



COASTAL SYSTEMS INTERNATIONAL, INC.

Coastal Engineering

Waterfront & Marinas

Civil Engineering

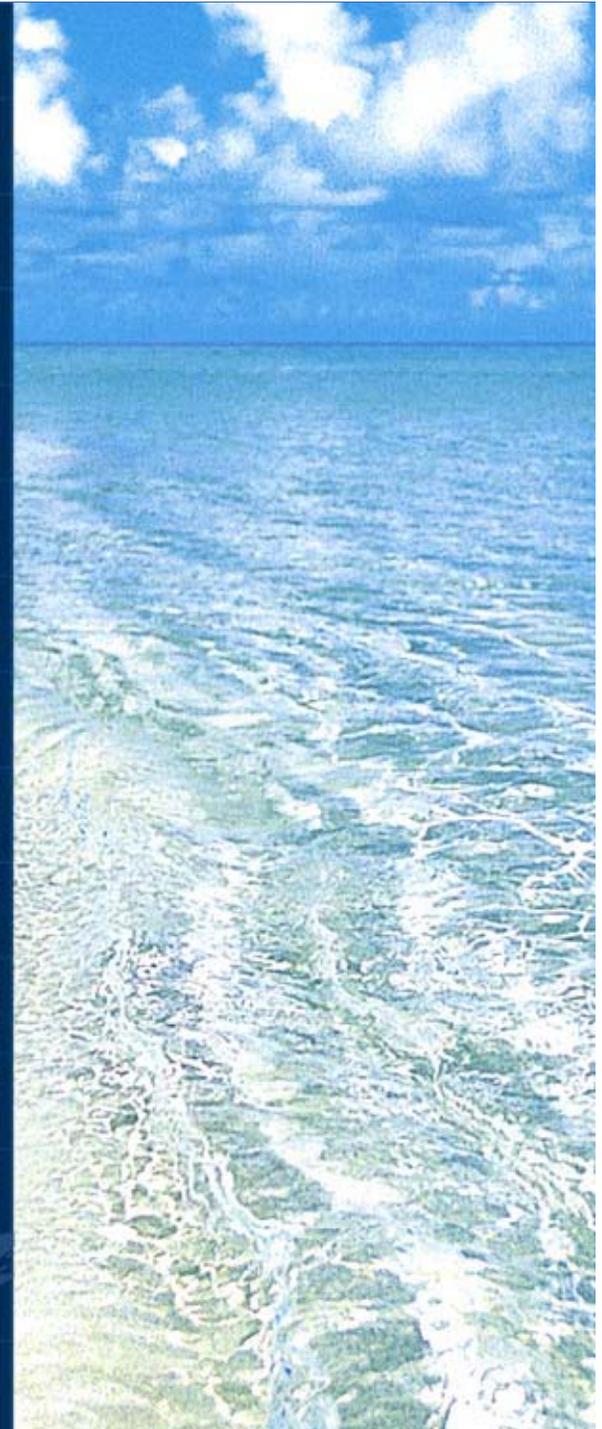
Regulatory Permitting

Site Investigations

Marine Environmental

Construction

Destination Development



Hot-Spot Management Study Town of Hillsboro Beach



Prepared for:



Town of Hillsboro Beach
1210 Hillsboro Mile
Hillsboro Beach, Florida 33062

Prepared by:



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February, 2012

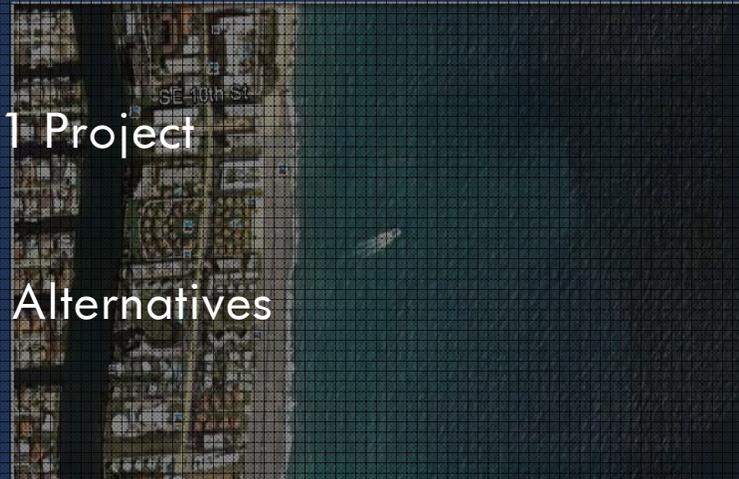


- Recap of November, 2011 Beach Workshop
- Review Scope of Work for Hot Spot Management Study
- Shoreline Stabilization Alternatives
- Numerical Modeling Approach
- Modeling Results – 7 Alternatives
- Environmental Permit Feasibility
- Recommendations



Recap of Beach Workshop

- Presentation at Beach Workshop – November 21, 2011
- Web Site <http://www.townofhillsborobeach.com/index.php?sec=82>
- 1997 Long Range Beach Renourishment Plan
- Three Beach Renourishment Projects
- Physical/Biological Monitoring of 2011 Project
- Boca Inlet Management
- Outlined Hot Spot Shore Stabilization Alternatives





Hot Spot Management Study – Scope of Work

- Feasibility Study – Stabilization of Northern 5,000' of Hillsboro Beach
- Historical Data – Erosion “Hot Spot” Rates and Coastal Processes
- Review Southeast Florida Coastal Structures
- Numerical Modeling – DHI MIKE-21
- Numerical Modeling - Sediment Transport
- Calibration of Numerical Modeling
- Shoreline Stabilization Alternative Simulations
- Review Environmental Permitting Feasibility
- Recommendations and Report Preparation
- Workshop Presentation

