Evaluation of Placement Alternatives for Matagorda Ship Channel Bottleneck Removal

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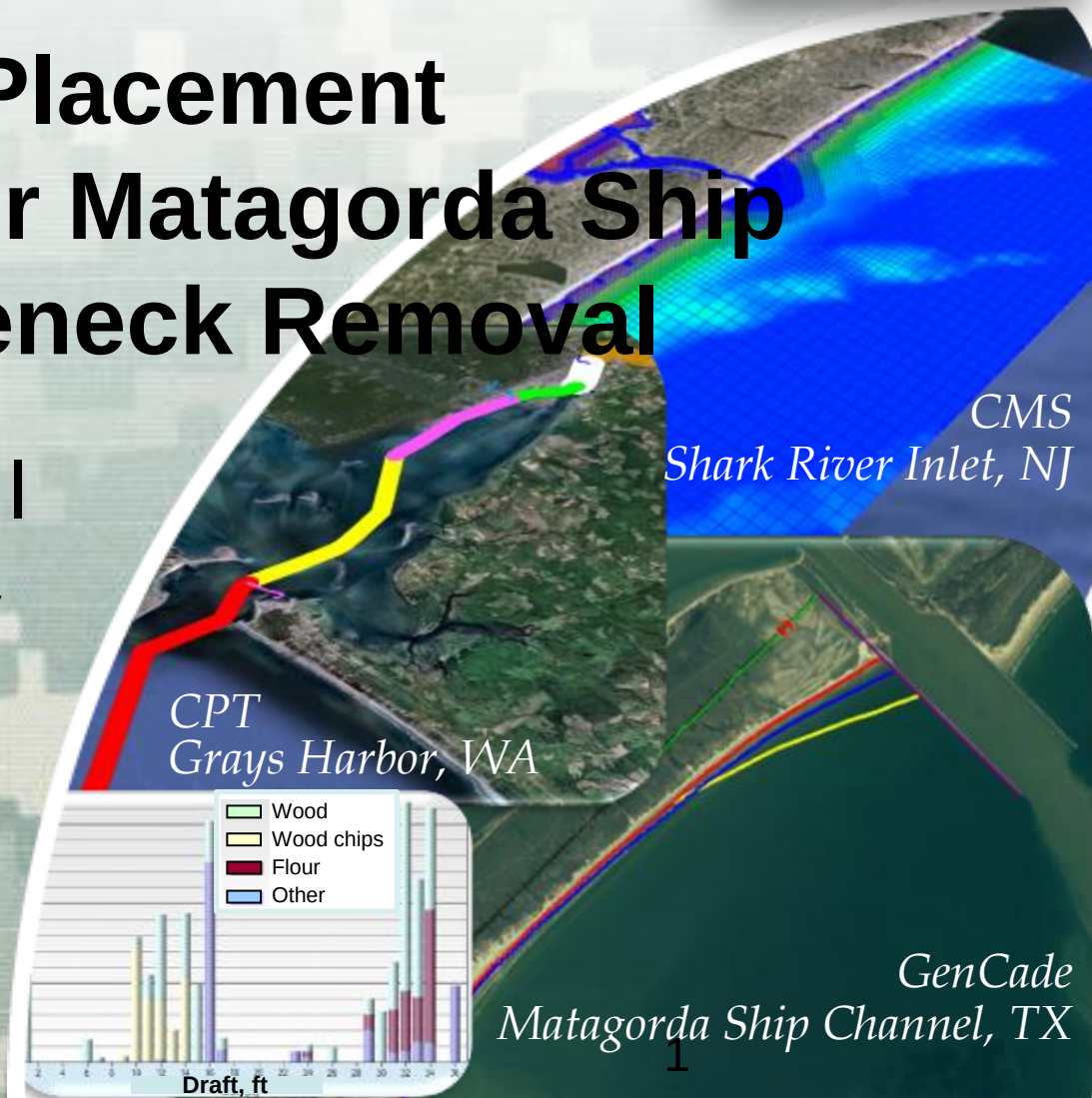
Ashley E. Frey



US Army Corps of Engineers
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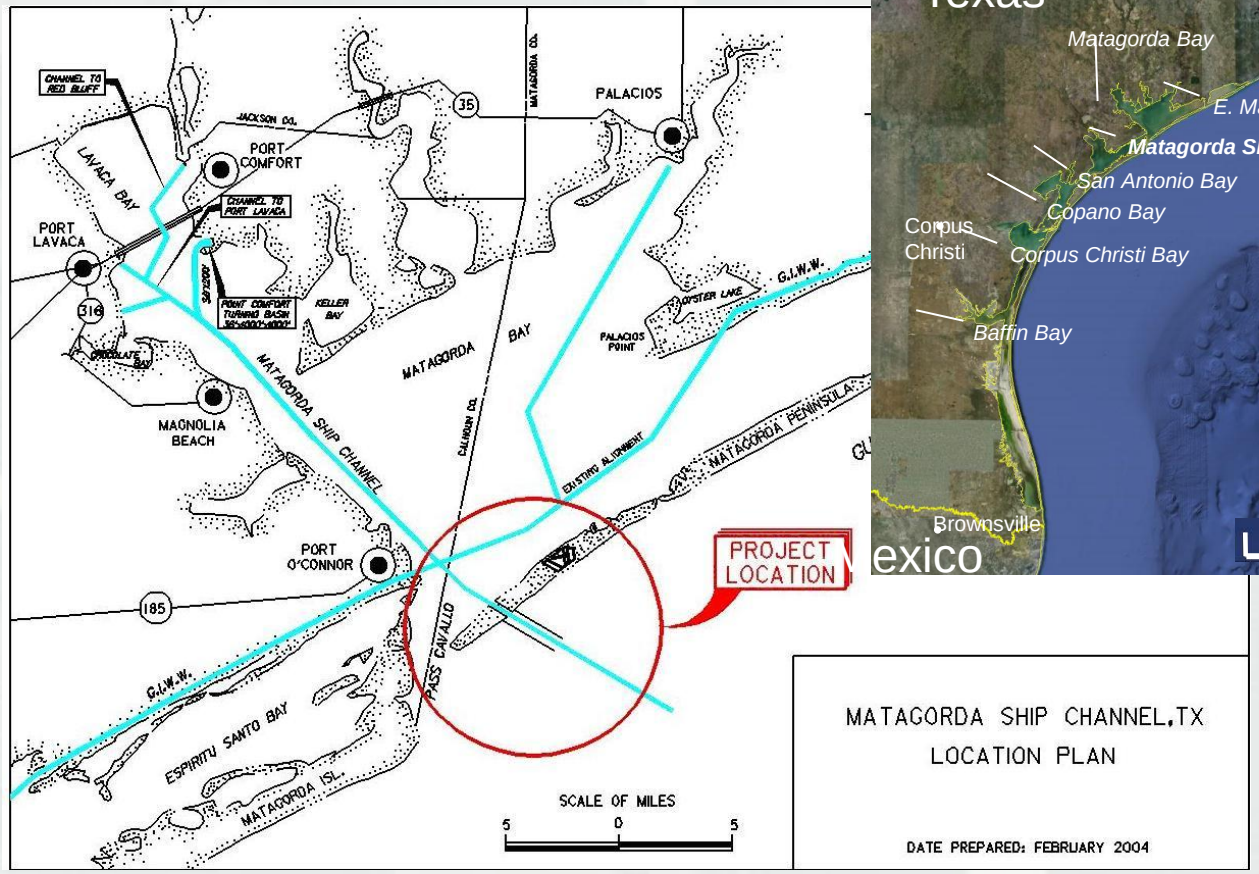
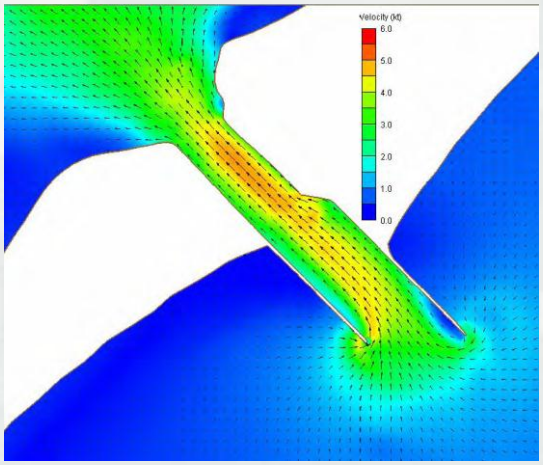
Project Location



Relevant Facts

- Authorized depth 36ft channel - 38ft Bar
- Channel has scour holes in the 80 - 90 ft deep between jetties
- Rated one of the most “problematic” in US for Nav.
  - Max current exceeds 3 knots 60% of the time
  - Max current exceeds 5 knots 20% of the time
  - Cross currents an issue
- Bottleneck has minimum width of 950ft
- Port Tonnage ranks between 50 and 100 in US
- Designed with fixed bed physical model
- Construction completed 1966

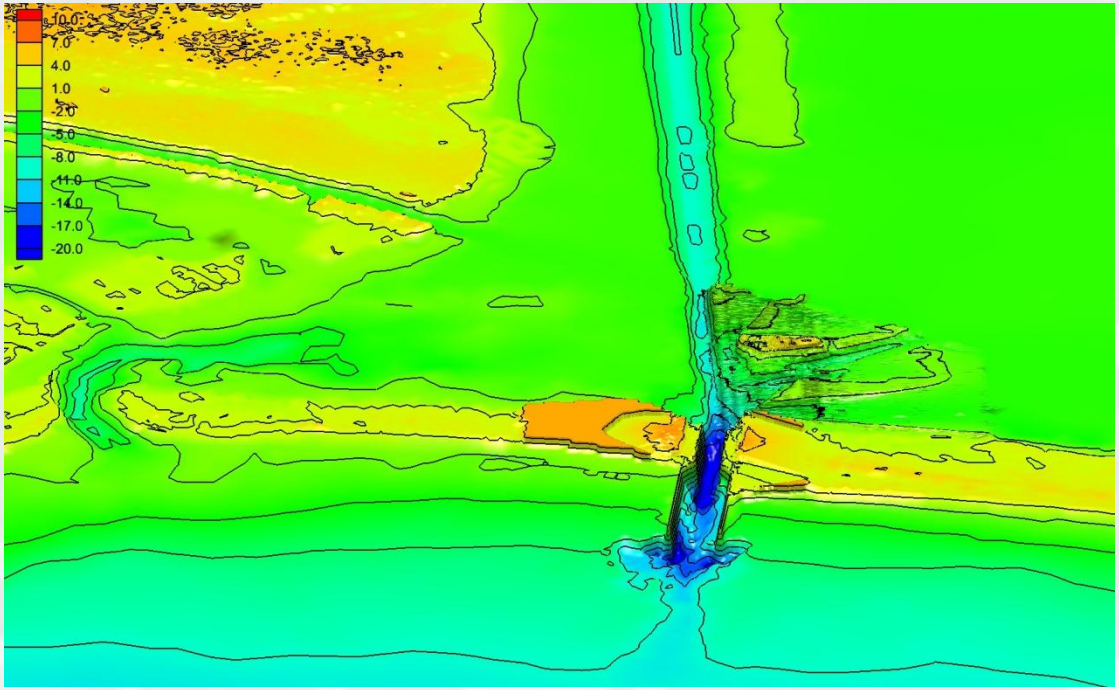
Selected Previous ERDC/CHL Technical Reports to Present



