US Army Corps of Engineers
Philadelphia District

Evaluating Beachfill Project Performance in the USACE Philadelphia District

Monica Chasten and Harry Friebel
Engineering Division

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Project/Study Phases

- Reconnaissance
- Feasibility
- Design/Plans and Specifications
- Construction
- Monitoring/Project Performance

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Overview

- USACE, Philadelphia District Beach Nourishment Program
- Monitoring of Beachfill Projects
- Cape May City and Ocean City Project Examples

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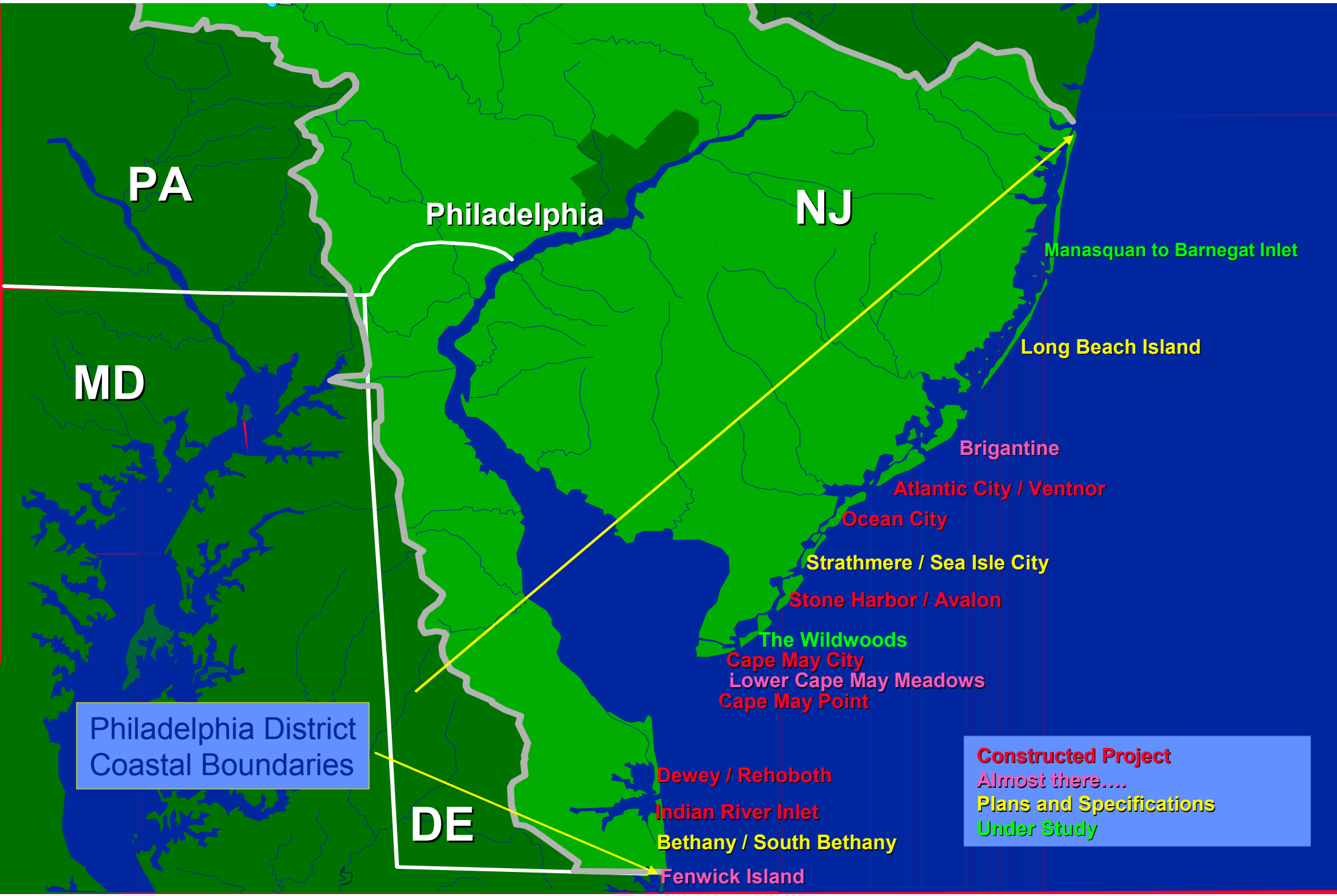
Keynotes

- Beach Nourishment Works!
- Importance of Project Monitoring
  - Must evaluate project performance to keep efficient
  - Monitoring program/techniques/analysis
  - Need adequate info for science-based decision making
- Adaptive Management/Design
- Regional Approach/Collaboration of Efforts
- Importance of Local Sponsor Relationships


PA
Philadelphia
NJ
MD
DE
Manasquan to Barnegat Inlet
Long Beach Island
Brigantine
Atlantic City / Ventnor
Ocean City
Strathmere / Sea Isle City
Stone Harbor / Avalon
The Wildwoods
Cape May City
Lower Cape May Meadows
Cape May Point
Dewey / Rehoboth
Indian River Inlet
Bethany / South Bethany
Fenwick Island
Philadelphia District
Coastal Boundaries
Constructed Project
Almost there….
Plans and Specifications
Under Study

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USACE -Philadelphia District Coastal Project Monitoring Program

- Projects initiated 1989-1992
- Program formalized in 1994
- Initial coastal projects were Ocean City, Cape May, Indian River Inlet and Barnegat Inlet
- Recent project additions include Avalon/Stone Harbor, Absecon Island, Cape May Meadows/Point
- Monitor for the project life

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Why do we Monitor?

- Assess project condition to ensure project functionality and determine maintenance requirements
- Evaluate project performance relative to design objectives
  - adjacent area and environmental benefits/impacts
  - develop solutions to improve performance
  - BE PROACTIVE!
- Cost of data collection/analysis is minimal compared to project costs and potential savings
- Need to document the benefits of beachfill

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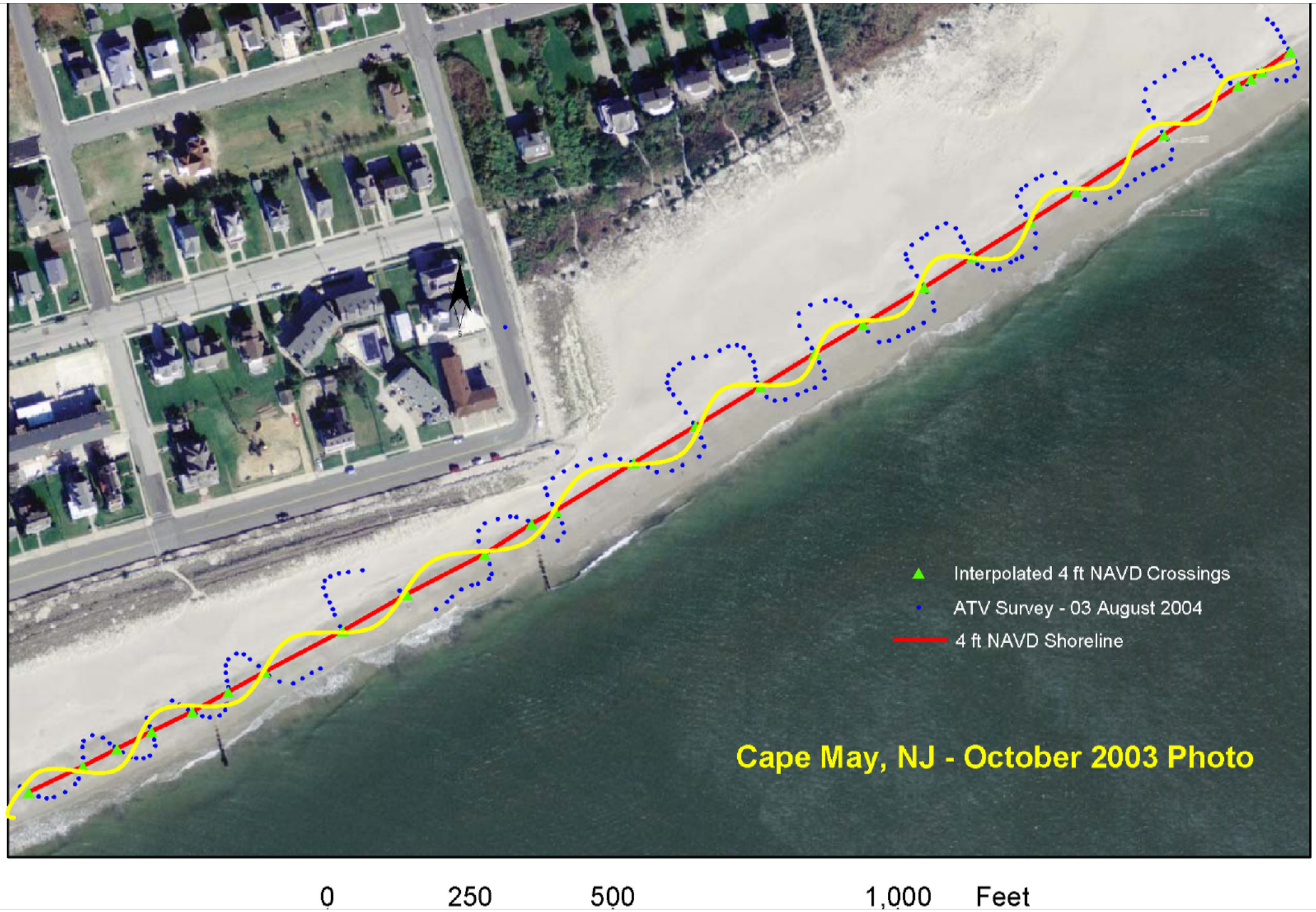
What data are typically acquired?

- Beach Profiles (improved accuracy, out to closure depth, semi-annually from 1994-present)
- Sediment Sampling
- Inlet/Borrow Area Hydrographic Surveys
- Aerial Photography (first quarterly/unrectified, now annually/rectified, also during construction)
- Water Level, Wave, Current and Meteorological Measurements (as need and funding permits)
- Environmental Monitoring (benthic, surf clam, etc)
- Other Measurements and Improvements (ATV, Tracer)

Rapidly-Deployed Shoreline Survey Vehicle


Interpolated 4 ft NAVD Crossings
ATV Survey - 03 August 2004
4 ft NAVD Shoreline
Cape May, NJ - October 2003 Photo
0
250
500
1,000
Feet

Development of Sea Sled Technology within District

Atlantic City
Beachfill Construction and Project Surveys

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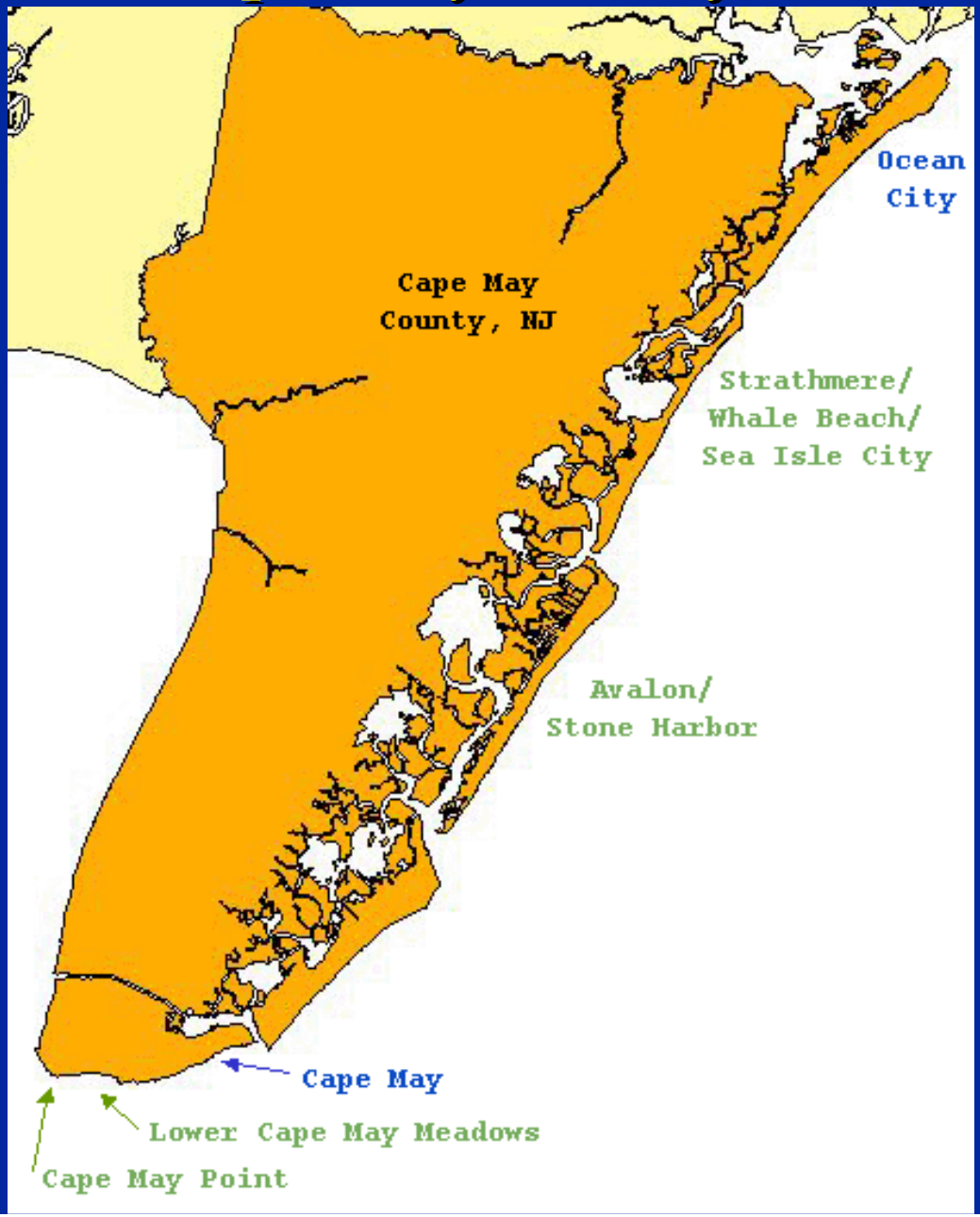
Beach Nourishment Case Examples