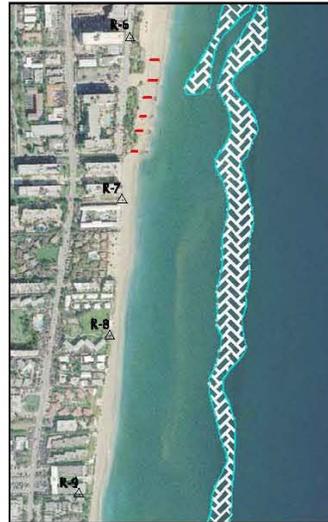
Shoreline Stabilization Alternatives



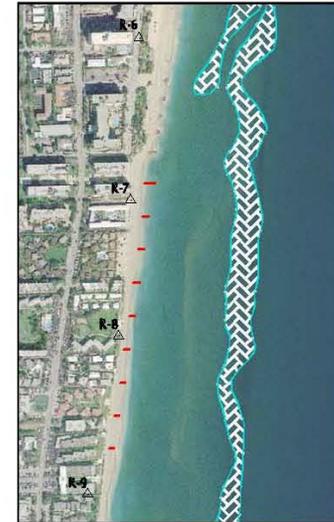
ALTERNATIVE 1



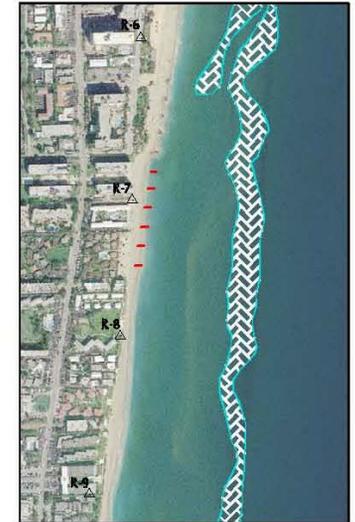
ALTERNATIVE 2



ALTERNATIVE 3



ALTERNATIVE 4A



ALTERNATIVE 4B



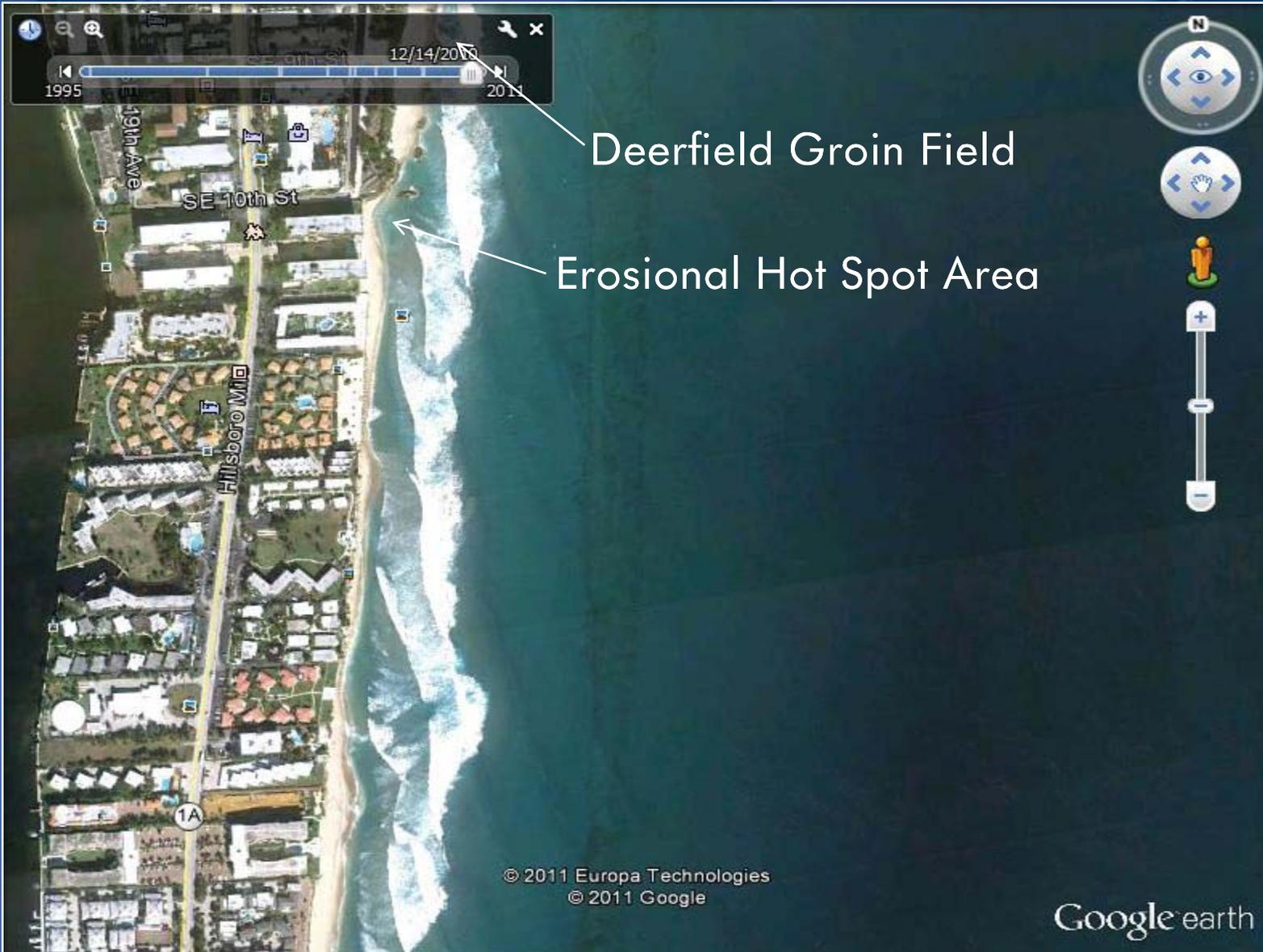
Shoreline Stabilization Alternatives



Alternative 2 – Continued Beach Nourishment



Shoreline Stabilization Alternatives



Alternatives 3 & 4 Groin Field Modifications



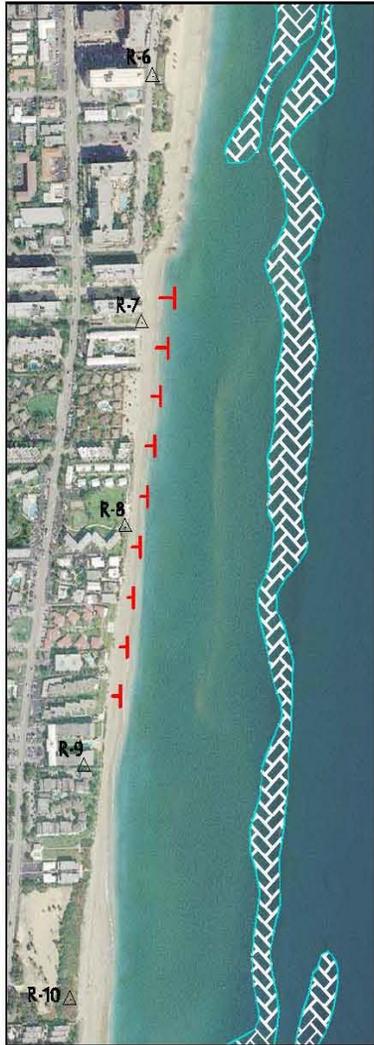
Shoreline Stabilization Alternatives



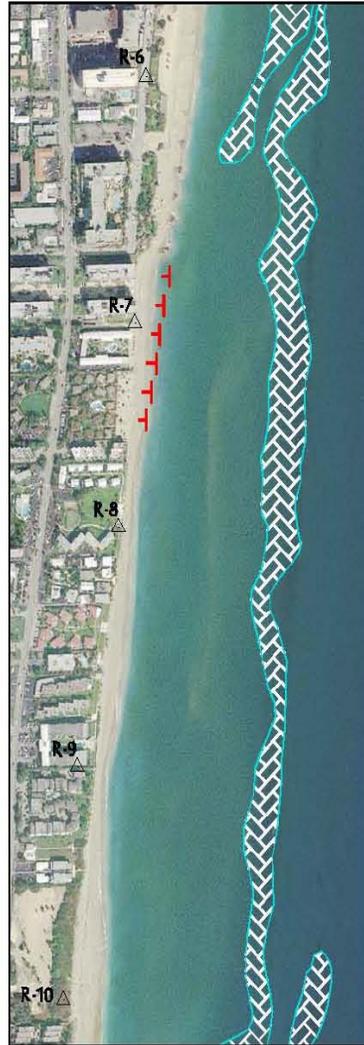
Groins



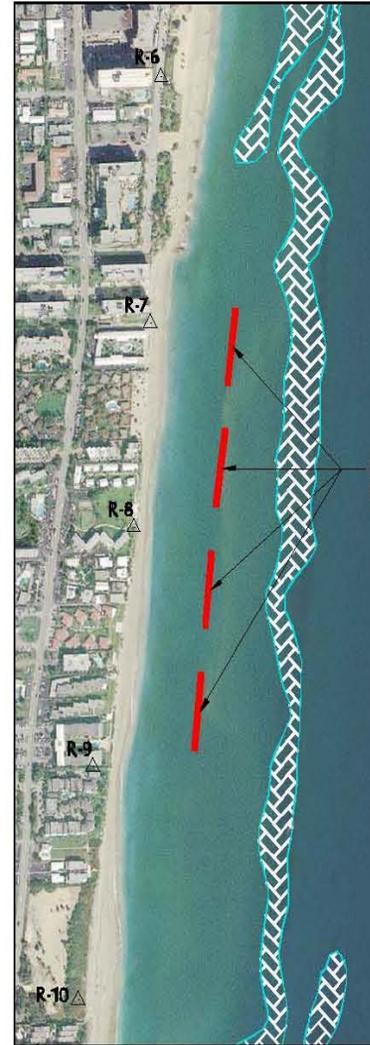
Shoreline Stabilization Alternatives



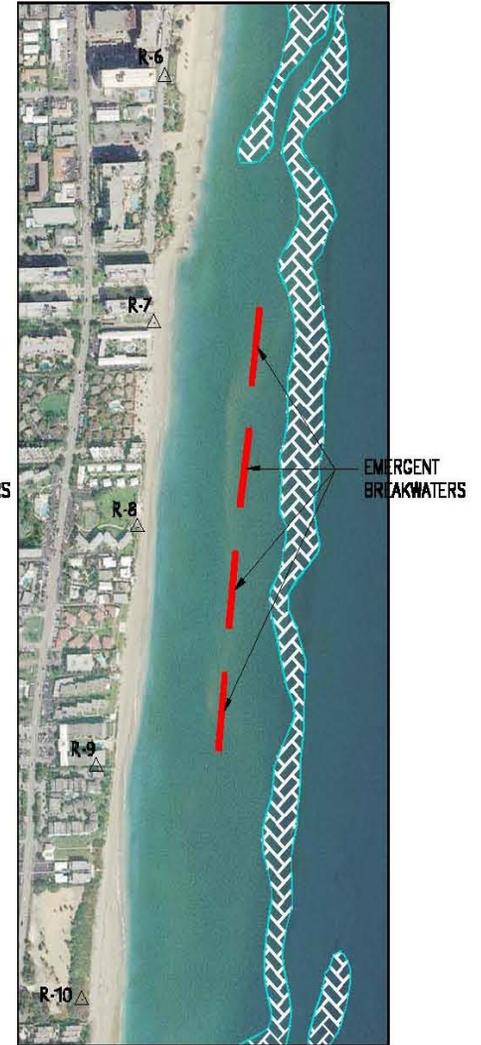
ALTERNATIVE 5A



ALTERNATIVE 5B

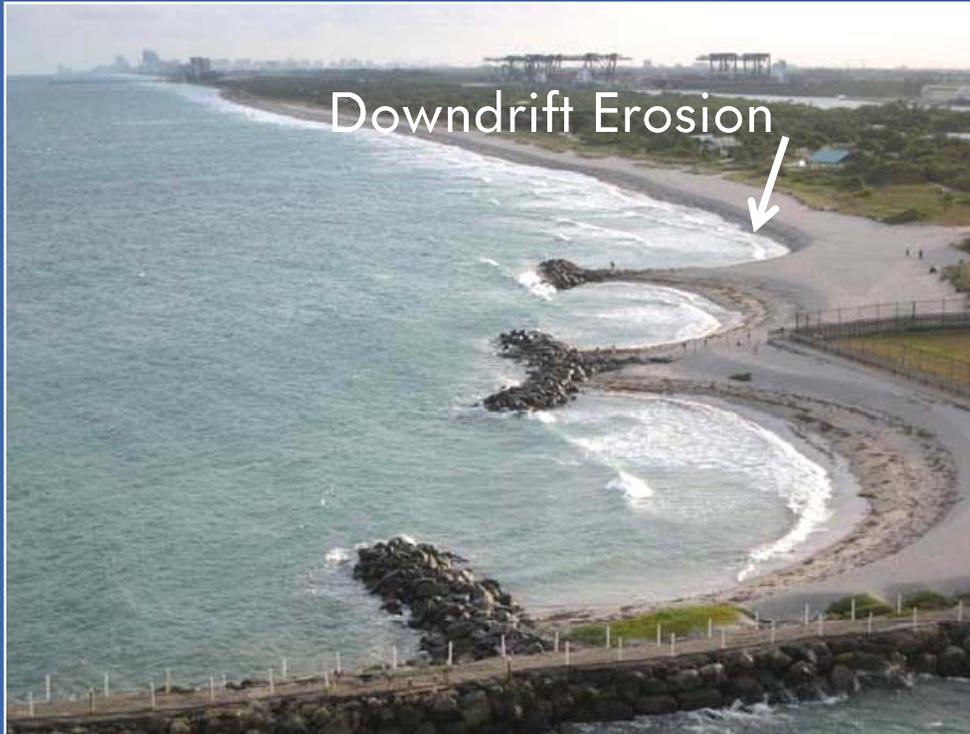


ALTERNATIVE 6A



ALTERNATIVE 6B

Alternatives 5a-6b



- Lack of Bypassing at Port Everglades
- Affect performance of coastal structures
- County and Corps of Engineers evaluating beaches in John U. Lloyd Park

Alternative 5 - T-Head Groins



Shoreline Stabilization Alternatives

- 32nd Street Nearshore Breakwaters, Miami Beach, Florida
- Aerial Photo – Post Construction 2002
- Designed by Coastal Systems
-



Alternative 6 – Emergent Breakwaters

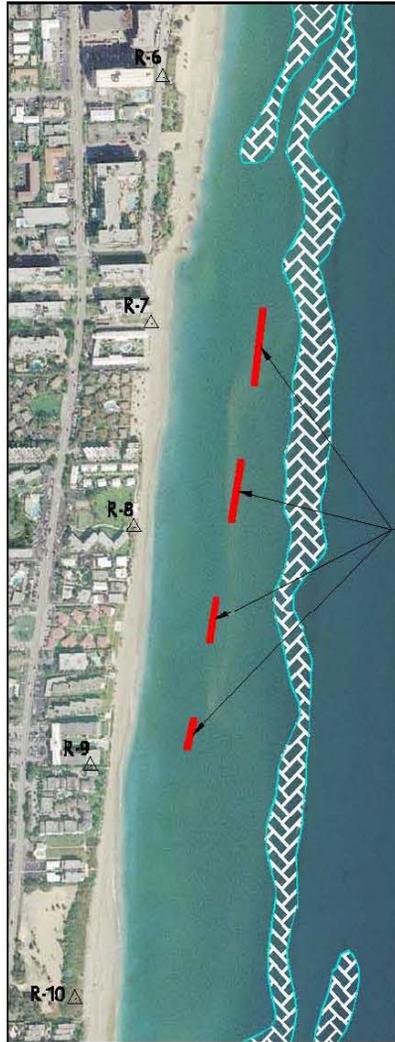


Shoreline Stabilization Alternatives

- 32nd Street Nearshore Breakwaters, Miami Beach, Florida
- Aerial Photo – 2011
- Coastal structures fully impounded with sand