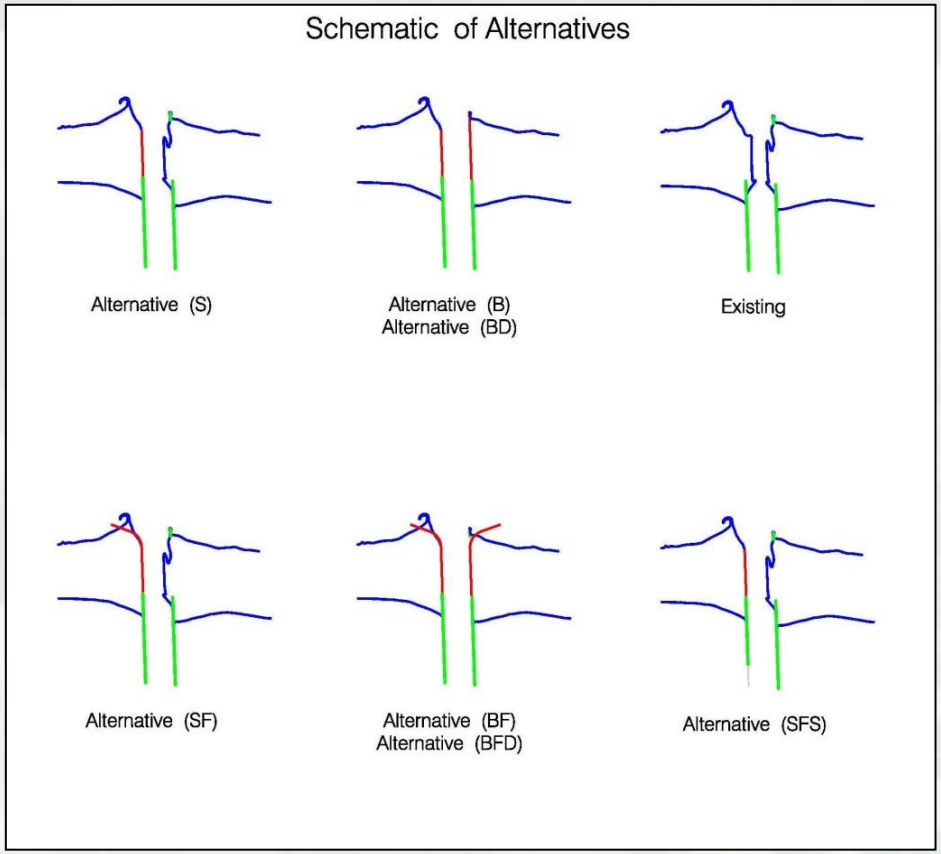
- 2000 - DMS Report
- 2006 - Jetty Stability Study
- 2008 - Pass Cavallo Study
- 2009 - Risks to Navigation
- 2010 - Placement alternatives; Summer 2008 and Winter 2004 conditions from previous studies
- Field Measurements, circulation modeling, Shoreline change, Ship Simulator study, risk analysis. But no combined wind, wave, hydrodynamic, and morphology approach for Sundown Island until now.

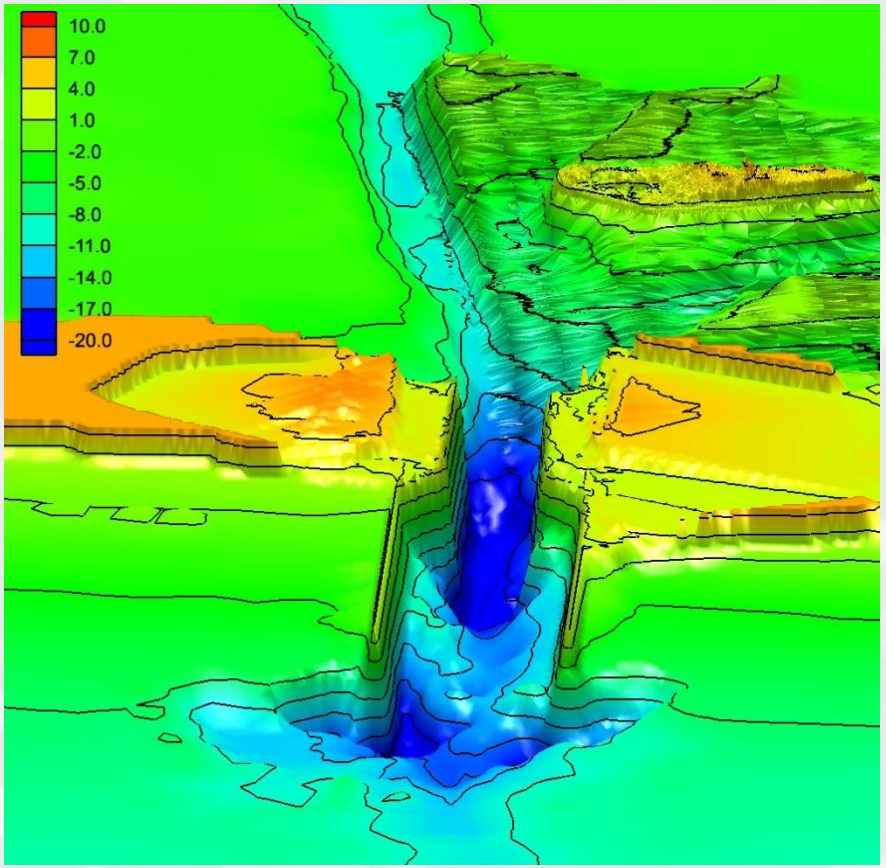
Study Objectives

- Remediate design deficiency
- Use 5.3 Mcy material (fine-med sand) beneficially
  - Sundown Island
  - Beach Placement
- Minimal impact on:
  - GIWW
  - Pass Cavallo

