35 Years of Beach Management on Marco Island

FL Shore & Beach Preservation
Annual Conference
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COASTAL ENGINEERING CONSULTANTS INC

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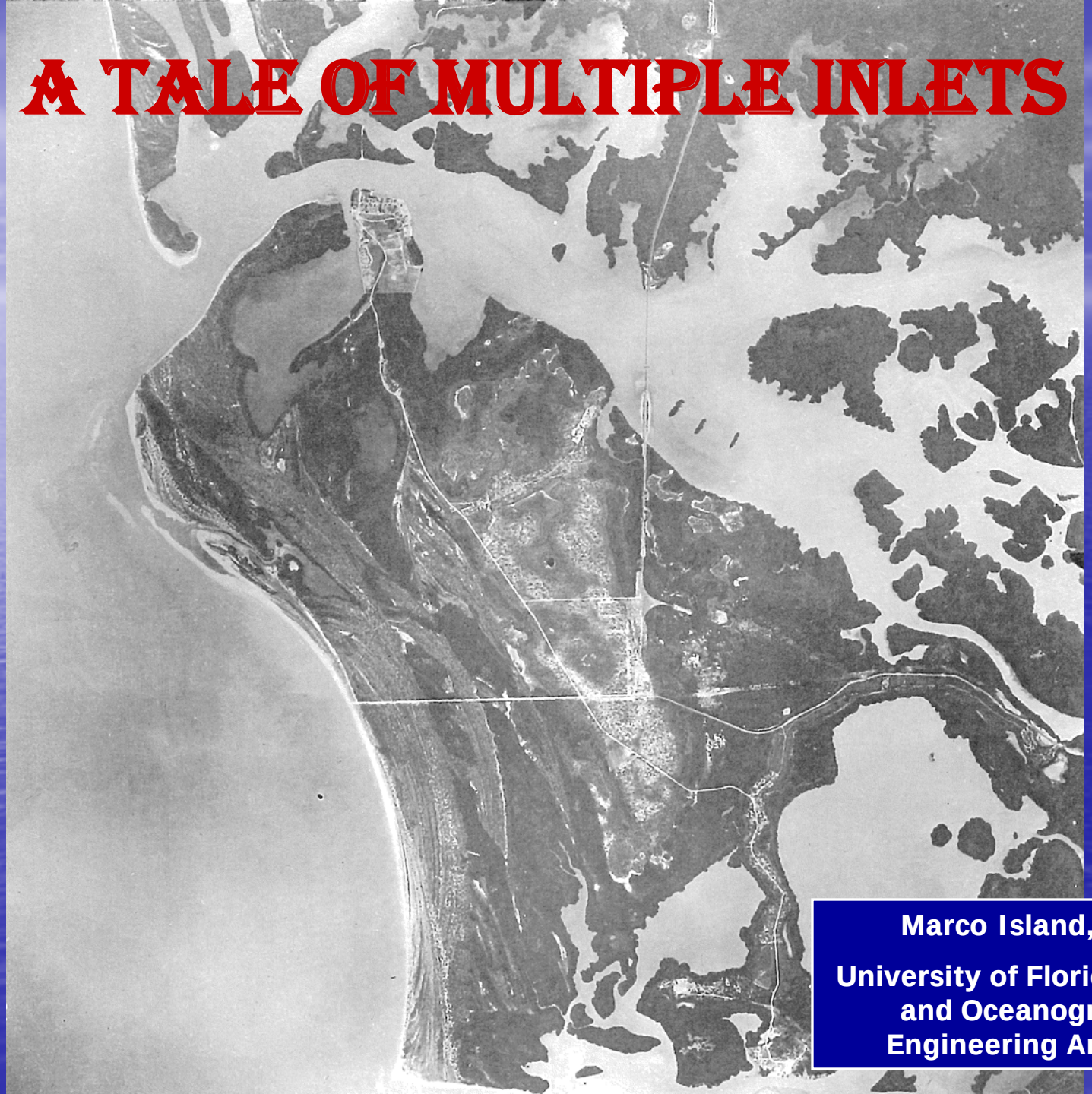
OUTLINE

- Photographic Journey through Time
- A Tale of Three Inlets
- Original Beach Management Plan
- North Beach Erosion Control Project
- South Marco Beach Renourishment Project

