
1935-12-06	 <a href="#">View Image</a>	<a href="#">zip file (0.6 MB)</a>	<a href="#">Details</a>



# Inlets Online Analytical Methods



## Technical Notes... Aerial photograph interpretation

### Aerial photo interpretation: vegetation line and dune line



Shinnecock Inlet, NY October 17, 1998

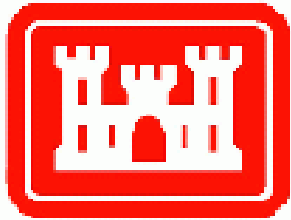
#### Features Off

- Primary Dune/ Vegetation Line
- Foredune Line

The primary dune (stable dune) line/vegetation line and foredune line are identified on the above aerial photograph. Recognizing these features is helpful for analyzing beach mobility, long-term storm impacts, and the sediment budget. Well vegetated dune areas indicate stable dune systems. Some areas, such as the west side of the jetty in the image, are unvegetated. The dune line in these areas is nonexistent due to the dynamic nature of the beach and established infrastructure.

- placement
- channel centerline
- wave-current interaction
- vegetation line
- dune line
- spit
- bluff line
- washover deposition and

[Back to Feature List](#)



# Inlets Online Analytical Toolbox



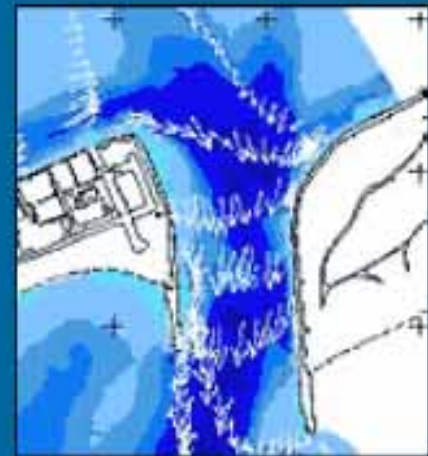
## Analytical Toolbox

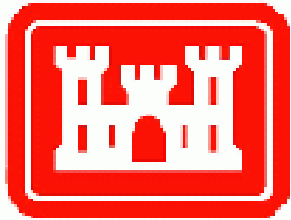
- HyPAS
- SBAS
- Flow Constriction Jet  
- Flow Net Calculator
- Nozzle-Type Constriction Jet  
- Flow Net Calculator
- Inlet Channel Equilibrium Scour  
Depth Calculator
- Tide Prediction Web Server (XTide)
- Corpscon



***Tools useful for  
coastal analysis***

Please Choose  
a Tool on the  
Left





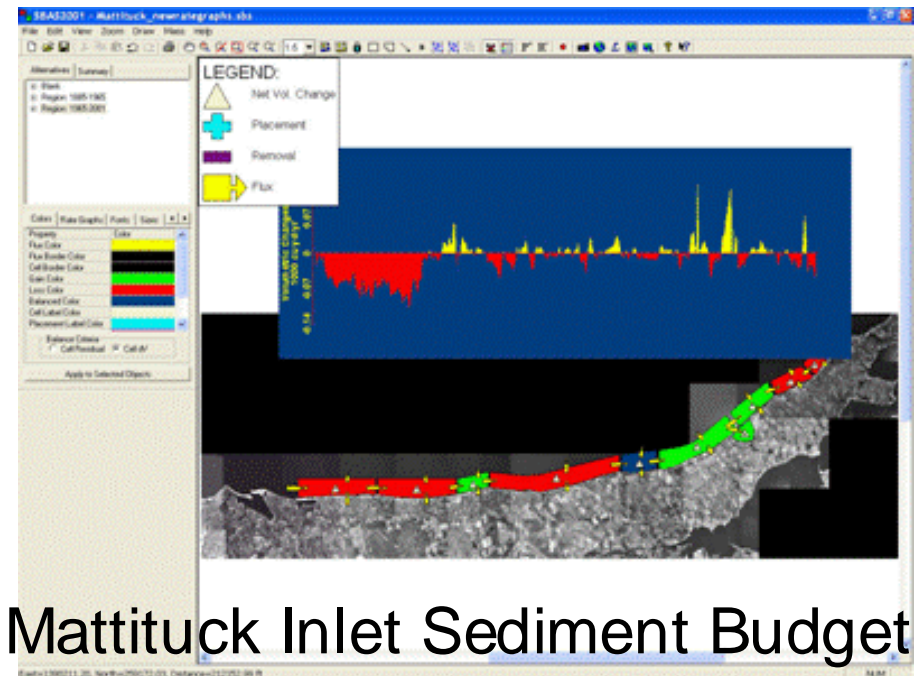
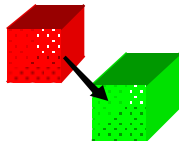
# SBAS and SBAS-A Sediment Budget Analysis System



A sediment budget is a tally of sediment gains and losses, within a specified area over time.