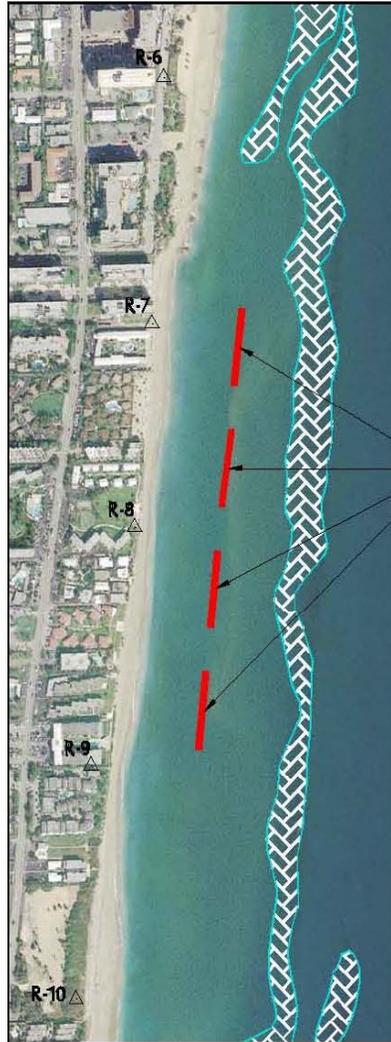


Alternative 6 – Emergent Breakwaters



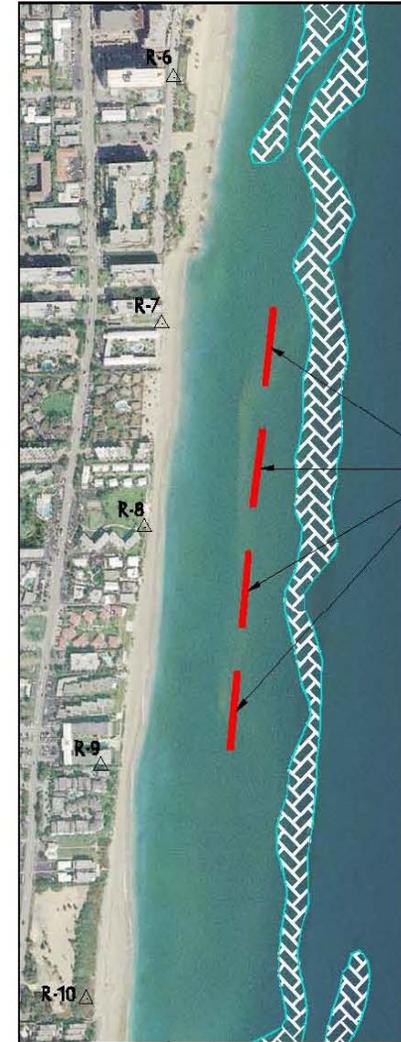
EMERGENT
BREAKWATERS

ALTERNATIVE 6C



SUBMERGED
BREAKWATERS

ALTERNATIVE 7A



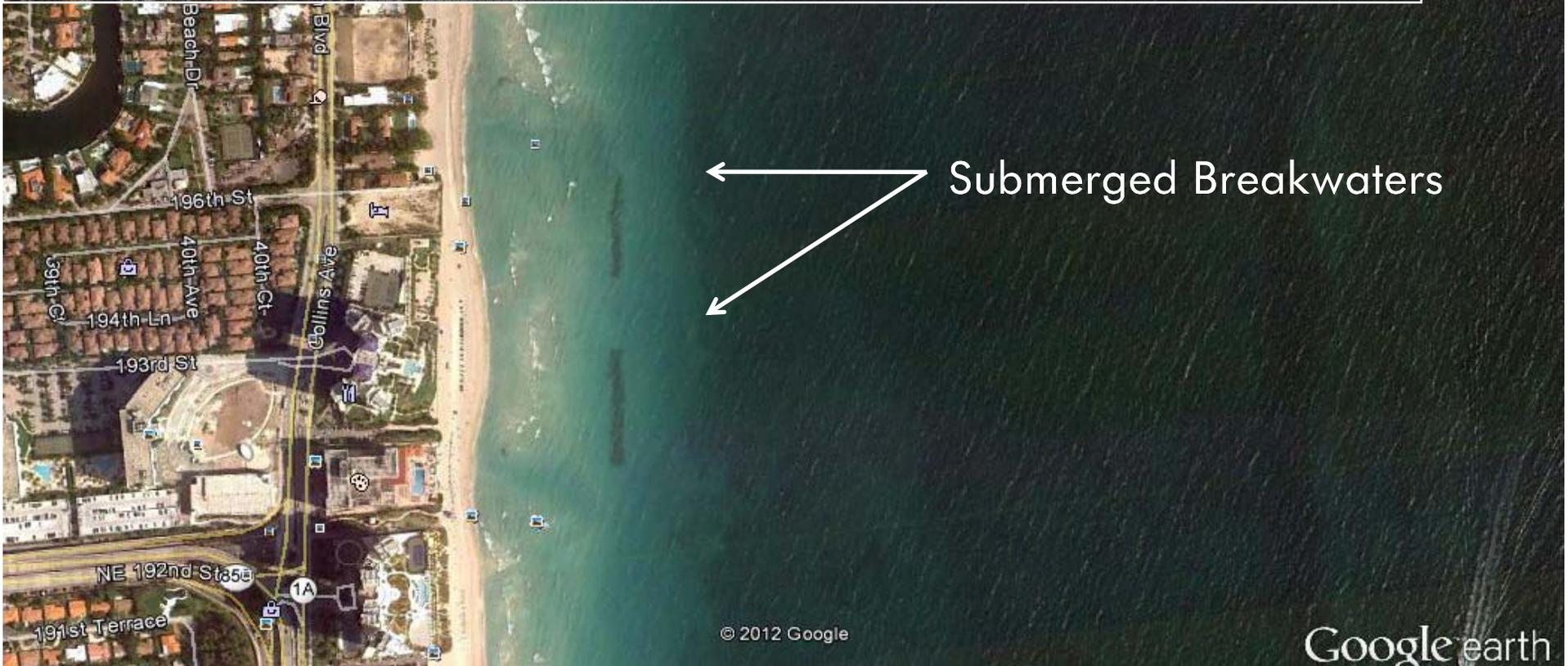
SUBMERGED
BREAKWATERS

ALTERNATIVE 7B



Shoreline Stabilization Alternatives

- Submerged Breakwaters - Sunny Isles – Miami-Dade County
- Aerial Photo – 2011
- Designed by the Corps of Engineers and constructed in 2001



Alternative 7 – Submerged Breakwaters

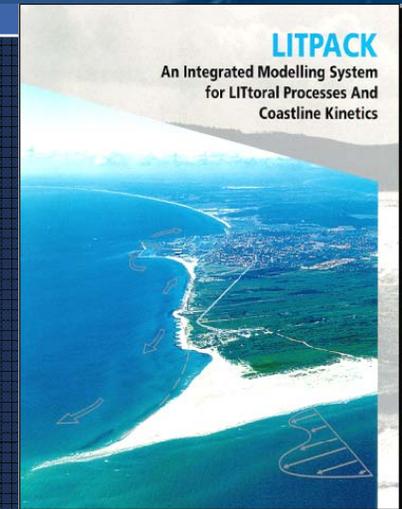


Numerical Modeling Approach

- DHI MIKE-21 Complete suite of models for coastal studies:

Morphological Modeling
Wave Modeling
Sediment Transport
Hydrodynamic

- Assessment of long-term shoreline response to coastal structures
- 20 Years of Development
- All software undergoes continuous development and is verified not only by DHI but also by professional users worldwide
- No other modeling package has been used for as many coastal/marine projects around the world as MIKE-21
- Coastal Systems – early user in U.S. since 1999





Worldwide Representative Project Applications of MIKE-21 and LITPACK:

- Thyboron Denmark – submerged groin extension (2005)
- Colywyn Bay Beach – Portugal (2011)
- Comandatuba Beach Resort – Brazil (2009)
- Piera, Greece – (2004)
- Artificial Reefs – German Baltic Sea Coast (2011)
- Coastline of Morocco
- Greys to Sunset Beach – Western Australia (2010)



Florida Project Applications of MIKE-21 and LITPACK:

- St. Lucie County Shoreline Study (2010)
- Town of Palm Beach Groin Study, Palm Beach County (2011)
- Indian River County Sector 3 Beach Nourishment (2008)

Projects Modeled by Coastal Systems:

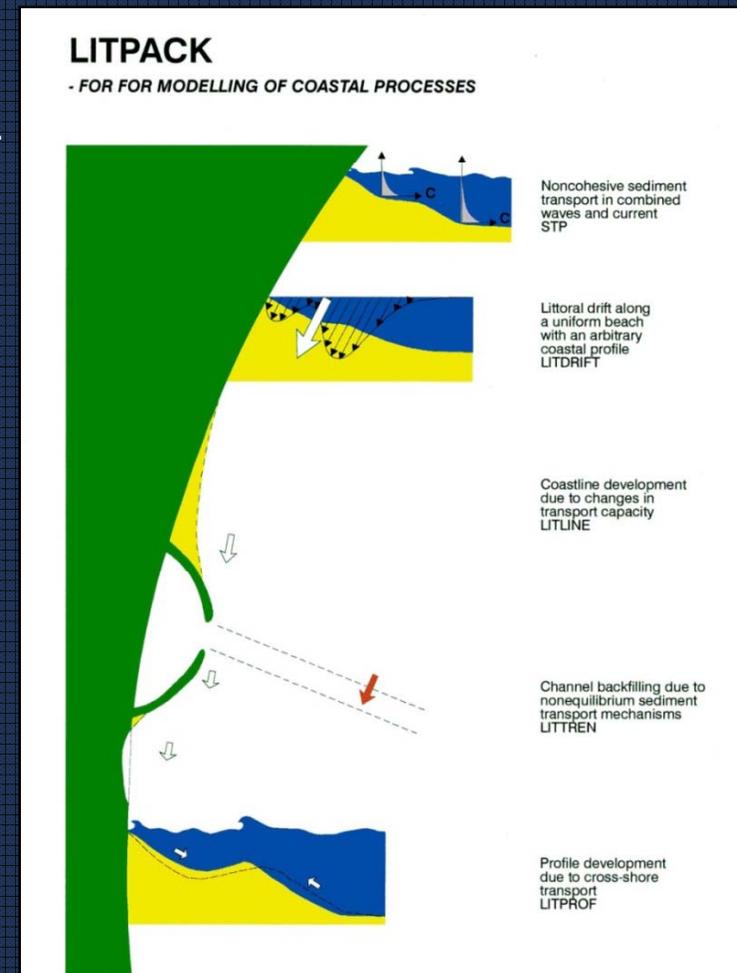
- Town of Palm Beach South End Beach Restoration (Reach 8), Palm Beach County (2011)
- Singer Island, Palm Beach County (2002)
- Miami Dade County, Bakers Haulover Inlet to Government Cut (2004)

LITLINE Modeling Summary

- LITLINE Module Part of LITPACK from DHI that includes STP, LITREN and LITPROF modules
- LITLINE Calculates coastline evolution for sediment transport
- Simulates the following shoreline and coastal structures:
 - Groins
 - Jetties
 - Revetments
 - Offshore (emergent) Breakwaters

Design of Optimization of coastal engineering projects

Efficient Simulation of Complex Coastal Problems





Numerical Modeling Approach

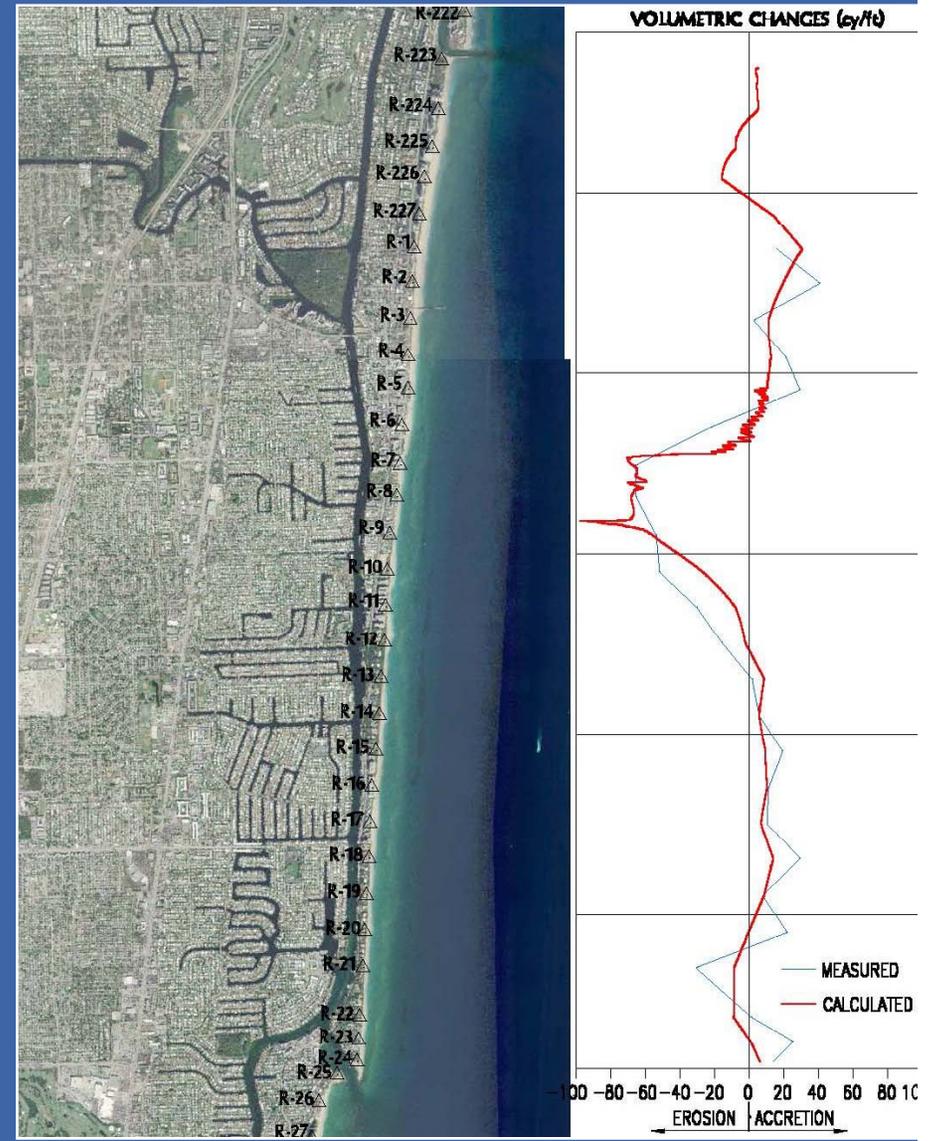
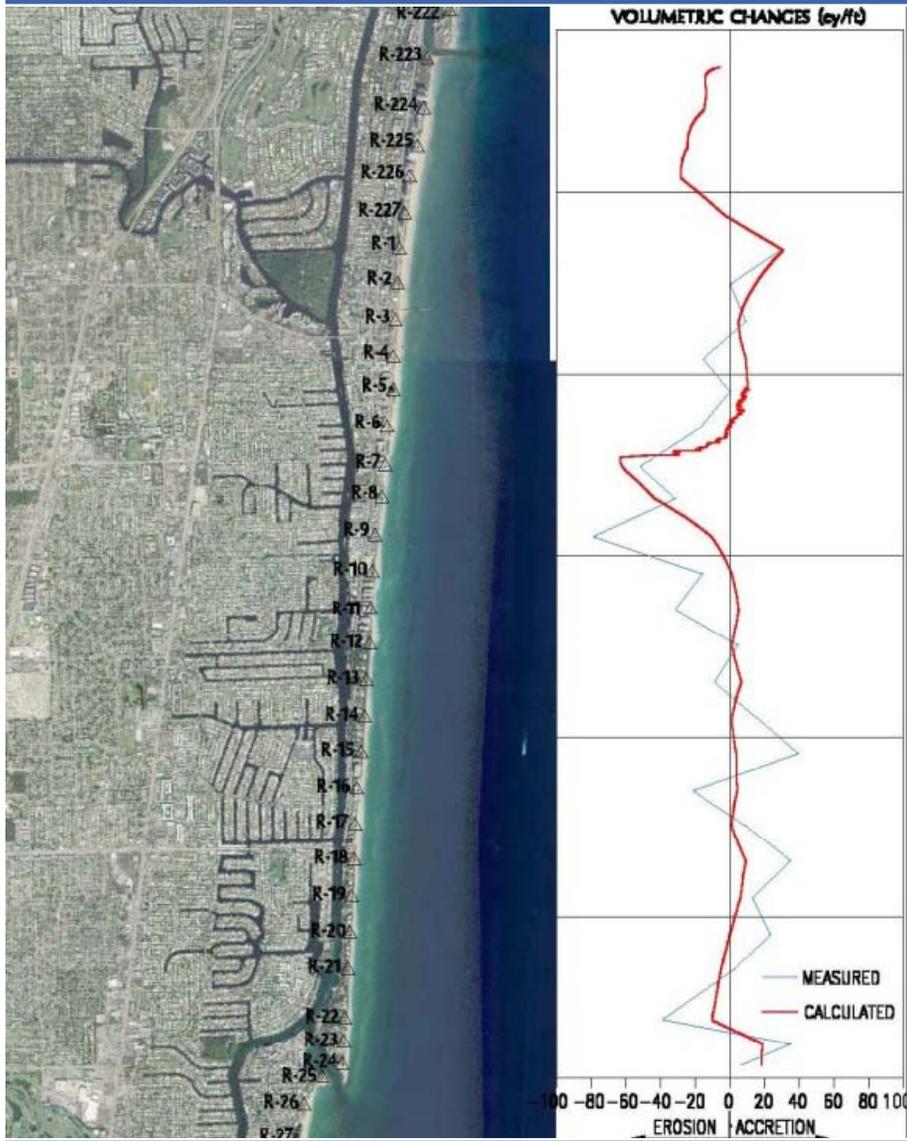
- Calibration Years 1999 – 2002 (3 years of data)
- Calibration Years 1999 – 2007 (8 years of data)
- LITLINE Calibration – *replicate measured data*
- Calibrate longshore sediment transport rates, historical shoreline positions, and volumetric changes
- LITLINE Note: assumes normal, annualized processes and continued bypassing at Boca Inlet