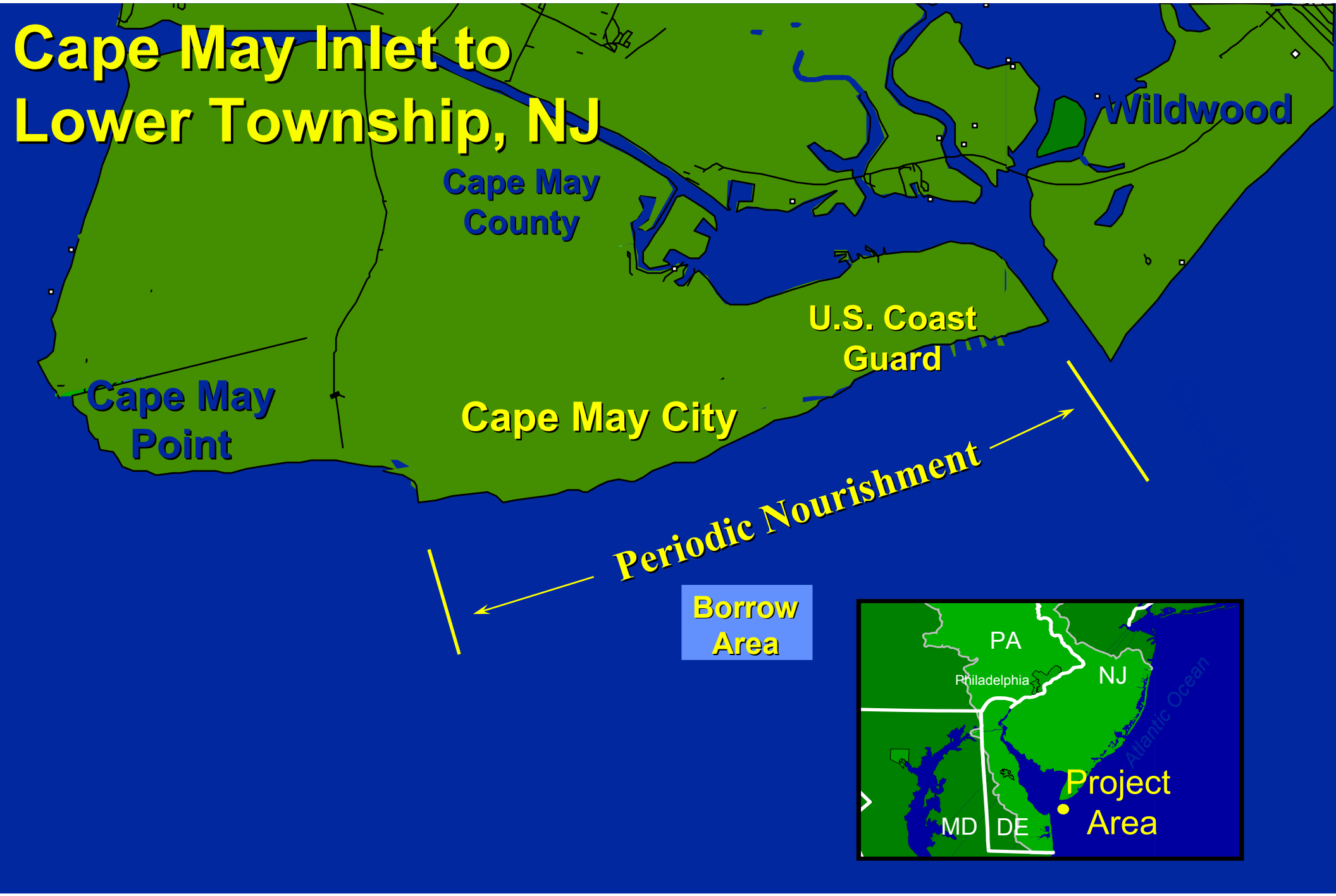
Cape May City, NJ

And

Ocean City, NJ

Cape May County, NJ




Cape May Inlet to
Lower Township, NJ
Wildwood
Cape May
County
U.S. Coast
Guard
Cape May
Point
Cape May City
Periodic Nourishment
Borrow
Area
PA
Philadelphia
NJ
Atlantic Ocean
Project
Area
MD
DE

Cape May Vicinity

Cape May Inlet to Lower Township

Before

After

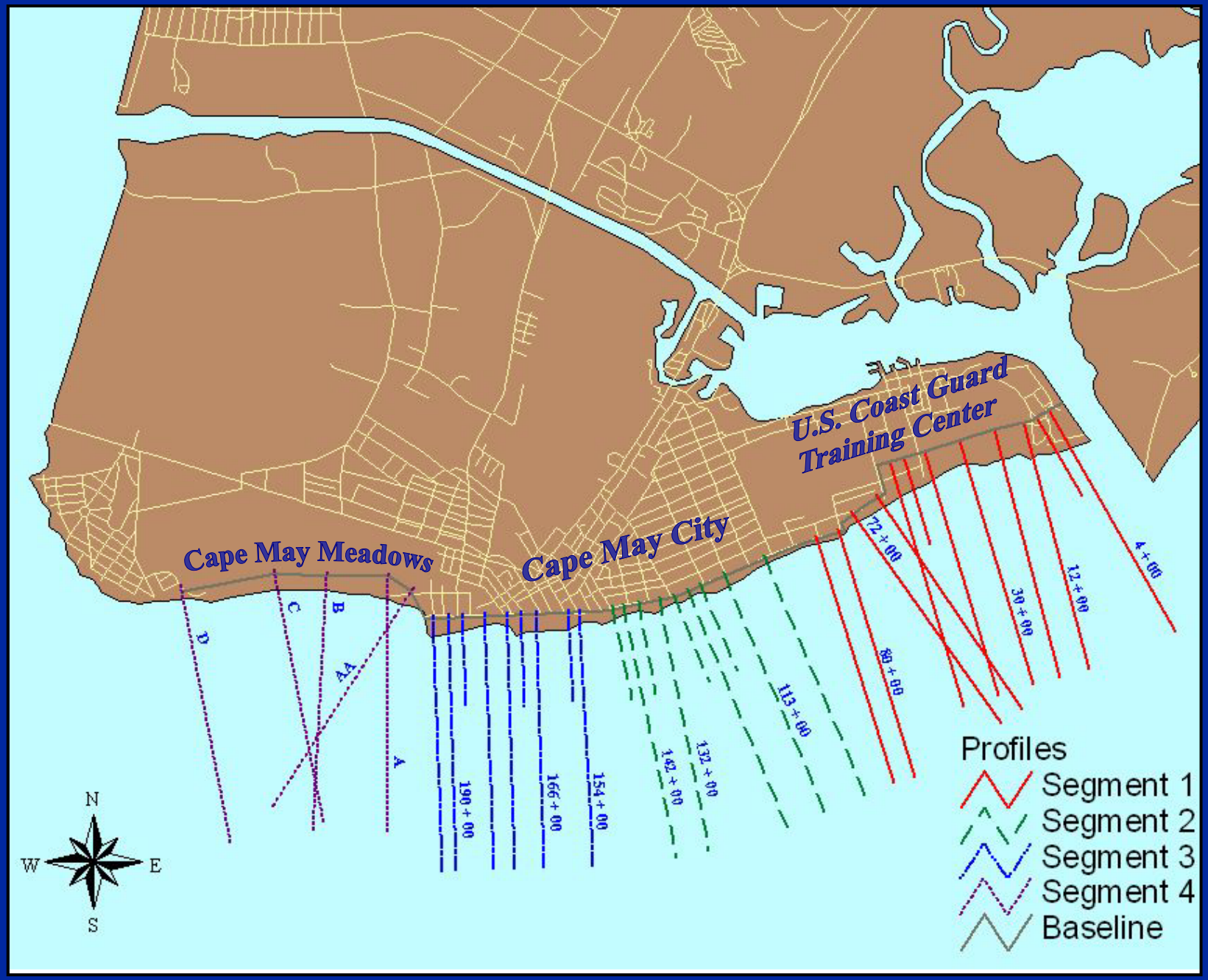
Cape May City Project
Looking South - March 2004

Cape May City Project
Looking South – March 2004

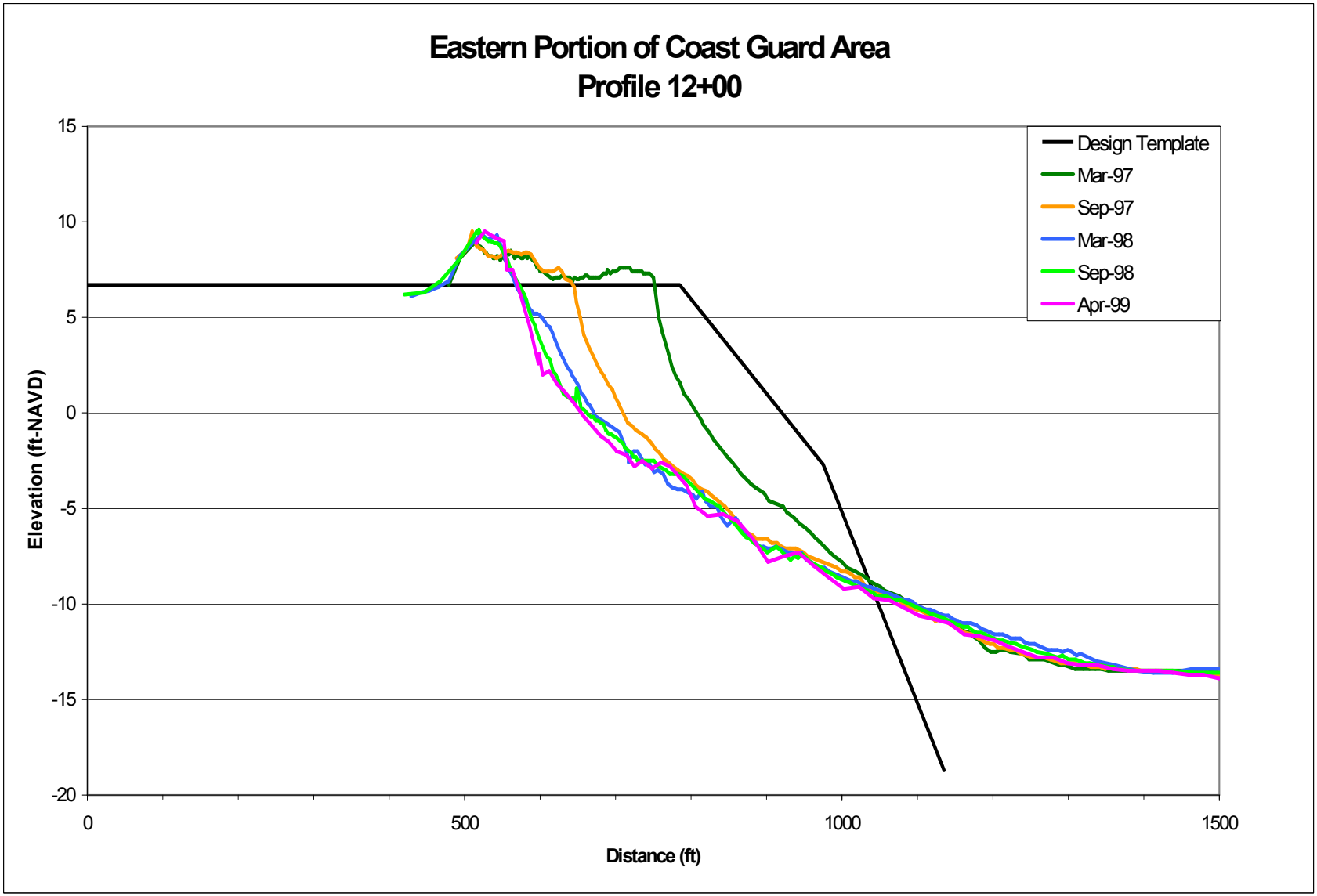
Cape May City
Looking North – September 2003

Cape May City
Looking North – September 2003

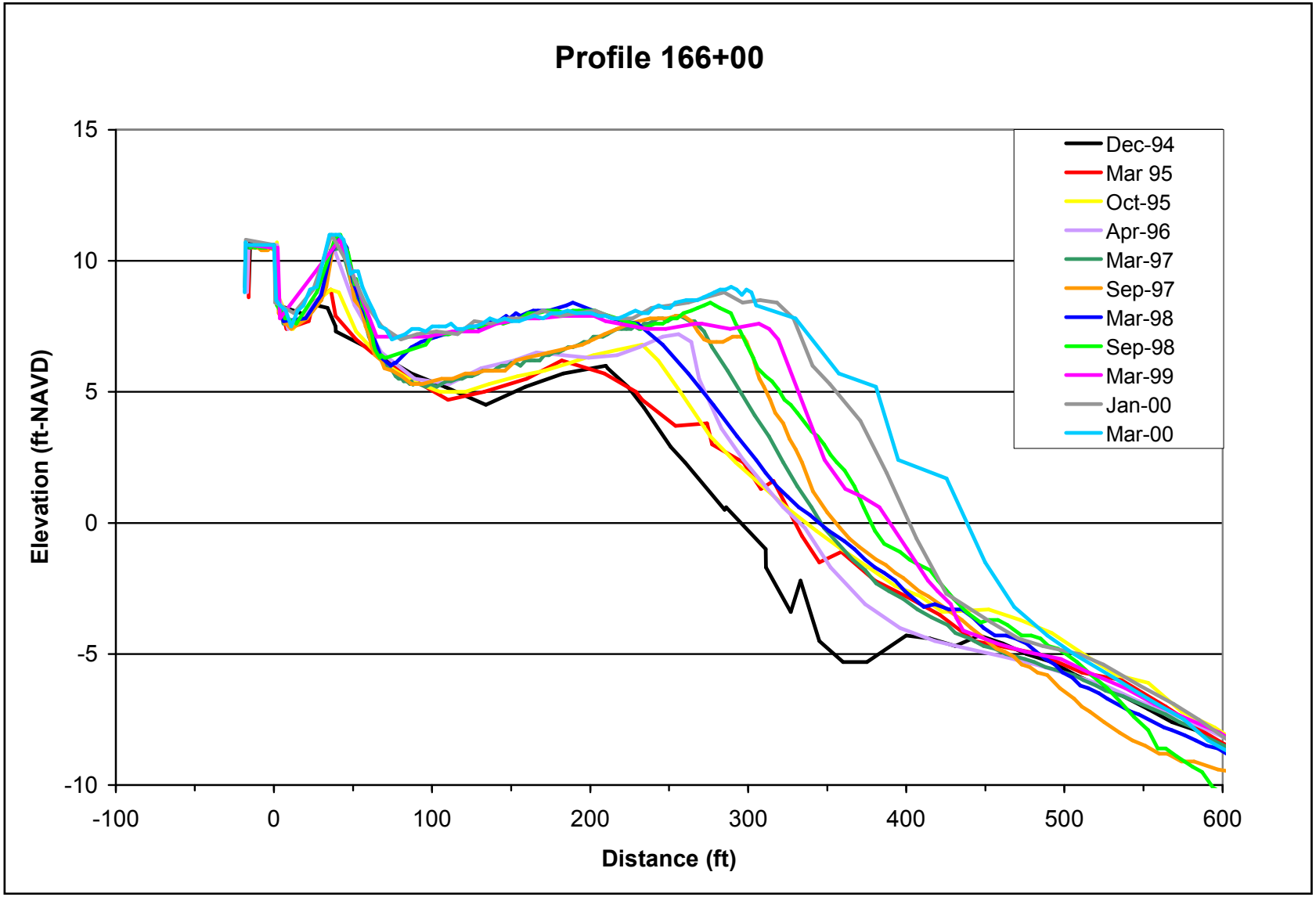
Cape May City
Dune Growth


U.S. Coast Guard Training Center
Cape May City
Cape May Meadows
D
C
B
AA
A
190+00
166+00
154+00
142+00
132+00
113+00
80+00
72+00
30+00
12+00
4+00
N
W
E
S
Profiles
Segment 1
Segment 2
Segment 3
Segment 4
Baseline