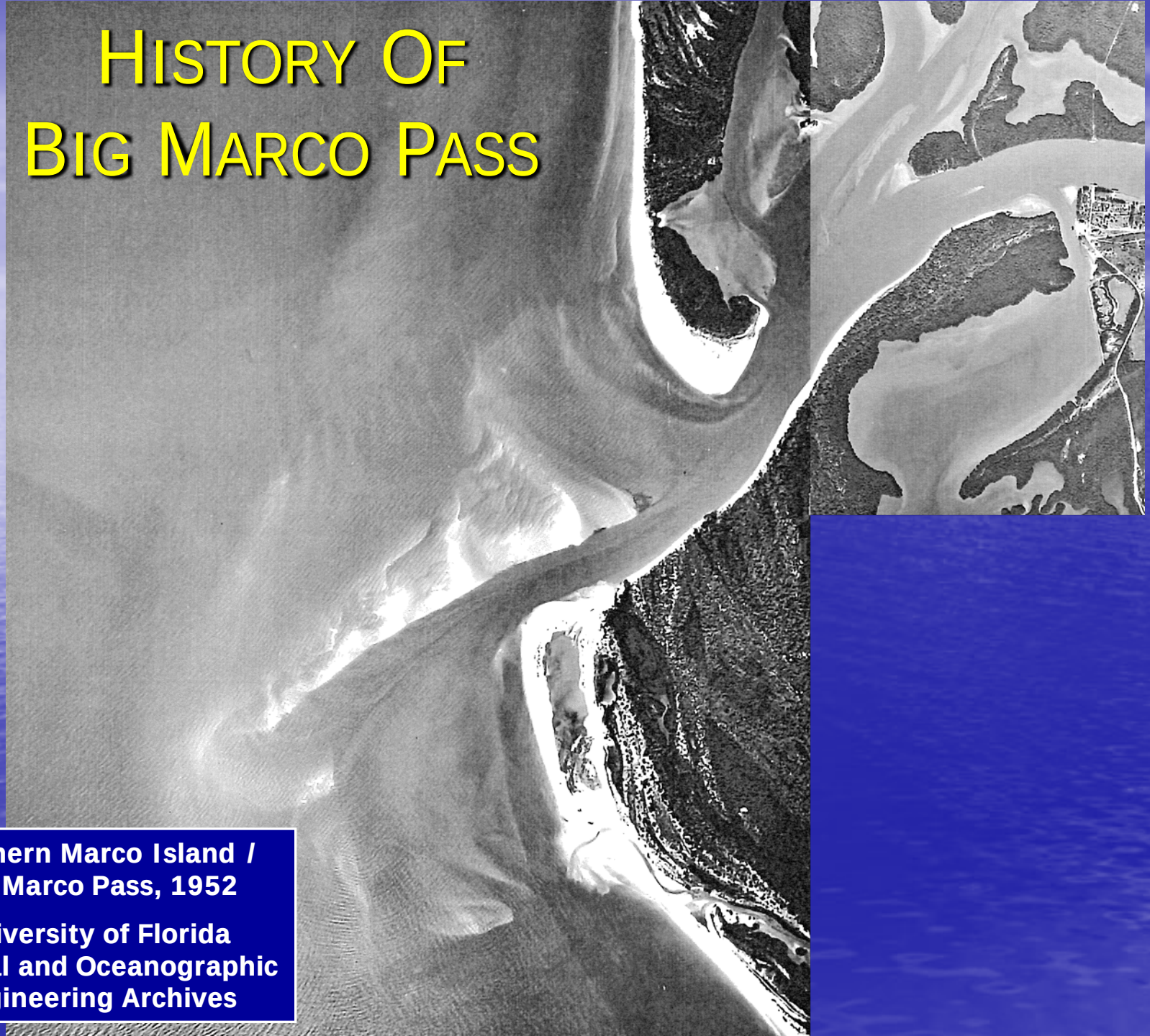
A TALE OF MULTIPLE INLETS



Marco Island, 1940

University of Florida Coastal and Oceanographic Engineering Archives

History Of Big Marco Pass



Northern Marco Island / Big Marco Pass, 1952

University of Florida Coastal and Oceanographic Engineering Archives

Southern Keewaydin to Northern Marco Island/ Little Marco, Capri and Big Marco Pass, 1969

University of Florida Coastal and Oceanographic Engineering Archives

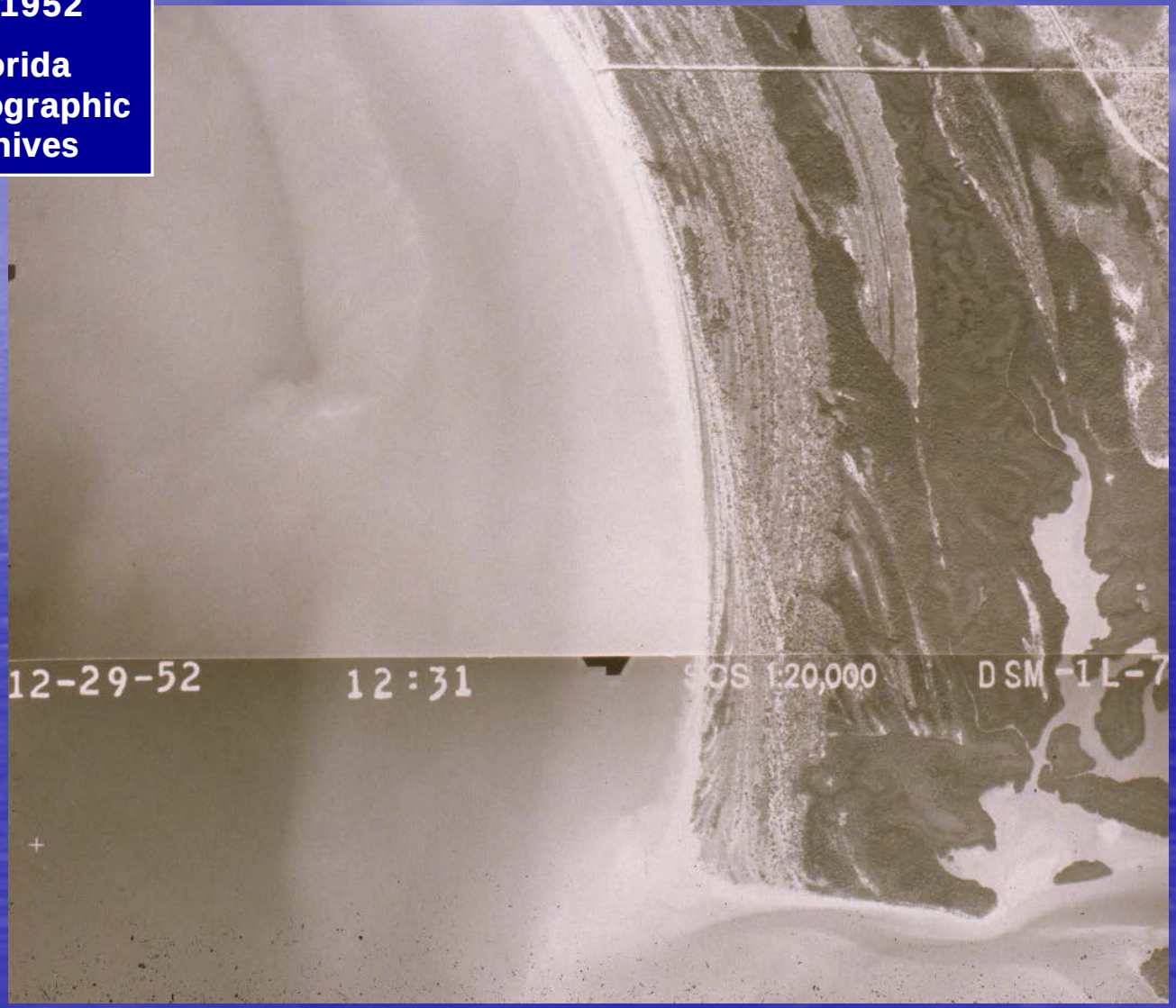
Northern Marco Island / Capri and Big Marco Pass, 1990

Florida Department of Transportation

History Of Caxambas Pass

Southern Marco Island / Caxambas Pass, 1952

University of Florida Coastal and Oceanographic Engineering Archives



1967

Southern Marco Island / Caxambas Pass, 1990

Collier County / CEC

Original Beach Management Plan Timeline

- 1977-79 Stephen's Dissertation on Caxambas Pass
- 1984-85 Local Beach Committee Formed
- 1986 Initial Engineering Report: regional erosion analysis, beach fill conceptual designs, nearshore hardbottom and resources mapping, and sand source search
- 1986-89 MSTU Established Project Funding
- 1987-88 Design and Permitting
- 1989 Appeal / Administrative Hearing
- 1990-91 Bid Process & Construction

Beach Management Plan Design Premises

- Restore gulf-front beach in two discrete segments, allowing natural processes to “fill” Central Beach
- Install nearshore breakwaters to mimic former protective ebb shoal / manage wave energy at southern end of gulf-front beach to address anthropogenic impacts
- Install terminal groins at end of littoral cell to prolong beach fill life
- Identify sand sources within inlet ebb shoals – provide high-quality, cost-effective beach fill and enhance navigation

Beach Management Plan Design Premises

The 1990-1991 Restoration Project

Pre-Con
1988

Post-Con
1991

The 1990-1991 Restoration Project

- Initial Restoration of 2.5 miles of critically eroding beaches
- Hideaway Beach
  - Placed ~ 70,000 CY from Big Marco / Capri Pass Shoal
- Tigertail – Central Beach
  - Placed ~ 570,000 on Gulf-front beach from Big Marco / Capri Pass Shoal
  - Advanced Shoreline ~ 290 feet
- South Beach
  - Placed ~575,000 CY from Caxambas Pass Shoal
  - Advanced Shoreline ~250 feet
  - Installed Two Terminal Groins
  - Breakwaters installation delayed via permit requirements