LITLINE Calibration



Numerical Modeling Approach

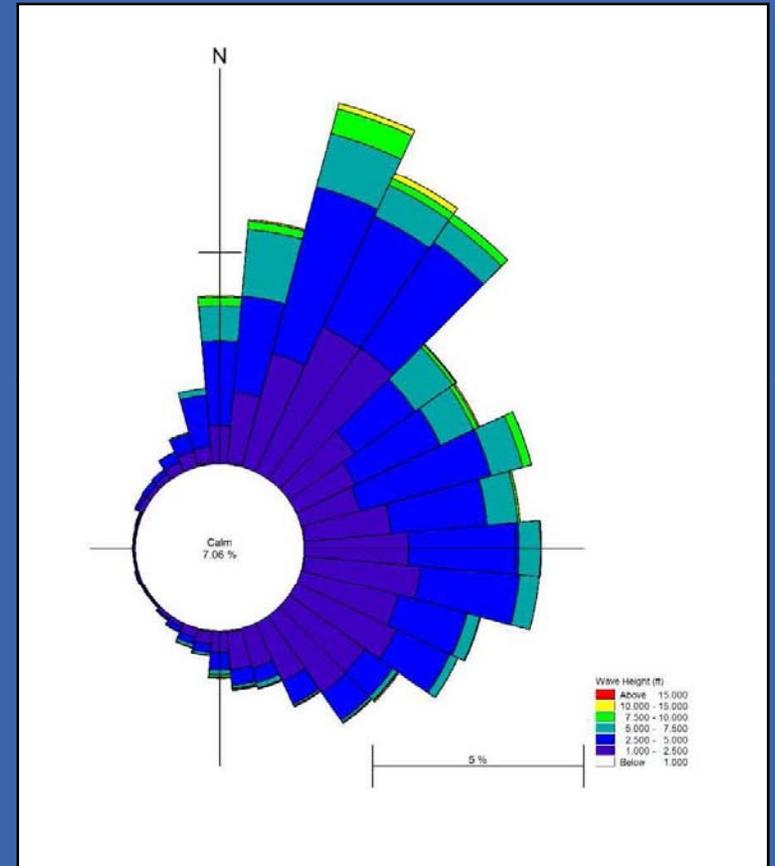
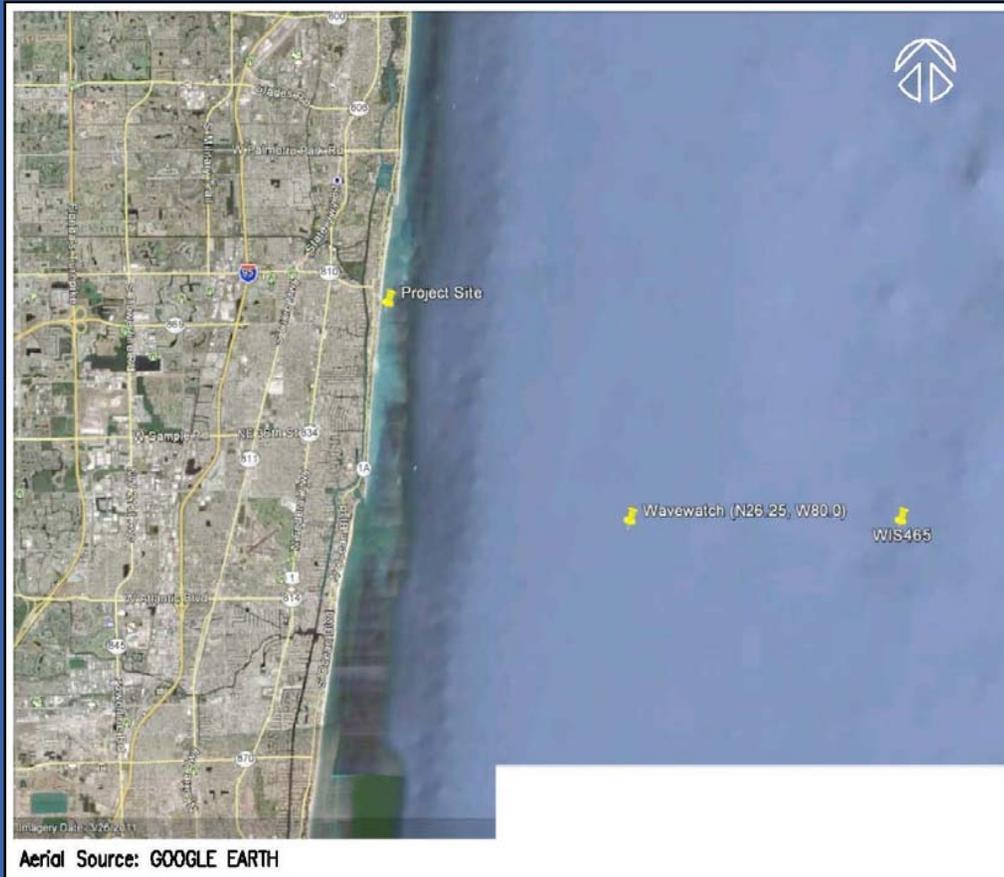


LITLINE Calibration

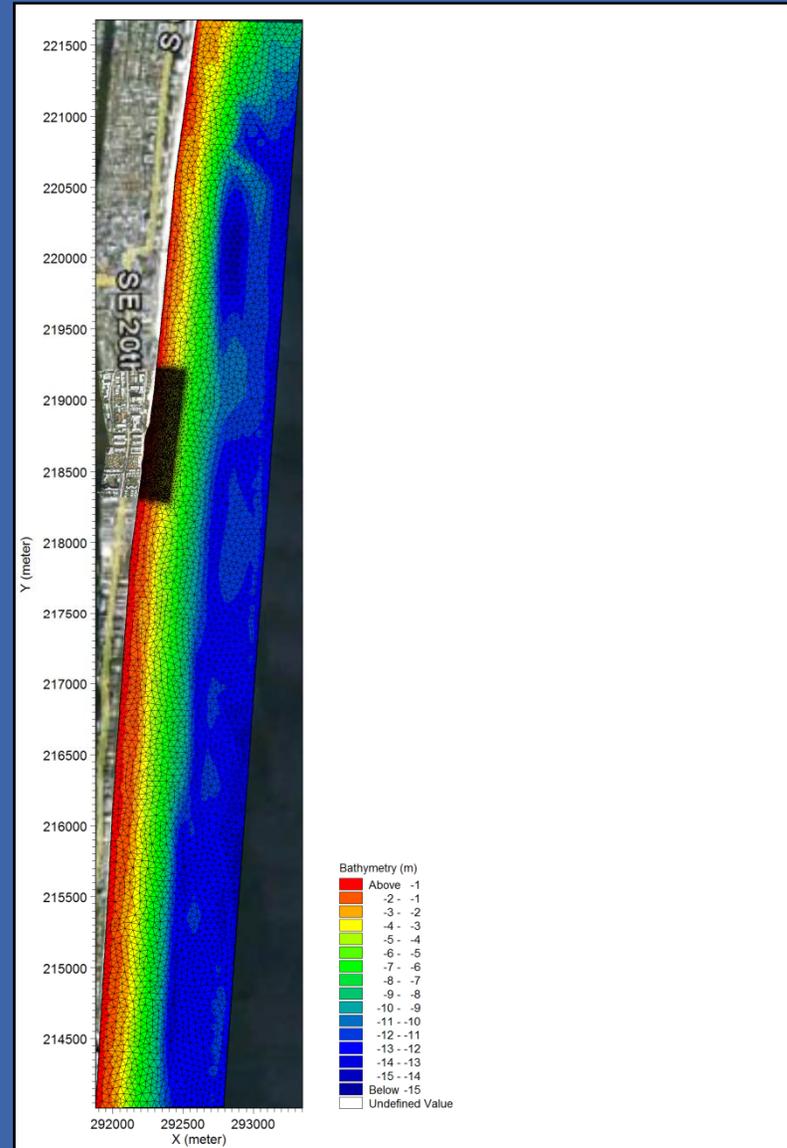
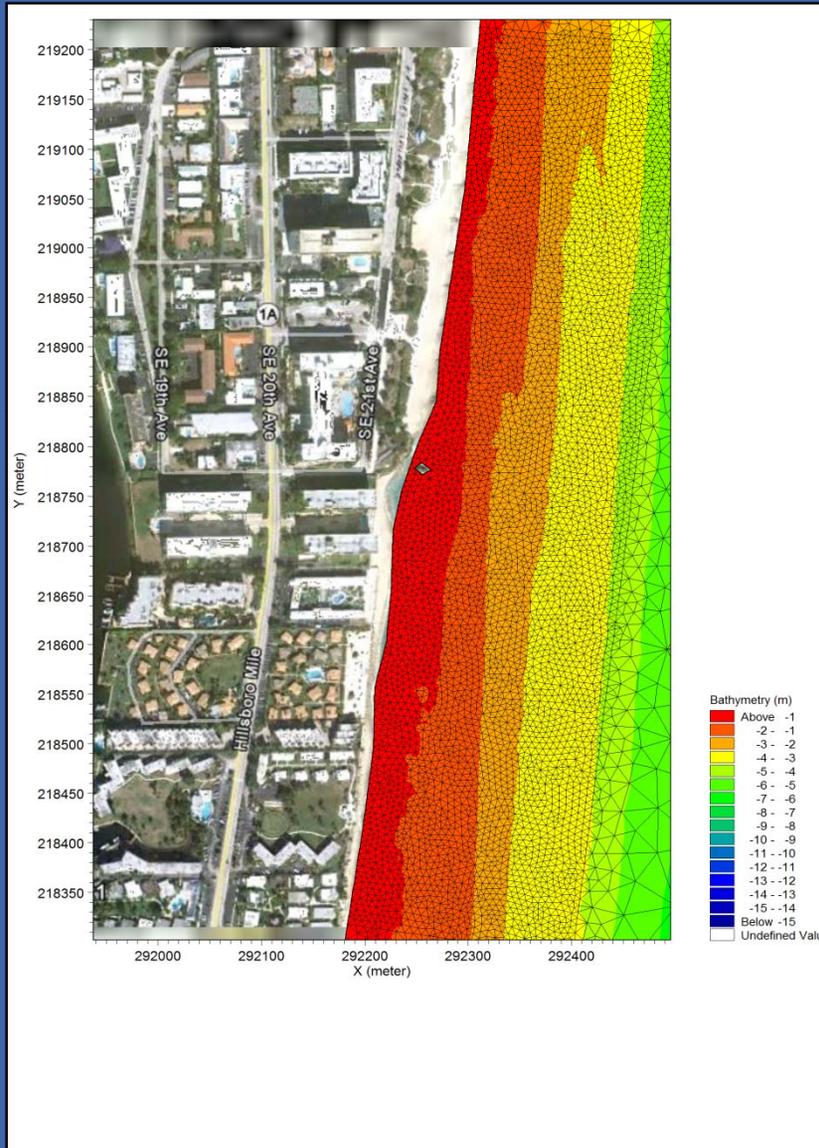