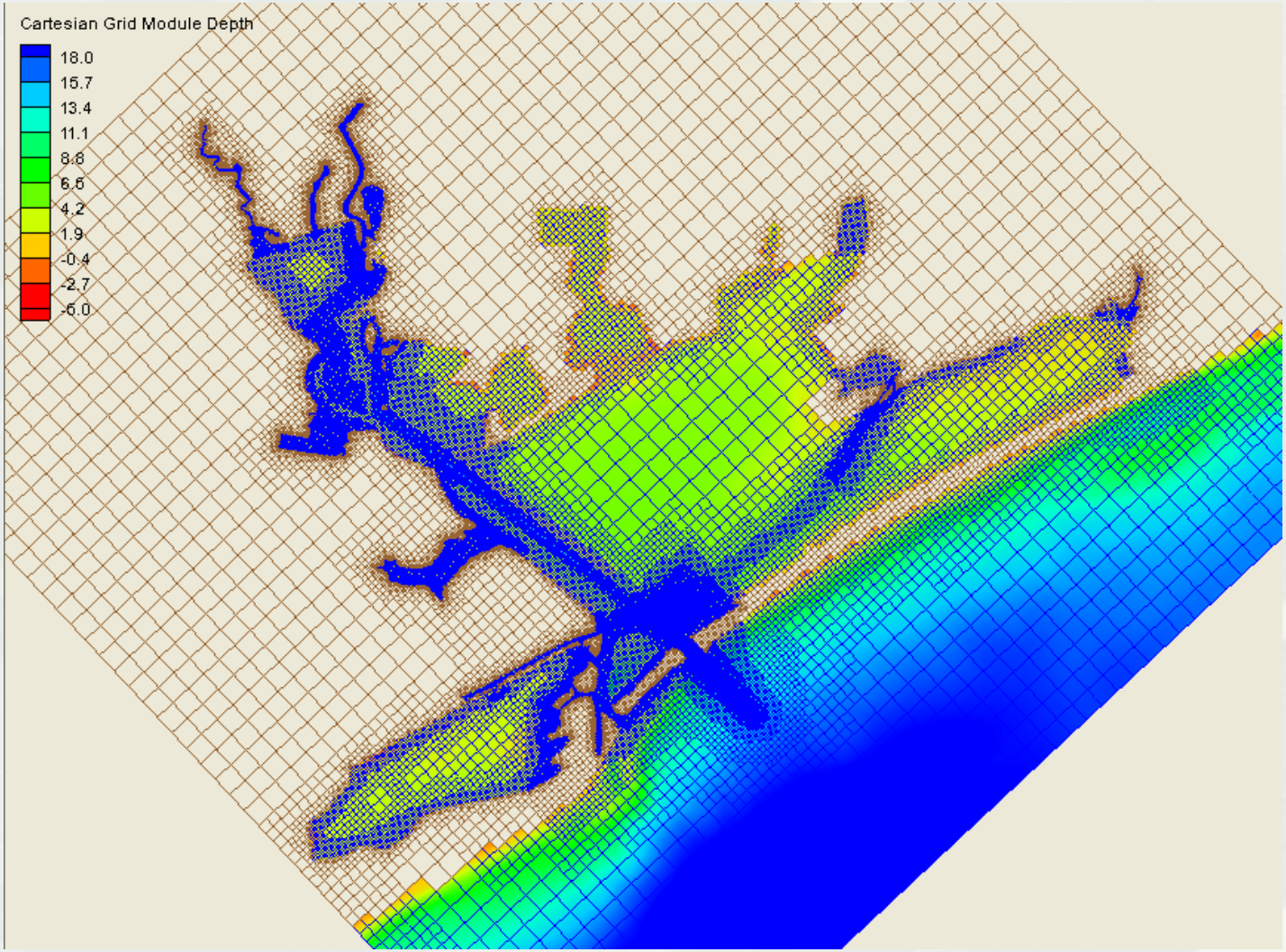


Bottleneck Alternatives

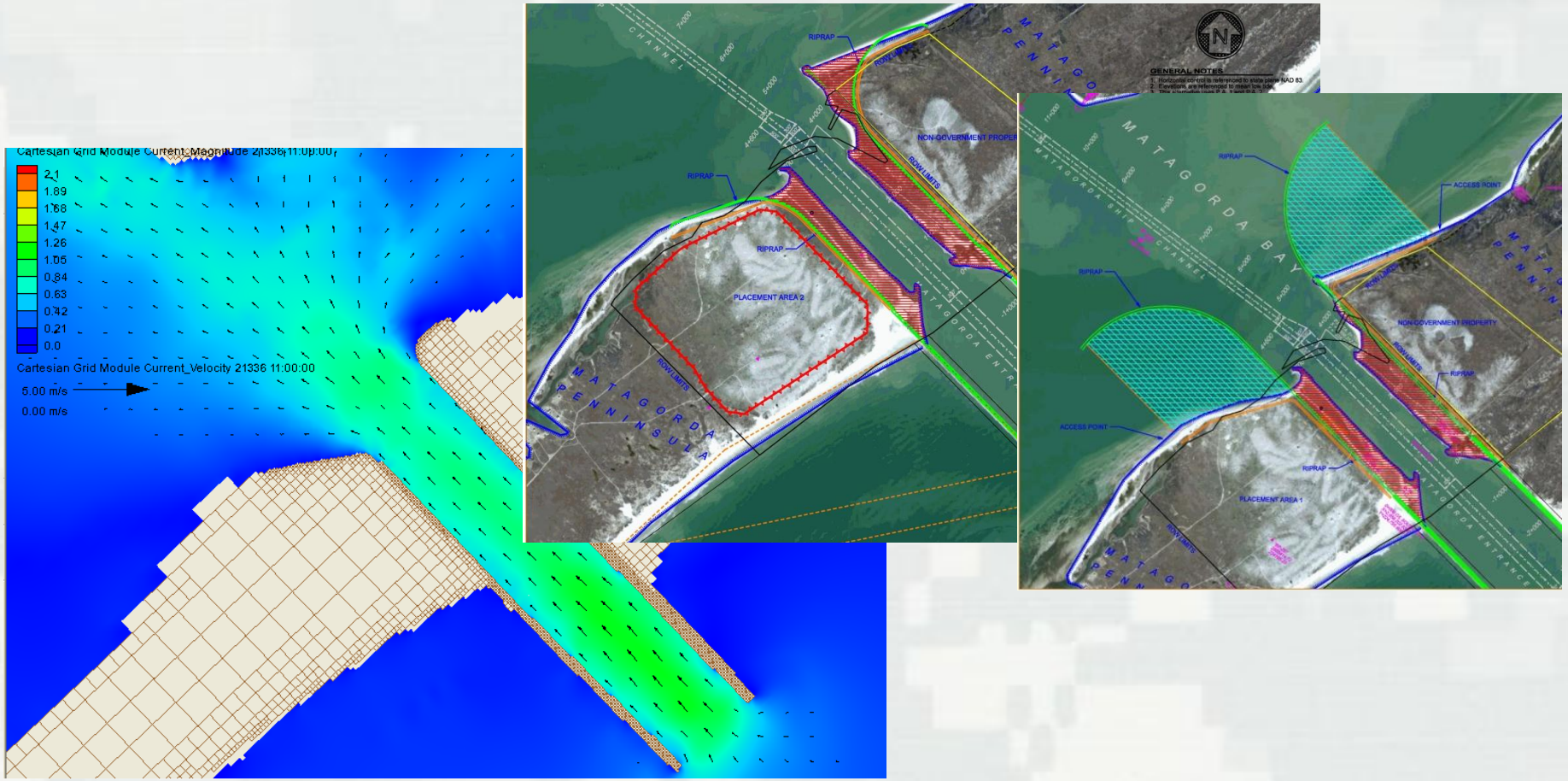




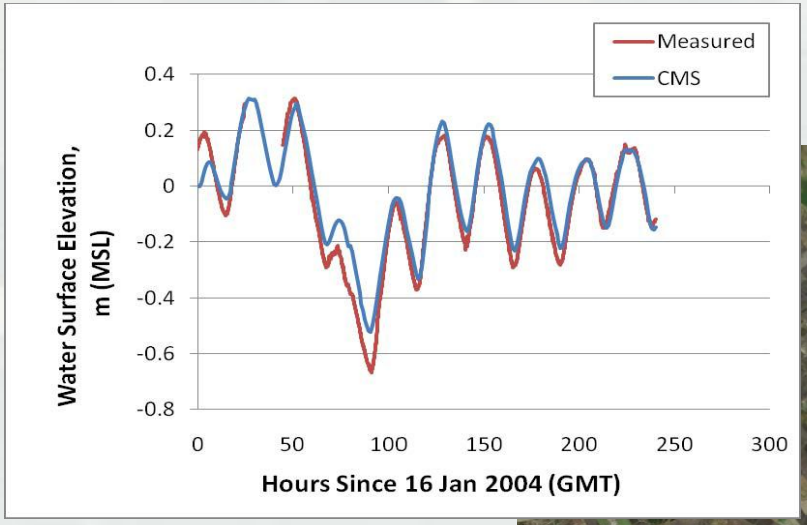
Coastal Modeling System Telescoping Grid