Hideaway Beach Management History

- 1997: Temporary Geotextile T-Groin Construction
  - Two (2) at South Point and three (3) at Royal Marco Point
- 2001: Dredging of Collier Bay Entrance
  - 24,100 cy removed and placed along the beaches
- 2005: Rock / Steel Sheet Pile T-Groin Construction
  - Original temporary T-Groins removed
  - Five (5) at South Point and five (5) at Royal Marco Point
  - Terminal jetty constructed at entrance to Collier Bay
  - 136,350 cy placed along South Point

Hideaway Beach Management History

- 2008: Emergency Revetment Construction
  - Between South Point and Royal Marco Point
- 2010: Additional Rock T-Groin Construction
  - Six (6) more between South Point and Royal Marco Point
  - 130,000 cy placed along new T-Groin field
- 2010-2011: North Beach Project Alternatives Analysis
- 2012: Emergency Dredging of Collier Bay Entrance
  - 9,000 cy removed and placed along North Beach
- 2012: Design and Permitting for North Beach

South Marco Beach Management History

- 1996: Breakwaters Installed
- 1997: First renourishment
  - Placed ~ 60,000 CY from Caxambas Pass Channel
- 1998-99: Truck Hauls
  - Placed ~12,000 CY to Restore Dry Recreational Beach

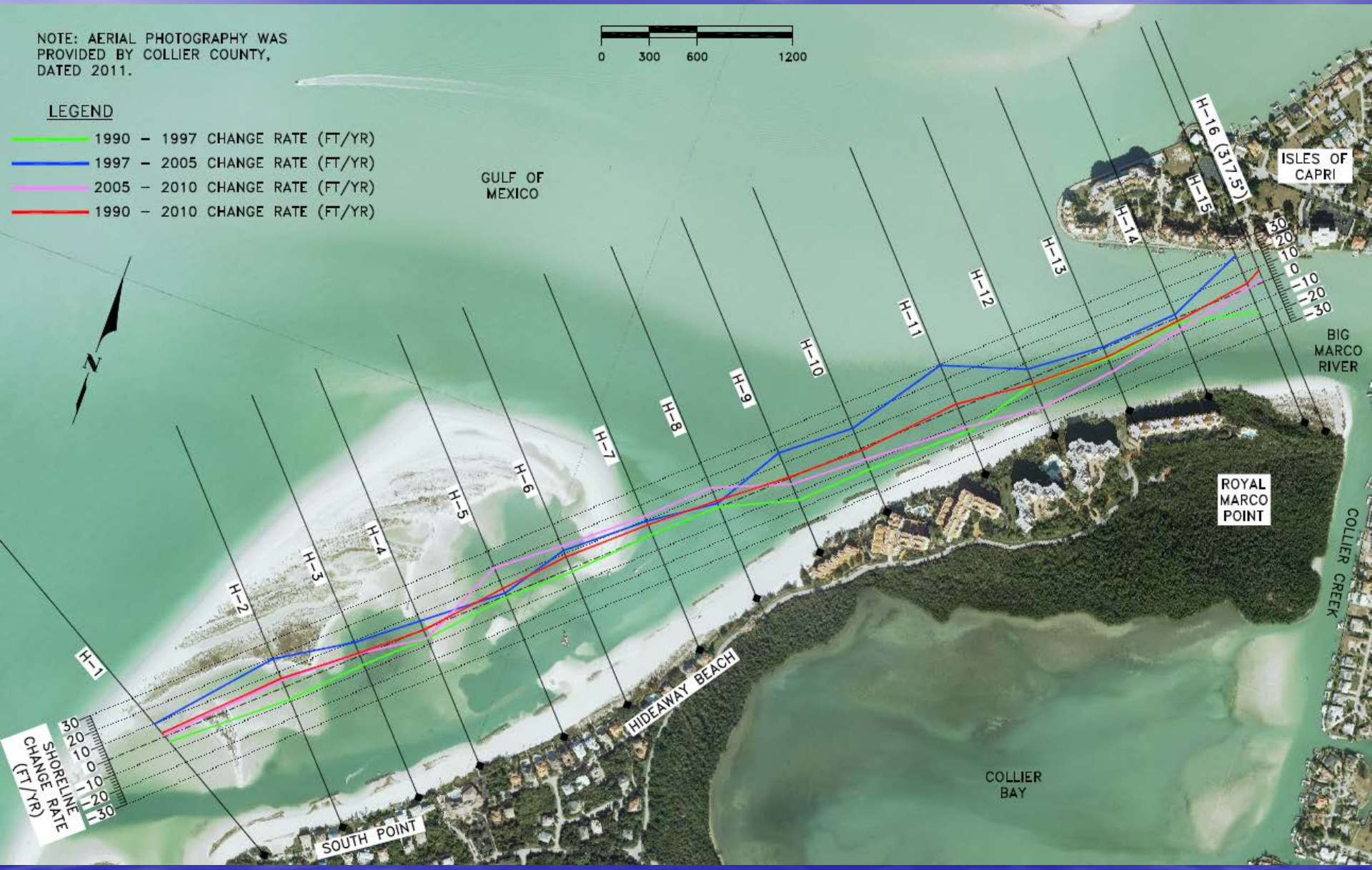
South Marco Beach Management History

- 2006-07: Second Renourishment
  - Placed ~176,000 CY from Caxambas Pass Channel
- 2008-2011: Annual Monitoring & Project Performance Analyses
- 2011: Alternatives Analysis
- 2012: Design and Permitting