Numerical Modeling Approach

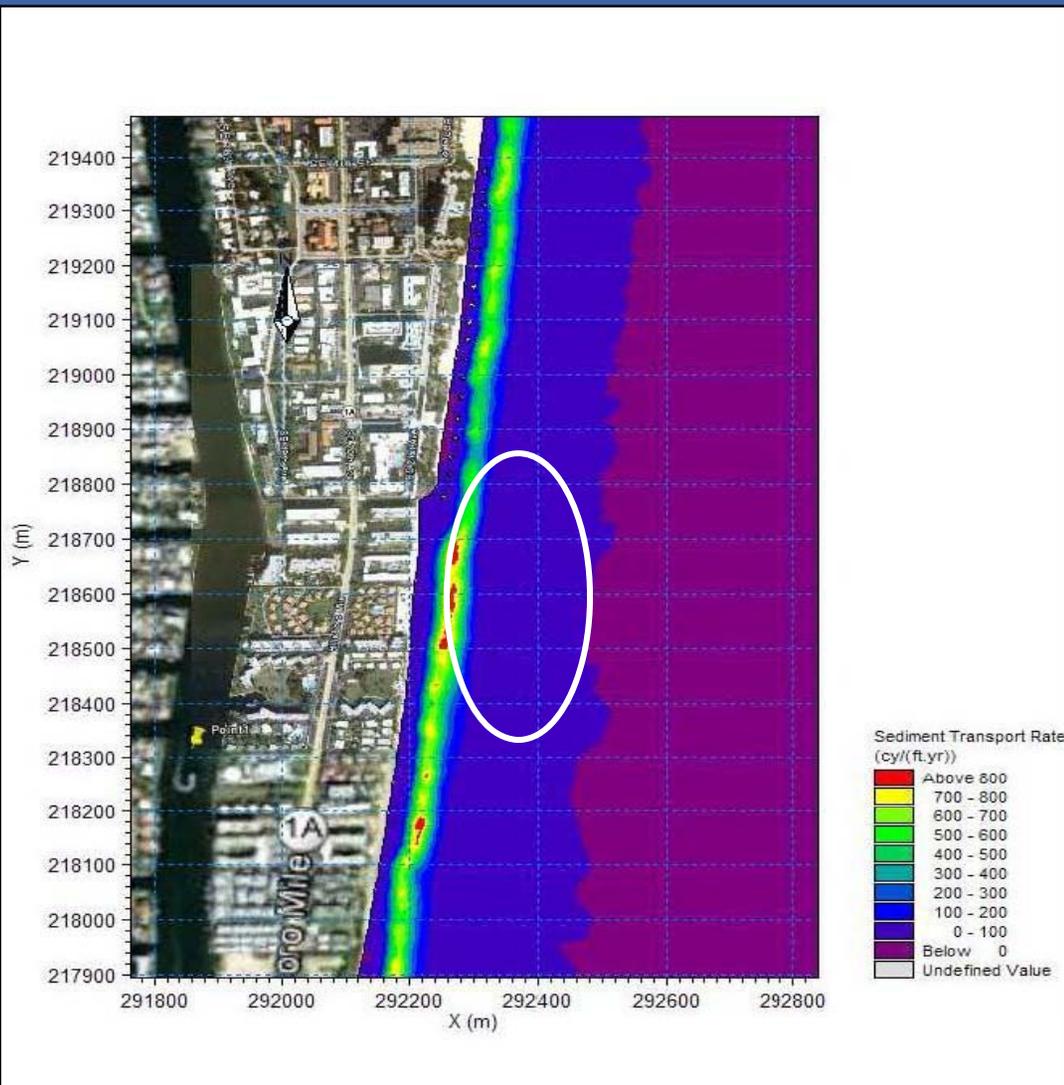
- Submerged Breakwaters not simulated with LITLINE Model
- Utilized MIKE 21 SW wave model coupled with HD (hydrodynamic model)
- Results of the nearshore wave and current modeling input into sediment transport model to estimate sediment transport rates



Wave Rose - Statistics from WIS 1980 – 1999 (19 years data)

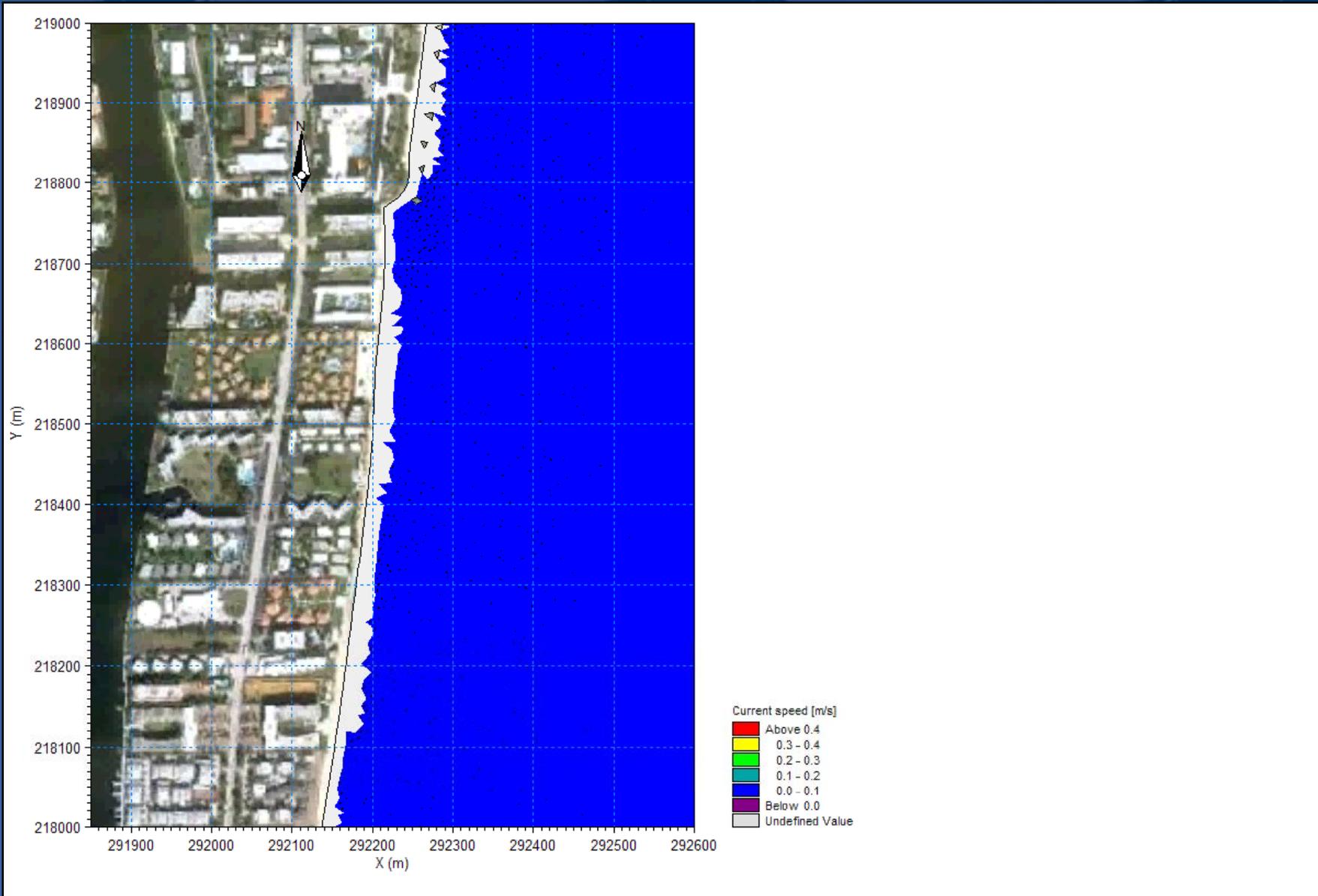


MIKE 21 Model - Mesh and Bathymetry



- High Sediment Transport Rate
- MIKE-21 Simulation Results consistent with beach measured data