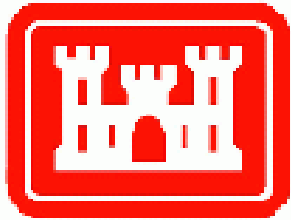


Stand-alone Windows version  
and Arc 8.x/9.x compatible  
extension



Mattituck Inlet Sediment Budget





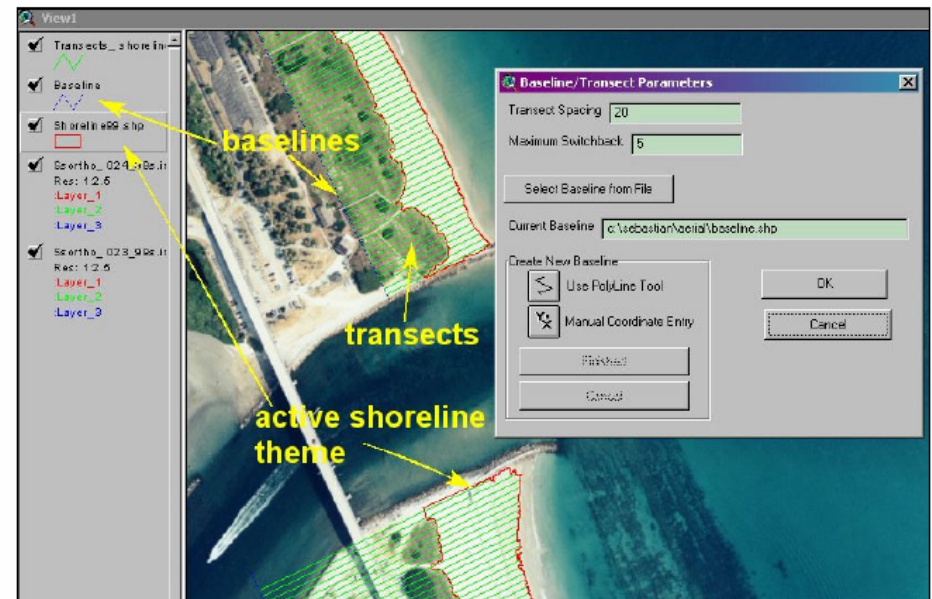
# BeachTools

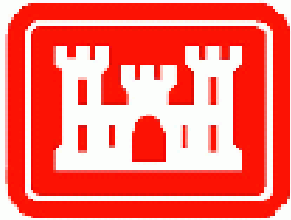
ArcView 3.2© Extension (upgrade in the works)



## BeachTools: Identify position of shorelines and other coastal features from aerial imagery

- mosaic imagery
- image histogram stretching
- delineation of coastal features
- baseline and transect generation tools





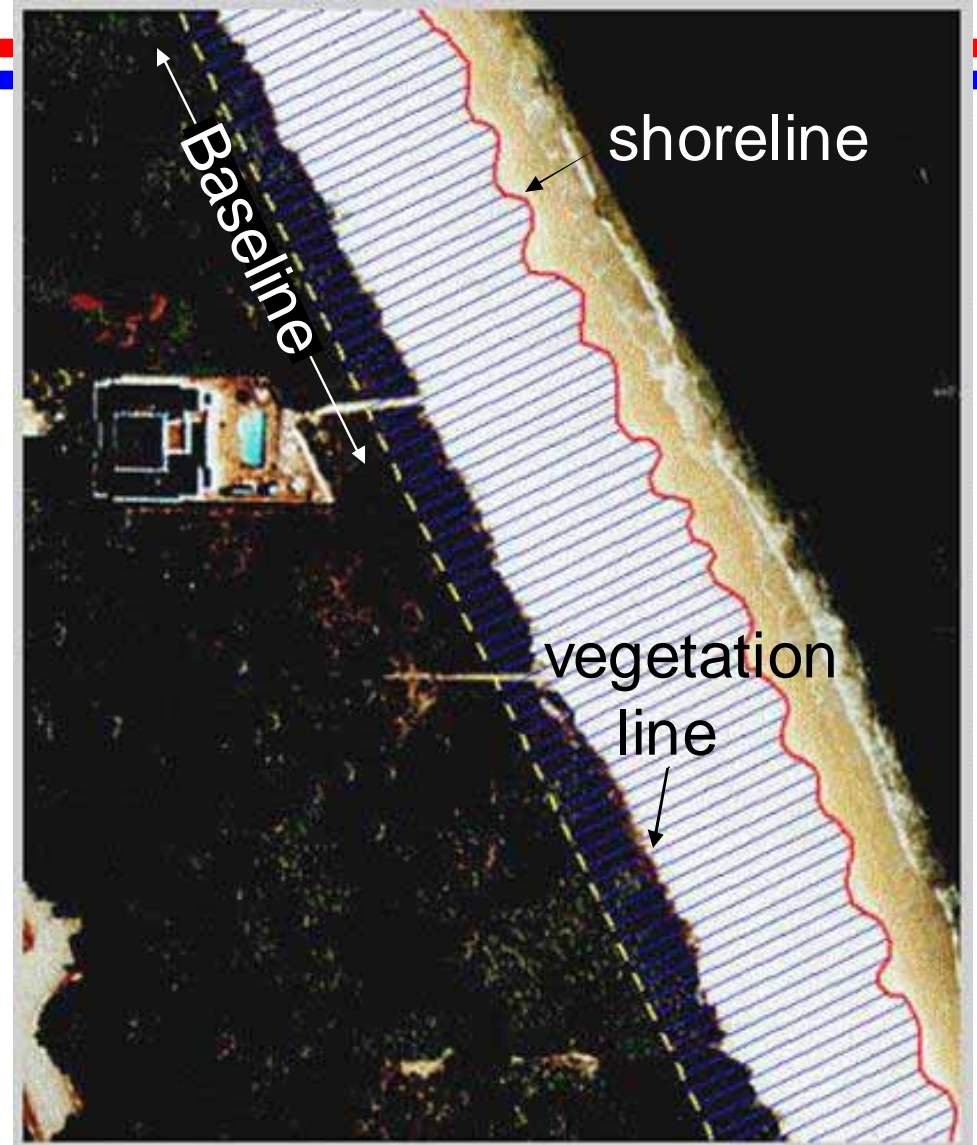
# ***BeachTools*** ***ArcView Extension***