Segment 1-Feeder Beach



Segment 3-Cape May City South



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Cape May City Project

- Feeder Beach Concept performing as designed
  - About 300,000 cu yd placed every 2 years at CG
  - Cape May City has needed minimal nourishment
- Proactive community – dune program
- Update Sediment Budget
- Should we change nourishment cycle?
- Borrow area concerns, RSM Demo Project

Regional Sediment Management: Cape May, NJ Demonstration Project

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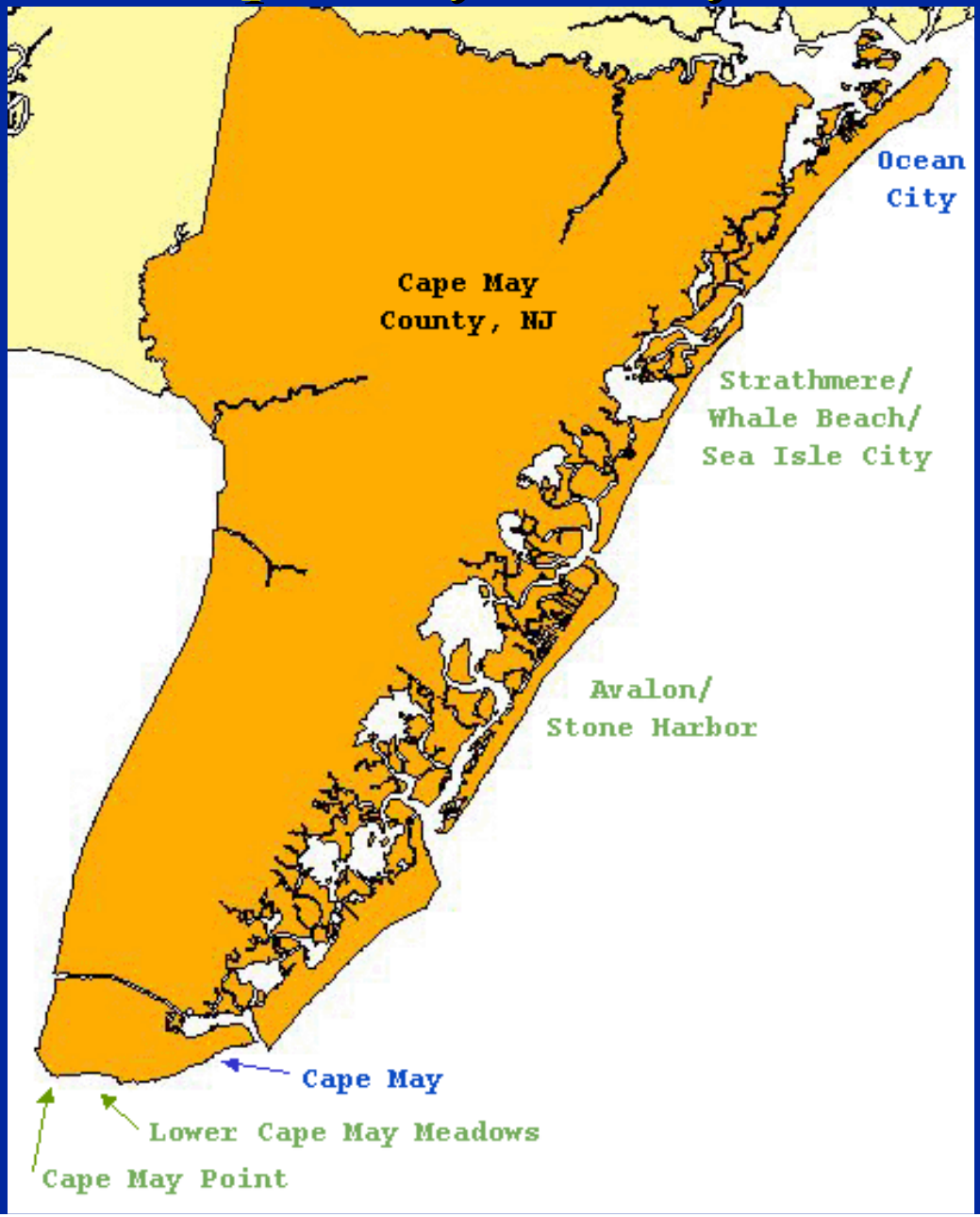
Cape May Fillet Area
Environmental and Geotechnical Testing

Cape May Meadows and Point
Initial Construction begins October 2004

Cape May Point
Initial Construction-January 2005

Cape May County, NJ

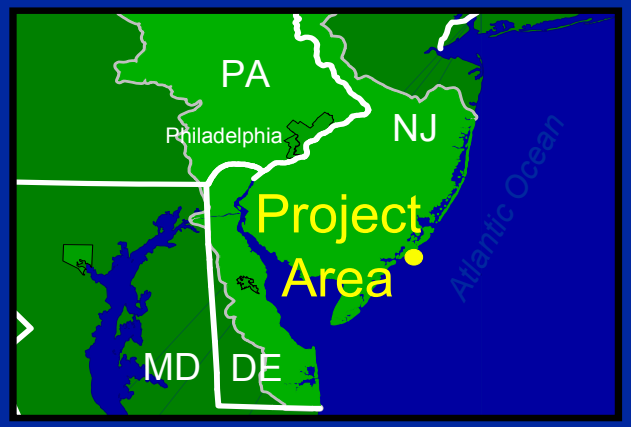


Great Egg Harbor Inlet and Peck Beach, NJ

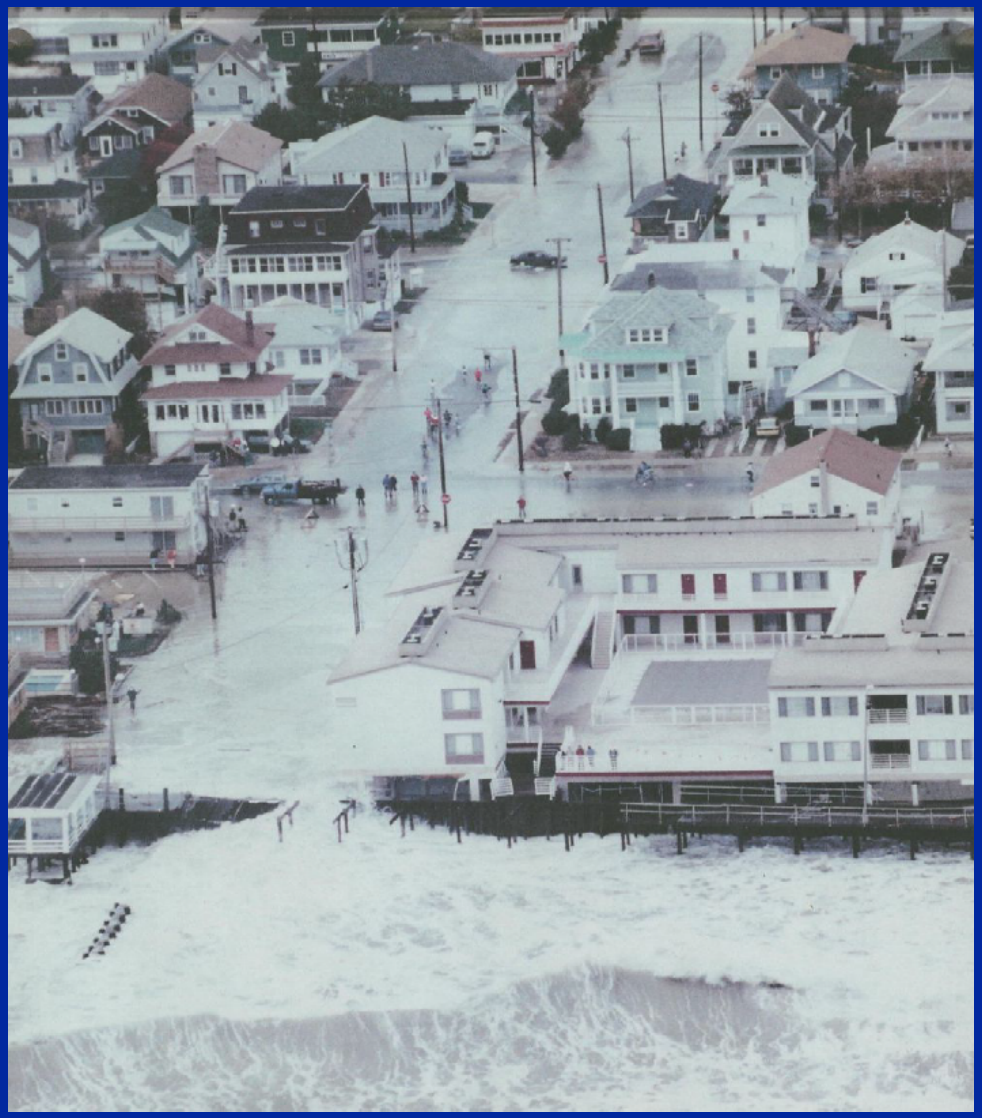
Ocean City

Periodic Nourishment

Borrow Area



Ocean City, NJ
During Halloween 1991 Storm



Great Egg Harbor Inlet and Peck Beach

Before

After

112th Year, Number 49 Ocean City, N.J. 08226-0238 Thursday, December 17, 1992 Three Sections Price 40¢ (609) 399-5411

'Eclipse northeaster' worst since '62; new beach saved city

By WILLIAM BARLOW
Sentinel-Ledger Staff

OCEAN CITY — Old-timers are calling the weekend's eclipse northeaster the worst storm since '62, but officials at every level are saying the damage would have been far worse if not for the nearly-completed beach replenishment project.

High tides flooded the city each day from Friday through Monday. The tides on Friday were higher than either of last winter's severe floods, with the oceanfront tide four feet above the normal high tide. While the tides had not returned to normal, at least by Tuesday most of the streets were clear at high tide. High winds began Thursday, just hours after Wednesday night's total lunar eclipse of the full moon (which would be closest to earth — in perigee — four days later).

> "We spent more time trying to get people out of where they shouldn't have been in the first place"
>
> — police captain

Massive amounts of sand were lost from beaches, according to officials, especially from the nearly-completed replenishment project, and on Friday waves broke freely over the bulkhead in the south end.

High winds pounded the resort from Thursday night into Friday morning and pushed water into the back bays. For eight consecutive high tides, streets throughout the island were flooded and often impassible.

On Friday night, weather equipment on the *Beachbuilder* dredge anchored on the bay side of Longport clocked winds at up to 90 mph.

U.S. Rep. Bill Hughes, along with

(please turn to page A16)

STORM

(continued from page 1)

city officials and Federal Emergency Management Agency regional director Stephen Kemp, toured the coastline by Coast Guard helicopter Tuesday. See related front-page story.

Hughes said Tuesday that if and when the area is declared a federal disaster, FEMA will be setting up both stationary and mobile offices throughout the region for property owners to report damage. He said he expects President Bush will declare a state of disaster in the near future, which is necessary before any federal aid will be available.

was in the helicopter, said most of the structural damage to private property was to beach stairs, decks and other structures on the ocean side of the bulkhead, or by debris striking houses. Deaney said it is likely a City Council discussion on a proposed ordinance banning such structures is likely to be held sooner than scheduled.

Deaney added there was less debris than from last winter's storms because the boardwalk wasn't damaged.

Other damage included a roof blown off an oceanfront house in the south end. Also, nearly anything

"We spent more time trying to get people out of where they shouldn't have been in the first place," he said. "People think they have motorboats instead of cars."

He said the police department received, at a conservative estimate, 56,700 calls in 72 hours. Many of the calls were inquiries as to the status of the bridges in and out of town.

Pollock said there was no danger to people's lives or else the island would have been evacuated.

Just the same, some people made for Red Cross shelters in order to wait out the worst of it Friday.

fied out-of-town property owners whose properties were severely damaged or where the possibility of further damage was eminent without attention. However, he added that the city does need to be notified about specific damage to private property, as other towns had requested, and that property owners should report the damage to FEMA when a local office is set up.

Gov. James Florio is reportedly setting up an 800 number for damage reports, and is pushing the federal government to declare the area a disaster.

Cumberland.

This storm appears to have done more damage than those of January, 1992 and October, 1991, according to the lawmakers. Although money will be available for shore protection in next year's budget, New Jersey will need federal aid to solve the immediate problem.

Gov. Jim Florio has also sent a formal disaster declaration to President Bush for Atlantic, Ocean and Monmouth counties, adding that additional counties would also need federal aid as figures continue to be filed.

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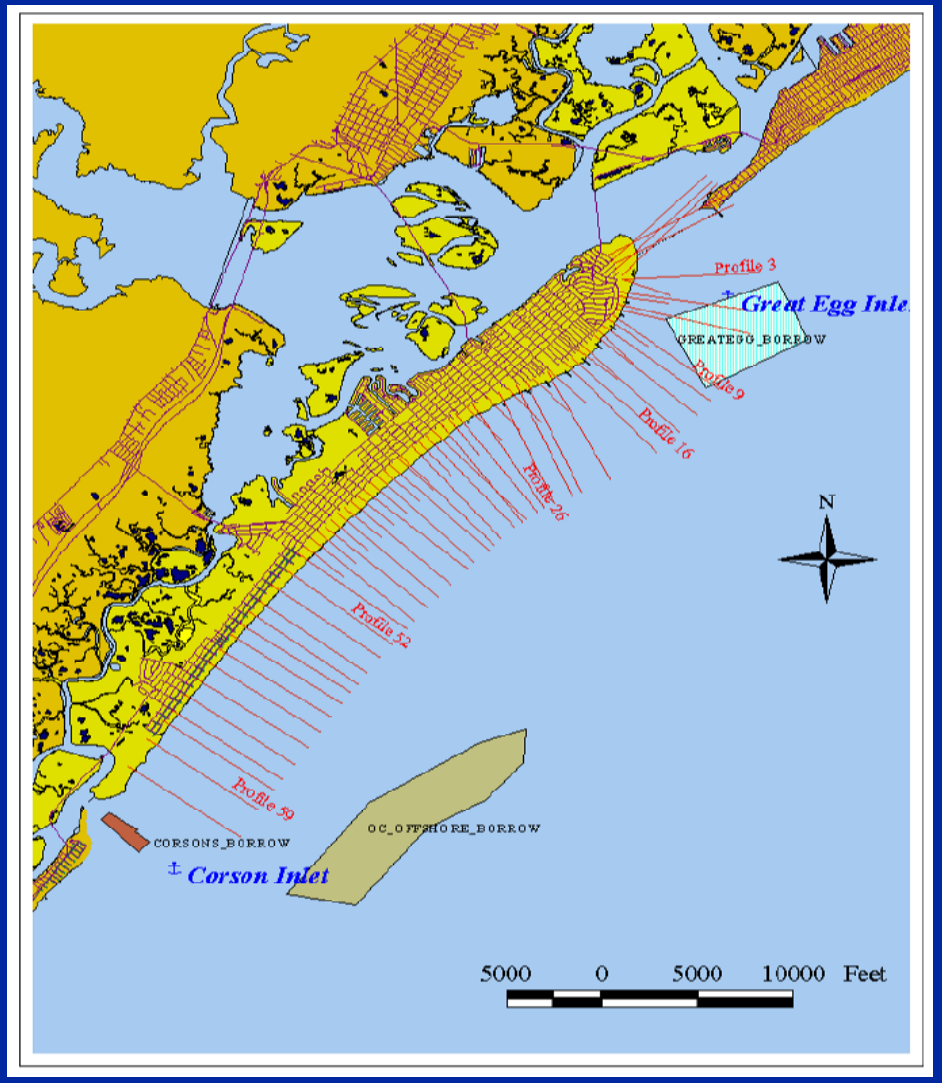
Ocean City, NJ Beachfill

- 4th Cycle of Renourishment completed from November 2003 to February 2004
- 1.6 Million Cubic Yds Placed from inlet to 15th Street (2 miles) @ approximate cost of $9 Million
- Southern portion of the project (2+ miles) has not needed fill since 1995
- Use of Monitoring Data to Improve Project Performance
- Proactive Stakeholders….RSM in Action!