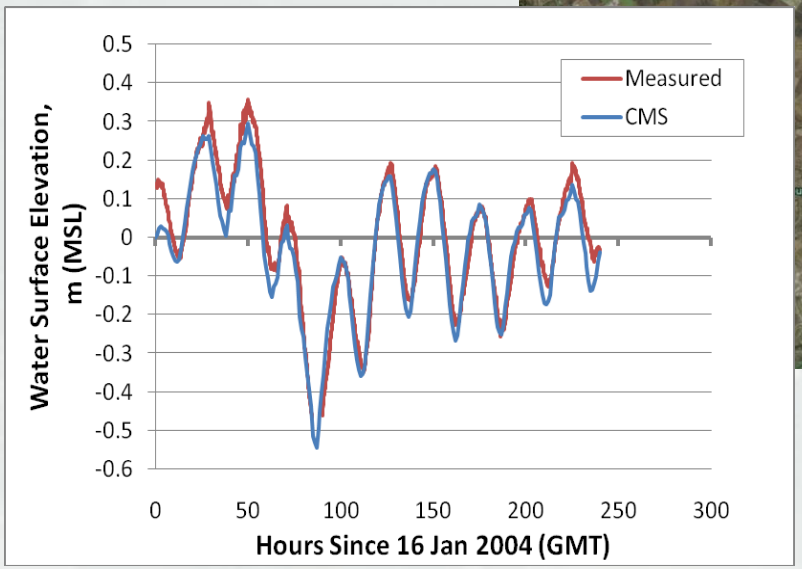


Reduced, Previously Proposed Flanges

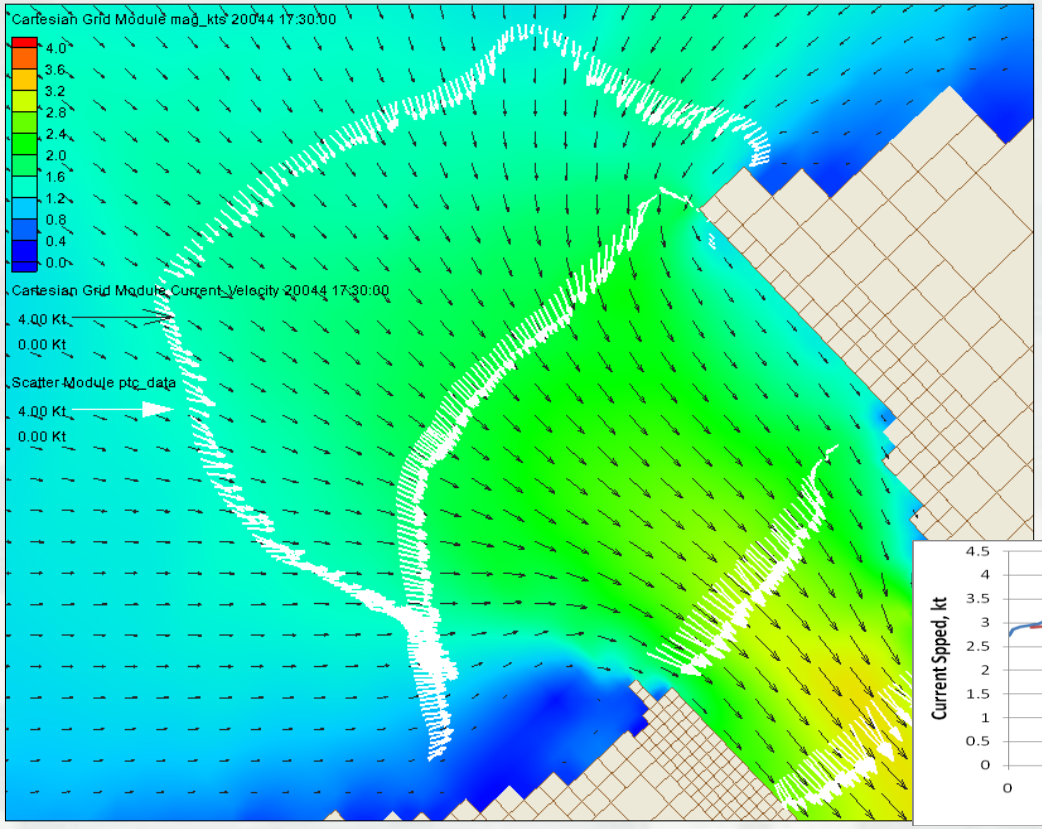


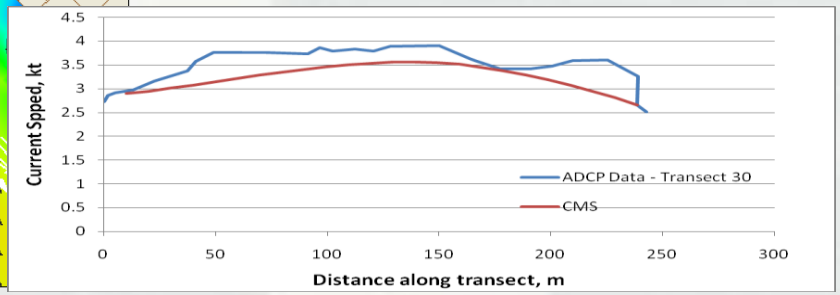
MSC Validation – Water Levels





MSC Validation - Currents



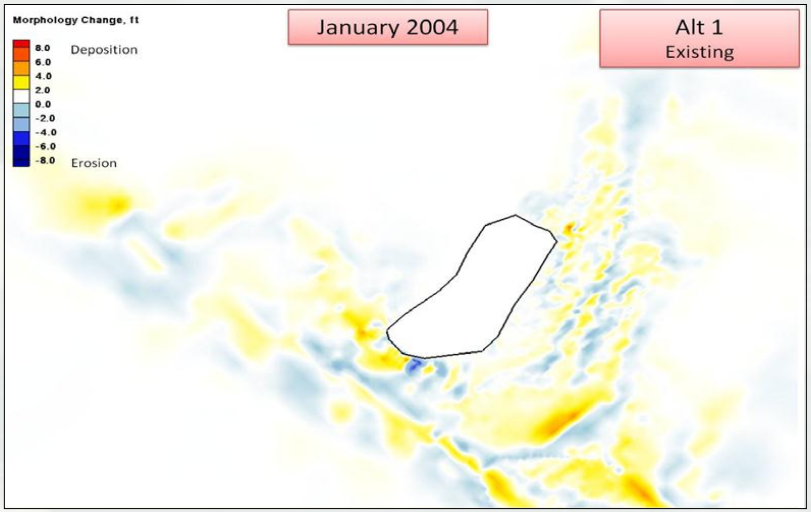


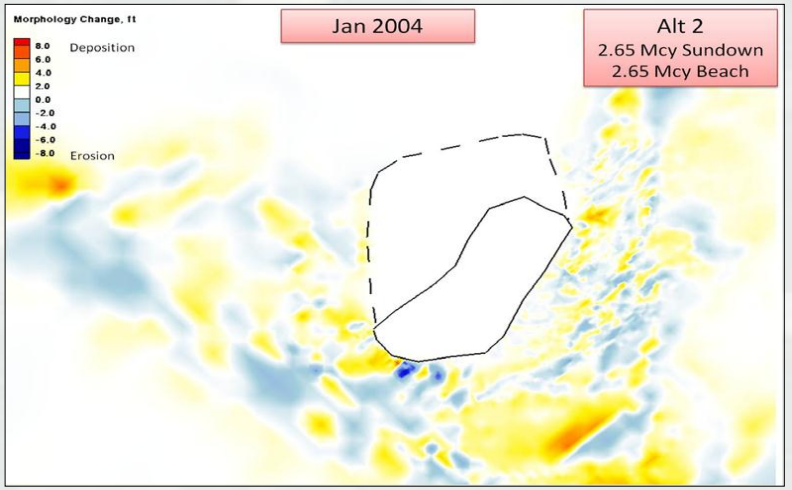
Sundown Island May, 2010

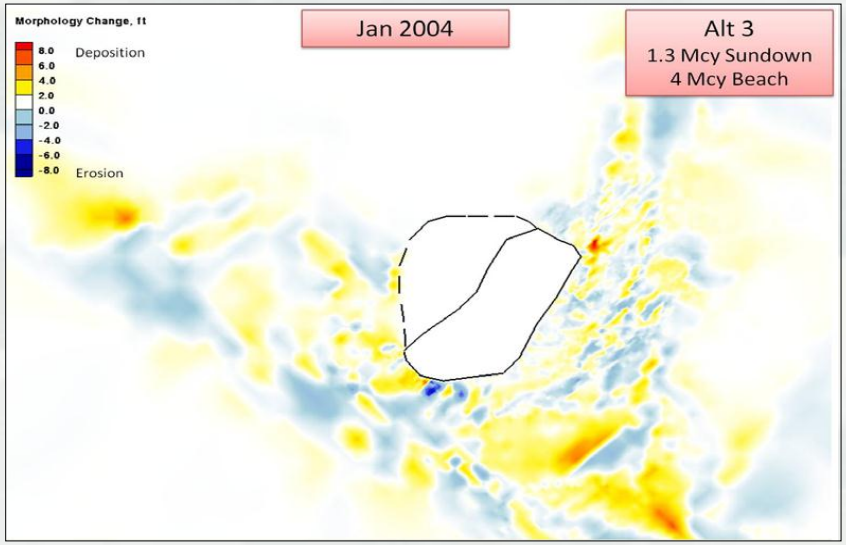
Current Speed Results (Summer 2008)

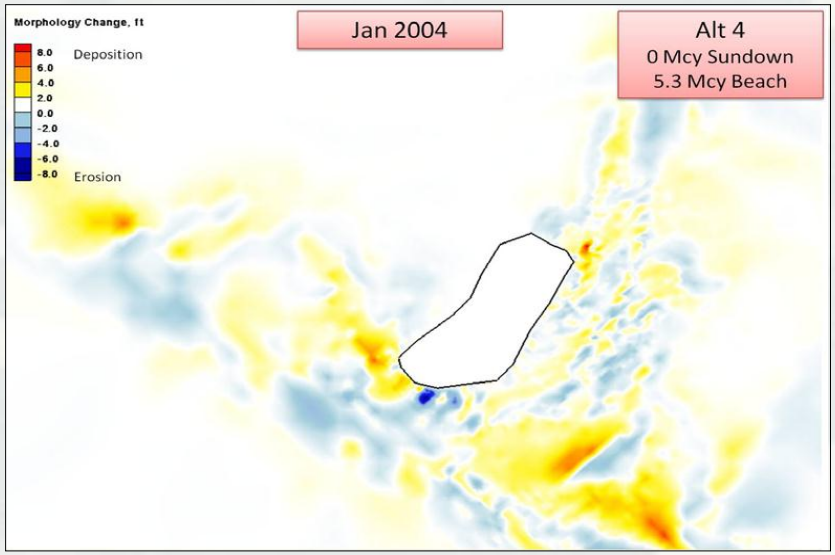
Alt - All but Existing have bottleneck removed Island/Beach (Mcy)	Max Flood Current (along channel)	Max Flood Cross Current	Max Ebb Current (along channel)	Max Ebb Cross Current
Existing	4.1	2.4	4.1	2.7
1.3/4.0	3.5	2.1	3.4	2.5
2.65/2.65	3.5	2.1	3.5	2.5
0/5.3	3.6	2.3	3.5	2.5