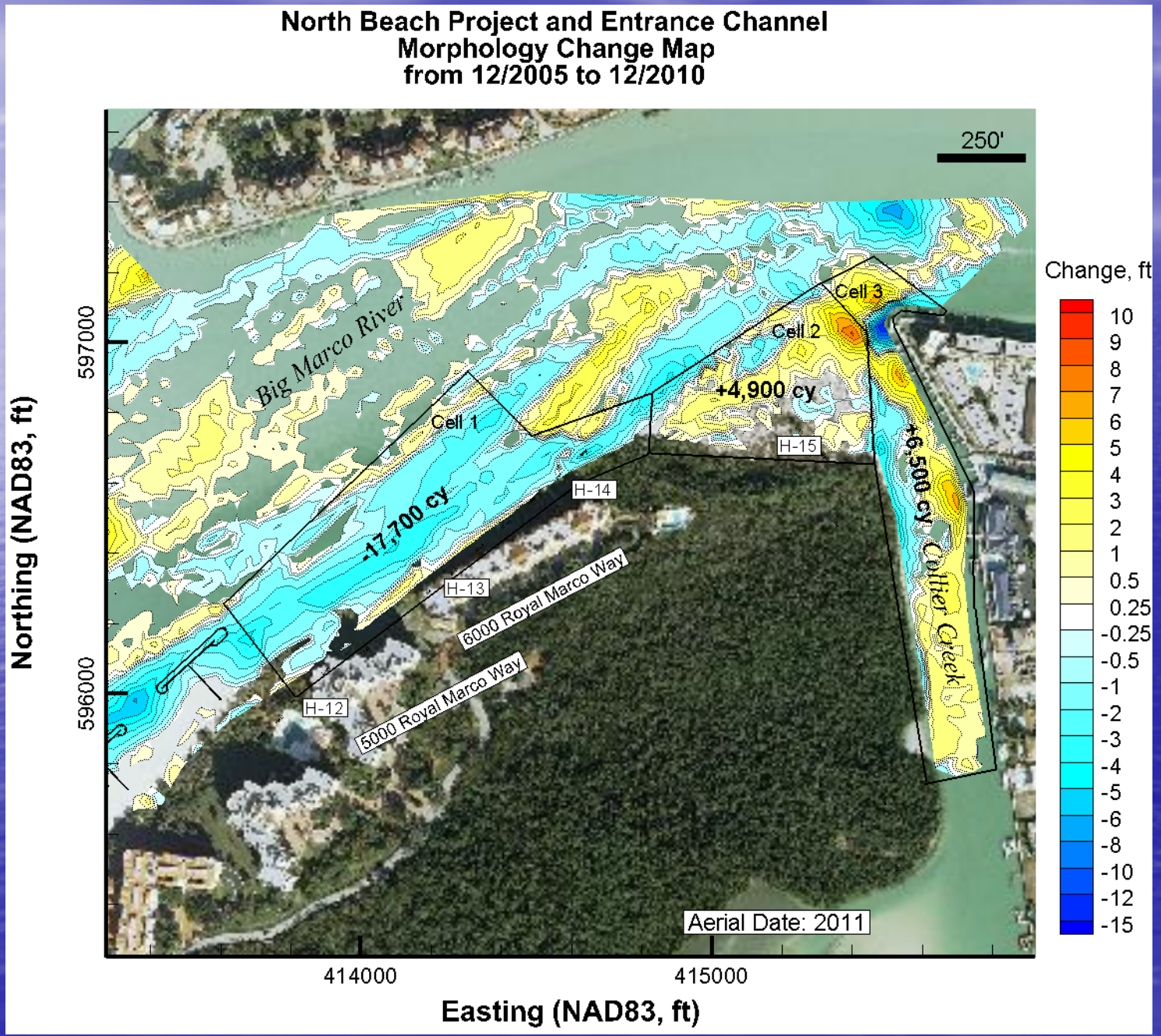
Current Affairs: Hideaway Beach Location Map