Music Pier Area
Storm Berm Concept
October 2004 vs. May 2005

Ocean City, NJ
Monitoring Line Locations



Ocean City, NJ South End

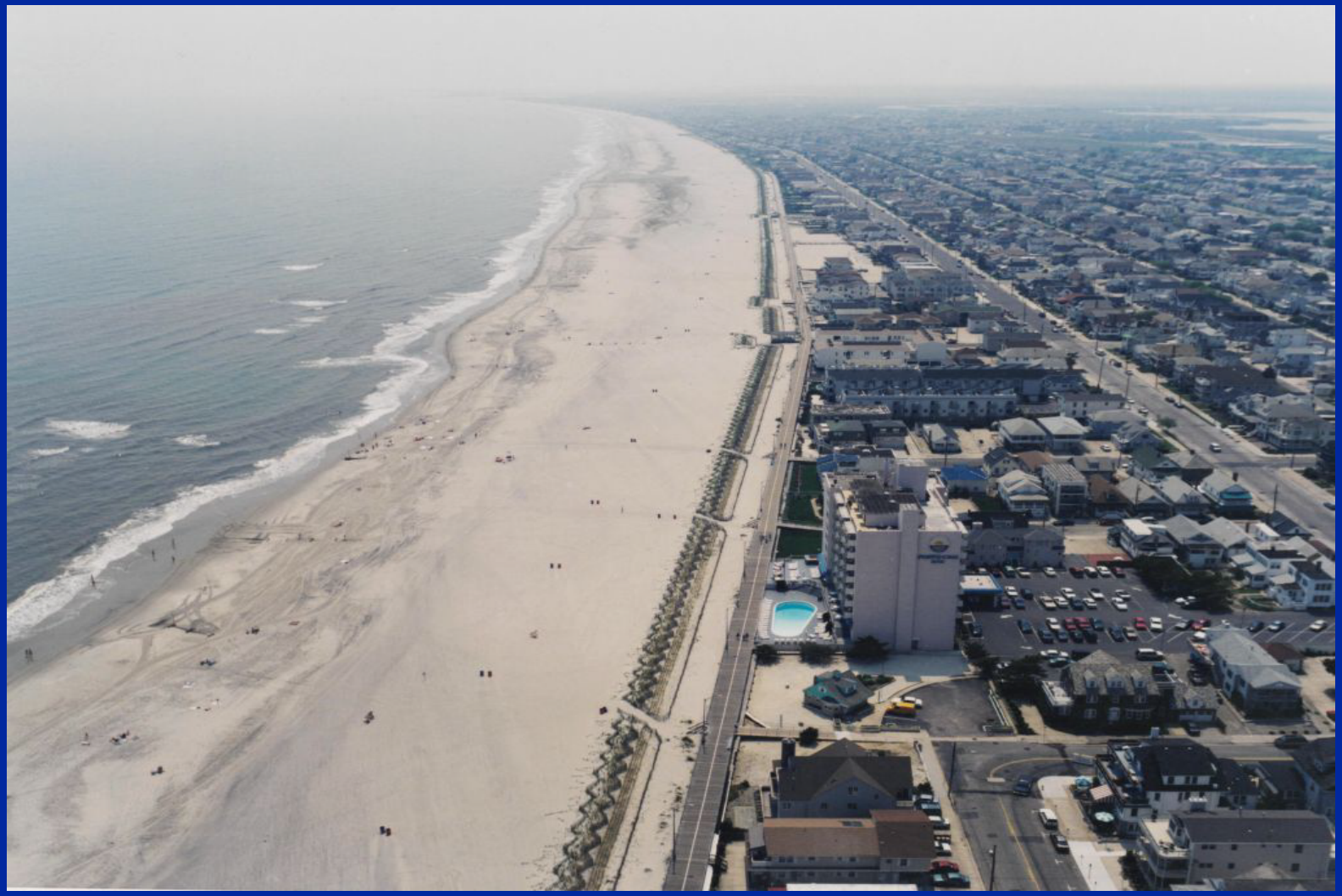
During Initial Construction-Summer 1992

October 2004

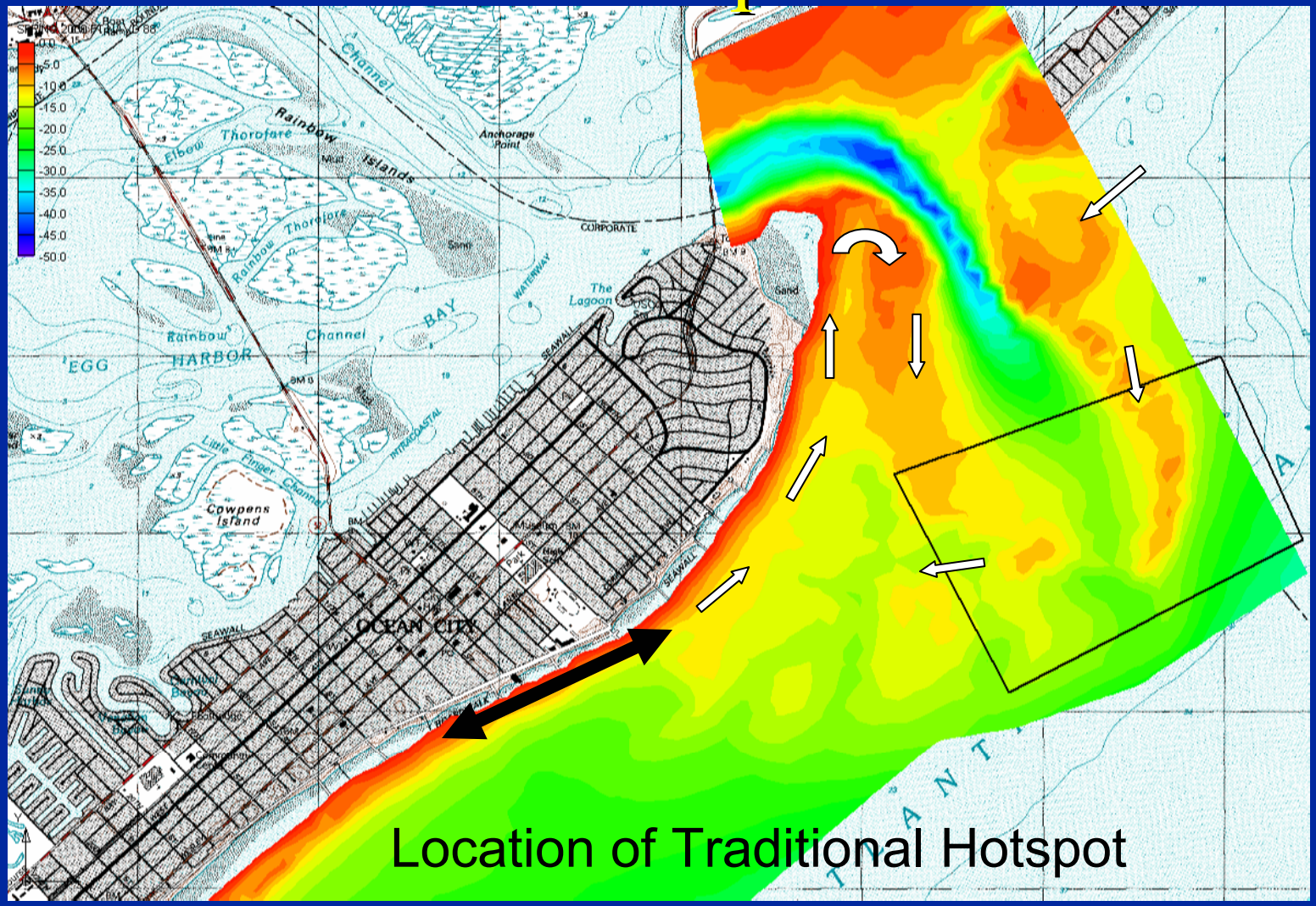
Ocean City, NJ
Southern Part of Project (no fill needed)
March 2004

Ocean City, NJ
Southern Part of Project (no fill since 1995)
Looking North - March 2004

Ocean City Dune Program



Understanding the Ocean City "Hot Spot"



Ocean City, NJ "Hot Spot"
4th Renourishment Cycle

Before (September 2003)

After (March 2004)

Ocean City, NJ North End
4th Renourishment Cycle

Before (September 2003)

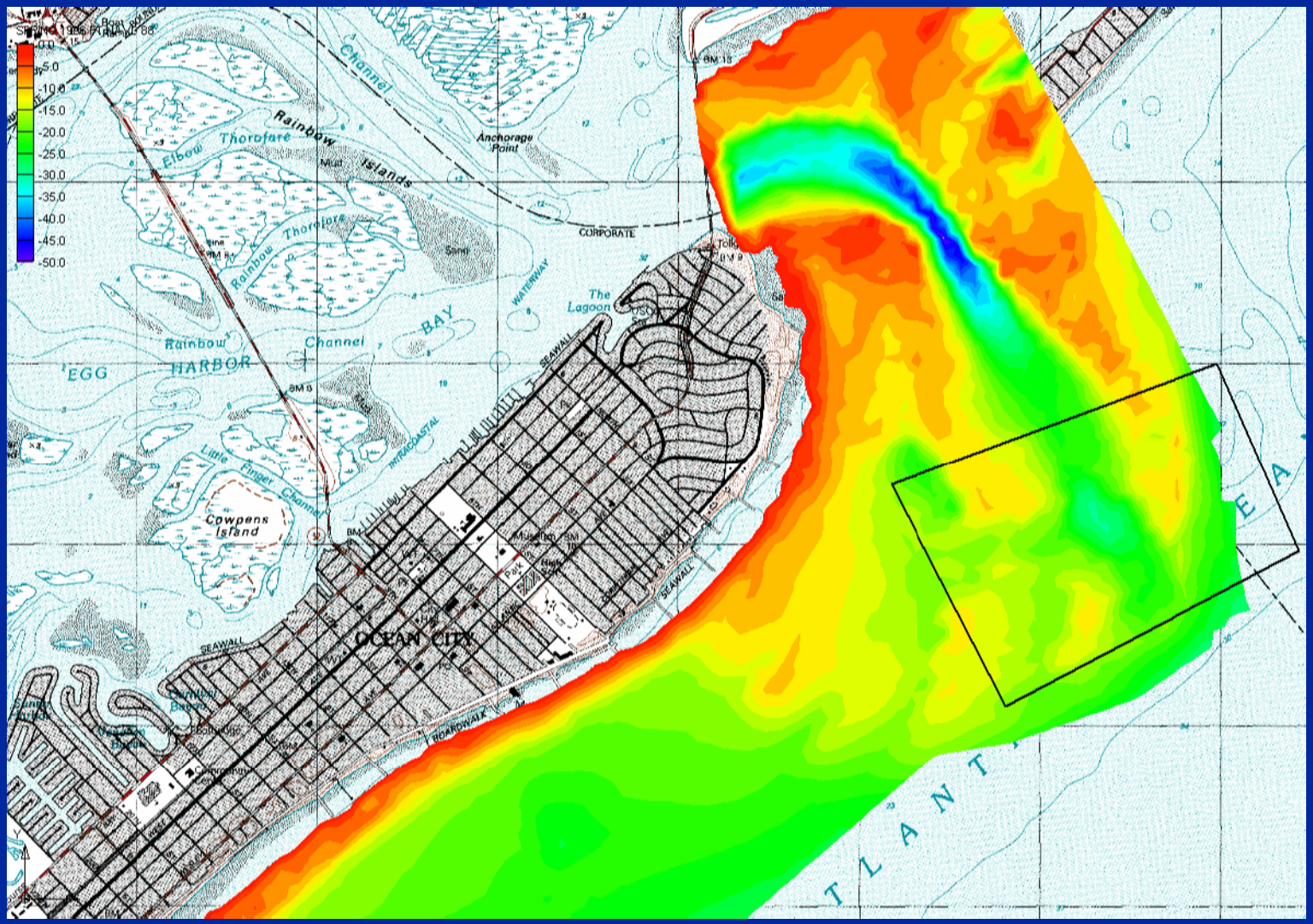
After (March 2004)