Estimated Annual Sediment Transport Rate from MIKE-21 Modeling



Current Simulation – Existing Conditions

- 10-year simulation
- No sandy beach remaining
- Erosion to the seawall

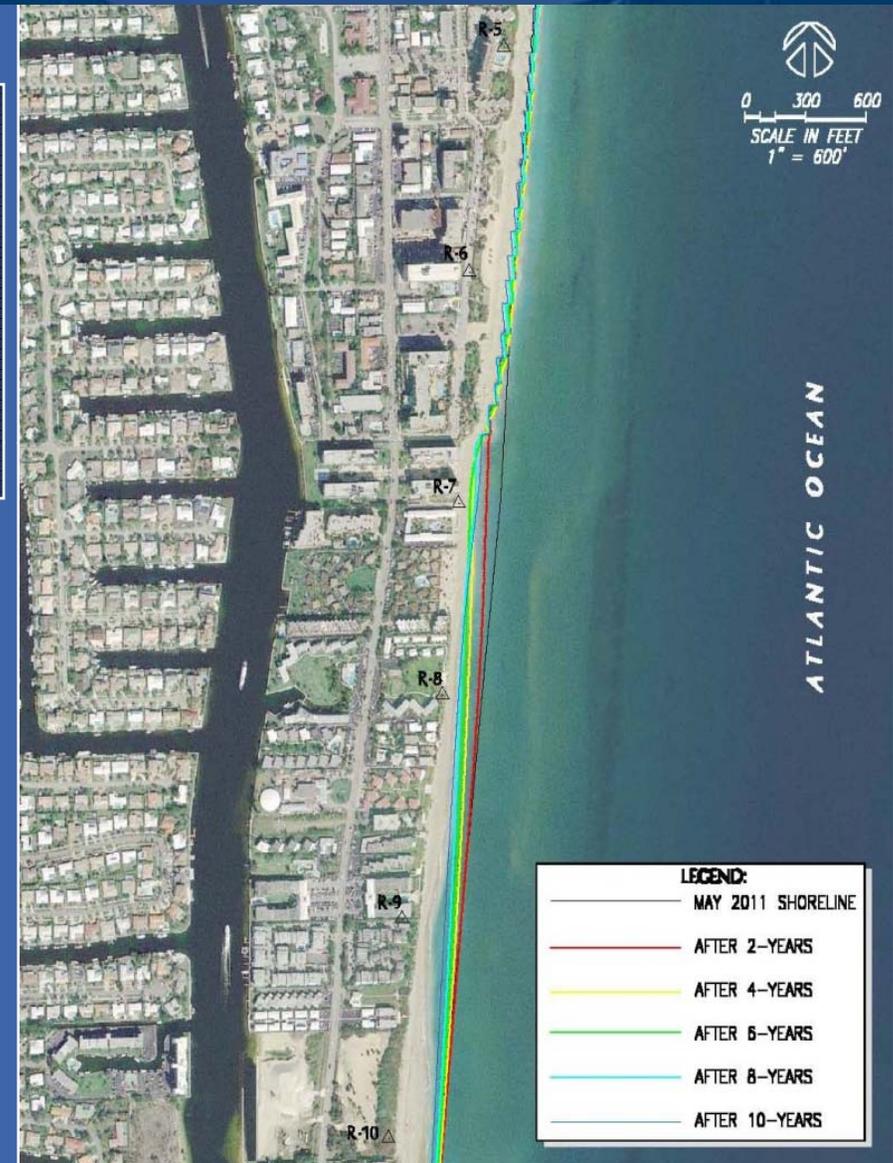


Option 1 – Do Nothing

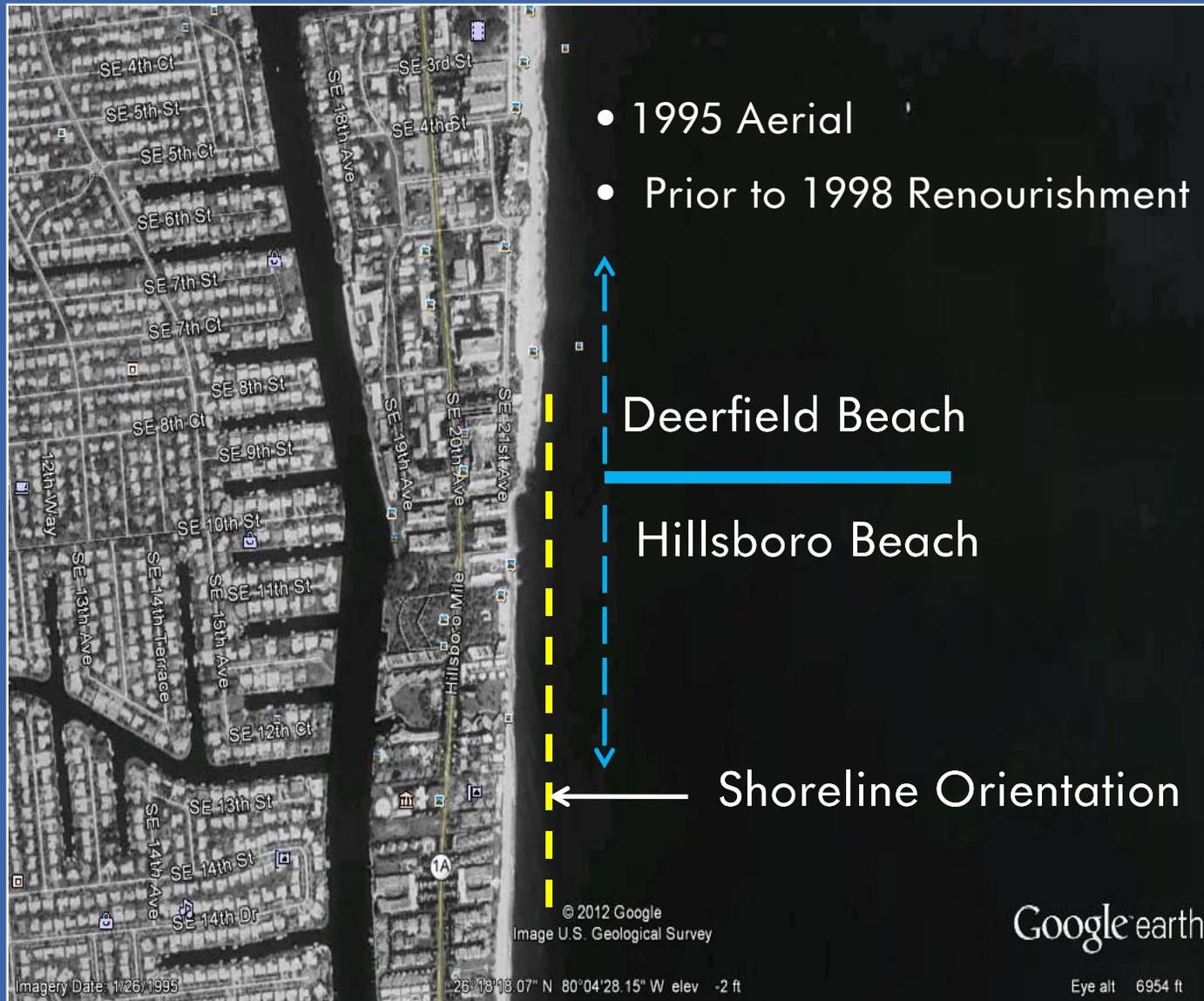


Modeling Results

- 10-year simulation
- Renourish every 4-6 Years
- 1997 Long Range Plan – every 8-10 years
- Viable Alternative



Option 2 – Continued Beach Nourishment



Option 3 & 4 Groin Modification Approach



Modeling Results



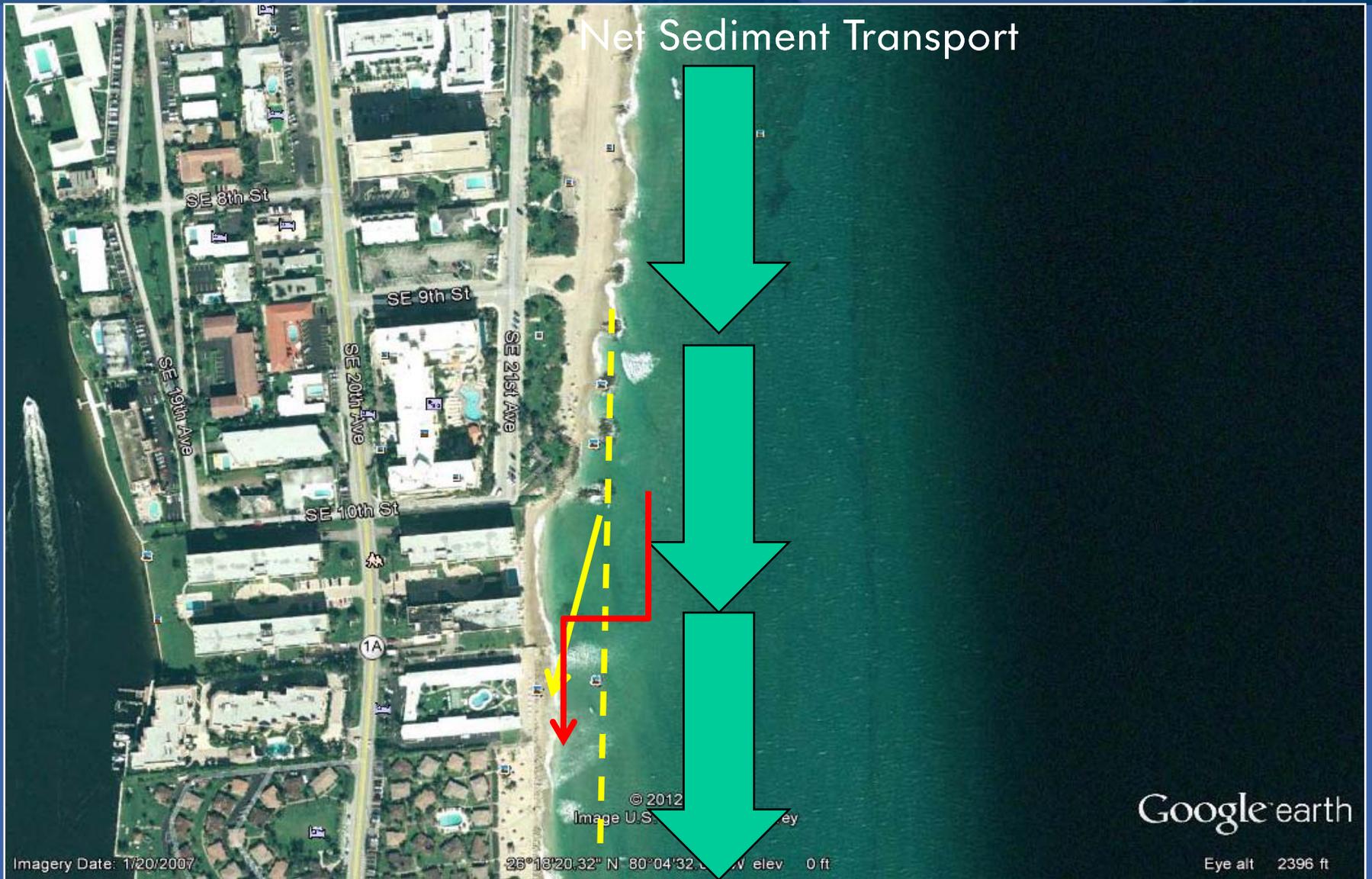
Option 3 & 4 Groin Modification Approach



Modeling Results



Option 3 & 4 – Groin Modification Approach



Option 3 & 4 – Groin Modification Approach

- 10-year simulation
- Taper southern 5 Groin Structures
- Modify approximately 25% of the groin field
- Still have to nourish beach every 4-6 years
- Not a viable Alternative