Morphology Change

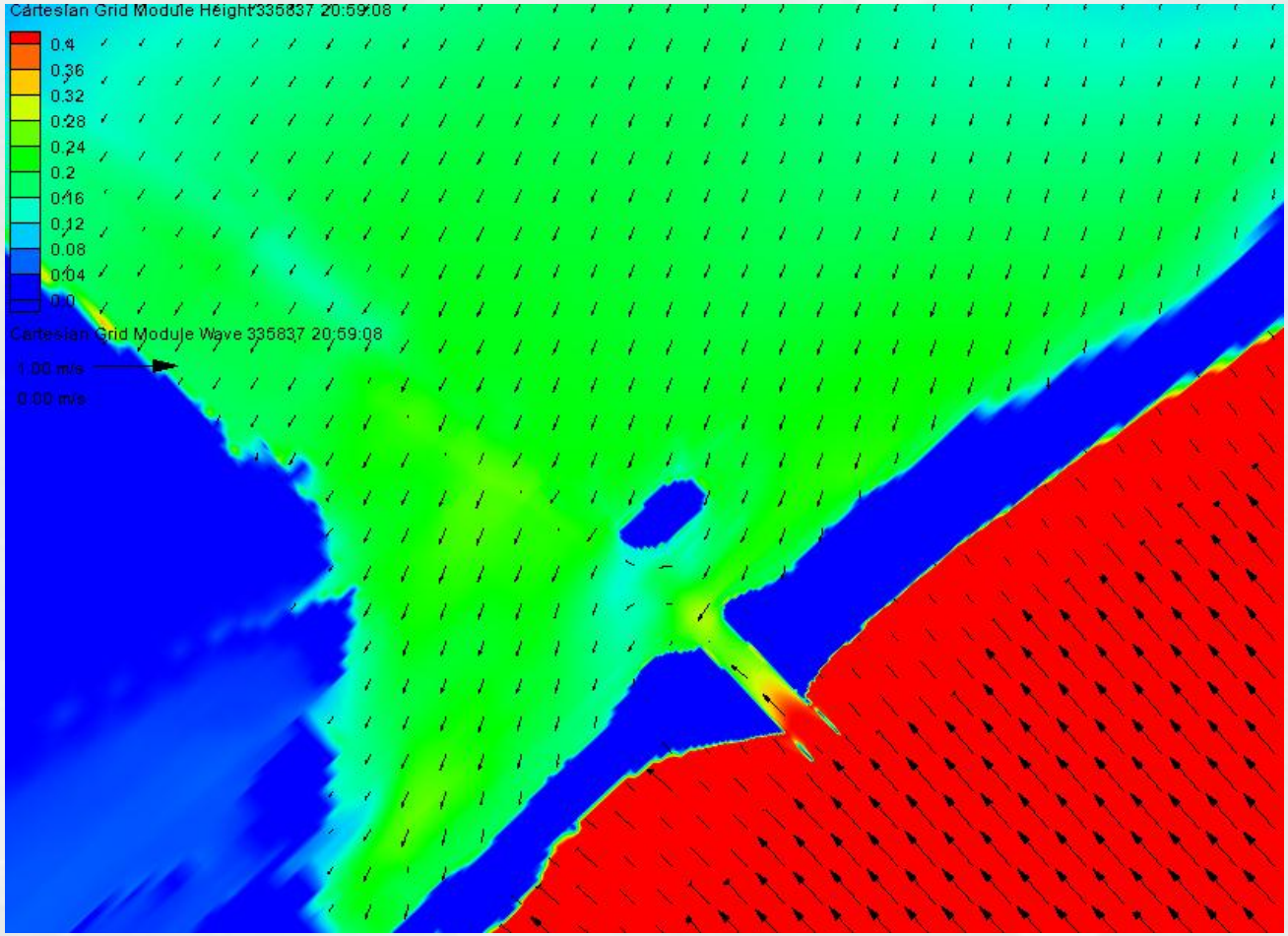




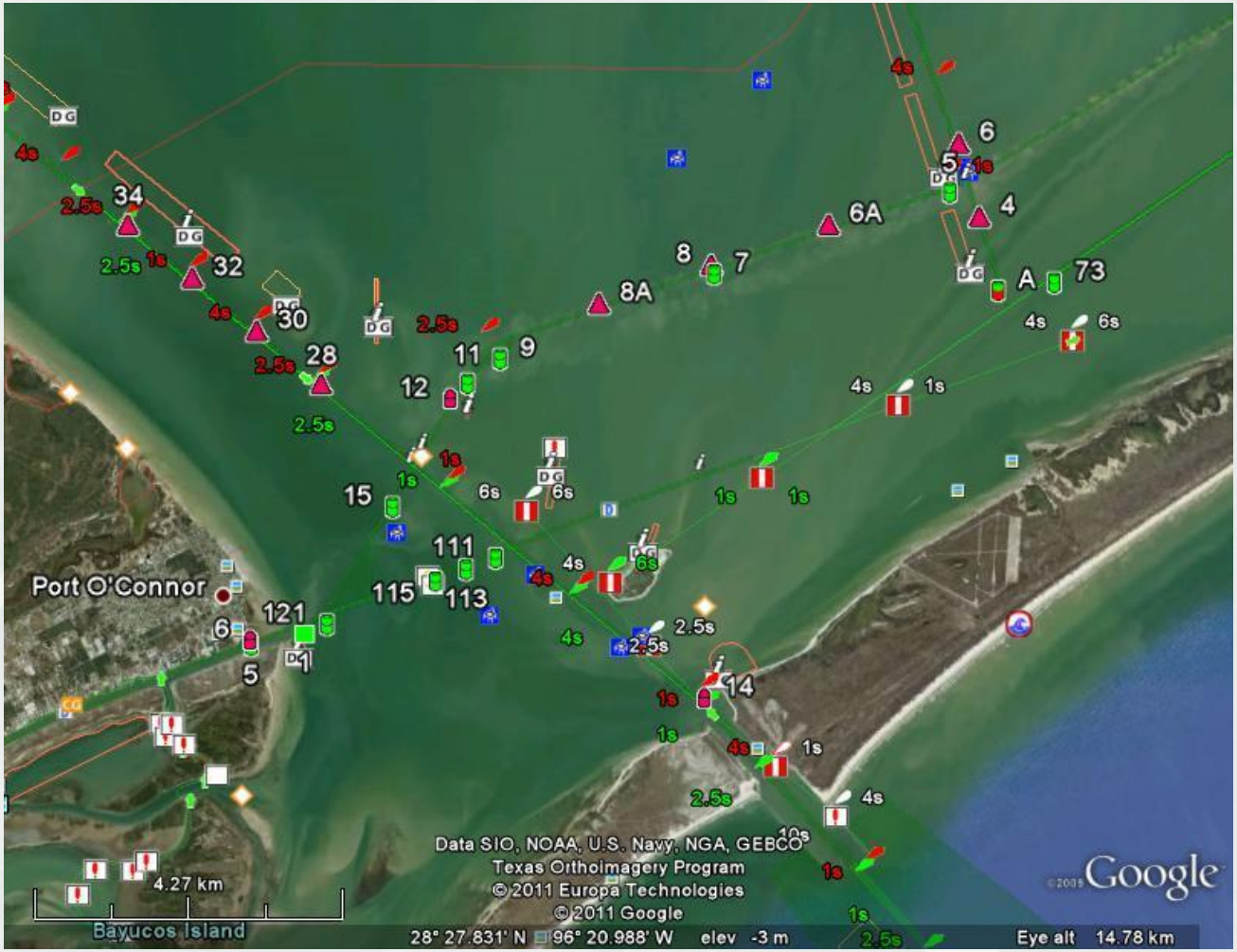




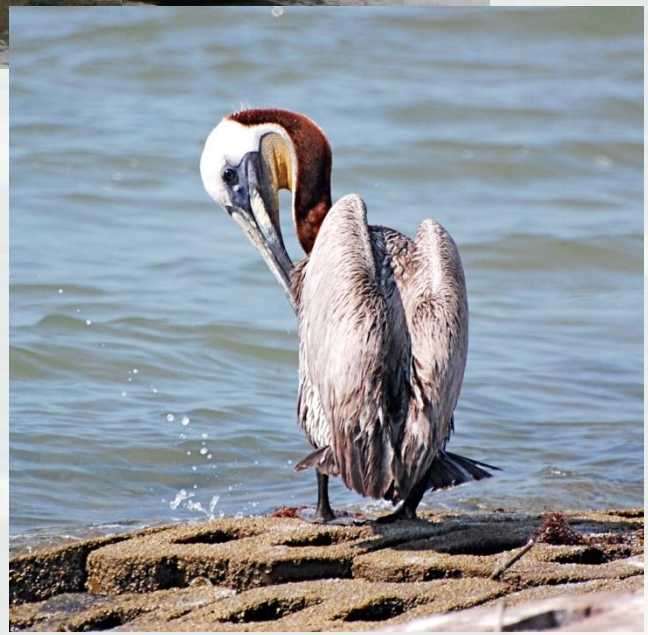
Waves – Full Plane Results



GIWW(s)


Port O'Connor
Bayucos Island
4.27 km
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Texas Orthoimagery Program
©2011 Europa Technologies
©2011 Google
28° 27.831' N 96° 20.988' W elev -3 m
Eye alt 14.78 km
Google

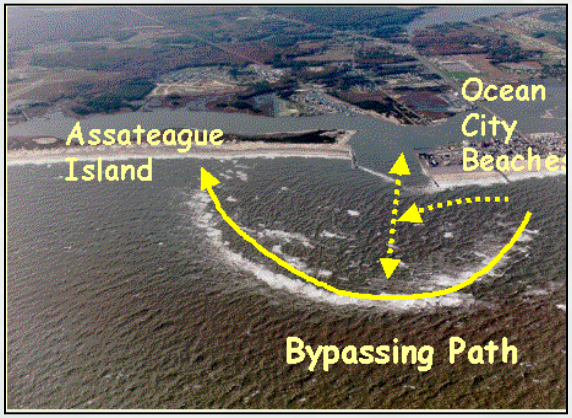
Sundown Island - Shore Protection? Costs a concern



GenCade Applicability

Regional processes,
Long-term morphology change

Project Planning & Design



Habitat Change

- Regional Sediment Management
  - Beach fills
  - Inlet bypassing
  - Channel maintenance
- Unifying technology for multiple projects
- Intuitive interface (SMS)

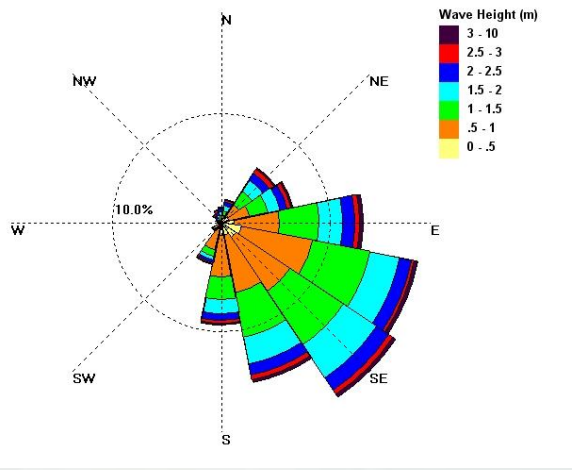
- Storm erosion hazard management
- Dune erosion, overwash, & breach susceptibility; coastal response to SLR
- Habitat evolution (Piping Plover; vegetation)

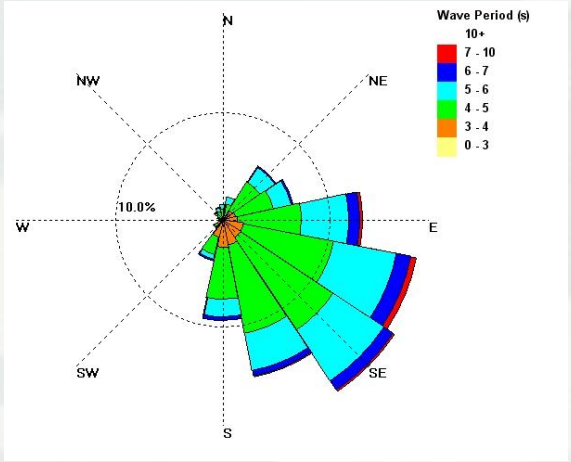
GenCade Setup and Alternatives

- Estimate shoreline change and longshore transport south of south jetty on Matagorda Peninsula

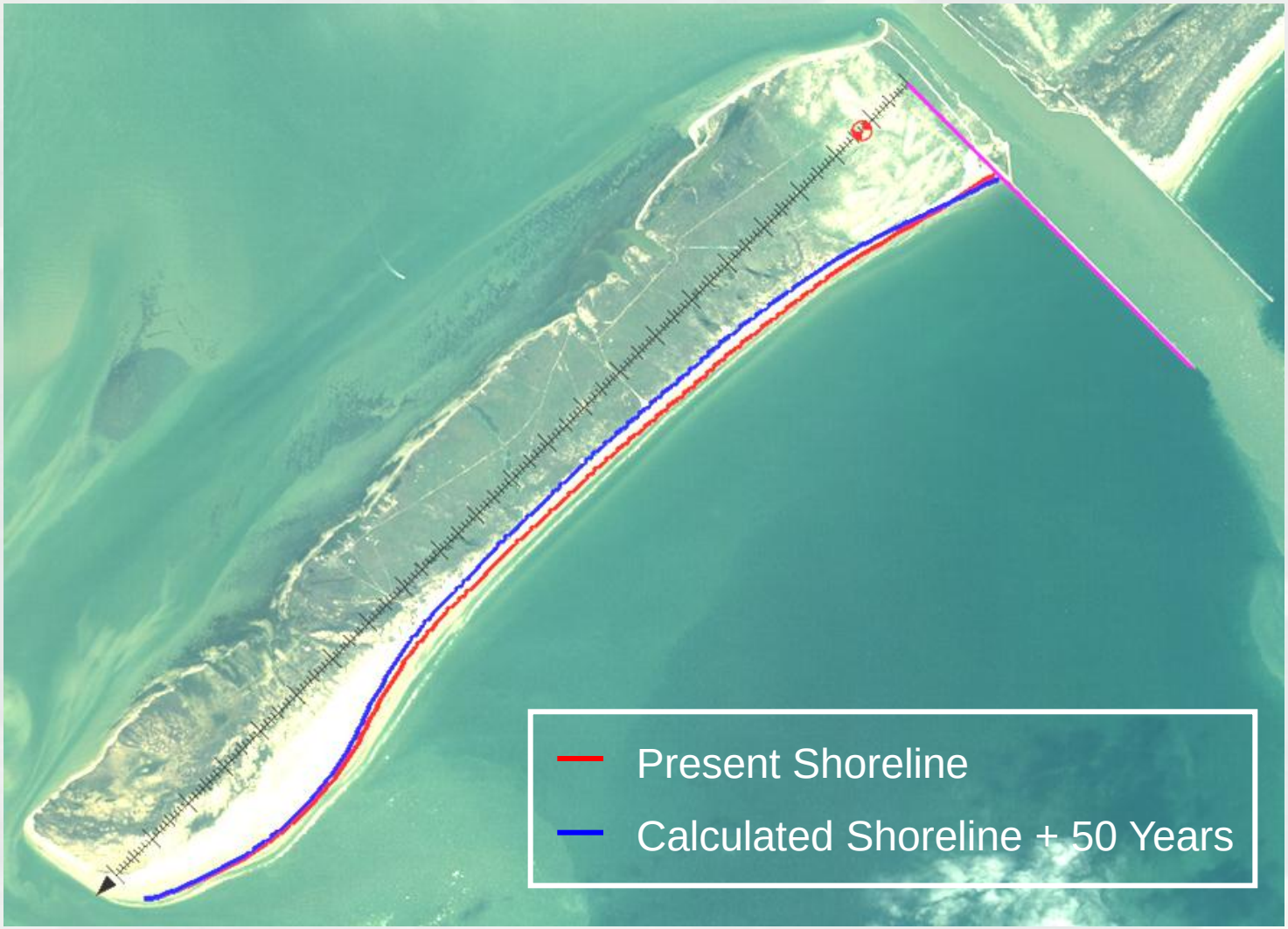
- Mean grain size = 0.18 mm
- Waves from Buoy 42019 of NOAA National Data Buoy Center
  - Eleven year record, 1997-2008
  - Repeated wave record in GenCade after 11 years