Aerial Date Dec. 2011

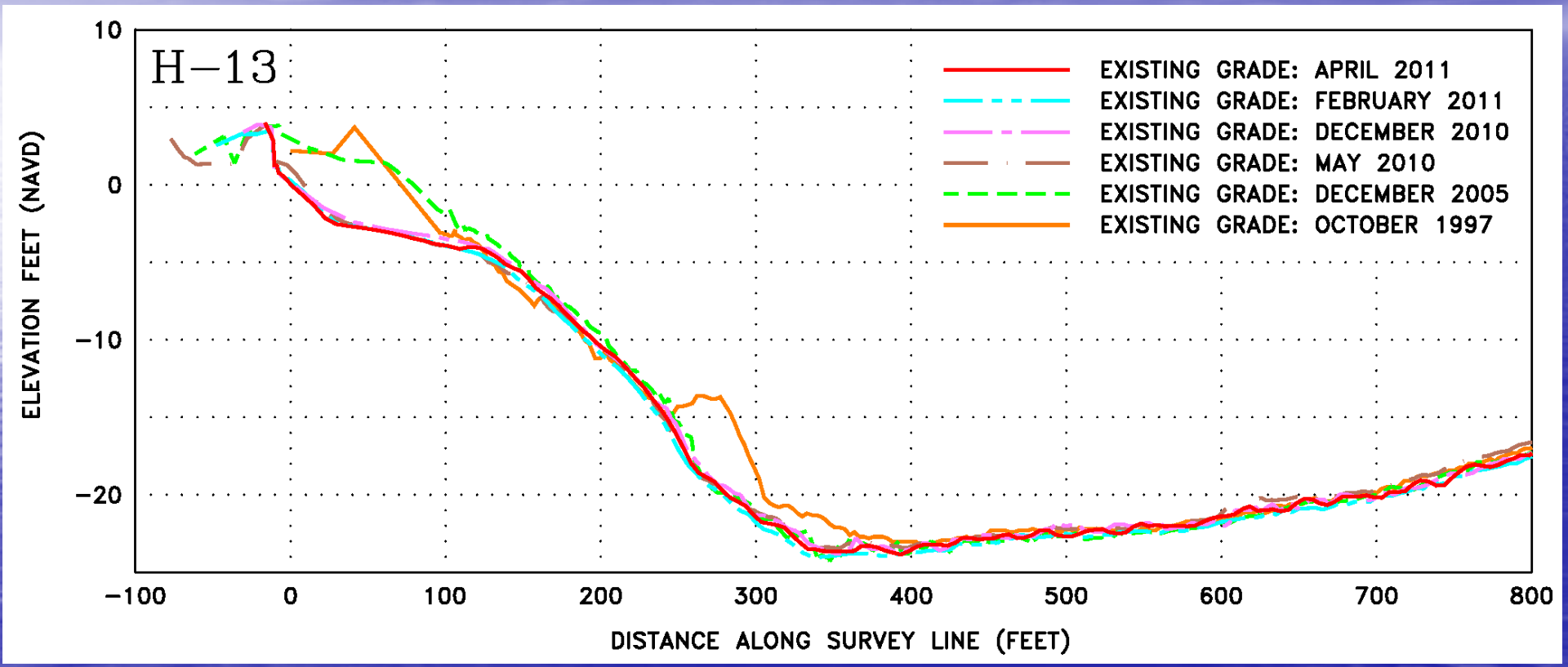
HISTORICAL SHORELINE CHANGE ANALYSIS



HISTORICAL VOLUME CHANGE ANALYSIS



NORTH BEACH PROFILE EVOLUTION

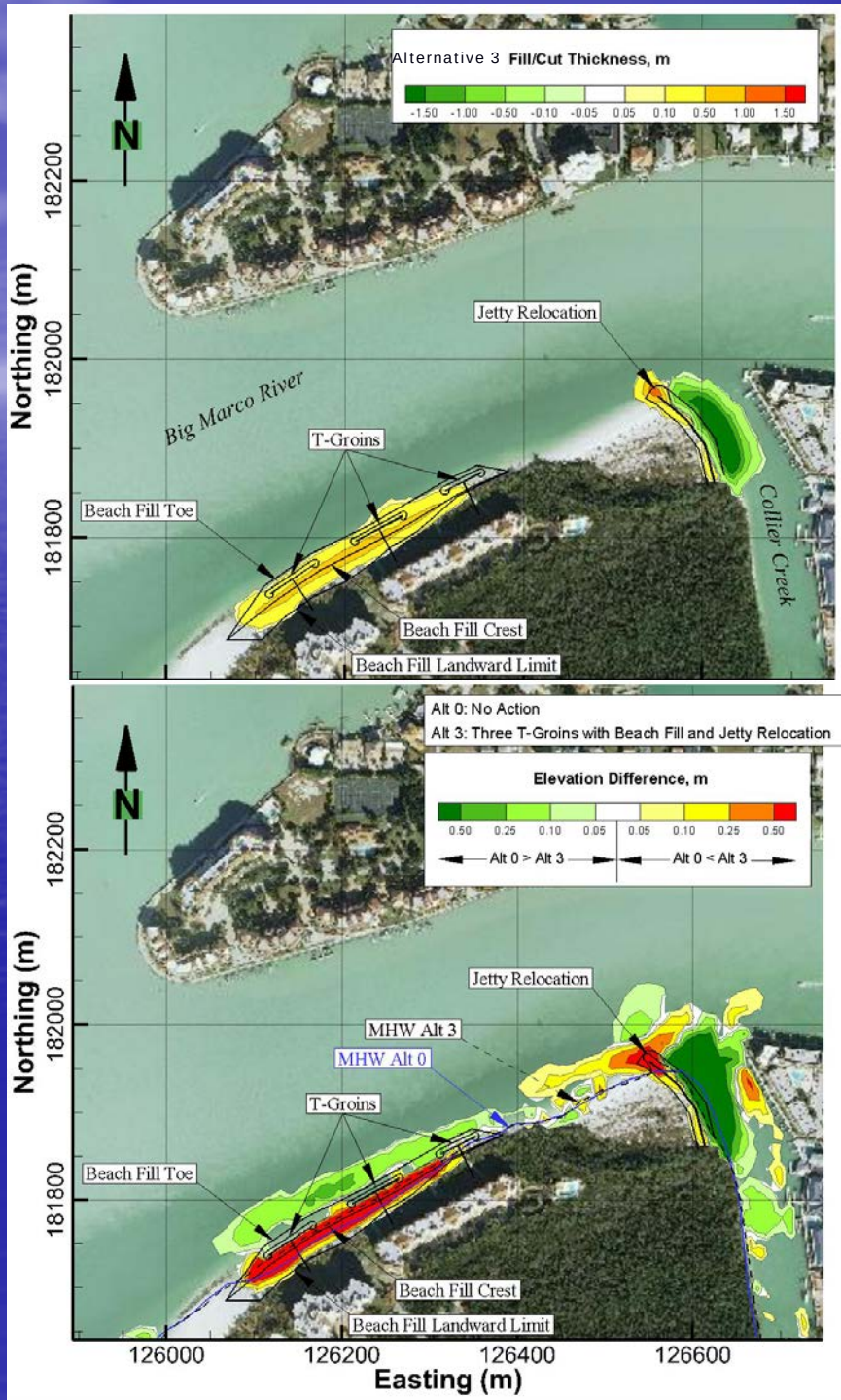


North Beach Erosion Control Project

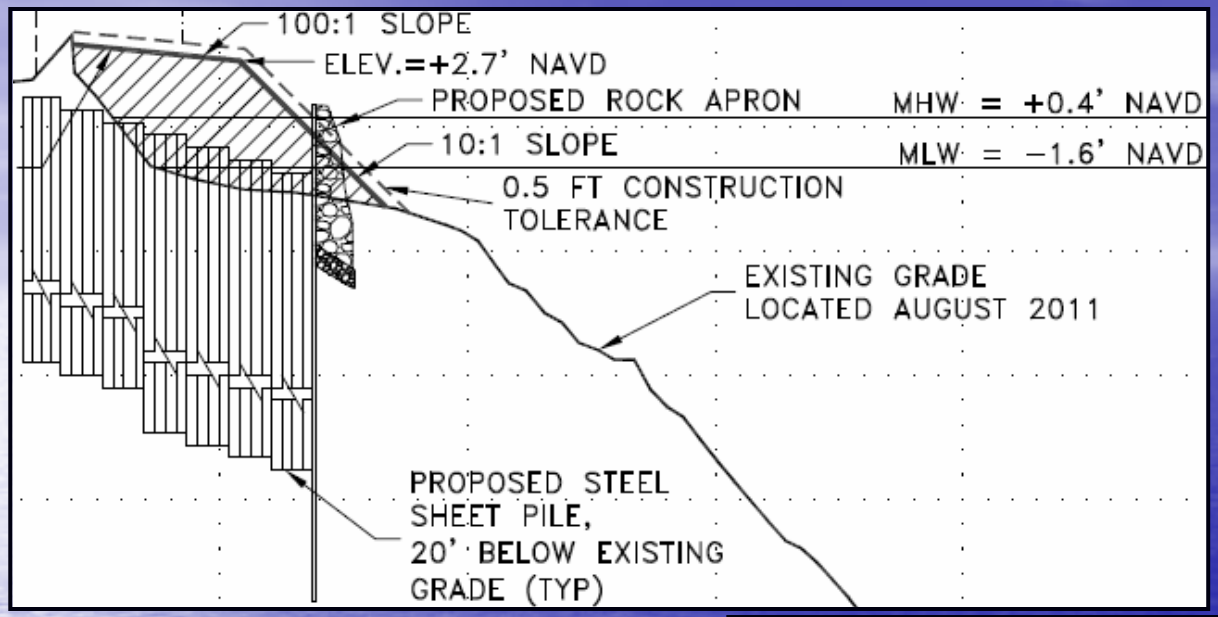
- Purpose
  - Restore Design Beach & Provide for Storm Damage Reduction
  - Erosion Control ~ Stabilize Shoreline
  - Restore & Sustain Safe Navigation at Entrance Channel
- Coastal Processes Analyses / Sediment Budget
- Alternatives Analysis
  - Desktop Screening ~ Selected Beach Restoration & Structural Compliments
  - Detailed Numerical Model Study ~ Combinations of beach fill and coastal structures