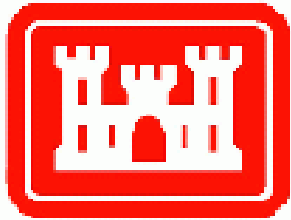


**User selects pixels that represent shoreline and vegetation line**

**BeachTools automatically generates continuous shoreline and vegetation line**

**Can generate transects and distances from a baseline**





# INLET-GIS

*Inlet, Nearshore, and Littoral Enhancement  
Tool for Geographic Information Systems*



- ArcView<sup>®</sup> 3.x extension (upgrade underway)
- Thematically classifies digital aerial photography
- Identify inlet shoals, channels, and other features
- Import bathymetry and merge with aerial analysis



➤ stretch image histograms



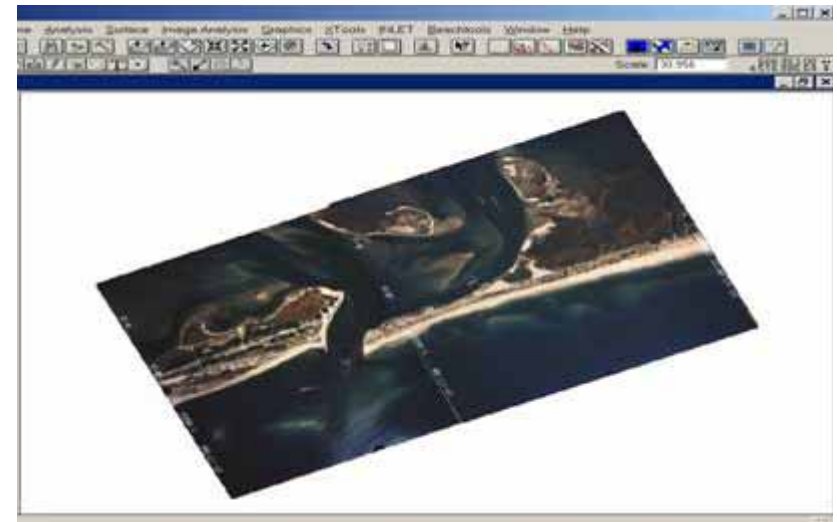
➤ classify themes

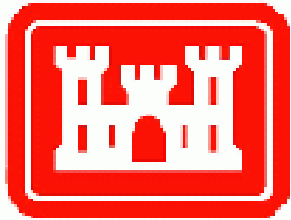


➤ clip shorelines



➤ import bathymetric  
and topographic data

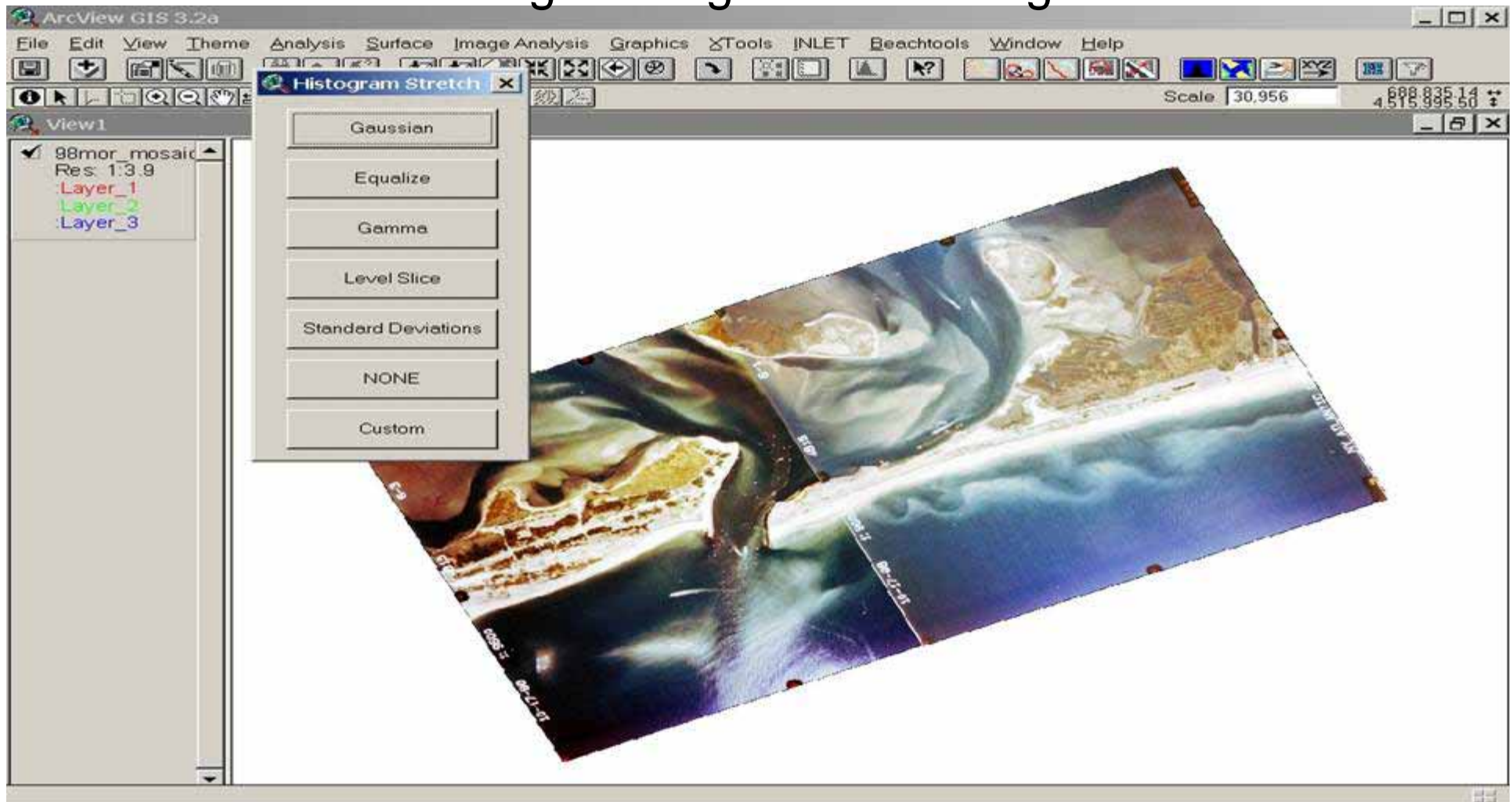




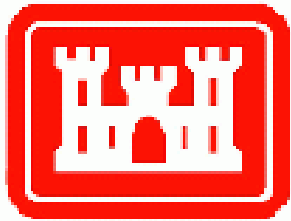
# INLET-GIS – steps to go through in mapping