GenCade Alternatives	
Alt 1	Existing Condition, No Action
Alt 2	2.65 Mcy Beach Placement
Alt 3	4.0 Mcy Beach Placement
Alt 4	5.3 Mcy Beach Placement

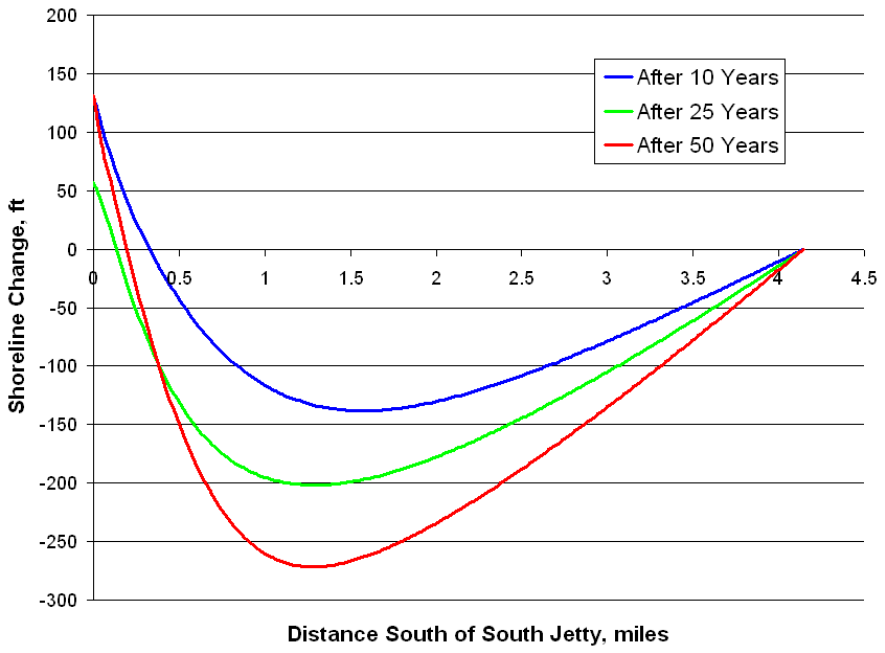


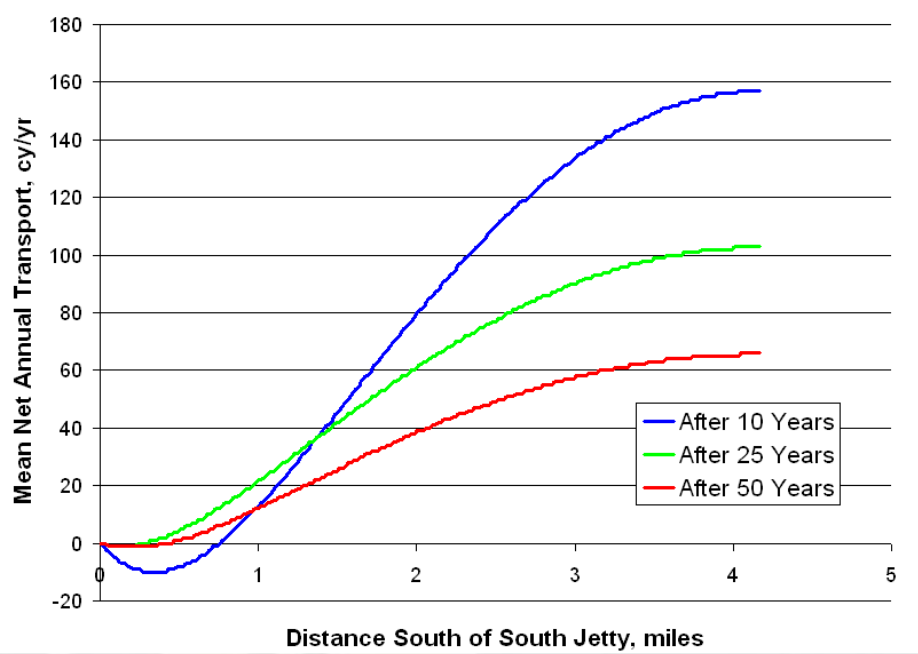


GenCade Results – Alt 1 – No Action



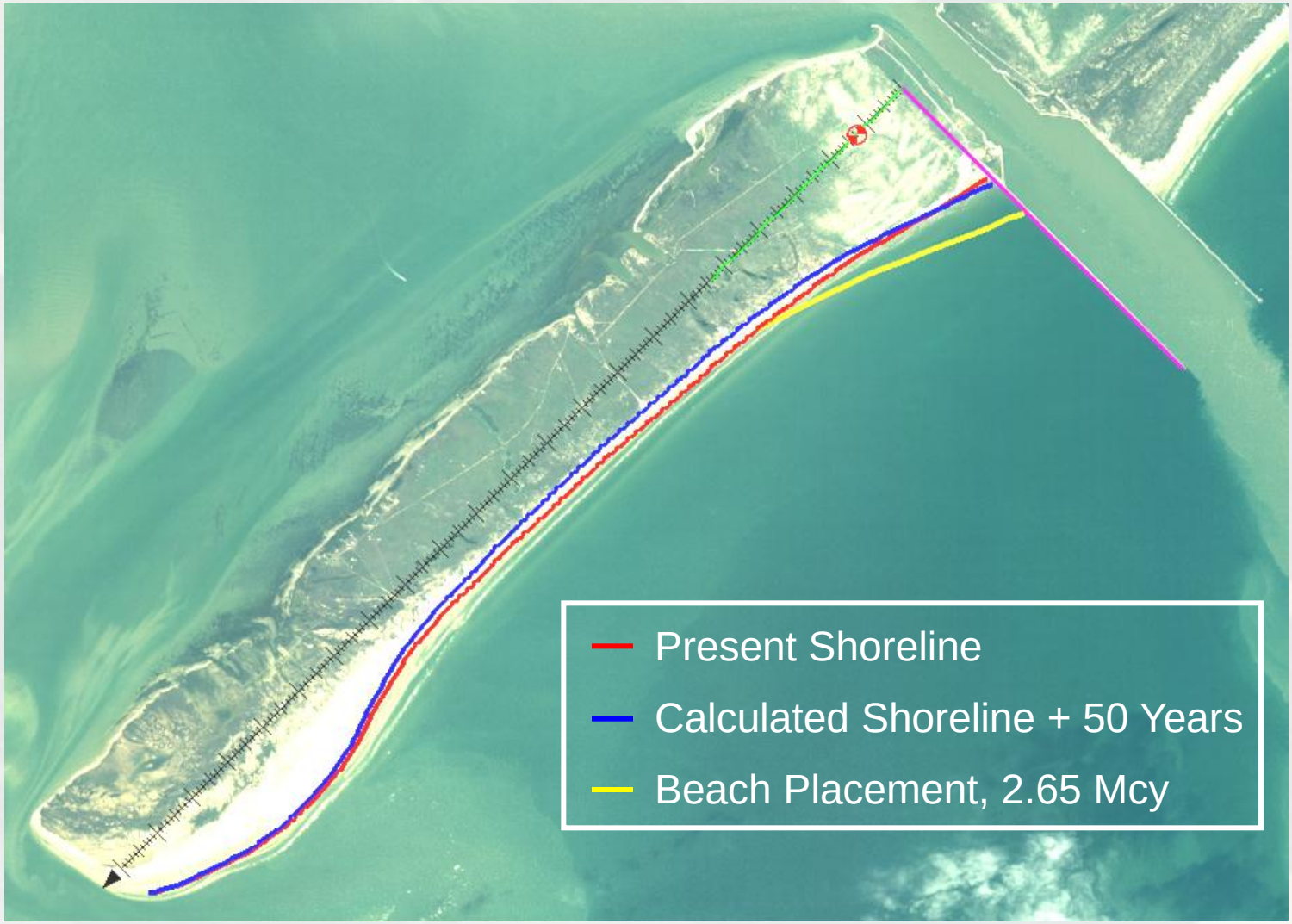
GenCade Results – Alt 1 – No Action



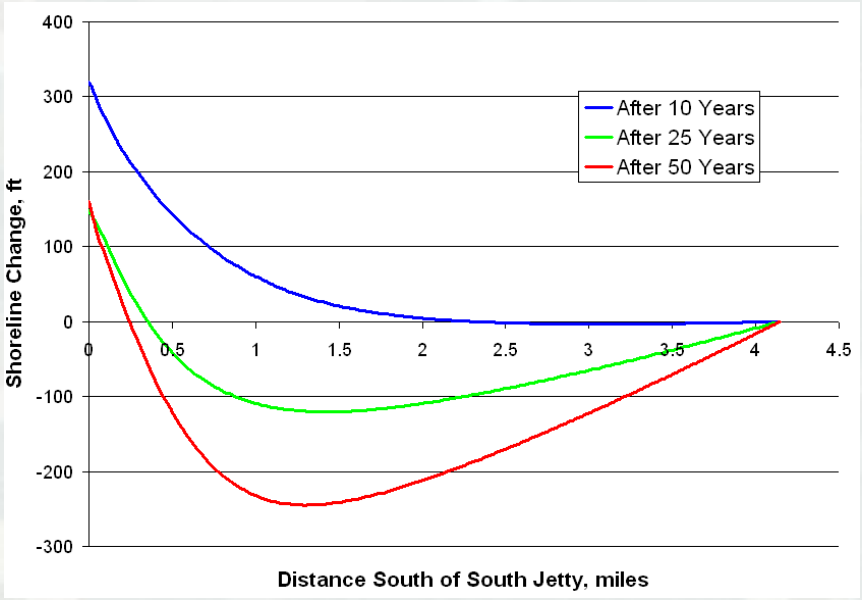


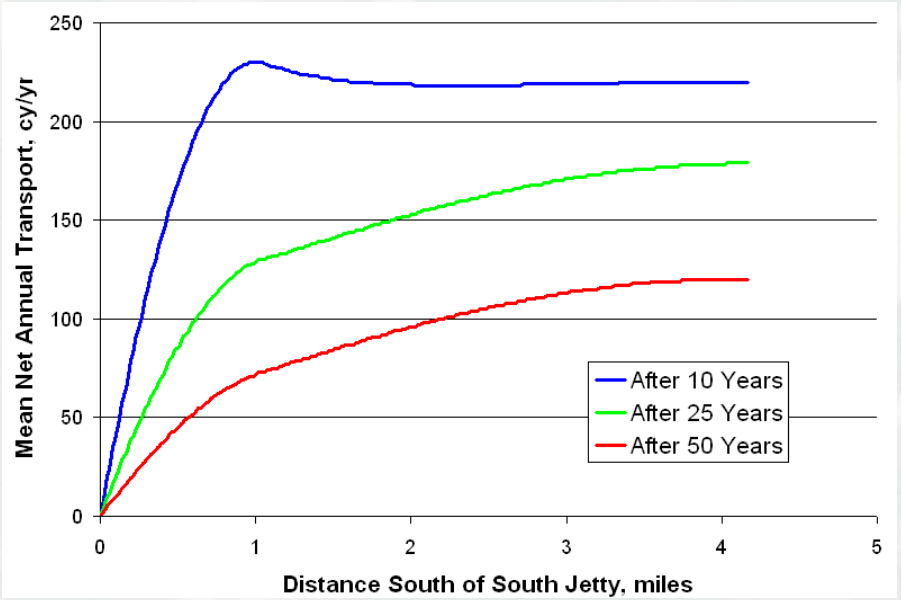
Note: K cy/yr

GenCade – Alt 2 – 2.65 Mcy Placement