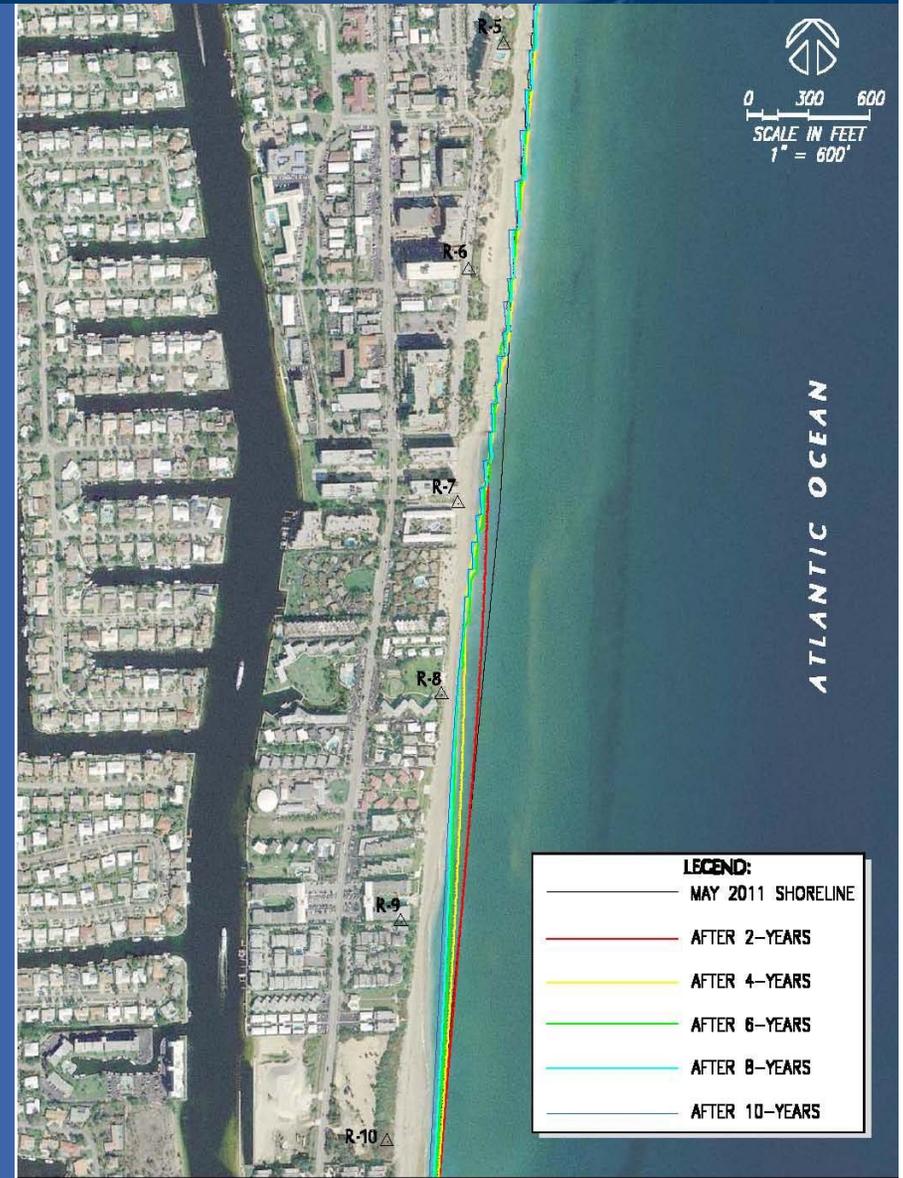
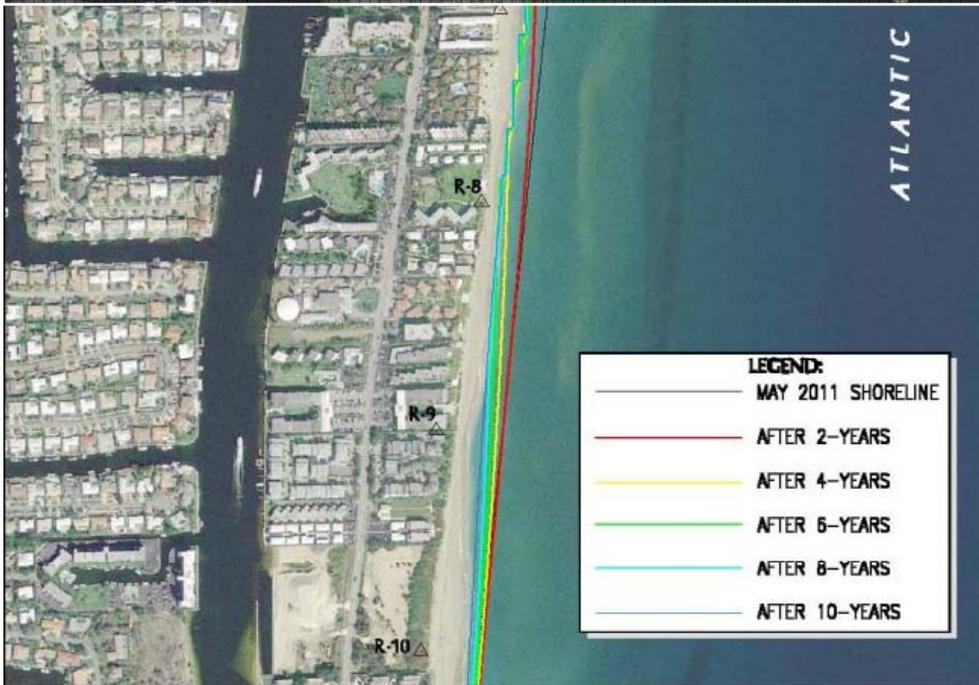


Alternative 3 – Modify Deerfield Groin Field



Modeling Results

- 10-year simulation
- Construct 9 groins – tapered (Alternative 4a)
- Construct 5 groins – tapered (Alternative 4b)
- Transfer of "Hot Spot" further downdrift (south)
- Still have to nourish beach every 4-6 years
- Not a viable Alternative

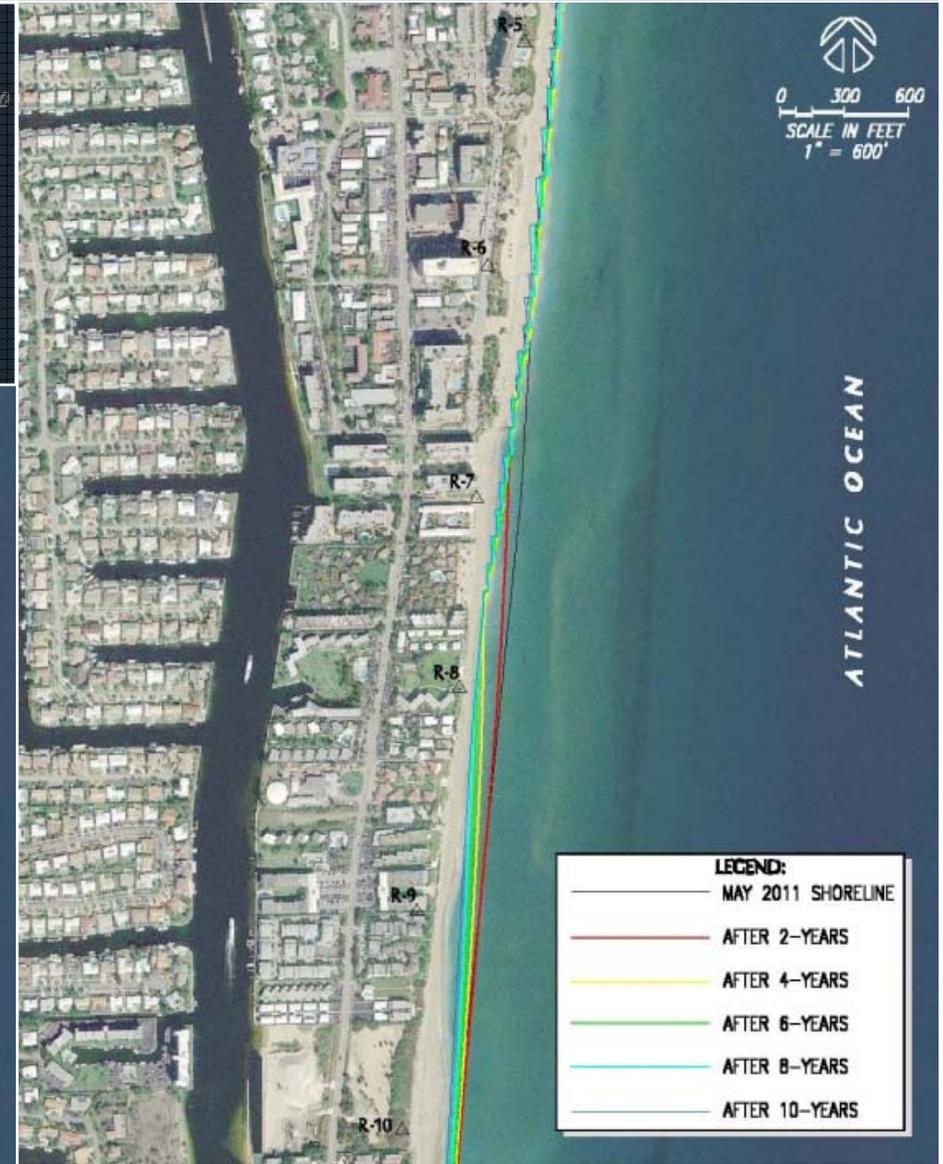


Alternatives 4a & 4b – Groin Field Extension into Hillsboro Beach



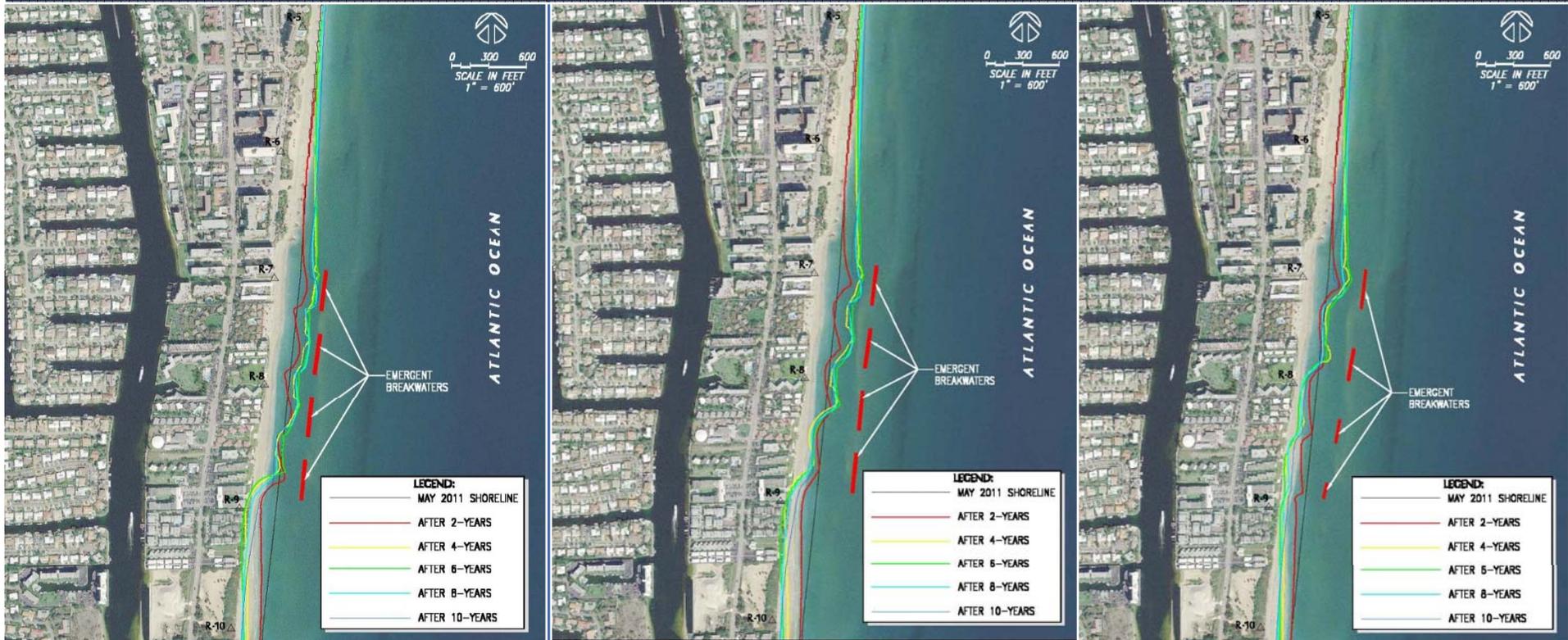
Modeling Results

- 10-year simulation
- Construct 9 T-Head Groins (Alternative 5a)
- Construct 6 T-Head Groins (Alternative 5b)
- Still have to nourish beach every 4-6 years
- Not a viable Alternative