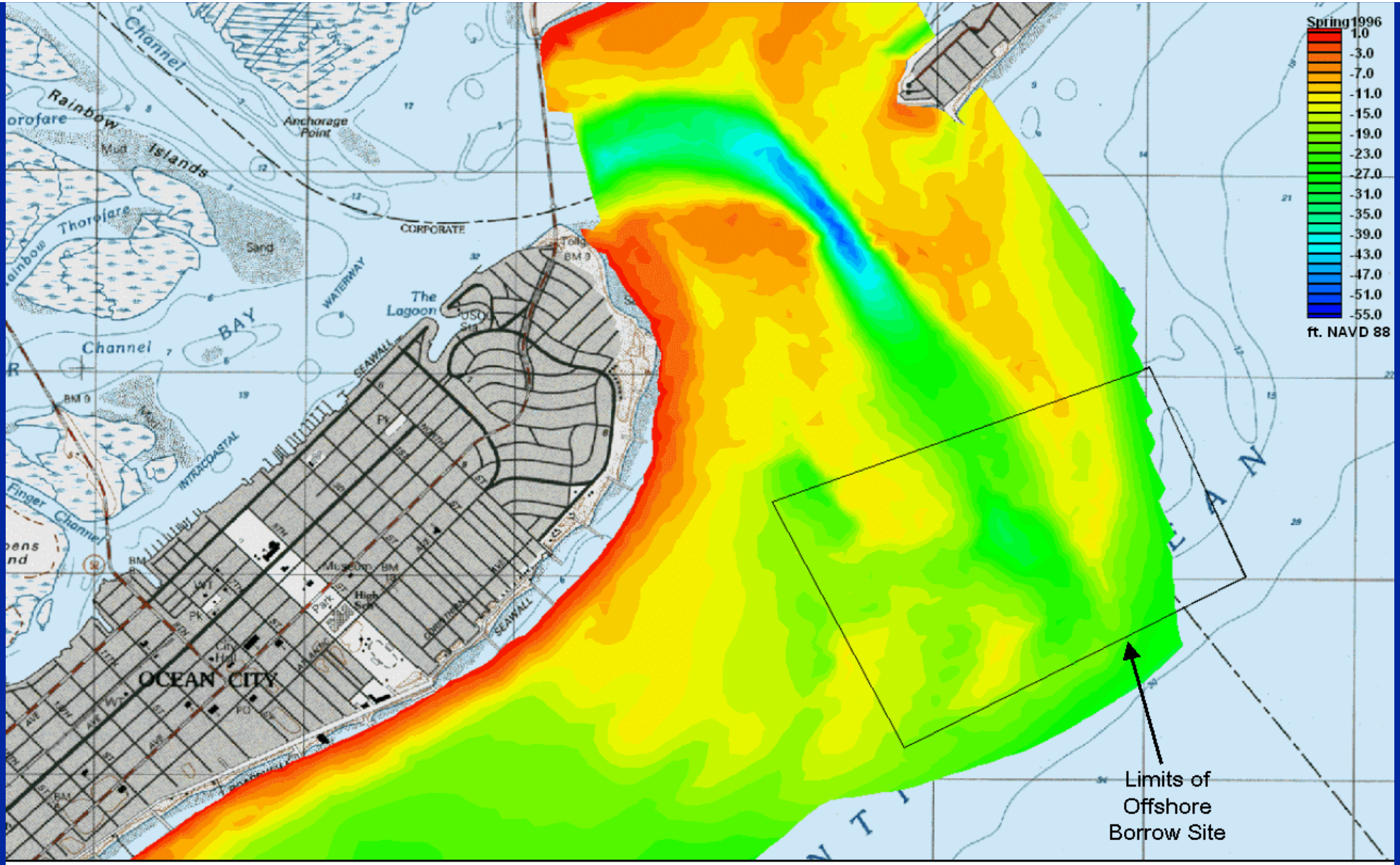
Erosion Issues

North End Closer to Inlet
January 2003

Hot Spot near 5th Street
May 2005

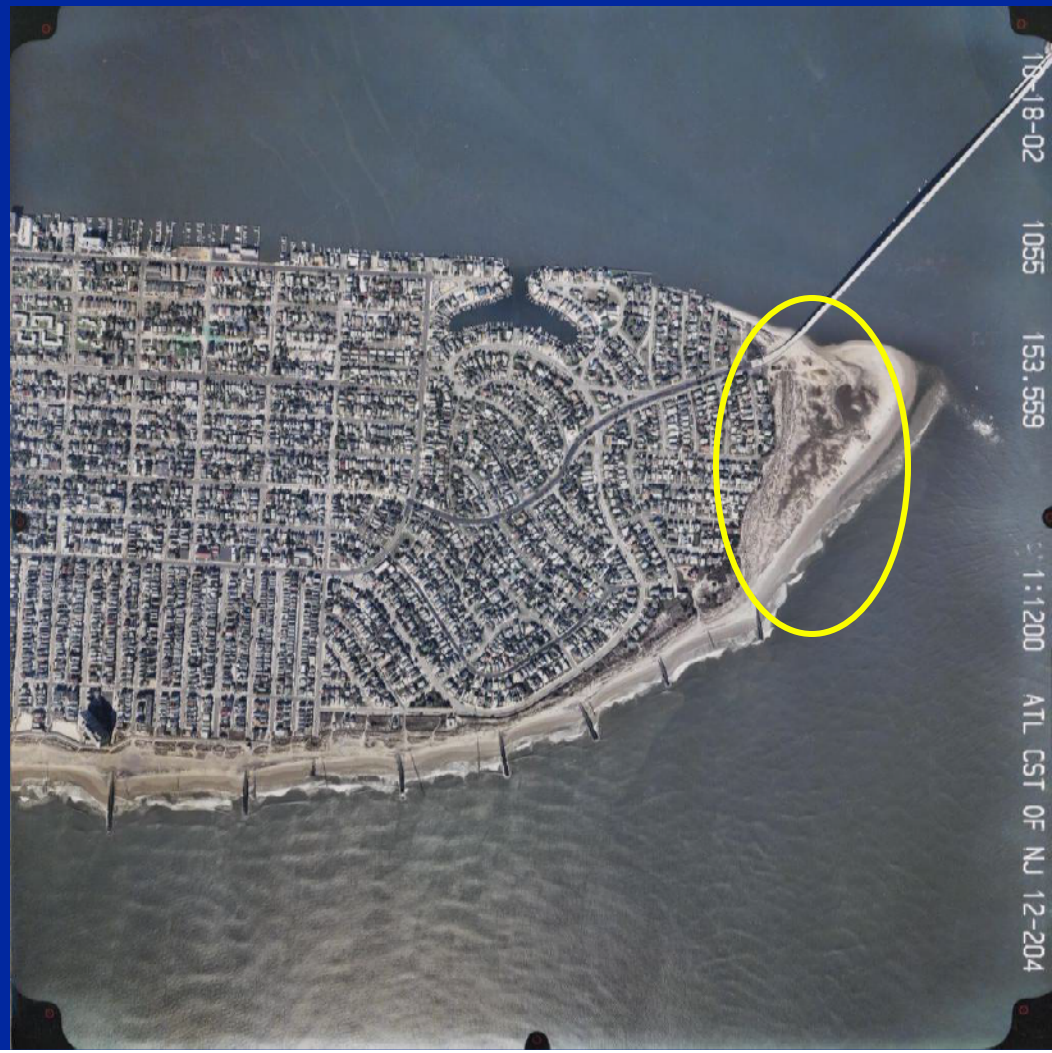
Great Egg Harbor Inlet
Spring 1996

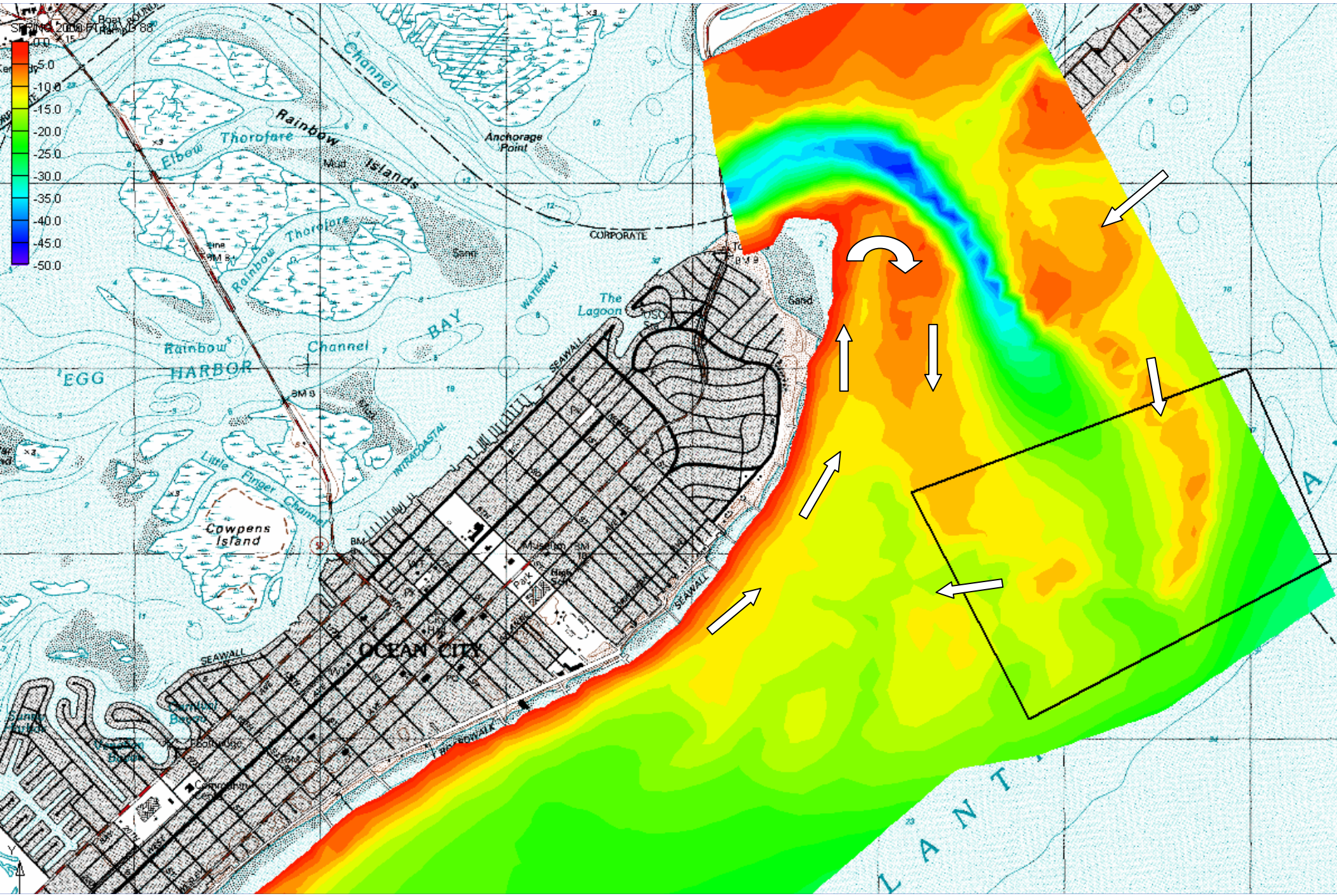




Great Egg Harbor Inlet
Spring 1996

How does your Garden Grow?
1994-2002




-0.0
-5.0
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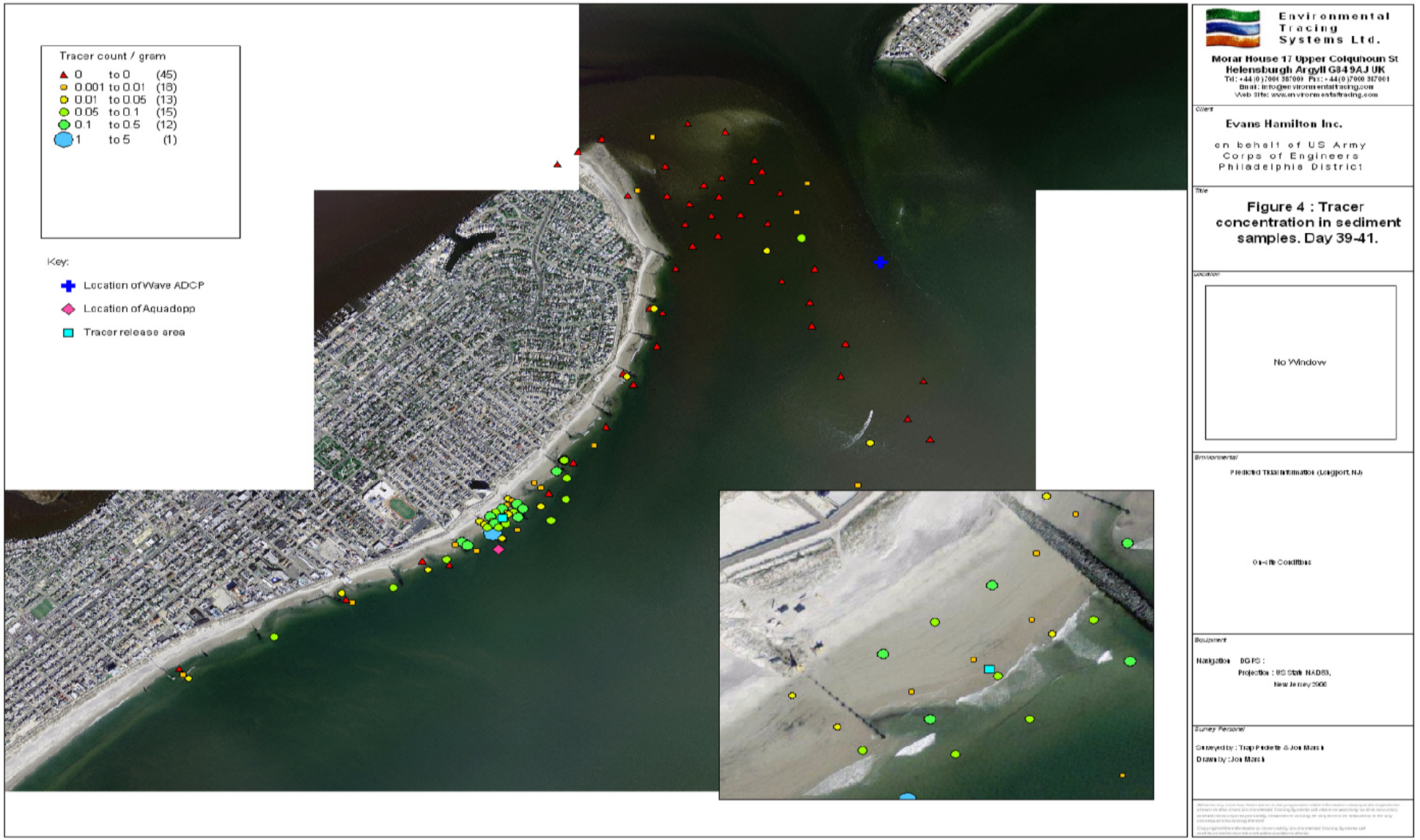
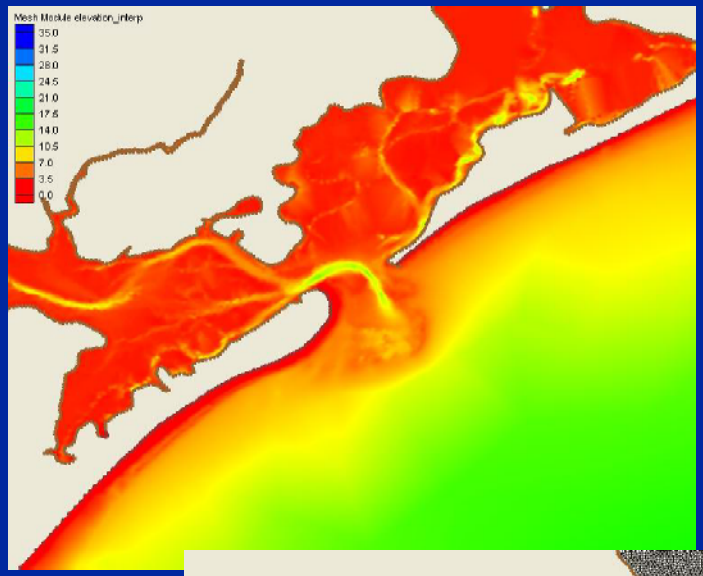
Channel
Rainbow
Elbow Thorofare
Mud Islands
Anchorage Point
CORPORATE
Rainbow Thorofare
WATERWAY
The Lagoon
BAY
Rainbow Channel
HARBOR
EGG
SEAWALL
INTRACOASTAL
Little Finger Channel
Cowpens Island
OCEAN CITY
BOARDWALK
ATLANTIC