## Image histogram stretching



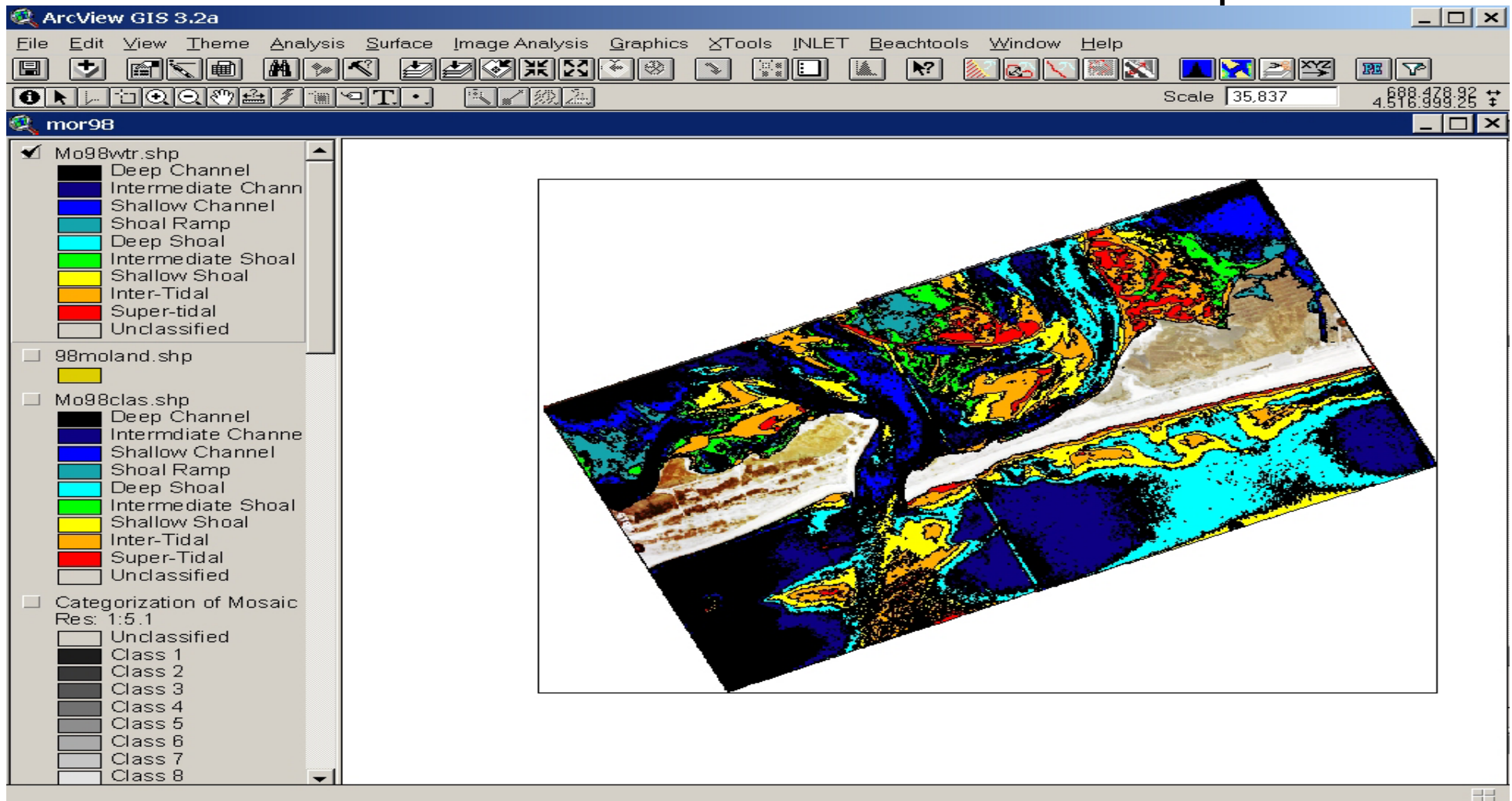


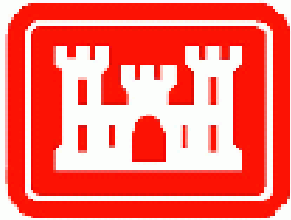


# INLET-GIS



## Thematic classification and land feature