ALTERNATIVES ANALYSIS

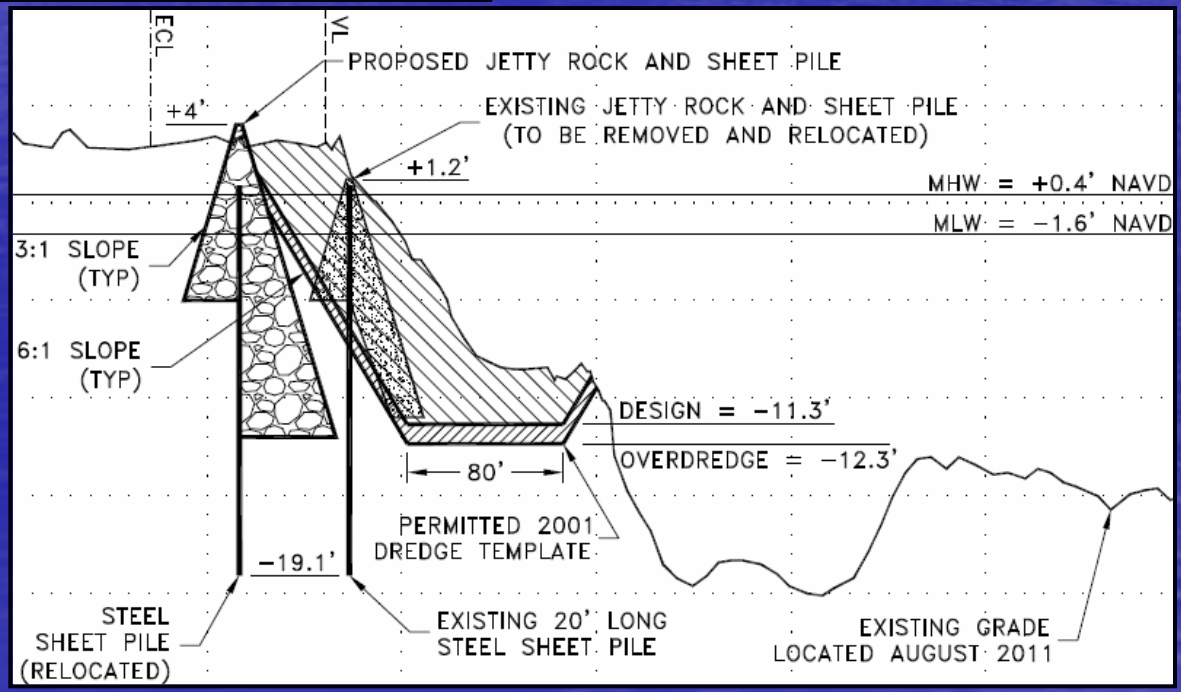
- Alternative 1: Beach Fill With Three T-groins
  - Address North Beach Erosion
- Alternative 2: Beach Fill With Jetty Extension
  - Address North Beach Erosion & Mitigate Channel Infilling
- Alternative 3: Beach Fill With Three T-groins & Jetty Relocation
  - Address North Beach Erosion & Enhance Navigation through Collier Creek Shoaling