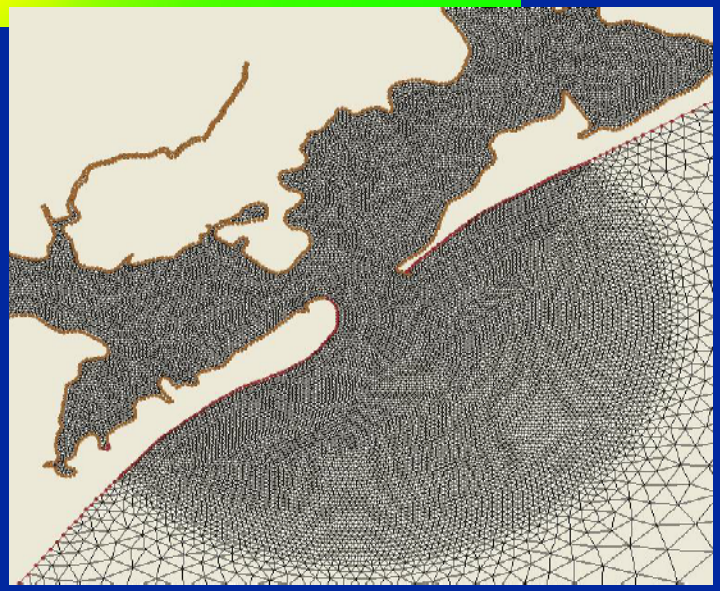
Tracer Study in Hot Spot Area – April 2004



Hydrodynamic Modeling of Great Egg Harbor Inlet

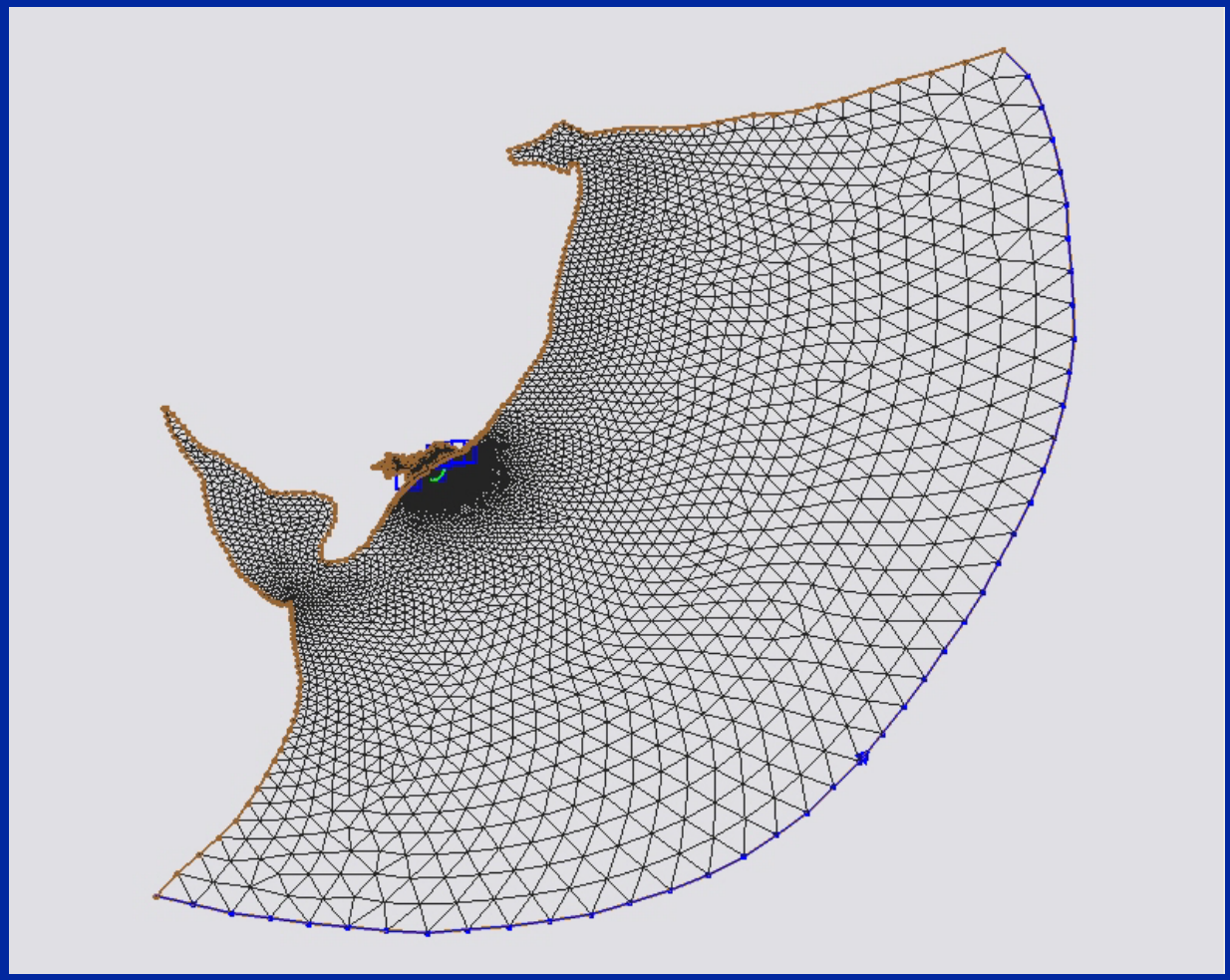
- Investigate hydrodynamic forces influencing the north end beachfill
- Evaluate existing and alternative borrow area locations
- ERDC's SMS Beta Version 9.0
- Inlet Modeling System includes ADCIRC, STWAVE and M2D





ADCIRC

- 2D finite element circulation model.
- Forcing can include tidal constituents, wind, atmospheric pressure, wave stress gradients and flow rate (river discharge).



STWAVE

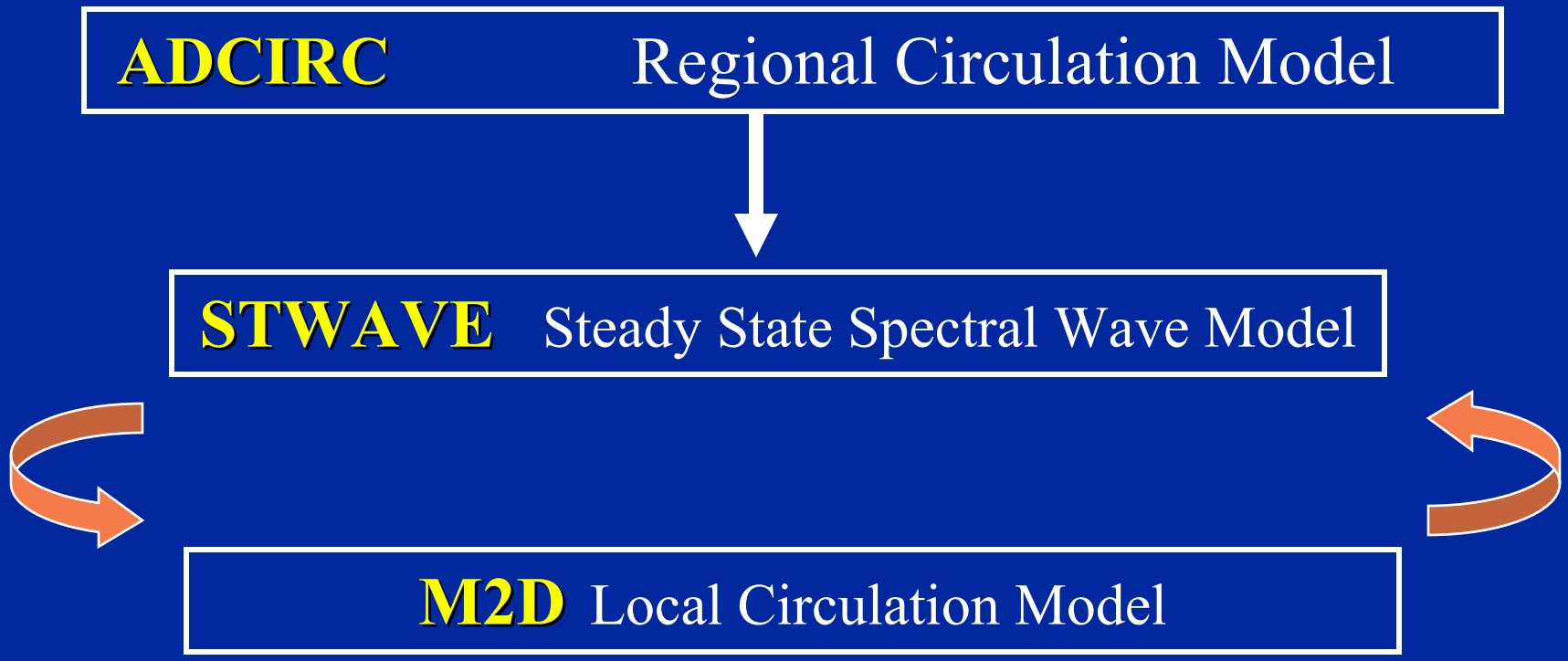
- Steady state spectral wave model.
- Rectangular grid.
- Model processes include refraction, shoaling, wave-current interaction, wave growth and breaking.
- Input – wave height, period, direction, spectrum and bathymetry.

Seaside Heights, Casino Pier,
10/16/02, Big Wednesday

M2D

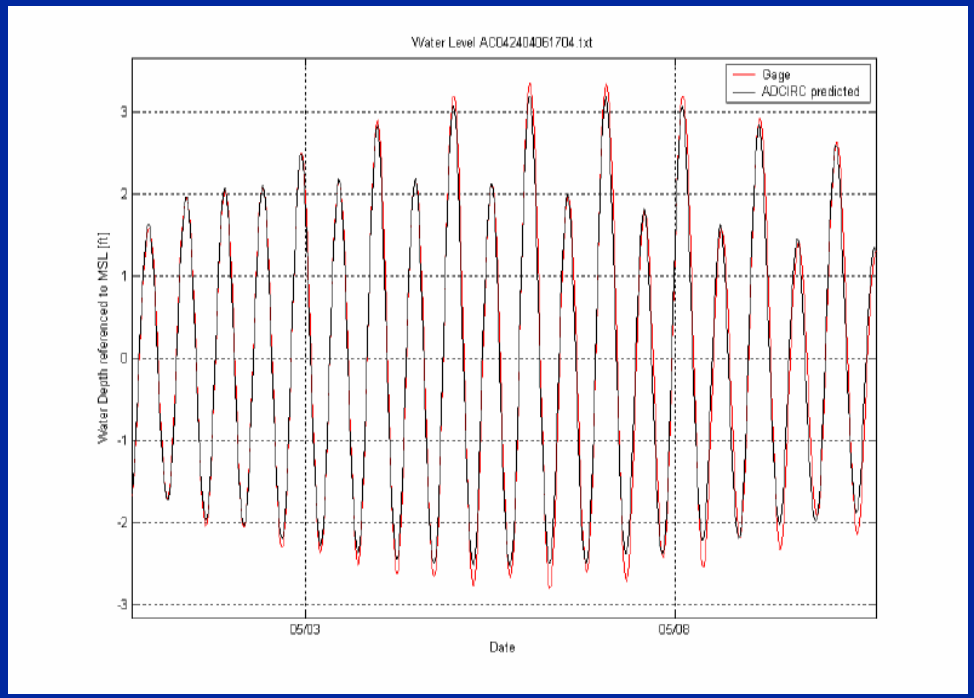
- Horizontal circulation model (water level & current).
- Rectangular grid, variable cell spacing.
- Input (forcing) – tidal constituents, water level, wind, waves, and flow rates.