clip

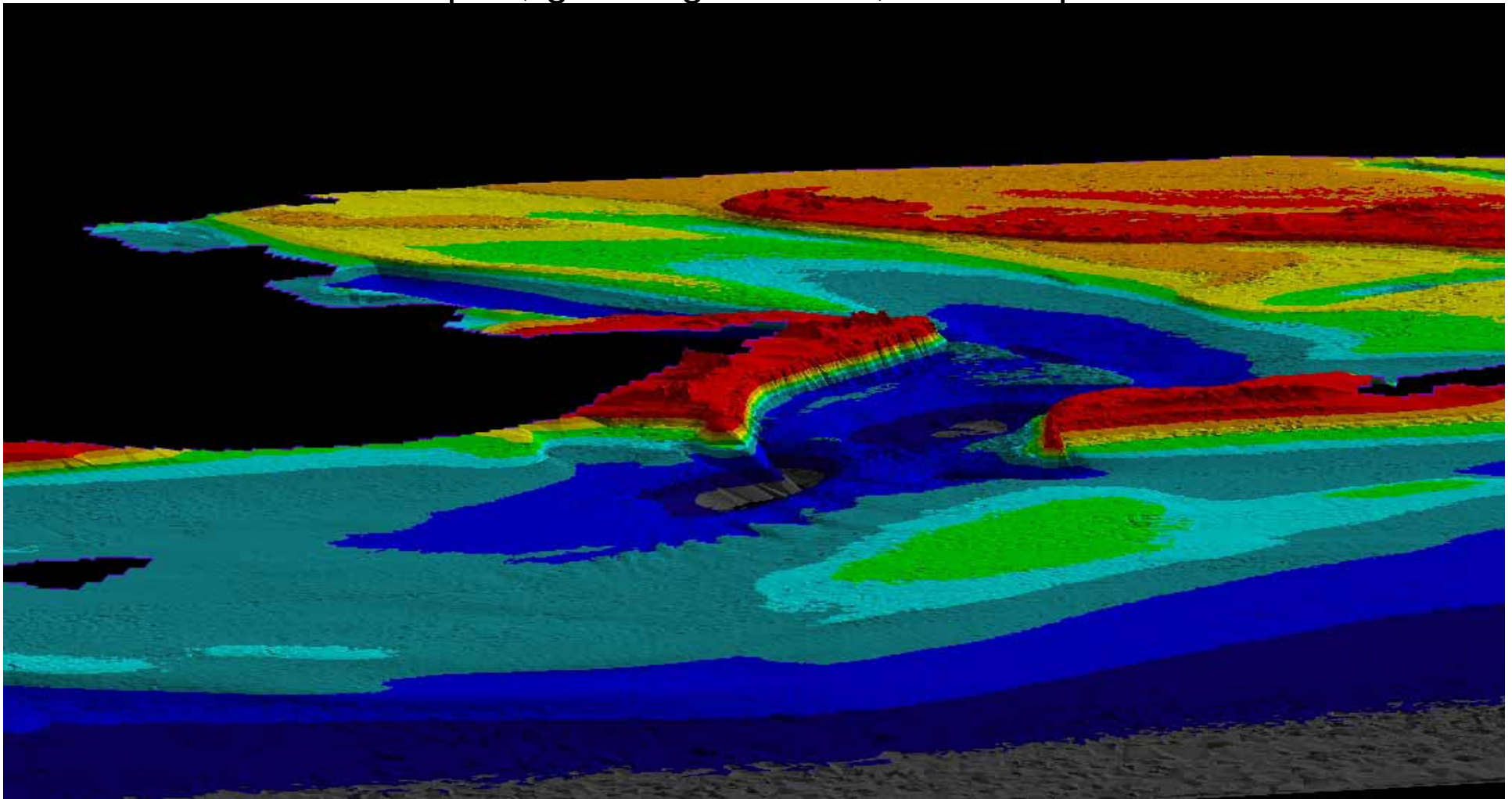


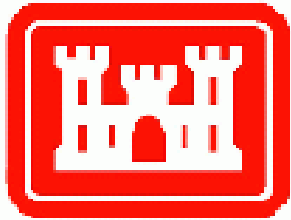


# INLET-GIS



Data import, grid/tin generation, and comparison