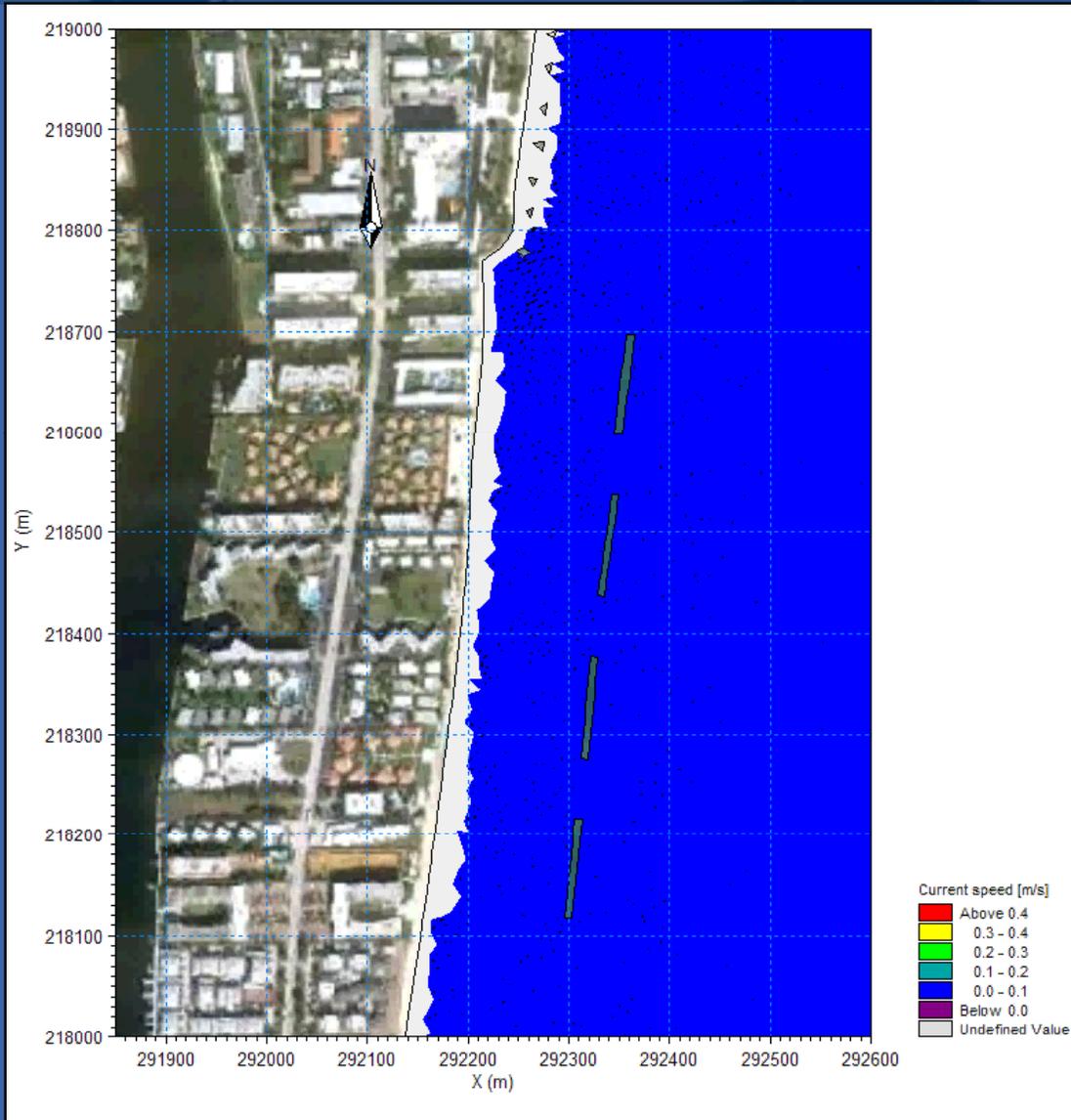


Alternatives 5a and 5b – T-Head Groins into Hillsboro Beach

- 10-year simulation
- Construct 4 variations of nearshore (emergent) breakwaters
- All options – transfer of hot spot further downdrift (south)
- Still have to nourish beach every 4 years
- Not a viable Alternative

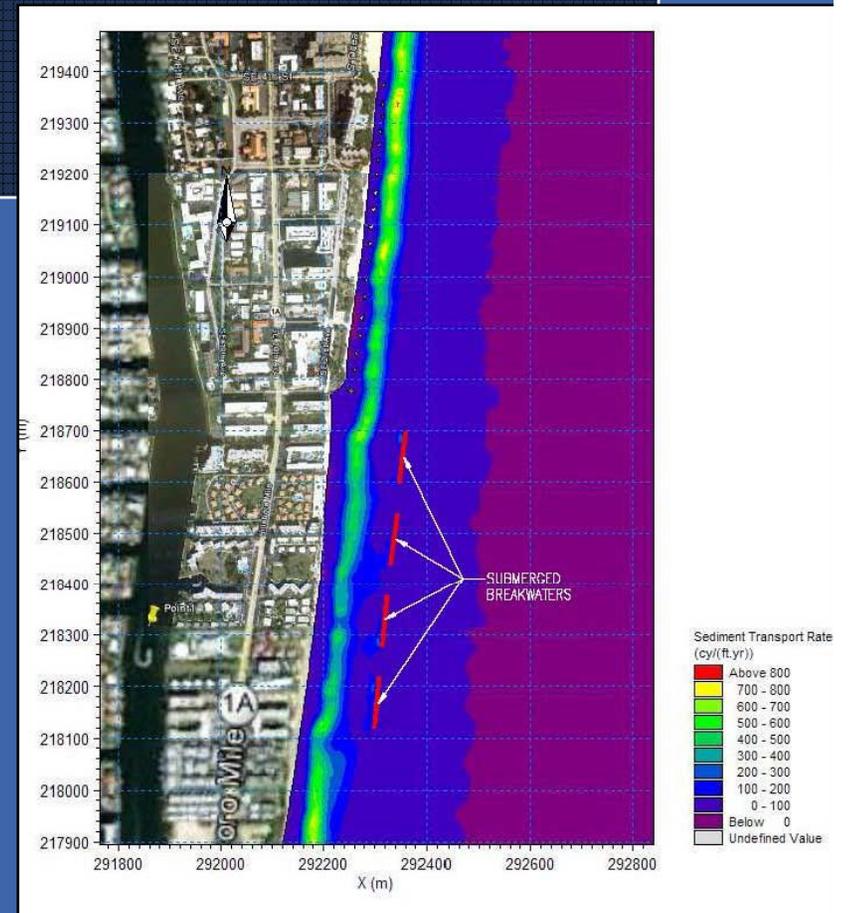
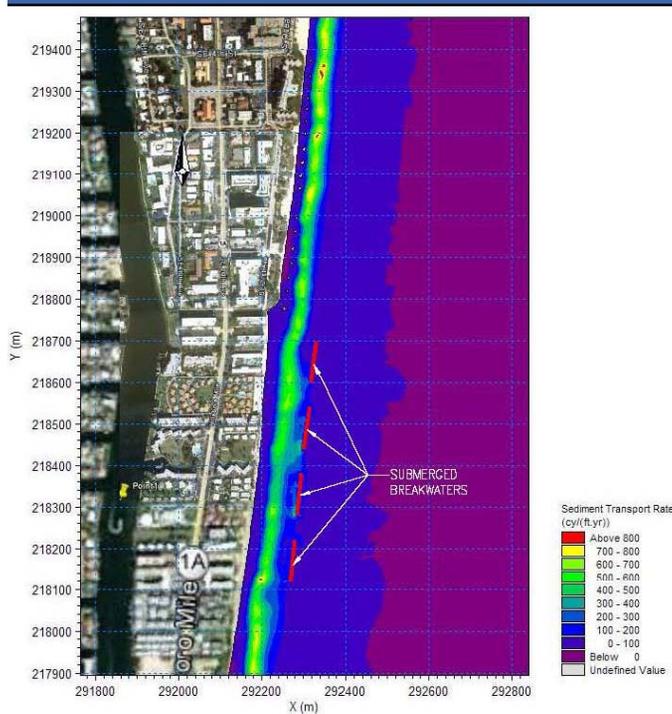


Alternatives 6a – 6c – Nearshore (Emergent) Breakwaters

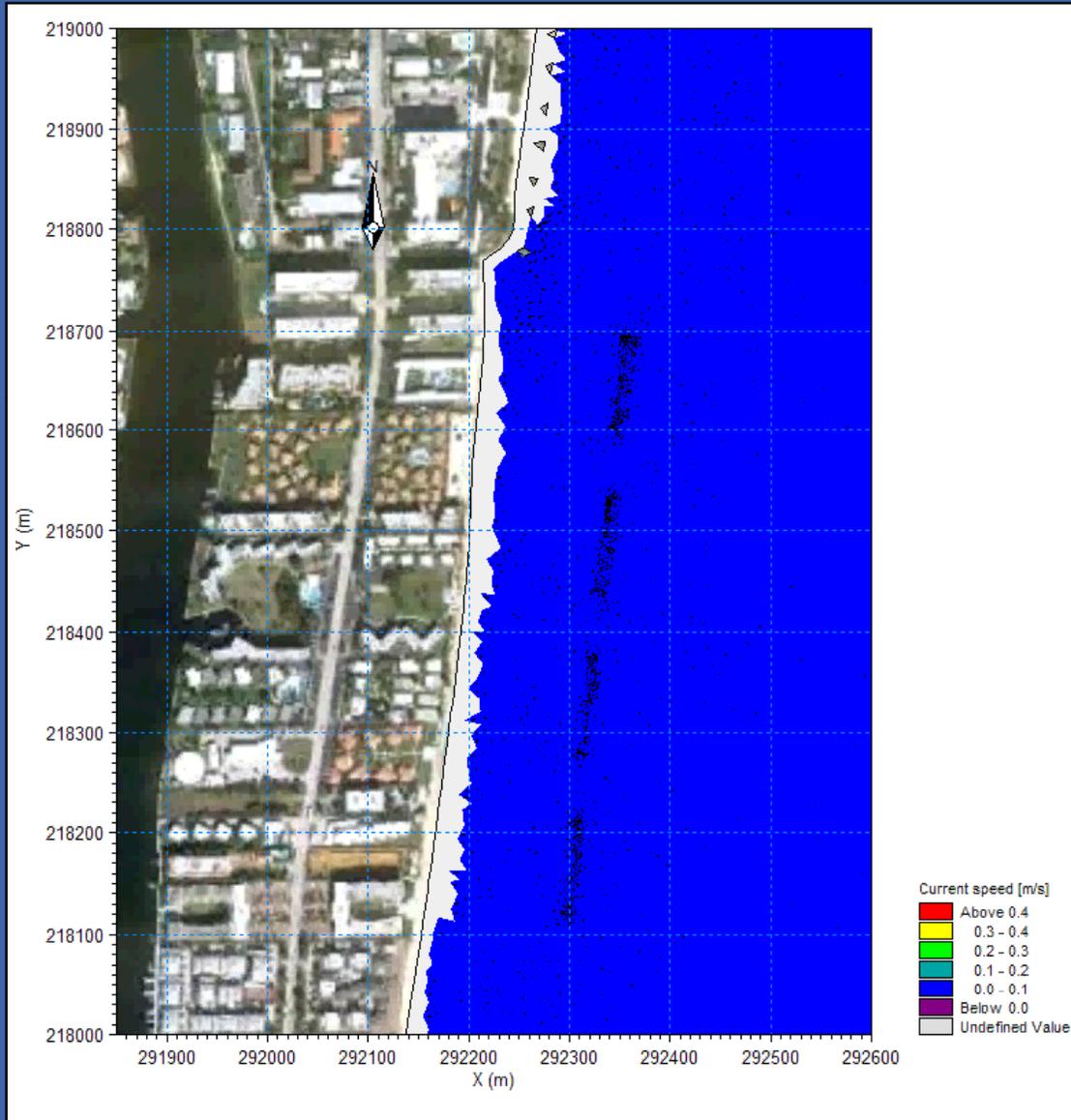


Alternative 6b – Current Simulation

- Construction of 4 submerged breakwaters
- Simulated with coupled MIKE-21 SW and HD Models
- Reduce sediment transport 20% for Alternative 7b
- Minimal downdrift impacts
- Viable Alternative



Alternatives 7a & 7b - Submerged Breakwaters



Alternative 7b – Current Simulation

- Summary of Modeling Results – Viable Alternatives

Twelve Alternatives Simulated with coastal process numerical modeling

- Viable Alternatives:

Alternative 2 - Continued Beach Renourishment

Alternative 7b – Submerged Breakwater



Environmental Permitting Feasibility

- Joint Coastal Permitting – federal and state agencies with jurisdiction (U.S. Army Corps of Engineers, Florida Department of Environmental Protection)
- Broward County EPGMD Permit
- Environmental Permits were issued for the 2011 beach renourishment project
- Anticipate 1-2 year process
- Avoidance of impacts to nearshore hardbottom
- Sand Source



Environmental Permitting Feasibility

- Section 5 and 6 of Report
- Joint Coastal Permitting – federal and state agencies with jurisdiction (U.S. Army Corps of Engineers, Florida Department of Environmental Protection)
- Broward County EPGMD
- Coastal structures difficult, if not impossible, to permit in Florida
- Precedent projects in Florida – areas with high erosion or at inlets
- Extensive opposition to permits can be expected from certain commenting agencies and NGO's
- Estimated Time Frame 3-6 years

Alternative 7b – Submerged Breakwaters



- Alternative 2 Continued Beach Renourishment
 - Evaluate Sand Sources – upland and offshore
 - Economic Analysis on nourishment Frequency, sources of funding
- Alternative 7b Coastal Structures
 - Conduct Pre-Application Meetings with Agencies
 - Outline a strategy for funding, design/permitting
 - Support needed – lobbying and legal
 - Cost/Benefit analysis for coastal structures
 - Detailed Numerical Modeling and Coastal Engineering



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