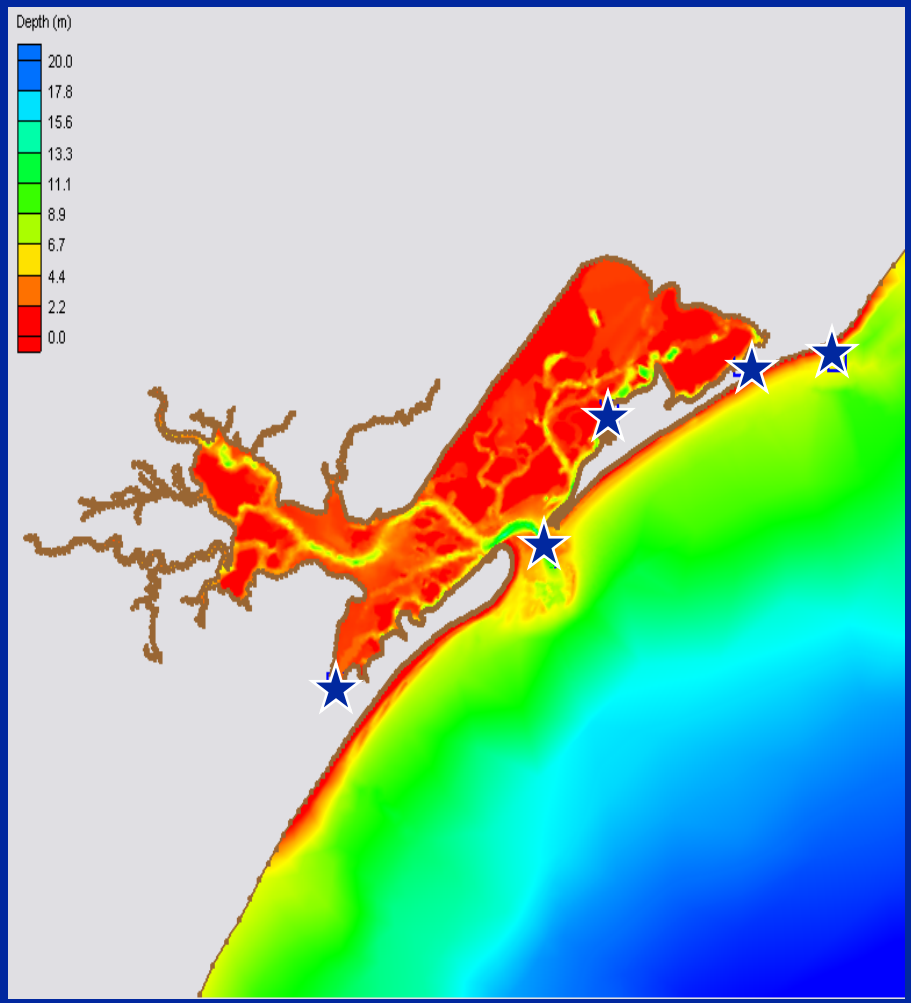
Coupling Models



Model Calibration

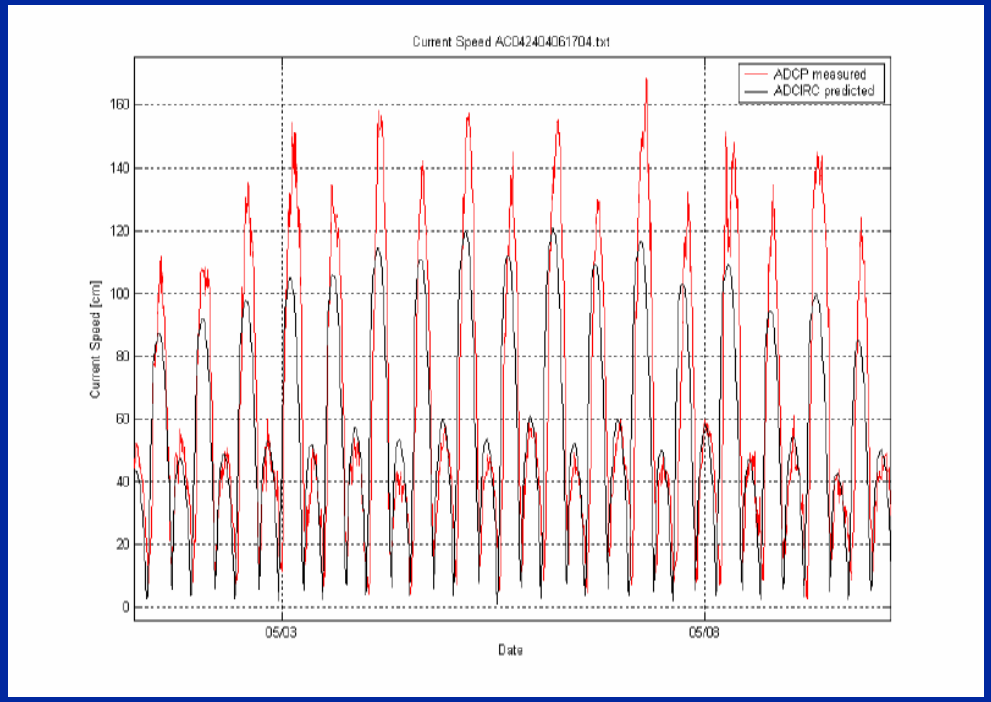
- Water Surface Elevation – range and phase differences at 5 locations.

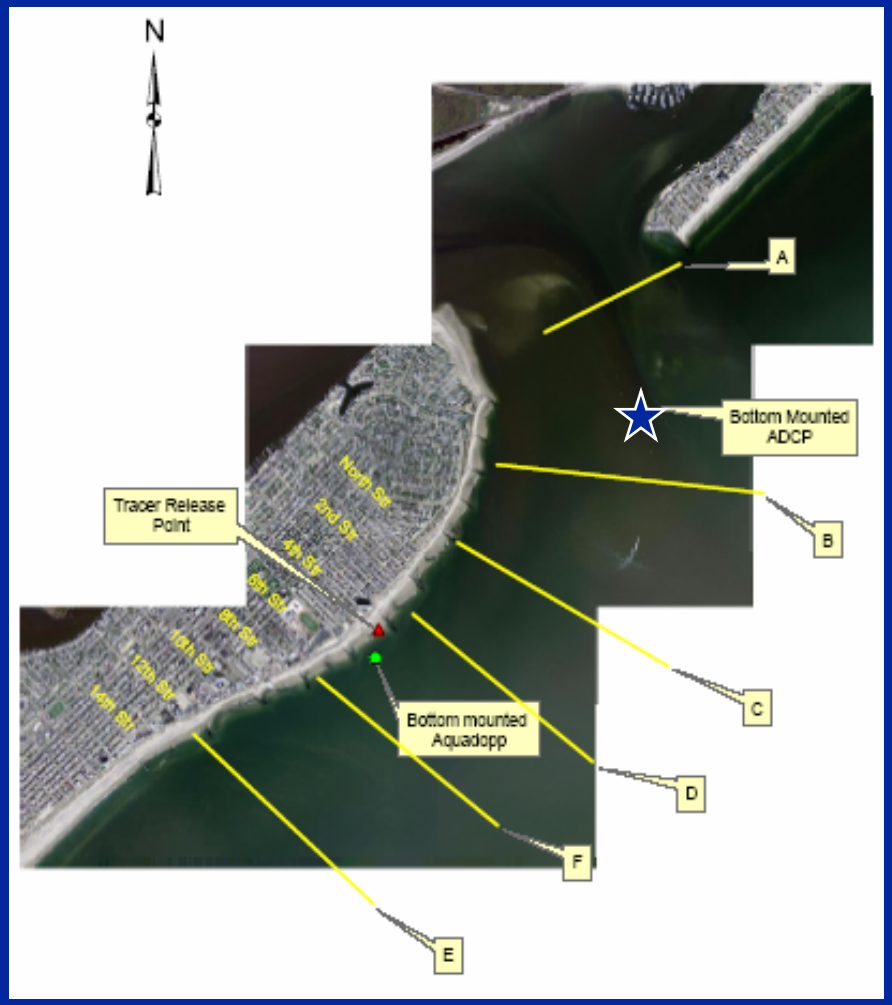




Model Calibration (con't)

- Current Velocities - magnitude differences at 7 different locations.





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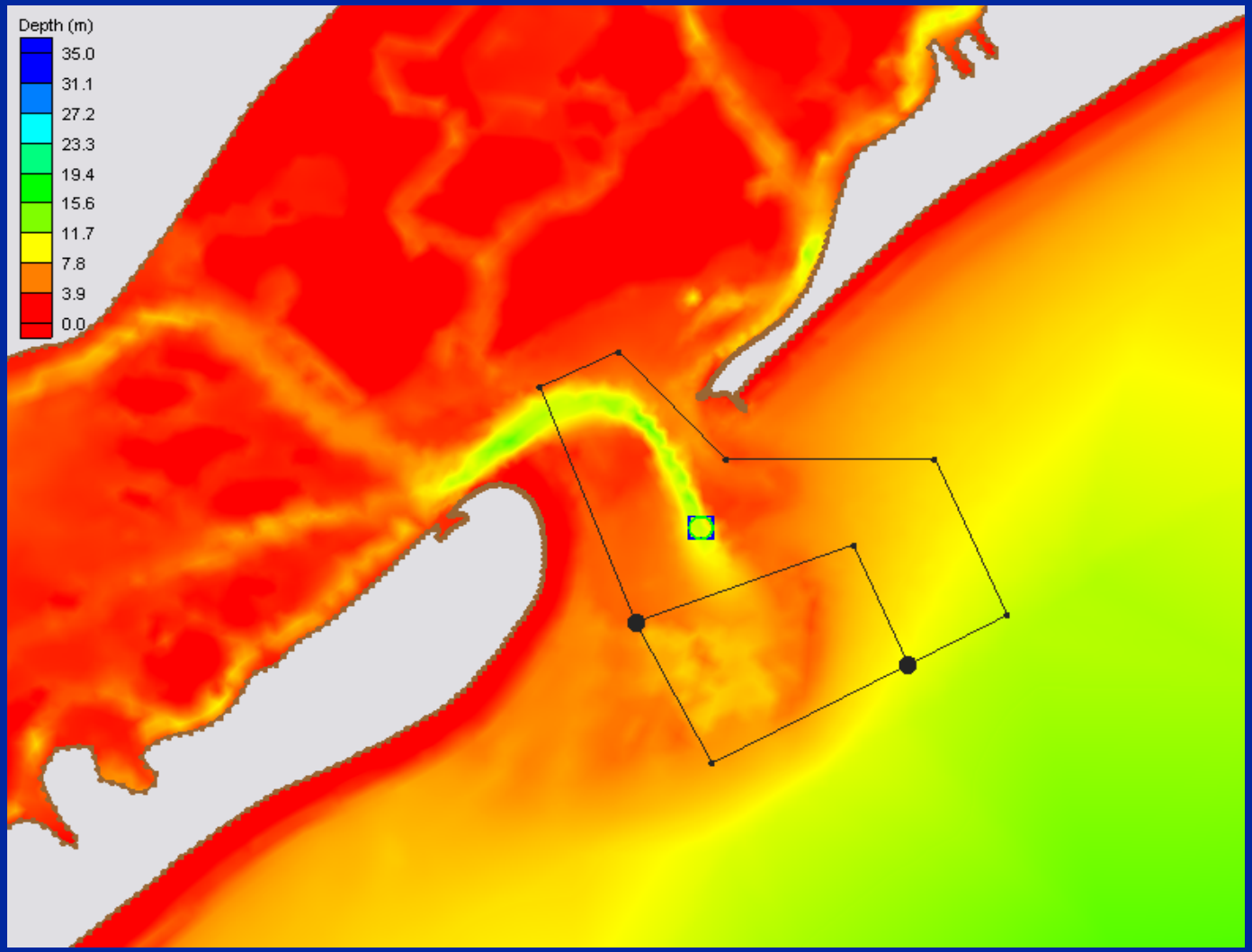
Continuing Analyses

- Hydrodynamic Model of Great Egg Harbor Inlet
- Borrow Area Modifications
- Updated Sediment Budget
- Template Modifications in Hot Spot Area? Storm berm concept, lower berm elevation?

Environmental and Geotechnical Testing



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Summary

- **Yes….beachfill is worth it!**
  - Overall performance of Ocean City and Cape May
  - Hot spots are small compared to overall project, inlet relationship
  - Long-term response of the system
- **Importance of Project Monitoring**
  - Must evaluate project performance to keep efficient, find cause and effect relationships
  - Fund not only data collection, but ANALYSIS to make sound management decisions (now included in Feasibility cost estimate)
  - USACE Engineer Manual Update (POC: Stan Boc)
- Adaptive Management/Design
- Importance of Local Sponsor Relationships
- Regional Approach/Collaboration of Efforts