Design & Permitting

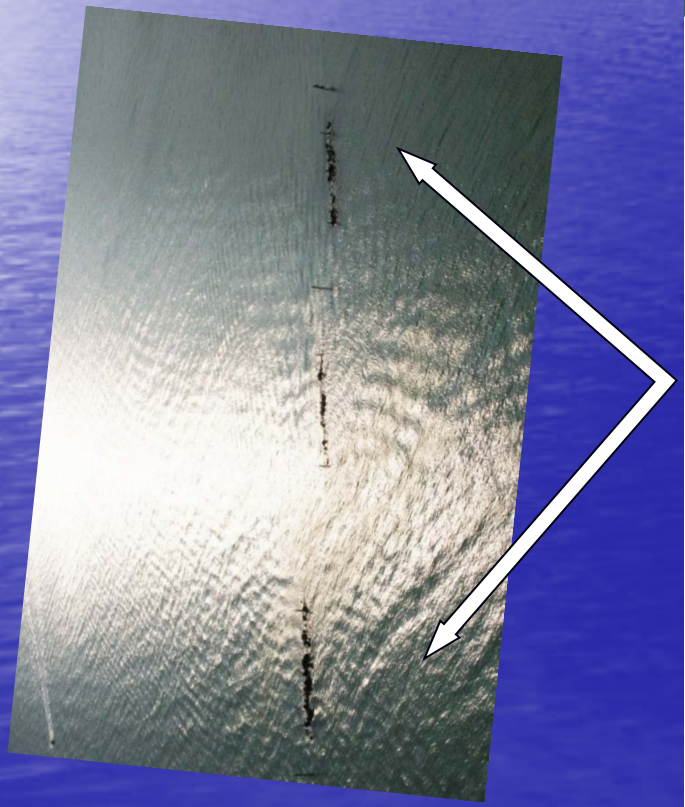


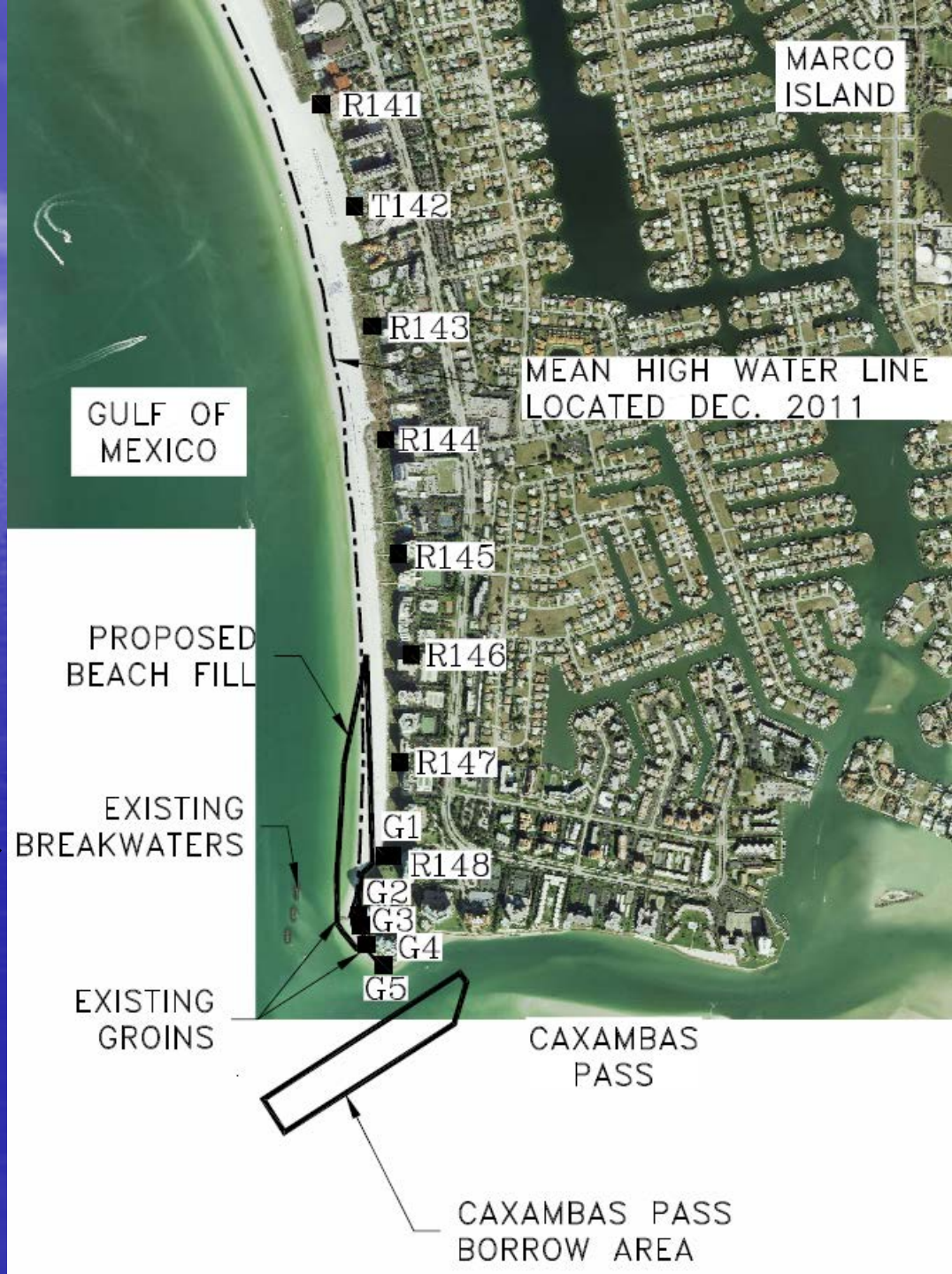
Beach Fill & T-Groins



Jetty Relocation

Current Affairs: South Marco Location Map

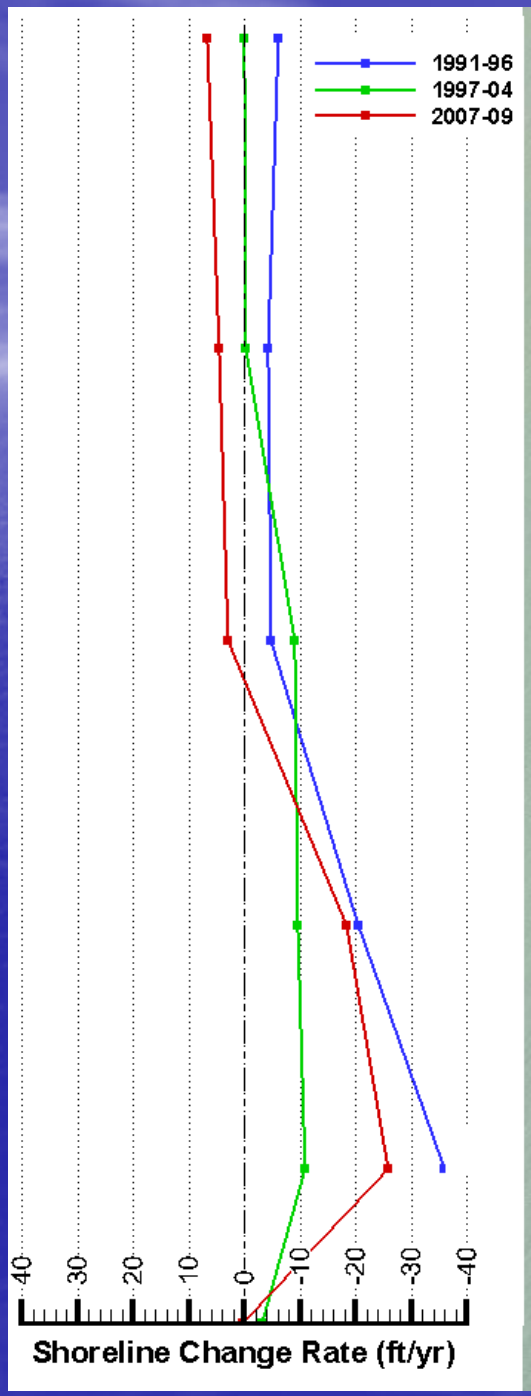




Fill Performance Analysis

Historic Shoreline Changes

- Post-breakwater installation shoreline erosion rates reduced compared to pre-breakwater installation
- Observed erosion pattern along localized shoreline segment from R-146 to groins (G-2)



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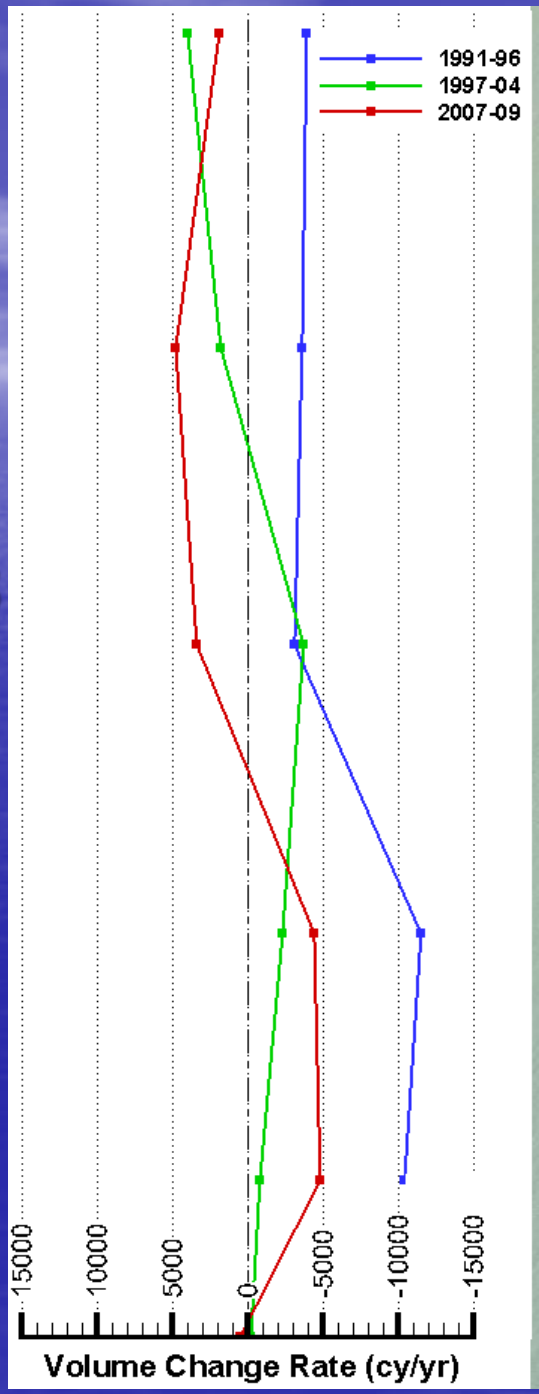
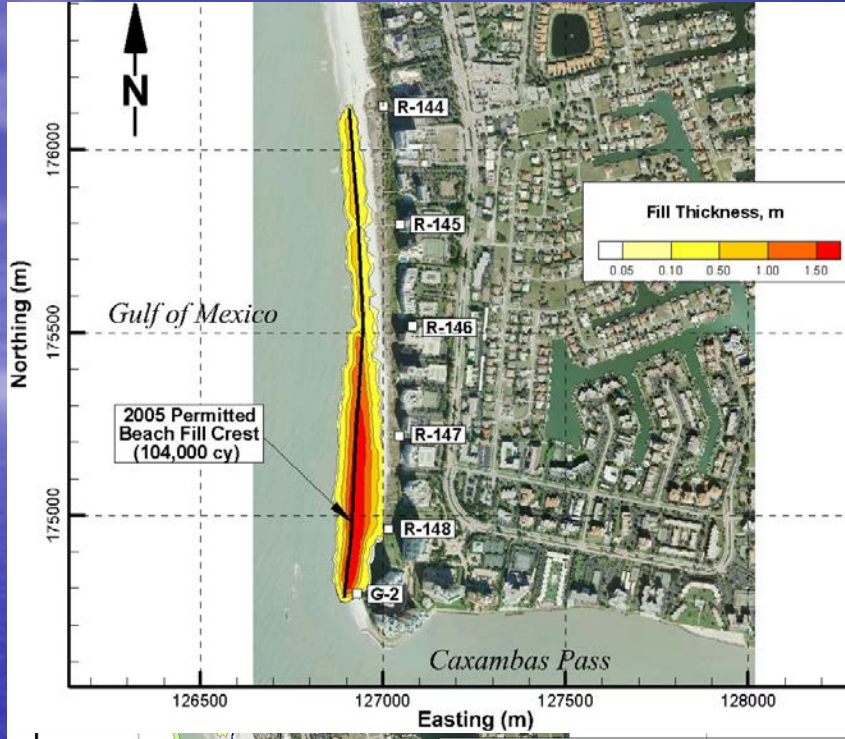