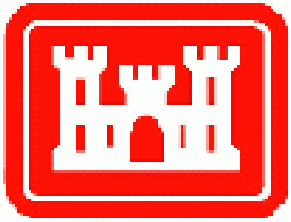
### III. Other Pertinent Research



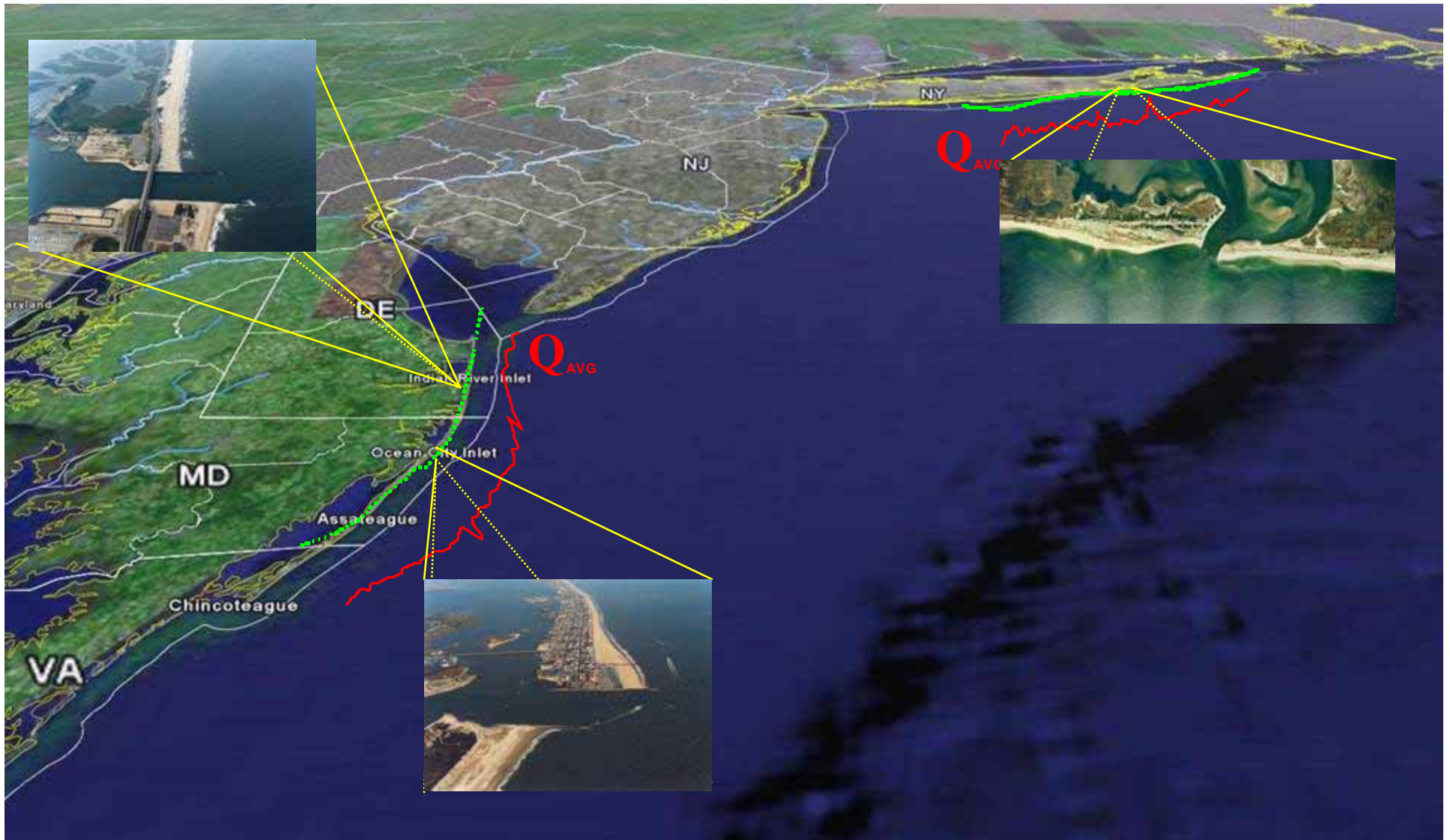
- System-wide Water Resources Program (SWWRP)
- Cascade and plovers...