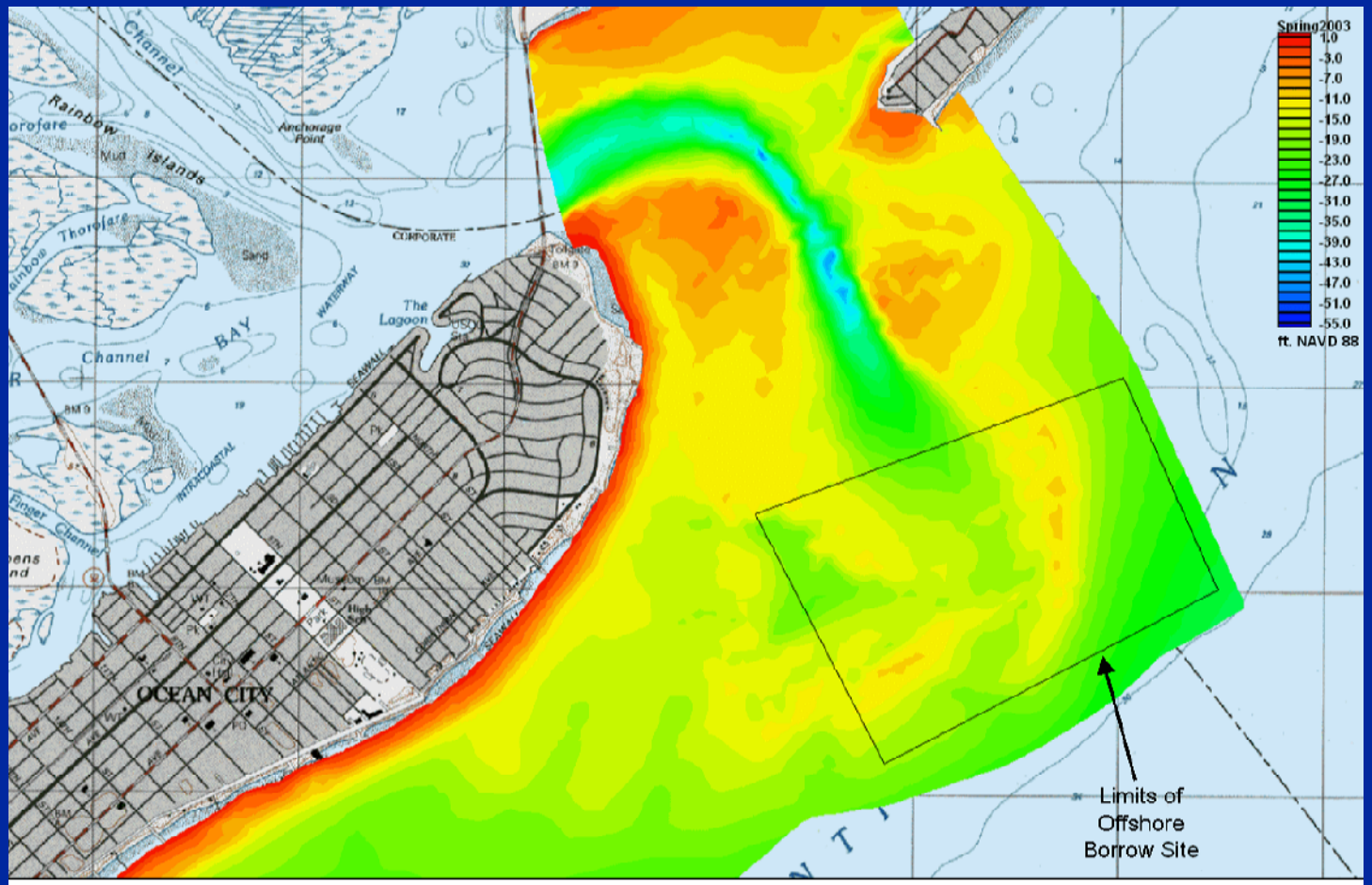
Extras

Atlantic City
After Beachfill - March 2004

Atlantic City North End Beachfill
February 2005

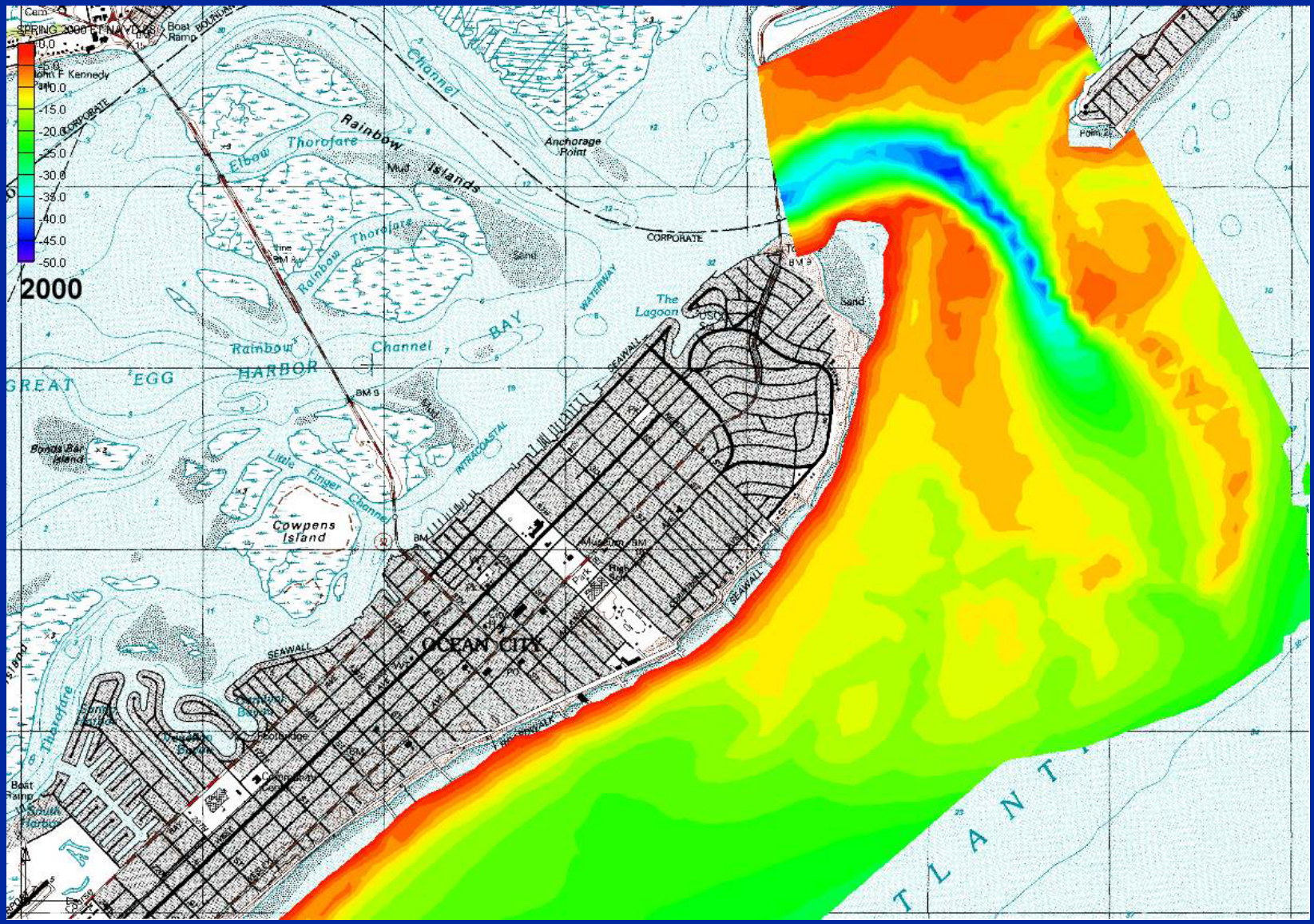
Ventnor Beachfill Erosion
February 2005

Great Egg Harbor Inlet
Spring 2003

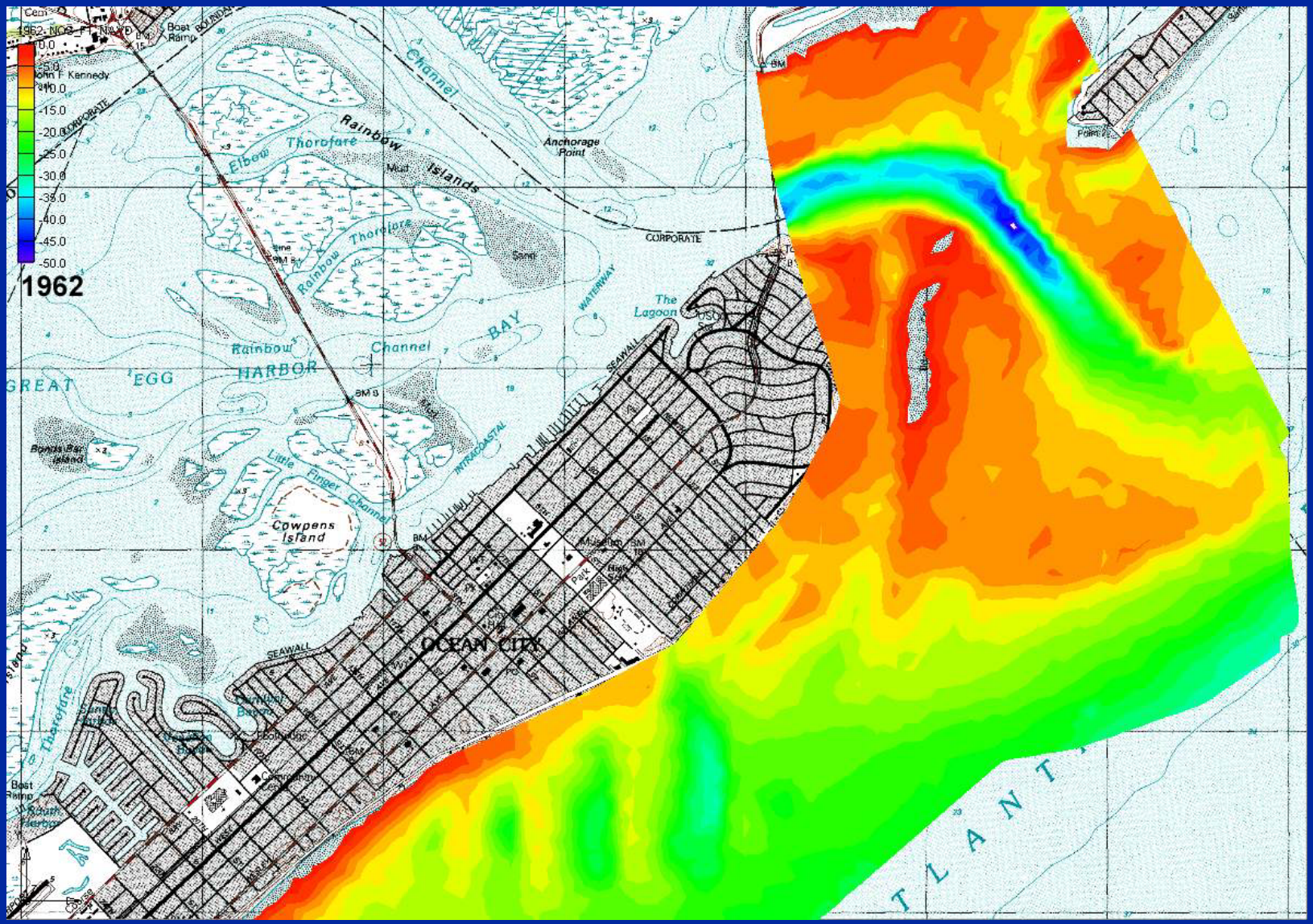


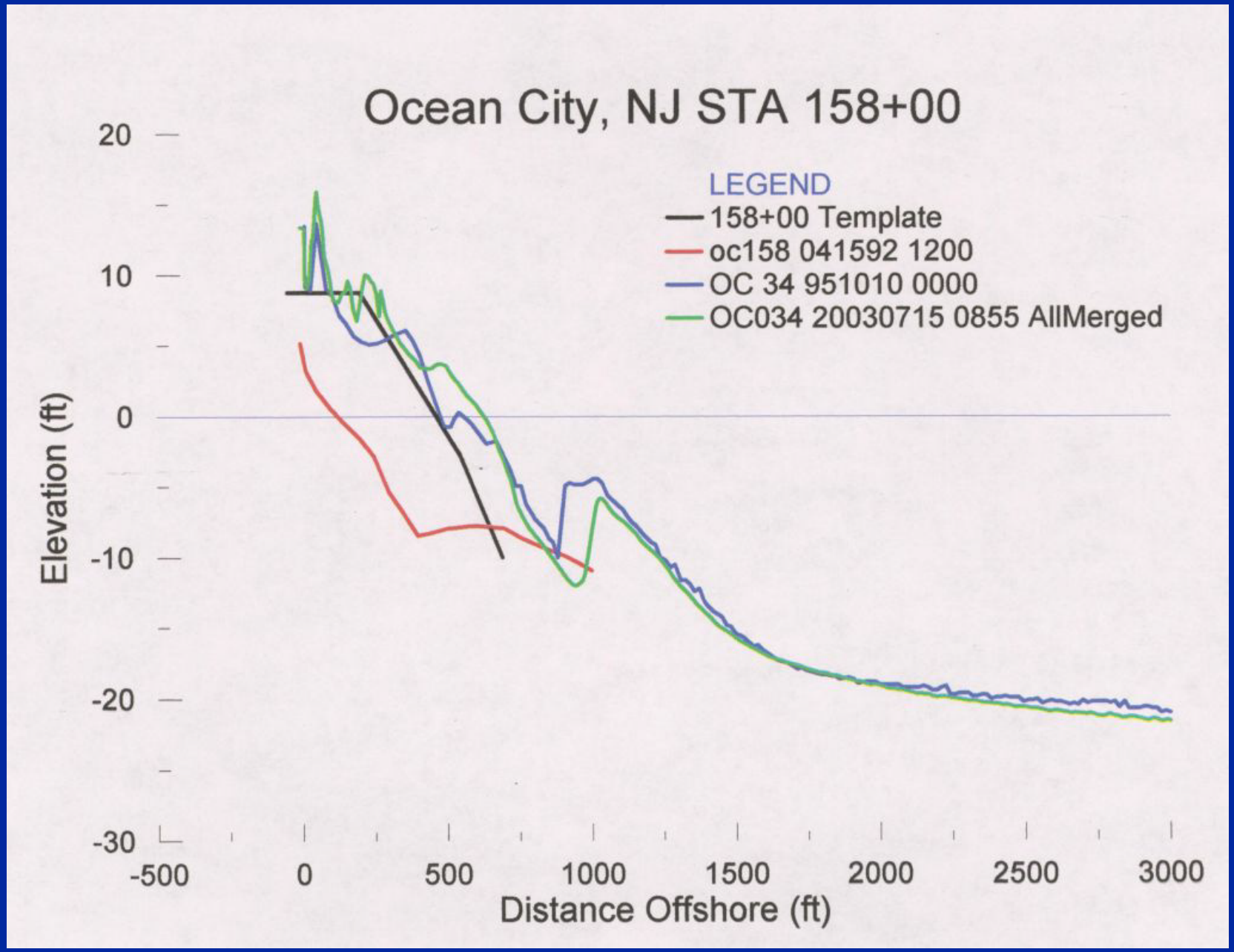
Great Egg Harbor Inlet
Spring 2003

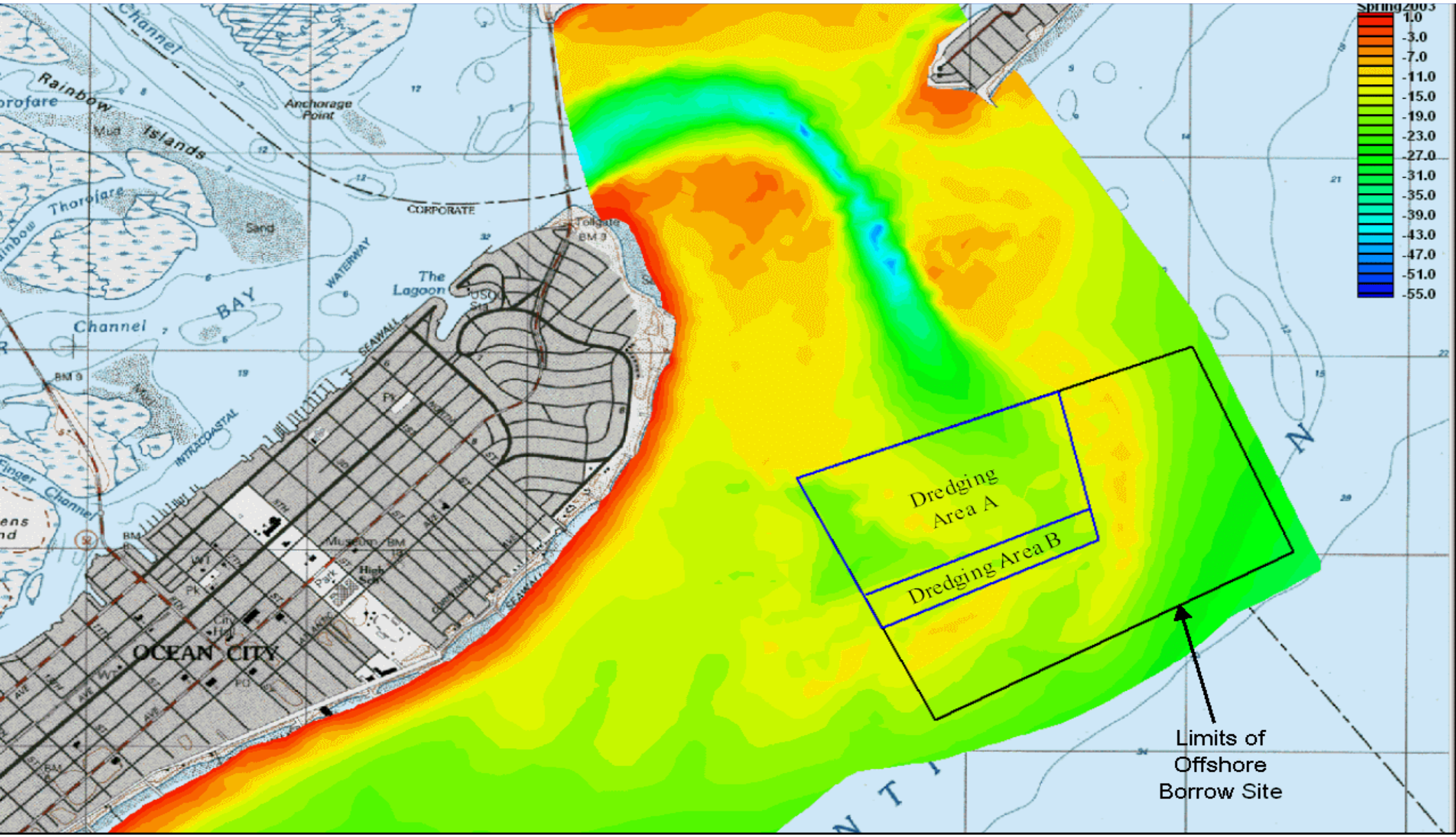
Great Egg Harbor Inlet
Spring 2000



Great Egg Harbor Inlet
1962




Ocean City, NJ STA 158+00
LEGEND
158+00 Template
oc158 041592 1200
OC 34 951010 0000
OC034 20030715 0855 AllMerged
Elevation (ft)
20
10
0
-10
-20
-30
-500
0
500
1000
1500
2000
2500
3000
Distance Offshore (ft)



Great Egg Harbor Inlet
Spring 2003