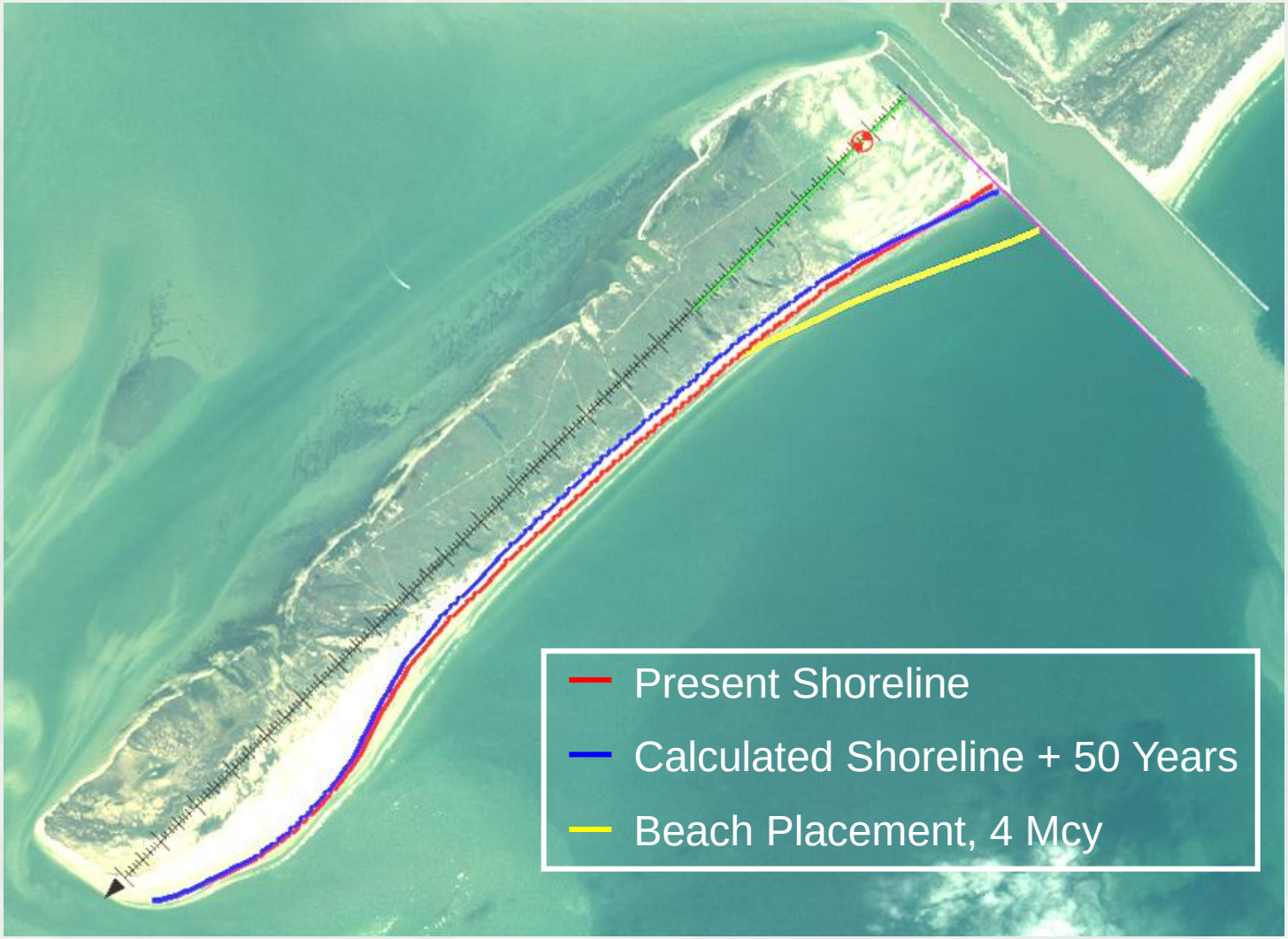


GenCade – Alt 2 – 2.65 Mcy Placement

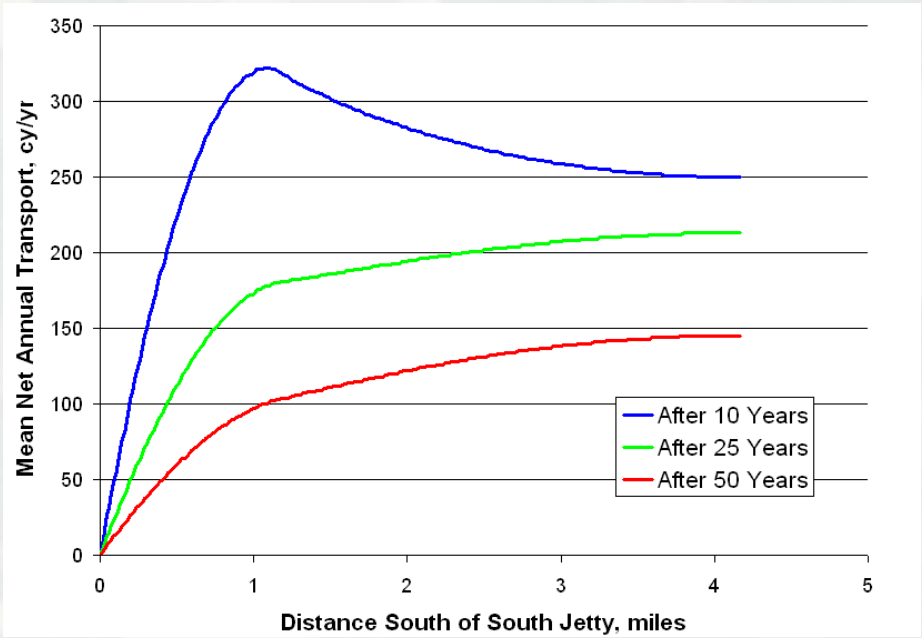




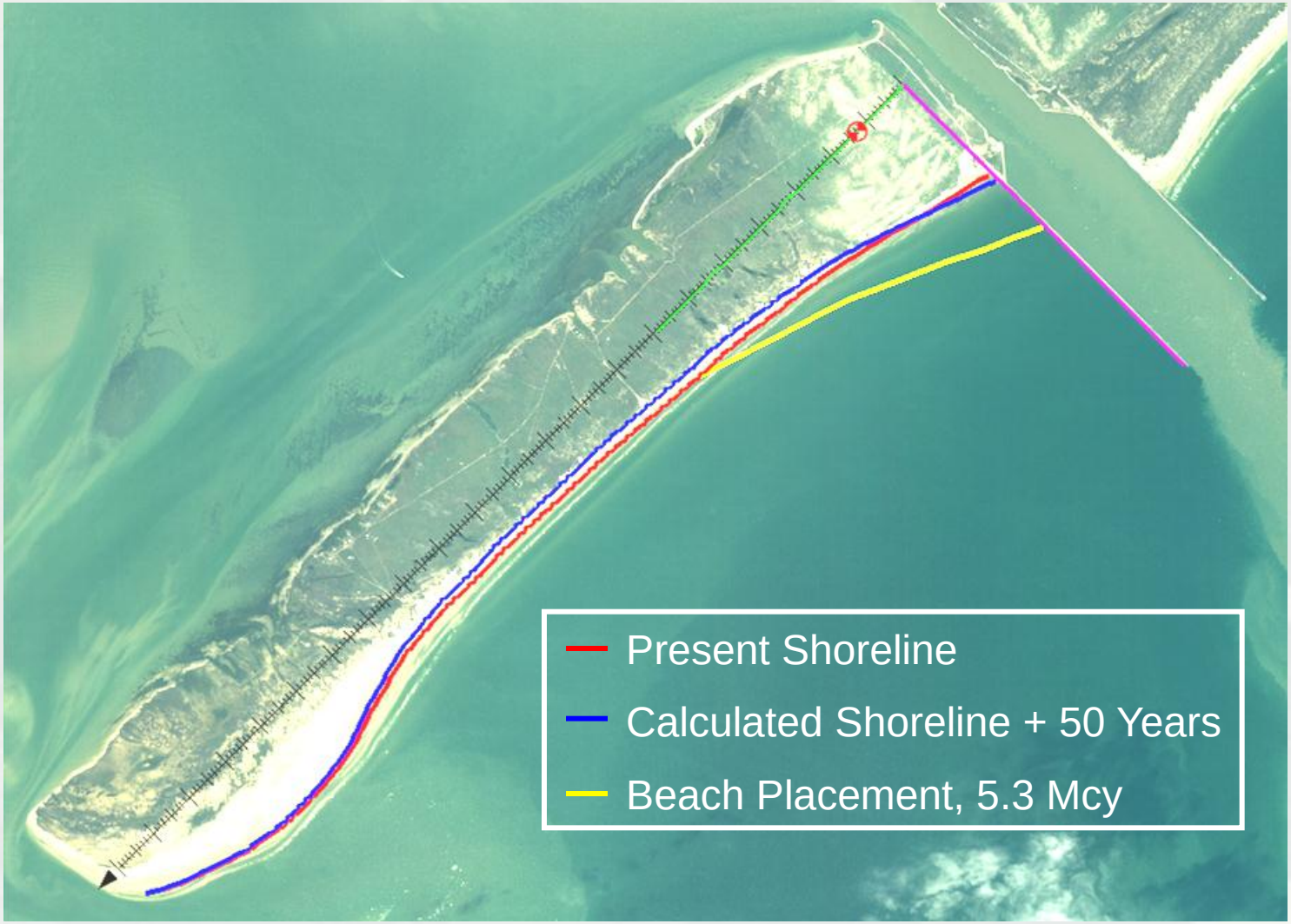
GenCade – Alt 3 – 4 Mcy Placement



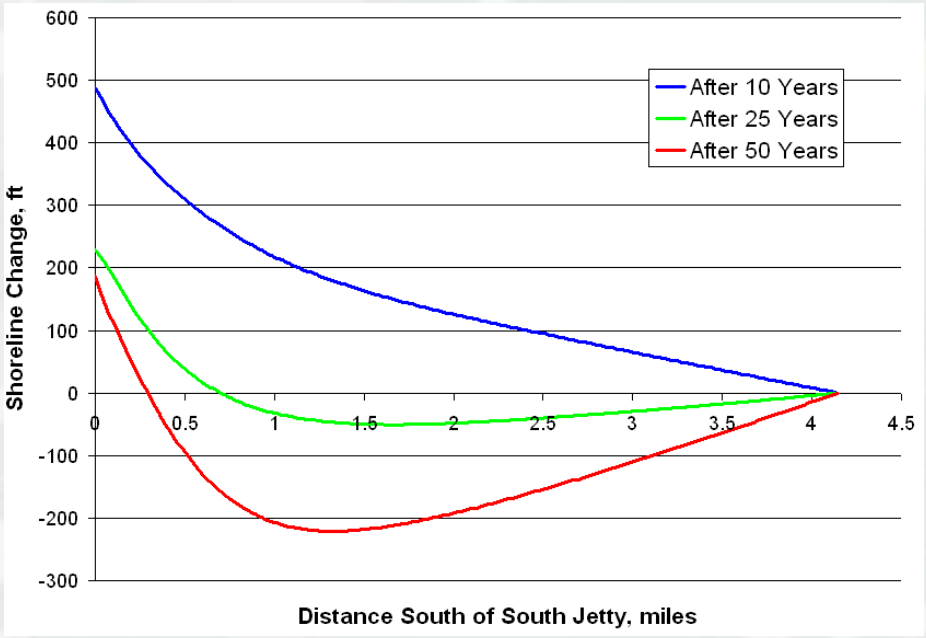
GenCade – Alt 3 – 4 Mcy Placement

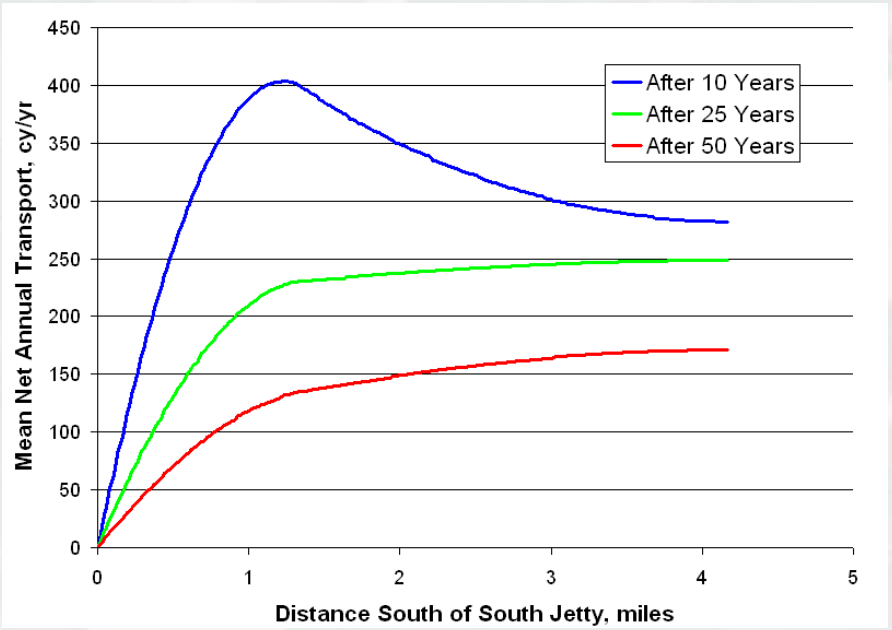


GenCade – Alt 4 – 5.3 Mcy Placement

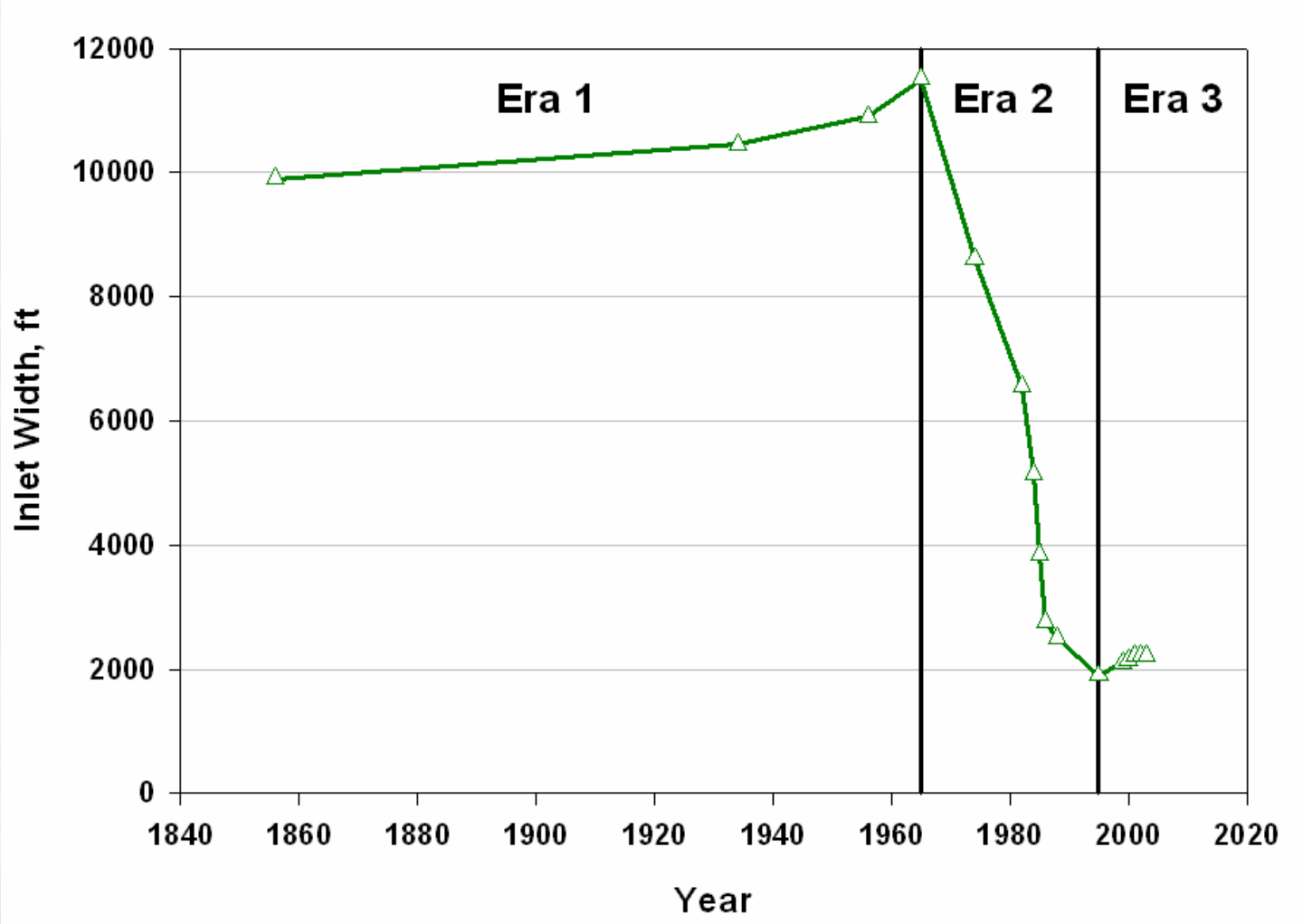


GenCade – Alt 4 – 5.3 Mcy Placement





Pass Cavallo Inlet Width



Conclusions

- Expansion of Sundown Island did not significantly increase MSC cross-channel current velocity.
  - Shore protection recommended to help limit influence on intracoastal waterway and ship channel
- All alternatives for beach placement are considered viable.
  - Pass Cavallo expected to remain stable
  - South jetty stabilization also a benefit.
- Removal of the bottleneck decreased currents relative to the existing condition both along the channel axis and cross-channel currents

Questions?