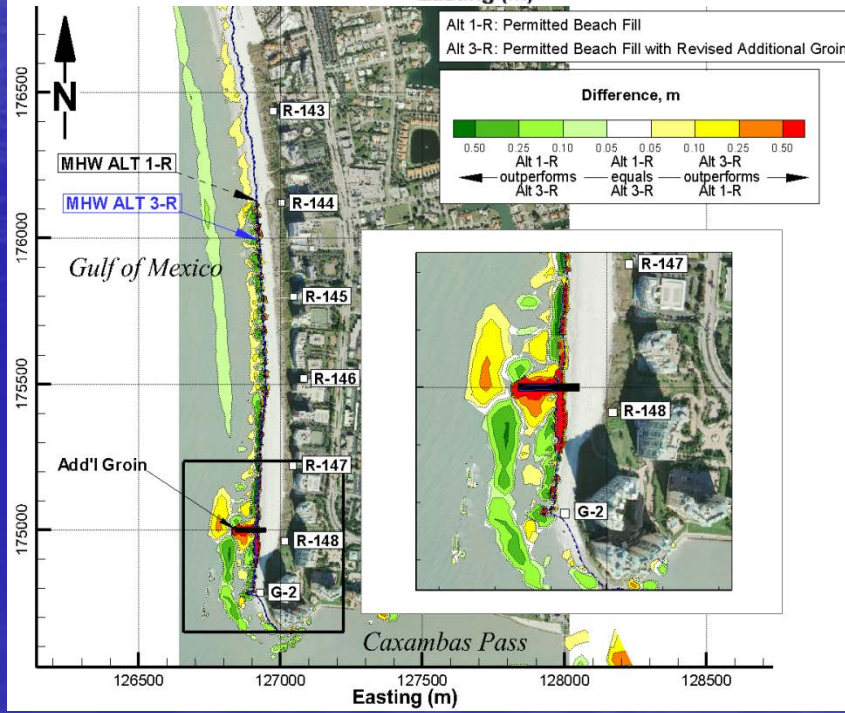
South Marco Beach Renourishment Project

- Purpose
  - Storm Damage Reduction
  - Natural Resource Habitat Restoration
  - Enhance Recreation
  - Offset Storm Erosion Losses
- Coastal Processes Analyses
- Alternatives Analysis
  - Desktop Screening ~ Address Localized Erosion off South End Through Structural Enhancements
  - Detailed Numerical Model Study ~ Combinations of beach fill and coastal structures
- Structural Repairs
  - Restore groins and breakwaters to original design form and function

Alternatives Analysis

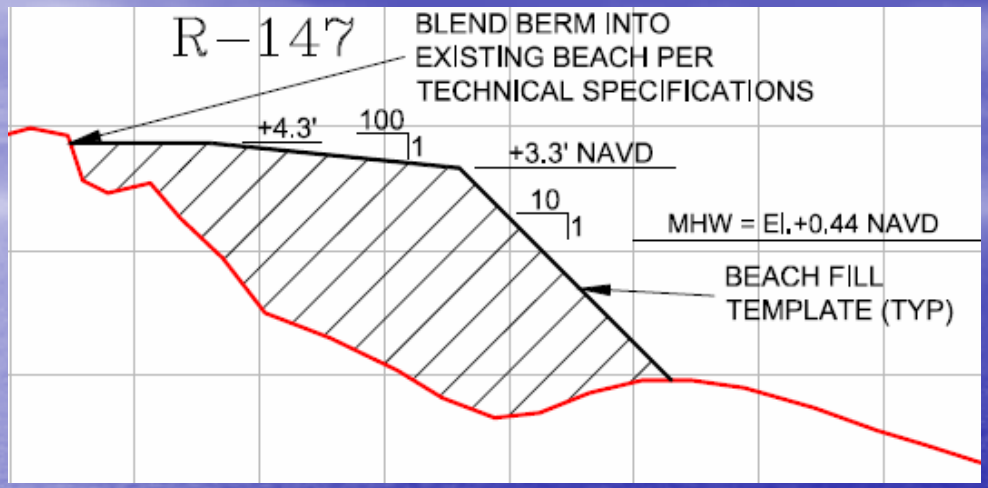
- Alternative 1: Beach Fill Only
- Alternative 2: Beach Fill with Feeder Beach
  - Overfill Northern Segment to "Feed" Southern Segment
- Alternative 3: Beach Fill with One Additional Groin
  - Enhance Project Life Through Addition of One Rock Groin
- Alternative 4: Beach Fill with One Additional Breakwater
  - Enhance Project Life Through Addition of One Breakwater



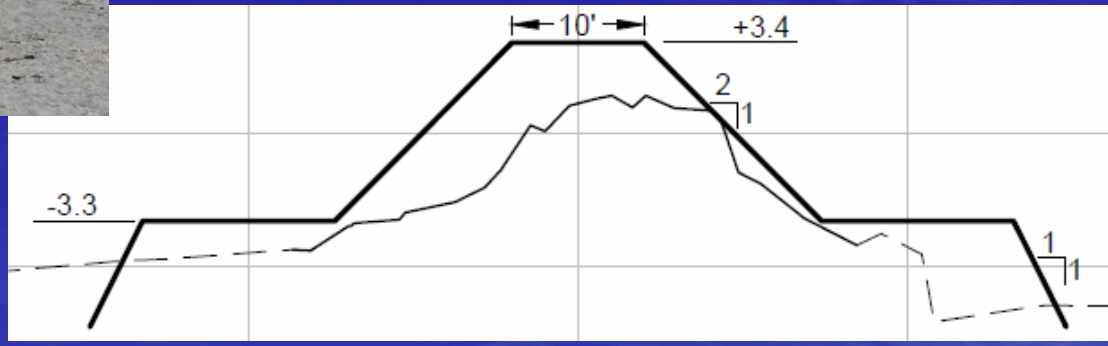


South Marco Current Project

Beach Fill



Breakwater and Groin Repairs



QUESTIONS?

- 35-Year Program with Documented Successes
- Utilizing Coastal Structures to compliment beach restoration and periodic renourishment management strategies
- Extend life cycle of projects
- Cost-effective nearshore and navigation channel sand sources
- Incremental Beach Management utilizing upland sand to address localized erosion in between renourishment cycles