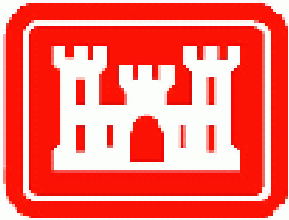




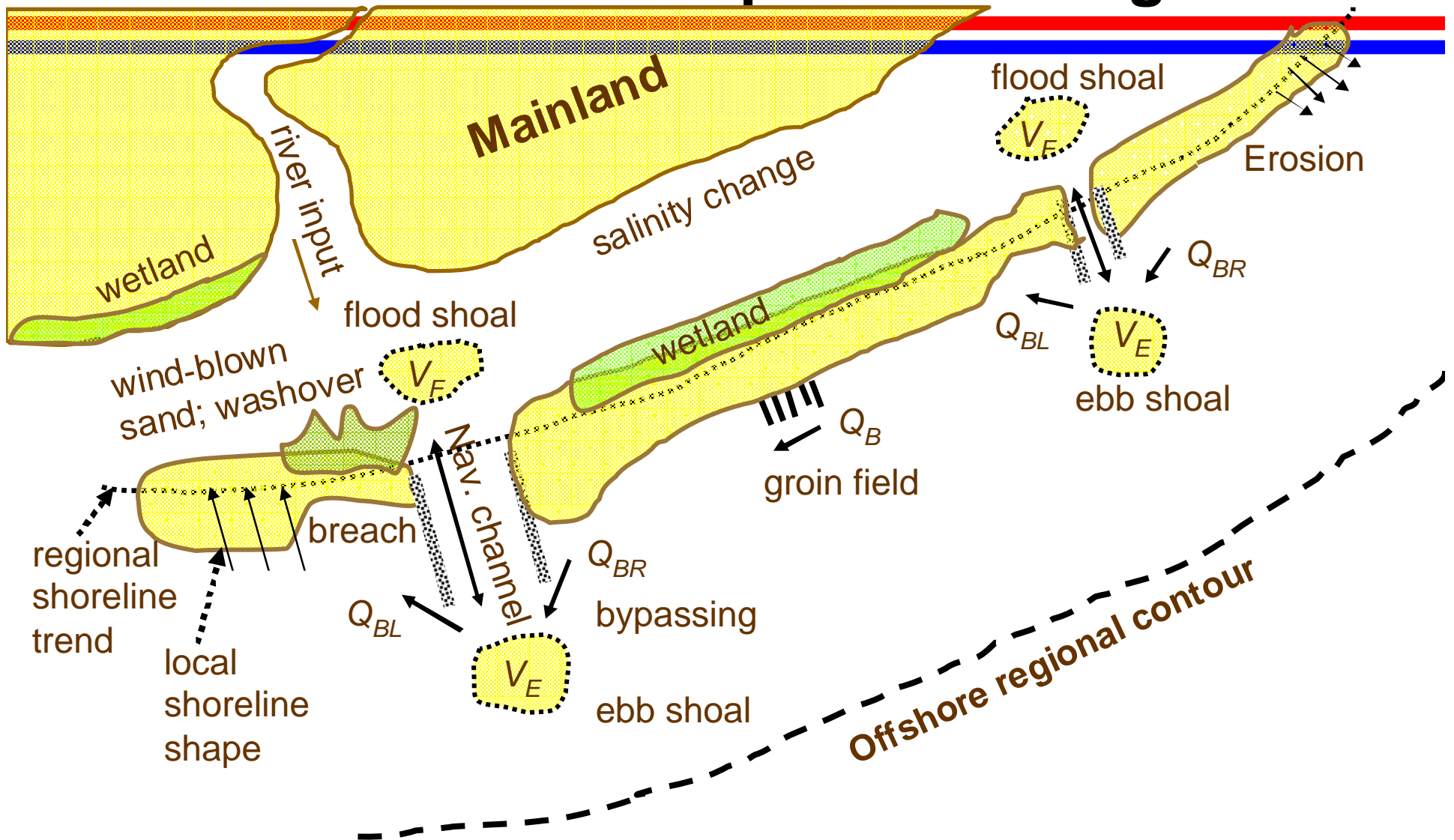
# Cascade

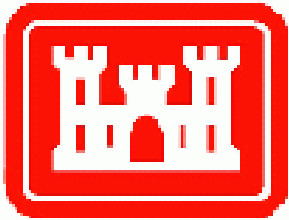






# Cascade Conceptual Coverage

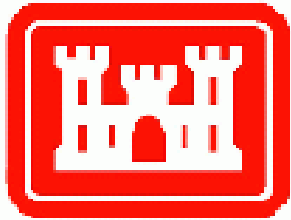




# Cascade Interface



The screenshot displays the Cascade 1.0 software interface. On the left, a map shows the Delmarva Peninsula with labels for Indian River Inlet, DE; Ocean City Inlet, MD; and Delmarva Peninsula. A 'Time Steps' list is visible at the bottom left, with 10950.0 selected. In the center, an 'About Cascade' dialog box shows the SMS logo and version information: Cascade 1.0 Beta, Build Date: Jul 11 2005. Below it, the 'Cascade Solution Plots' dialog box lists various plot options, with 'Cell 88' and several volume and flow options checked. On the right, two graphs are shown. The top graph plots 'Ave Transport Q' (y-axis, -300,000 to 150,000) against 'Distance' (x-axis, 0 to 10,000). It features a green line with a sharp upward spike labeled 'Reversal in Transport!' and a horizontal line at zero labeled 'Ocean City Inlet'. The bottom graph plots 'Volume' (y-axis, 0.0 to 2.0) against 'Time' (x-axis, 0 to 17,500), showing several colored lines (yellow, purple, blue, red, pink) representing cumulative volume over time.

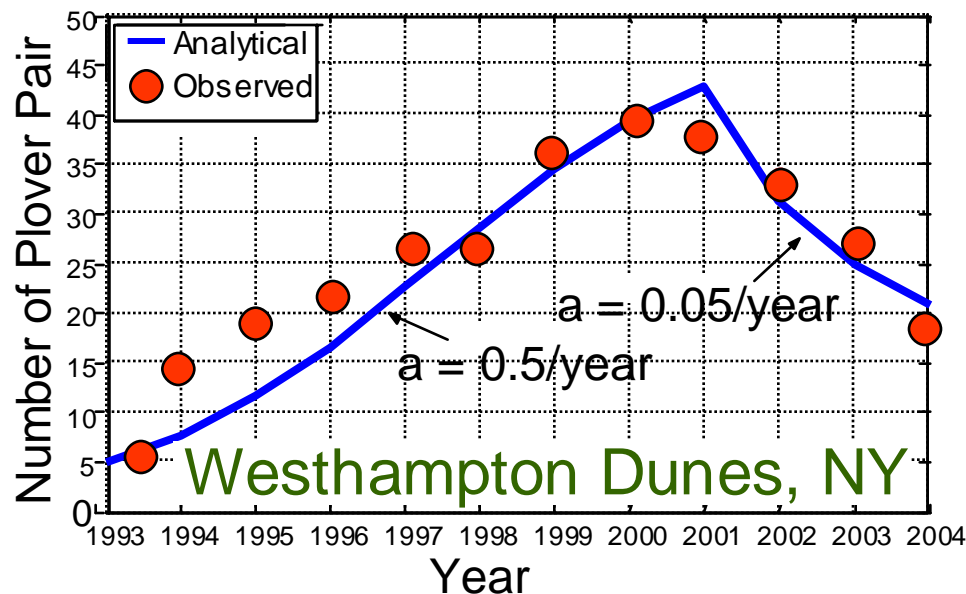


# Cascade Ecological Sub-Module

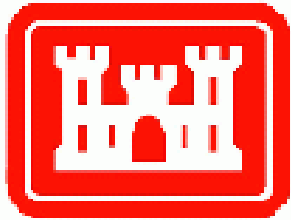
## *Piping Plover Habitat & Population Dynamics*



- Plover require unvegetated sand.
- Cascade will calculate overwash and breaching.
- Plover population model will link to Cascade.







## Cascade -- Ecological Enhancements?



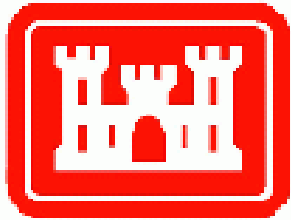
Relate area of plover habitat to time-dependent population

Benefits of predator trapping programs

Determine area of foraging habitat available through time

Determine potential benefits from dredging and placement





# More Information & Collaboration



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